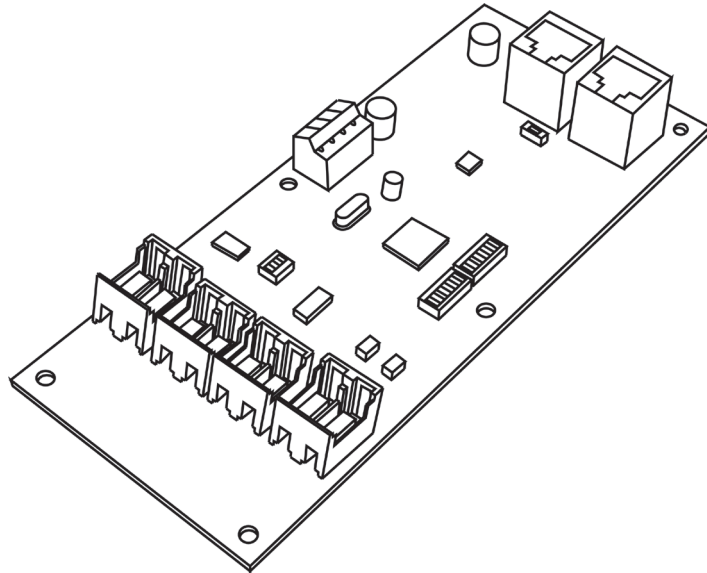


# CUB44-AD12A

DATA SHEET

<http://www.steptecnica.com/en/index.html>


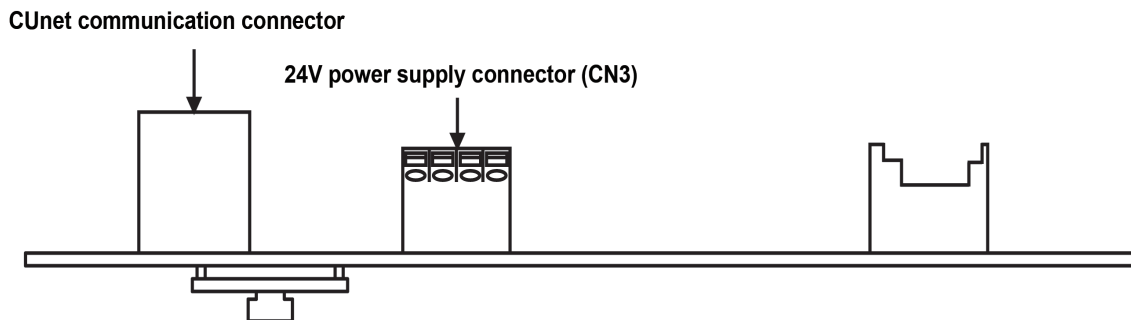
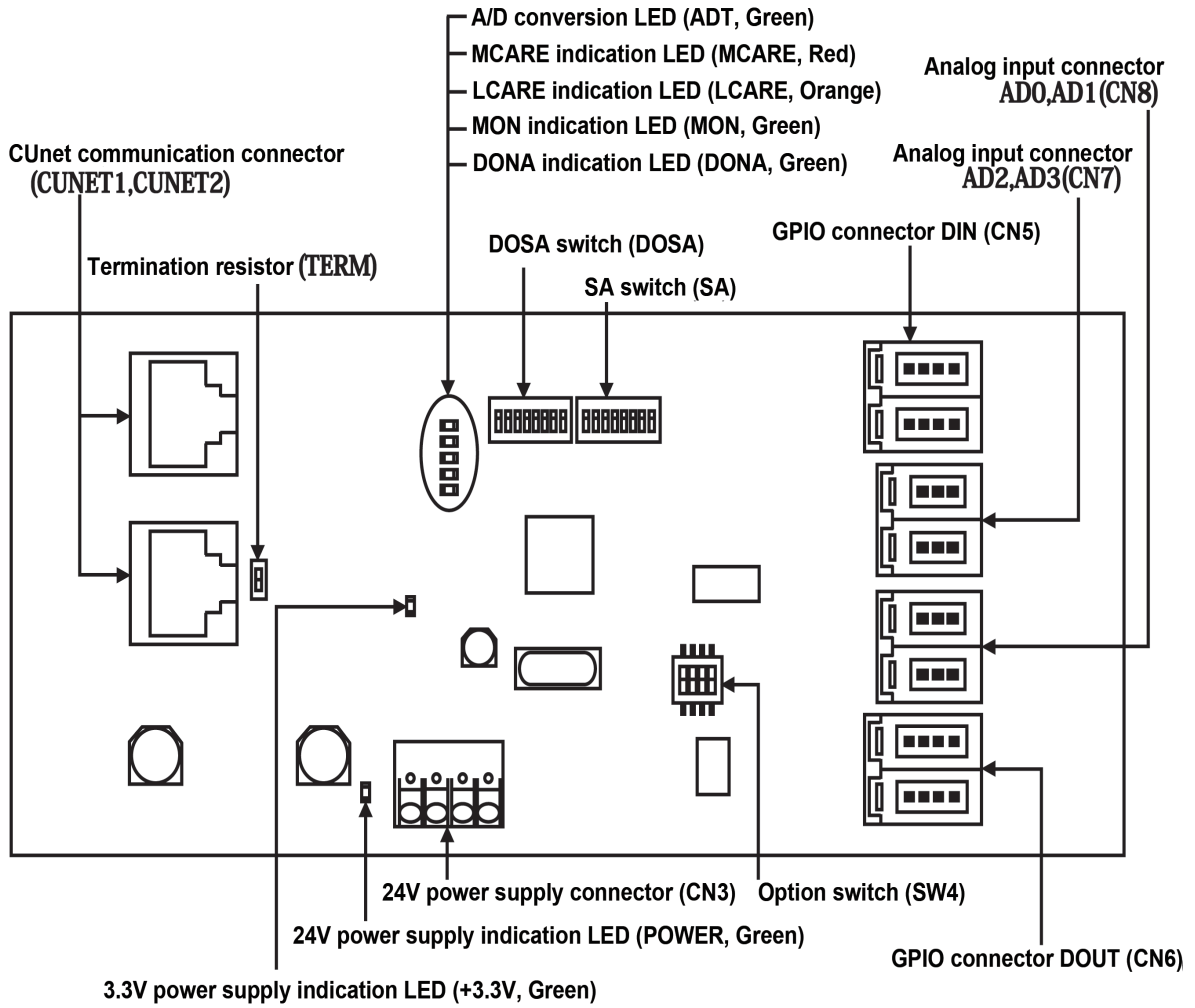
## ■ Features

