

# Melec



AL- Series USB Master

## AL2-02/USB

### Instructions Manual (For designers' use)

# USER'S MANUAL

Please ensure to read and understand this Instructions Manual before using the Product. Please keep this Instructions Manual at hand so that it is always available for reference.

MN0199

## Introduction

This instructions manual explains the handling of "AL- Series USB Master AL2-02/USB", emphasizing the specifications to enable proper and safe use.

The manual is thus intended for designers of control systems using servo motors and stepping motors. Before using the product, read this manual carefully for better understanding.

Keep the manual handy so that you can read it whenever you want.

## Description of safety

This product must be handled correctly.

Handling the product incorrectly may cause unexpected accidents resulting in personal injuries or damage to your properties.

Many of those accidents can be avoided if you have advance information on dangerous situations.

This manual provides precautions where dangerous situations are predicted. The manual provides the following alert marking and messages for this purpose:

 **WARNING**

This indicates a hazardous situation that could result in death or serious personal injury if you do not perform the procedure correctly.

 **CAUTION**

This indicates a potentially hazardous situation that could result in personal injury or physical damage if you do not perform the procedure correctly.

## Before use

This product is not designed for use in the equipment related to nuclear power, aerospace equipment, vehicles, marine vessels, medical equipment directly in touch with human body, equipment anticipated to give a serious impact to properties, and other equipment required to provide high reliability.

Take failsafe measures so that the whole system operates safely even if the input power causes an error, a signal line is disconnected, or the main unit fails.

Be sure to use this product within the scope of the specifications described in this instruction manual in accordance with the specification method described therein.

Set up the product before operating it.  
Please refer to the Section 3, "Setting."

Please refer to separate manual "AL- series device driver manual for Windows" also when you handle this product.

Introduction  
Description of safety  
Before use

	Contents	PAGE
<b>1 . Overview</b>		
1-1. Features -----		4
1-2. Product configuration -----		5
1-3. Example of system configuration -----		5
1-4. Function block diagram -----		6
1-5. Externals of product -----		7
<b>2 . Specifications</b>		
2-1. General specifications -----		8
2-2. Communication specifications -----		8
2-3. Master specifications -----		9
2-4. Input and output signal table -----		10
(1) Serial communication connector(J1) -----		10
(2) USB communication connector(for ONLINE: J2, and for OFFLINE: J4 ) -----		10
(3) Power supply connector(J3) -----		10
2-5. Outside dimensions -----		11
<b>3 . Setting</b>		
3-1. Setting of USB number (S1) -----		12
3-2. Setting of AL- communication -----		12
(1) Address setting of the AL- communication -----		12
(2) Baud rate setting of the AL- communication -----		12
(3) Retry setting of the AL- communication -----		12
3-3. Setting of Extend-unit communication -----		12
<b>4 . Connection</b>		
4-1. Connection of AL- communication system -----		13
(1) Core connection of AL- communications cable -----		13
(2) Connection of terminator -----		13
(3) Wiring distance of AL- communication -----		13
(4) Power supply for communication -----		13
<b>5 . OFFLINE</b>		
5-1. Support environment of OFFLINE -----		14
5-2. OFFLINE specification -----		14
<b>6 . Maintenance</b>		
6-1. Maintenance and inspection -----		16
(1) Cleaning method -----		16
(2) Inspection method -----		16
(3) Replacement method -----		16
6-2. Saving and disposal -----		16
(1) Saving method -----		16
(2) Disposal method -----		16