This product has 4 channels of 12 bit resolution analog input interface, and interface for isolated 4 inputs / 4 outputs. Analog data and each I/O data can be shared with devices in CUnet network by connecting to network.

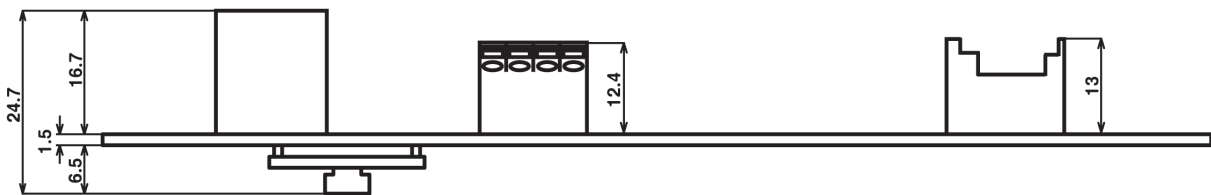
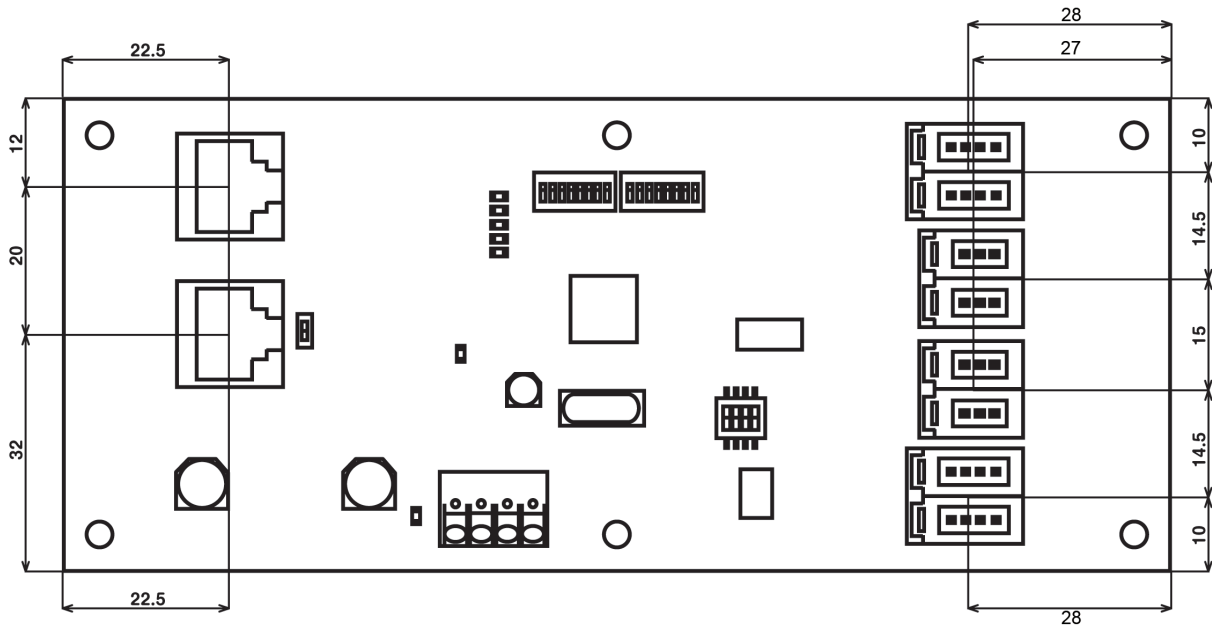
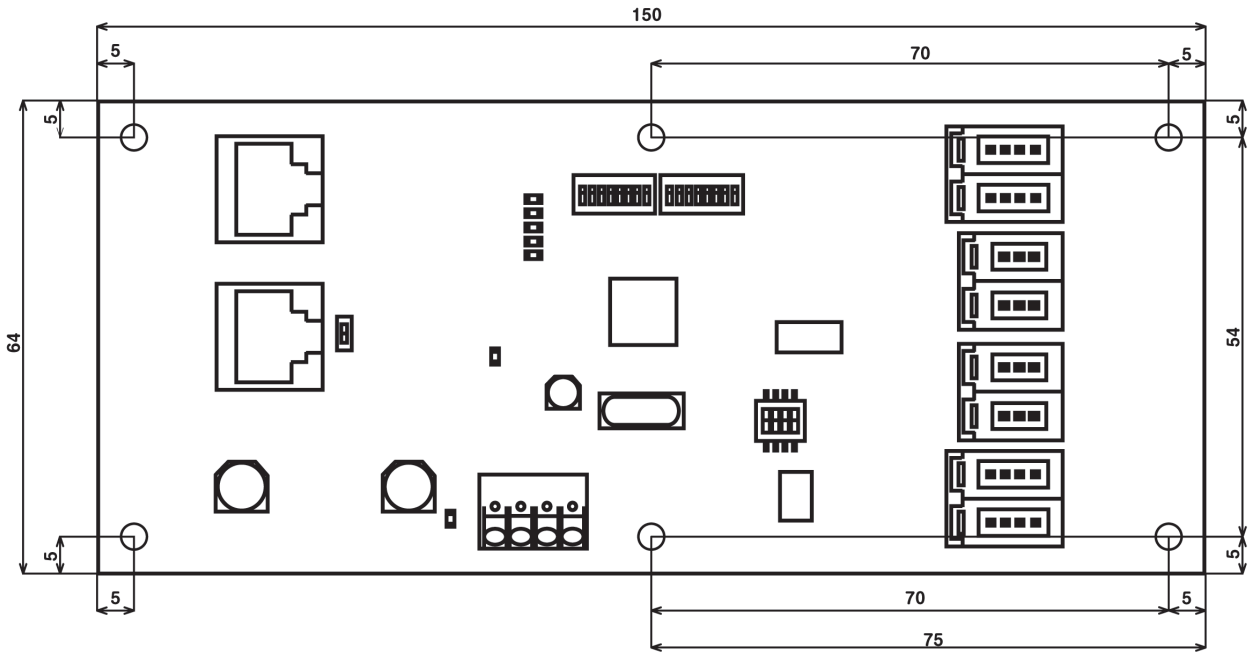
## ■ Main specifications

- Supply voltage
  - Supply voltage : DC24V (+10%, -15%)
- Consumption current (DC 24V supplied)
  - Consumption current : Max. 20mA / Min. 13mA (approx.)
  - Power consumption : Max. 480mW / Min. 312mW (approx.)
- Size / Weight
  - Size : W 150 × D 64 × H 24.7 (+1) (mm)
  - Weight : 58 g (typ.)
- Operating conditions
  - Temperature : Operating temp. : 0°C to 55°C / Storage temp. : -20°C to 65°C
  - Humidity : Operating humidity : 0% to 90% (With no condensation)  
Storage humidity : 0% to 90% (With no condensation)
  - Installation : Screw lock (Can be installed by M3 screw) (Fits with optional DIN rail)
- Functional specifications
  - AD converter (MKY44-AD12A embedded 12bit AD converter)
    - Input range : 0 to 5V
    - Number of channels : 4 channels
    - Conversion rate : MAX 10ksps/ch
  - General-purpose input specifications
    - 4 inputs isolated by photocoupler
  - General-purpose output specifications
    - 4 outputs isolated by photocoupler

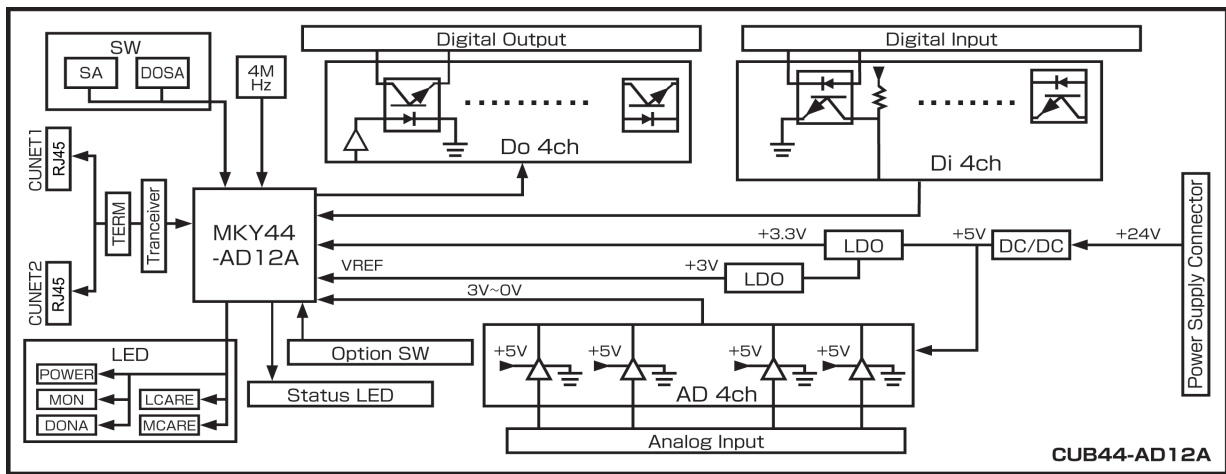
■ Panel view



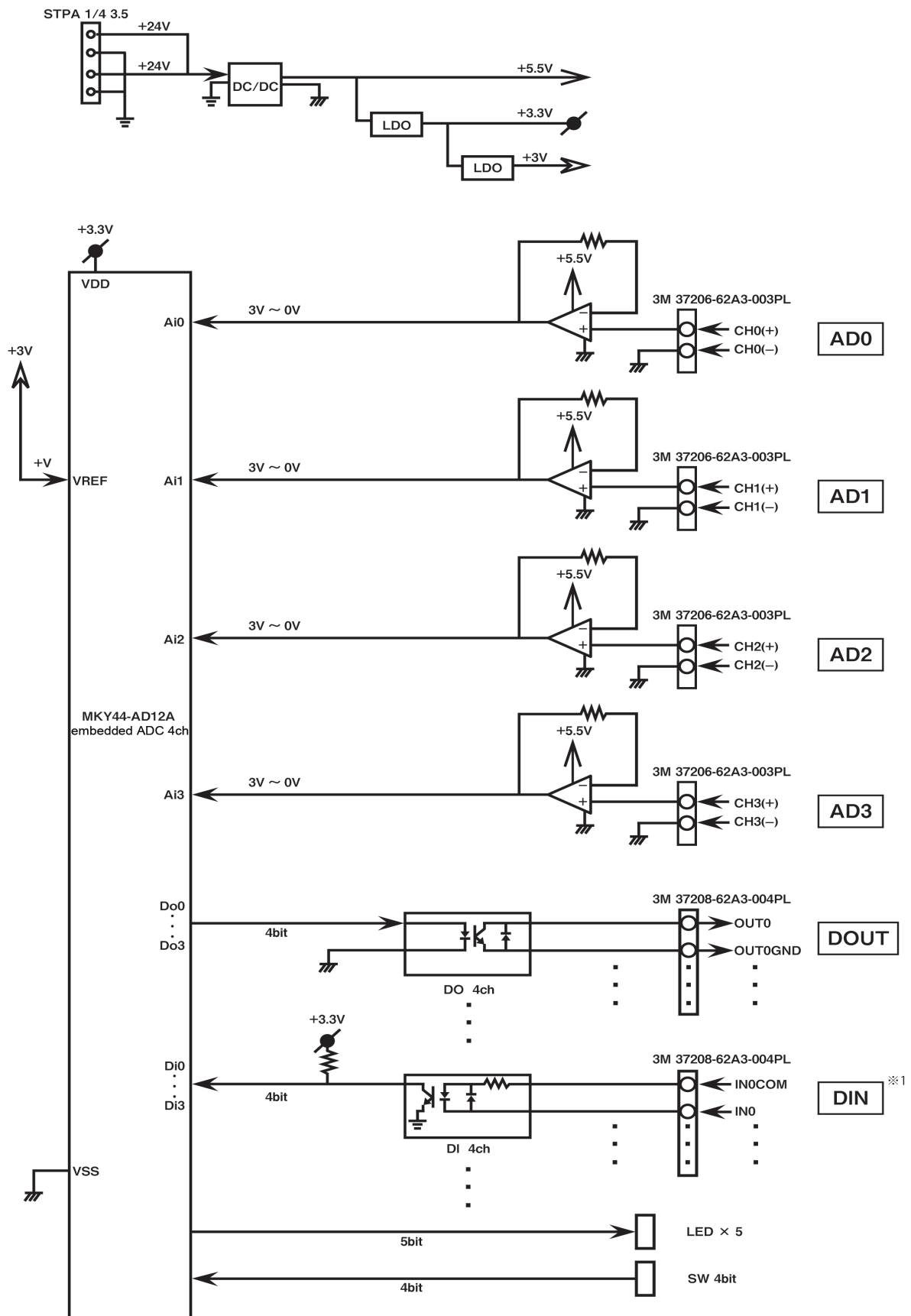
External dimensions (mm)



■ Block diagram and pin connection



## ■ Block diagram



※ 1... When DiInv has been ON, input is treated as positive logic, Hi = 1, Lo = 0.  
 When DiInv has been OFF, input is treated as negative logic due to logic inversion, Hi = 0, Lo = 1.