The main parts which revised by this manual

# 1 . Overview

## 1-1. Features

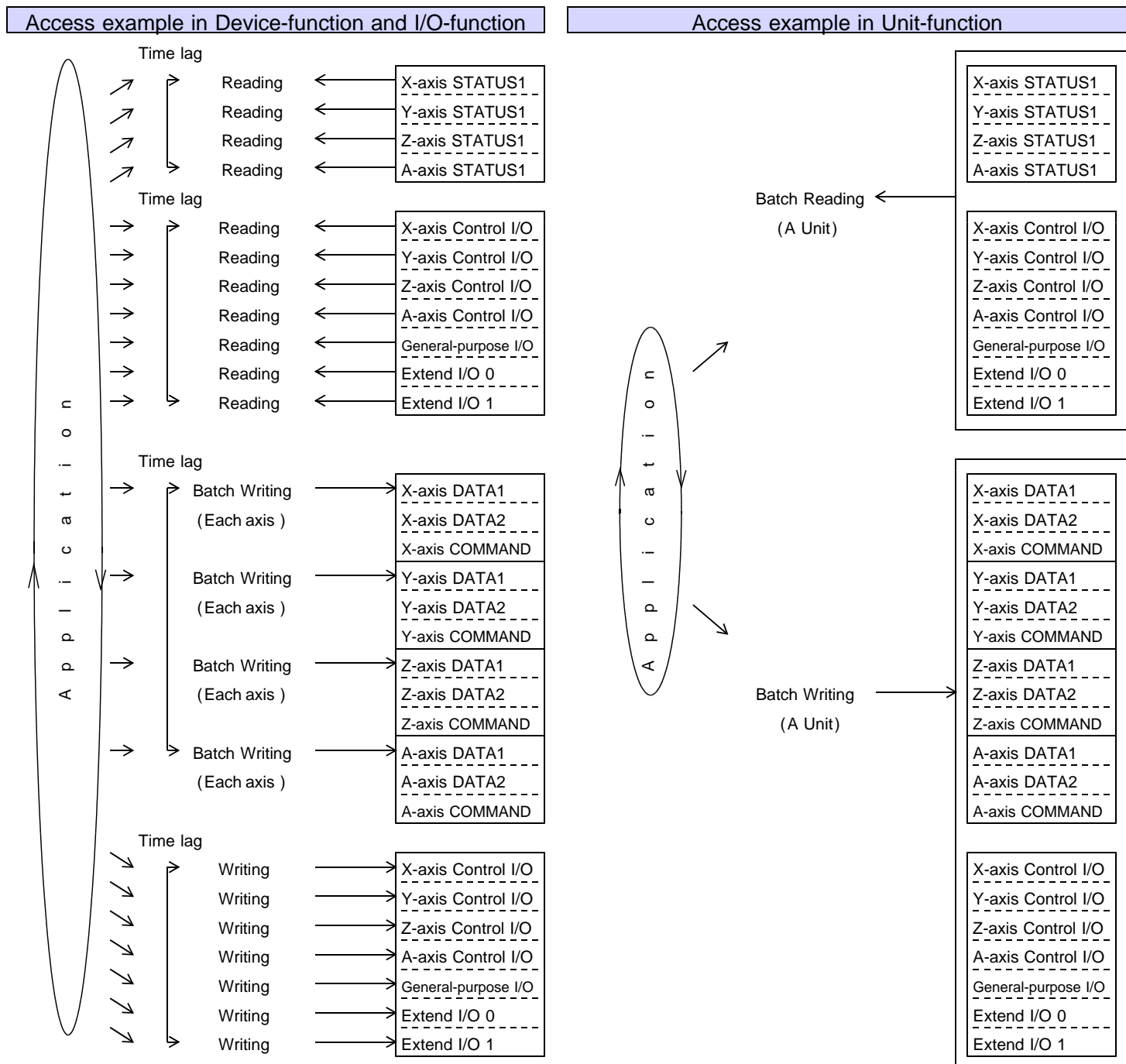
The AL- series is a high speed serial communication system of original controlling the flexible stepping motor, servo motor which can cope easily as well and I/O in the decentralization of the device and supporting axial addition.

- The AL- series is an insulation type high-speed serial communications of 20 Mbps/50 m or 10 Mbps/100 m.
- The wiring for the personal computer system can be omitted with USB of a personal computer general-purpose port.
- The shift of board controller C-VX870 series (Device-function) for PCI made of our company and the USB series (Device-function and Unit-function) is easy depending on the device driver function for Windows.

The status of four axis batch reading and the command of four axis batch execution by the Unit-function is possible. This Unit-function can perform a unit and AL- interface by one function execution from an application.

By this,

- The time crunch can be done compared with accessed Device-function of each axis and I/O-function of each I/O port.
- The Unit-function (writing) suppresses the difference at time until it instructs time each axis and each I/O output signal.
- The Unit-function can reduce the load of the application.
- It supports the Device-function, and can use the Device-function.
- The Unit-function can be used together with the Device-function and the I/O-function.



AL2-02/USB is a master for the AL- series that can do the direct connection to the USB port of PC. The user controls the motor controller and I/O etc. of the AL- series by this master.

- It conforms to USB2.0 (FULL SPEED:12Mbps).
- Shape is small in W24 × H76.1 × D94.4. And, it is a master unit that can be handled like HUB.
- Confirming the operation of each axis of each slave unit and the I/O signal can do immediately without the user program by the USB off-line application software that our company offers.