## ■ CUnet specifications

Communication method	: Half-duplex
Isolation method	: Pulse transformer
Termination resistor	: Enable / disable can be switched by TERM switch of CUB44-AD12A.
Communication distance / rate	: 100m/12Mbps, 200m/6Mbps, 300m/3Mbps (Factory setting : 12Mbps)

Station address and communication rate settings : Set in SA switches of CUB44-AD12A

DIP-SW 1	Signal	Status
8	BPS 1	Communication rate can be selected as below. BPS 1, BPS 0 = OFF, OFF 12Mbps (Factory setting)
7	BPS 0	BPS 1, BPS 0 = OFF, ON 6Mbps BPS 1, BPS 0 = ON, OFF 3Mbps BPS 1, BPS 0 = ON, ON None (Not to set)
6	SA5	Set SA value in hexadecimal number which treats ON state as "1"  Factory setting : SA=1
5	SA4	
4	SA3	
3	SA2	
2	SA1	
1	SA0	

Master station address and sampling method settings : Set in DOSA switches of CUB44-AD12A

DIP-SW 2	Signal	Status
8	Stype1	Select sampling method of analog value Stype1, Stype0 = OFF, OFF Cyclic (Factory setting)
7	Stype0	Stype1, Stype0 = OFF, ON Single trigger Stype1, Stype0 = ON, OFF Period average Stype1, Stype0 = ON, ON Moving average
6	DOSA5	Set DOSA value in hexadecimal number which treats ON state as "1"  Factory setting : DOSA=0
5	DOSA4	
4	DOSA3	
3	DOSA2	
2	DOSA1	
1	DOSA0	

Status LED : Four LEDs which indicate the communication status are equipped with CUB44-AD12A

DONA	MON	LCARE	MCARE	Status
---	---	---	---	① Power OFF ② Hardware reset is active ③ Link is not established with any CUnet devices after the recovery from hardware reset.
---	●	---	---	Link is not established with CUnet device which is set by DOSA.
●	●	---	---	Communicating successfully
---	---	---	●	Inappropriate SA, DOSA settings of DIP-SW
---	---	□	---	Additional link failure is found at link destination.
---	---	---	□	Additional link failures are found for 3 consecutive scans at link destination.
---	---	□	□	① Link failures are found three consecutive scans at link destination of CUnet. ② Hardware reset is executed.
---	---	▲	▲	① Blinking alternately every 1 second : DIP-SW read hardware abnormality including ST44SW. ② Blinking alternately every 2 seconds : internal abnormality of MKY44-AD12A

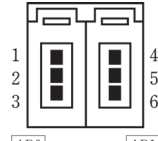
● Continuous lighting   □ Flash lighting for approx. 50ms   ▲ Blinking alternately for every few seconds

Recommended communication cable

- Shielded cable  
ZHY262PS  
ZHT262PS
- Shielded duplex cable  
ZHY262PBA

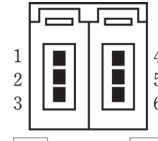
## ■ Connector specifications

Pin assignment of analog connector  
(AD0, AD1)



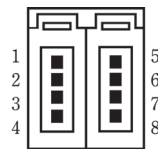
Pin #	Signal name
1	CH0 (+)
2	CH0 (-)
3	N.C.
4	CH1 (+)
5	CH1 (-)
6	N.C.

Pin assignment of analog connector  
(AD2, AD3)



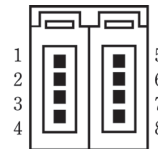
Pin #	Signal name
1	CH2 (+)
2	CH2 (-)
3	N.C.
4	CH3 (+)
5	CH3 (-)
6	N.C.

Pin assignment of general-purpose output connector  
(DOUT)



Pin #	Signal name
1	OUT0
2	OUT0GND
3	OUT1
4	OUT1GND
5	OUT2
6	OUT2GND
7	OUT3
8	OUT3GND

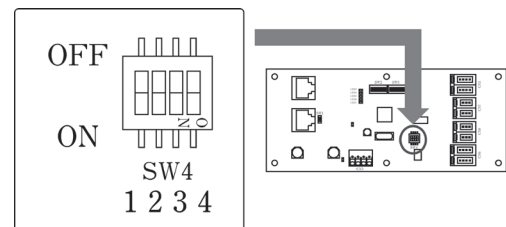
Pin assignment of general-purpose input connector  
(DIN)



Pin #	Signal name
1	IN0COM
2	IN0
3	IN1COM
4	IN1
5	IN2COM
6	IN2
7	IN3COM
8	IN3

## ■ Optional switch settings

	Signal name	Description	Factory setting
1	MODsel	Setting the execution mode of CUB44-AD12A ON = Setting mode OFF = Operation mode	OFF
2	POLsel	Setting the indication method of analog value in shared memory When this switch is ON, the indication will be bipolar mode (with $\pm$ nV code) and the half of the standard input voltage (5V) is treated as "0x000". The each of input voltages are respectively described as follows ; 2.5V = 0x000, 5V = 0x7FF, 0V = 0x800. When this switch is OFF, The indication will be unipolar mode (with no 0 - nV code) and the each of input voltages are respectively described as follows ; 0V = 0x000, 5V = 0xFFFF.	OFF
3	DoClr	Setting the function to initialize the general-purpose output (DOUT) into OFF in DONA state. ON : DOUT is initialized in DONA state. OFF : The initialization in DONA state is disabled.	OFF
4	Dilnv	Setting the logic inversion function for general-purpose input (DIN) ON : The input is treated as positive logic. OFF : The input is treated as negative logic due to logic inversion.	ON



---

## ■ Mechanical specifications

○ AD converter (MKY44-AD12A embedded 12-bit AD converter)

Input range	: 0 to 5V
Number of channels	: 4 channels
Conversion rate	: MAX 10ksps/ch

○ General-purpose input specifications

4 inputs isolated by photocoupler

Current source output supported

Plus common	: INOCOM
Minus input	: INO
Maximum concurrent inputs	: No limit
ON / OFF delay	: 20 $\mu$ s (typ) / 80 $\mu$ s (typ)
Input resistance	: 4.7k $\Omega$
Input current	: 5.1mA or lower (at 24V DC)
Isolation	: Photocoupler
ON voltage	: DC5.0V (min)
OFF voltage	: DC2.0V (max)
Maximum rating input voltage	: 80V
Maximum rating input current	: 50mA

○ General-purpose output specifications

4 inputs isolated by photocoupler

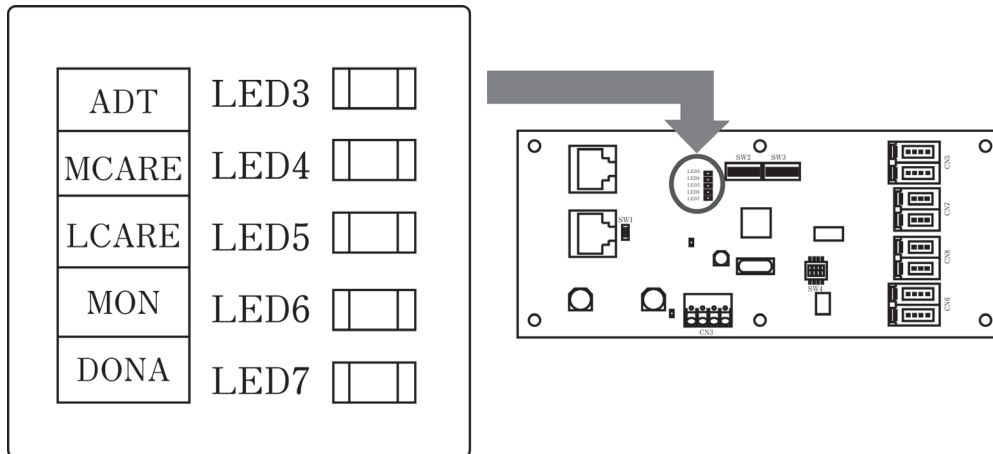
Current source type

Plus-common	: OUT0
Outputs	: OUTOGND
Number of inputs and outputs	: Outputs 4ch
Maximum concurrent outputs	: No limit (at 24V DC)
Isolation	: Photocoupler
Rated load voltage	: DC 32V
Rated load current	: 0.1mA/ output
Leakage current	: 100 $\mu$ A (max)
ON delay	: 0.2ms (min)
OFF delay	: 0.3ms (max)



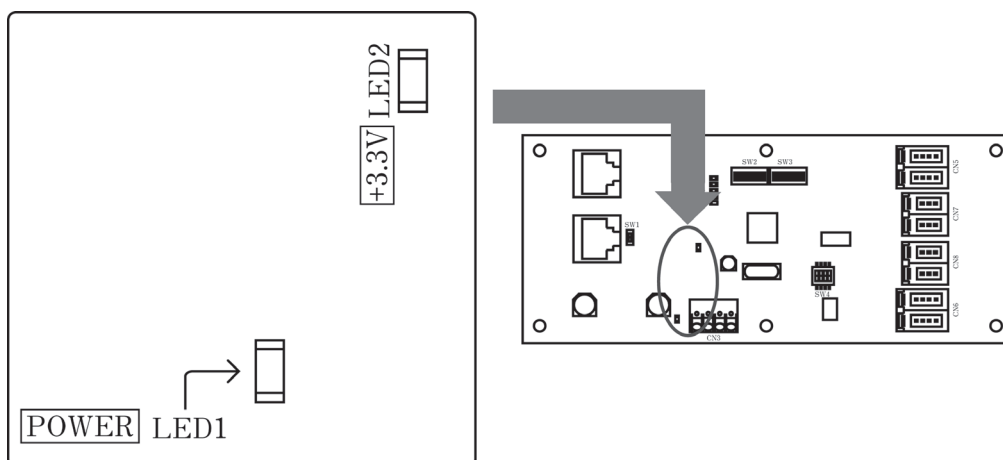
## ■ LED indication for the states of CUnet communication and AD conversion

LED name	Lighting color	Description
ADT	Green	Lit at A/D conversion
MON	Green	Indicating link state of devices in CUnet
DONA	Green	Indicating the state of communication with the device which has station address set by DOSA
LCARE	Orange	Additional link failure is found at link destination.
MCARE	Red	Additional link failures are found three consecutive scans at link destination.

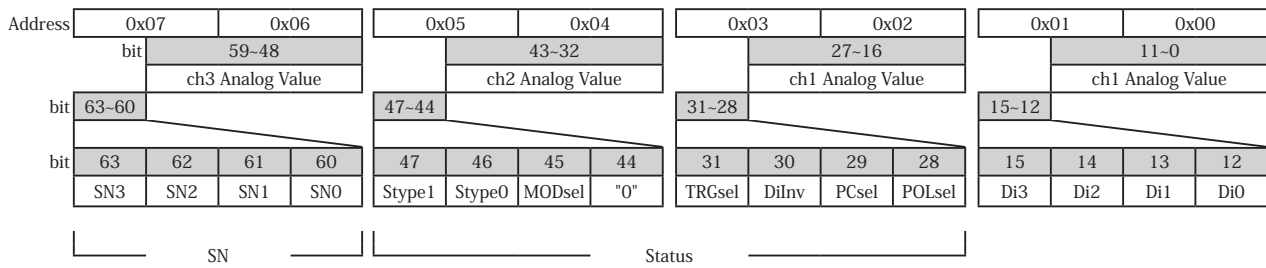


## ■ LED indication for the state of power supply

LED name	Lighting color	Description
+3.3V	Green	3.3V power supplied
POWER	Green	24V power supplied



## ■ Configuration of shared memory



Bit	Description																
11 ~ 0 (ch0 Analog Value)	Indicating analog value input to analog input ch0 (AD0)																
15 ~ 12 (Di3 ~ Di0)	These bits are indicating general-purpose input connector (DIN). Each of corresponding bits are as follows : bit12 : IN0, bit15 : IN3																
27 ~ 16 (ch1 Analog Value)	Indicating analog value input to analog input ch1 (AD1)																
28 (POLsel)	Indicating analog input method set by SW4 - 2 When this bit is 1, bipolar input is set as input method. (SW4 - 2 : ON) When this bit is 0, unipolar input is set as input method. (SW4 - 2 : OFF)																
29 (PCsel)	Indicating peak-cut enable / disable set by mail function When this bit is 1, peak-cut is enabled. (bit1 of FS : 1) When this bit is 0, peak-cut is disabled. (bit1 of FS : 0)																
30 (DiInv)	Indicating the state of logic inversion function for general-purpose input (DIN) set by SW4 - 4 When this bit is 1, the function is disabled (SW4 - 4 : ON) When this bit is 0, the function is enabled (SW4 - 4 : OFF)																
31 (TRGsel)	Indicating trigger method set by mail function When this bit is 1, software trigger is set as trigger method. (bit0 of FS : 1) When this bit is 0, hardware trigger (bit0 of FS : 0)																
44	Unused : '0' is always set to this bit.																
46 (Stype0)	Indicating sampling method Stype0 bit indicates Stype0 of DOSA switch.	<table border="1"> <thead> <tr> <th>Sampling method</th> <th>Stype1</th> <th>Stype0</th> </tr> </thead> <tbody> <tr> <td>Cyclic</td> <td>0</td> <td>0</td> </tr> <tr> <td>Single trigger</td> <td>0</td> <td>1</td> </tr> <tr> <td>Period average</td> <td>1</td> <td>0</td> </tr> <tr> <td>Moving average</td> <td>1</td> <td>1</td> </tr> </tbody> </table>	Sampling method	Stype1	Stype0	Cyclic	0	0	Single trigger	0	1	Period average	1	0	Moving average	1	1
Sampling method	Stype1		Stype0														
Cyclic	0	0															
Single trigger	0	1															
Period average	1	0															
Moving average	1	1															
47 (Stype1)	Stype1 bit indicates Stype1 of DOSA switch. When the bit is 1, switch is set ON.																
59 ~ 48 (ch3 Analog Value)	Indicating analog value input to analog input ch3 (AD3)																
60 ~ 63 (SN)	CUB44-AD12A issues the sequence number when the analog value in shared memory has been renewed. The number is incremented as in order as 0x01 → 0x02 → ... and if the number reaches 0xF, next it returns to 0x01. (It proceeds as 0xE → 0xF → 0x01 → 0x02 → ...) User can check the renewal of the analog value according to sequence-number of SN. SN may indicate 0x0 right after power-on. Analog value at this time is invalid.																

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## ■ Performance

### Performance of A/D function

Standard accuracy	:	Integral non-linearity	Max. $\pm$ 3LSB
Temperature coefficient	:	0.002% / °C	

### Sampling method and data renewal timing

- The method that MKY44-AD12A independently perform A/D conversion
  1. **Cyclic** ... 102  $\mu$  s ~ 2,365  $\mu$  s at 12Mbps (Factory setting : 2,365  $\mu$  s)  
In cyclic mode, MKY44-AD12A renews the analog value at constant cycle.  
The cycle is determined by "communication rate" and "cycle time".
  - The method that user orders A/D conversion at any time
    2. **Single trigger** ... A/D conversion starts when conversion start trigger is received.
  - The method that MKY44-AD12A independently perform A/D conversion, and calculate period average / moving average.
    3. **Period average** ... Computation time : Peak-cut disabled : 400  $\mu$  s ~ 16s / Peak-cut enabled : 800  $\mu$  s ~ 18s
    4. **Moving average** ... Computation time : 200  $\mu$  s ~ 1s

<b>Setting items for period average / moving average</b>
--

- |  |                     |   |  |                          |   |   |                     |   |   |
|--|---------------------|---|--|--------------------------|---|---|---------------------|---|---|
| <table><tr><td>① Sampling interval</td><td>:</td><td>200 <math>\mu</math> s ~ 1s (Unit : 100 <math>\mu</math> s , only even number is valid )</td></tr><tr><td>② Average sampling count</td><td>:</td><td>2 / 4 / 8 / 16 times (Peak-cut enabled : 4 / 6 / 10 / 18 times)</td></tr><tr><td>③ Peak-cut function</td><td>:</td><td>The average value is calculated omitting each data of maximum and minimum values from sampling value.</td></tr></table> | ① Sampling interval | :   | 200 $\mu$ s ~ 1s (Unit : 100 $\mu$ s , only even number is valid ) | ② Average sampling count | : | 2 / 4 / 8 / 16 times (Peak-cut enabled : 4 / 6 / 10 / 18 times) | ③ Peak-cut function | : | The average value is calculated omitting each data of maximum and minimum values from sampling value. |
| ① Sampling interval  | :                   | 200 $\mu$ s ~ 1s (Unit : 100 $\mu$ s , only even number is valid )                                    |  |                          |   |   |                     |   |   |
| ② Average sampling count   | :                   | 2 / 4 / 8 / 16 times (Peak-cut enabled : 4 / 6 / 10 / 18 times)                                       |  |                          |   |   |                     |   |   |
| ③ Peak-cut function  | :                   | The average value is calculated omitting each data of maximum and minimum values from sampling value. |  |                          |   |   |                     |   |   |

- For details of setting change, refer to "Parameter Setting Change Using the Mail Function" in MKY44-AD12A Data Sheet.

## ■ Wiring

(Refer to each detailed specifications for pin assignments.)

- AD converter

Analog connector : 3M : 37206-62A3-003PL 3 pin  
 Recommended connector : 3M : 37103- ○ -000FL 3 pin  
 (○ is to be filled with applicable wire AWG & OD. For details, refer to manufacturer's catalog.)

- General-purpose inputs / outputs (GPIO)

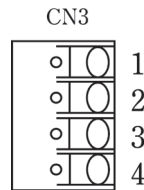
General-purpose input connector : 3M : 37208-62A3-004PL 4 pin  
 Recommended connector : 3M : 37104- ○ -000FL 4 pin  
 (○ is to be filled with applicable wire AWG & OD. For details, refer to manufacturer's catalog.)

General-purpose output connector : 3M : 37208-62A3-004PL 4 pin  
 Recommended connector : 3M : 37104- ○ -000FL 4 pin  
 (○ is to be filled with applicable wire AWG & OD. For details, refer to manufacturer's catalog.)

- Power supply

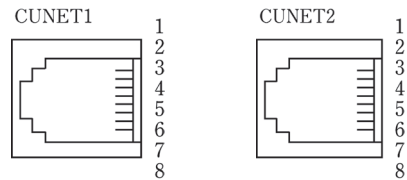
Power supply connector : SPTA 1/4-3.5  
 Applicable wire diameter : 0.2 mm<sup>2</sup>~ 1.0 mm<sup>2</sup> (Twisted pair)  
 Peeling length : 8mm  
 Maximum supply current : 9A  
 Pin assignment : See the following table.

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



- CUnet communication connector (CUNET1 and CUNET2 have the common wiring and pin assignment.)

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



#8 pin is connected to FG of CUNET1.

#8 pin of CUNET2 can be connected to FG with jumper.

## Cautions for installation of the product

- ❗ **Do not touch with wet hands at installation or uninstallation.**  
To do so may result in causing electroshock or failure of the parts.
- ❗ **Do not directly touch the internal parts with your hands during power-on.**  
To do so may result in causing electroshock or failure of the parts.
- ❗ **Always plug off before installation and uninstallation.**  
Installation or uninstallation with plug connected may result in causing electroshock or failure of the parts by unexpected power-on.
- ❗ **Before installation, discharge static electricity from your body.**  
Especially in dry season, static electricity is likely to stay in human body, so be sure to discharge static electricity from your body before installation or uninstallation. (Wearing anti-static gloves is recommended.)
- ❗ **Do not drop or shock the product.**  
Note that part failure caused by dropping is out of repairing guarantee. When any abnormal sound, smell or smoke are observed, immediately power-off the board. Left the board remained so may cause fires or severely damage the equipments.

Date	Version	Content	Note
AUG 2013	1.0	Issued the first edition	
DEC 2016	1.1	Corrected the description of termination setting method	P6
DEC 2018	1.2	Replaced the figures of external dimensions	P3
		Added SA, DOSA factory settings	P6
		Corrected e-CON plug part number 37204-○-000FL → 37104-○-000FL	P12

Document No. : DS\_CUB44AD12A\_V1.2E  
Issued date : December 2018

<b>Related documents :</b>	<b>CUnet Introduction Guide</b>	<b>STD_CUSTU_Vx.xE</b>
	<b>CUnet Technical Guide</b>	<b>STD_CUTGN_Vx.xE</b>
	<b>CUnet IC MKY43 User's Manual</b>	<b>STD_CU43_Vx.xE</b>
	<b>CUnet I/O-IC MKY46 User's Manual</b>	<b>STD_CU46_Vx.xE</b>
	<b>CUnet HUB- IC MKY02 User's Manual for CUnet</b>	<b>STD_CUH02_Vx.xE</b>
	<b>CUnet IC MKY44-AD12A Data Sheet</b>	<b>DS-MKY44-AD12A-Vx.xE</b>

StepTechnica Co., Ltd. ZIP 358-0011 757-3, Shimofujisawa, Iruma, Saitama <http://www.steptechnica.com/en/index.html>

### Cautions

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