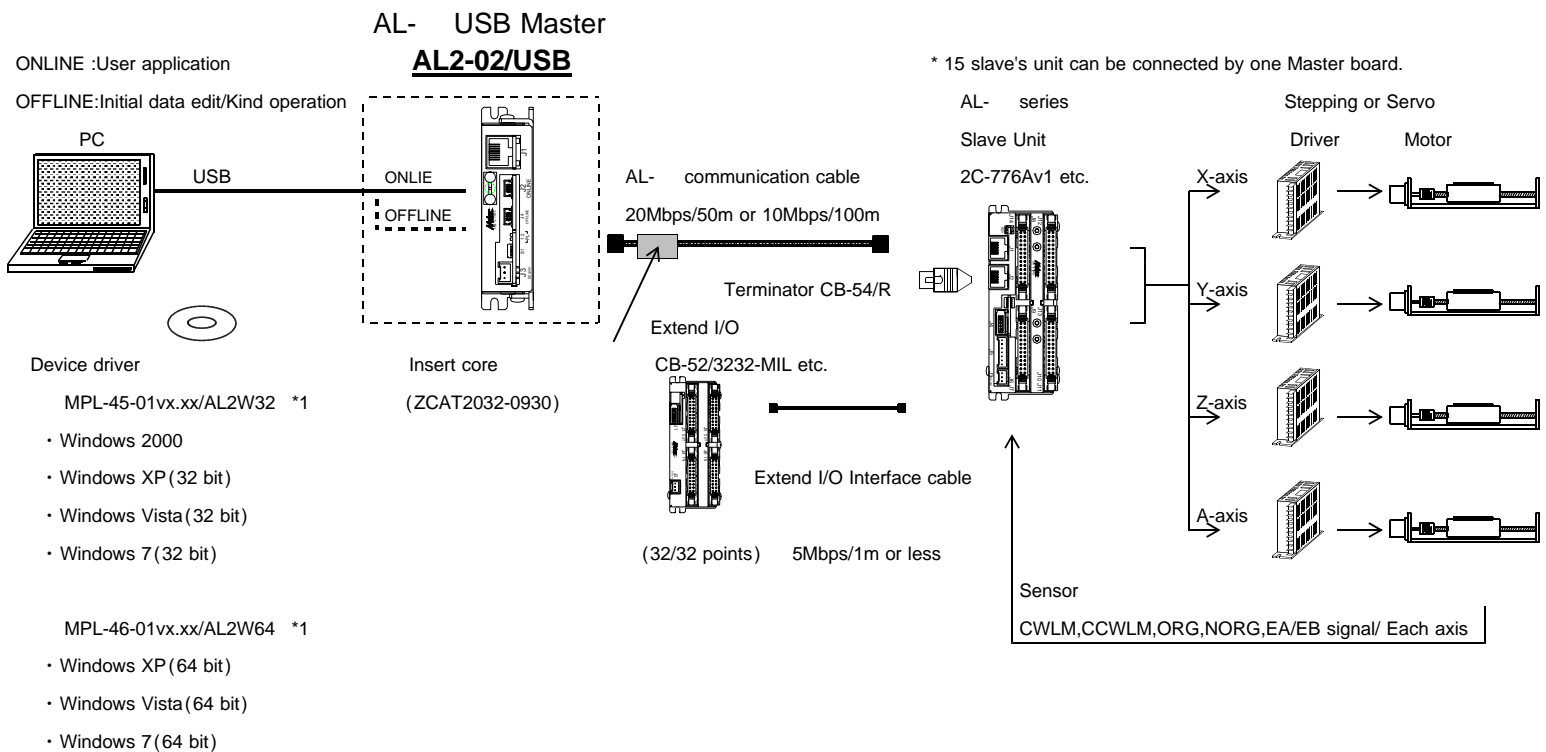
Moreover, the master can back up the setting data of each slave unit.

The setting data that this master backs up can transmit each slave automatically when the Initial-data-transfer-function is executed. Also, it is possible to overwrite data from the user application.

### 1-2. Product configuration

Product name	Rating	Maker	Quantity	Remarks
Master of AL-	AL2-02/USB	Melec Inc.	1	For USB (Main Unit)
Connector	51103-0300	Molex	1	For power supply connector (Accessory)
Contact	50351-8100	Molex	4	(Accessory)








### 1-3. Example of system configuration



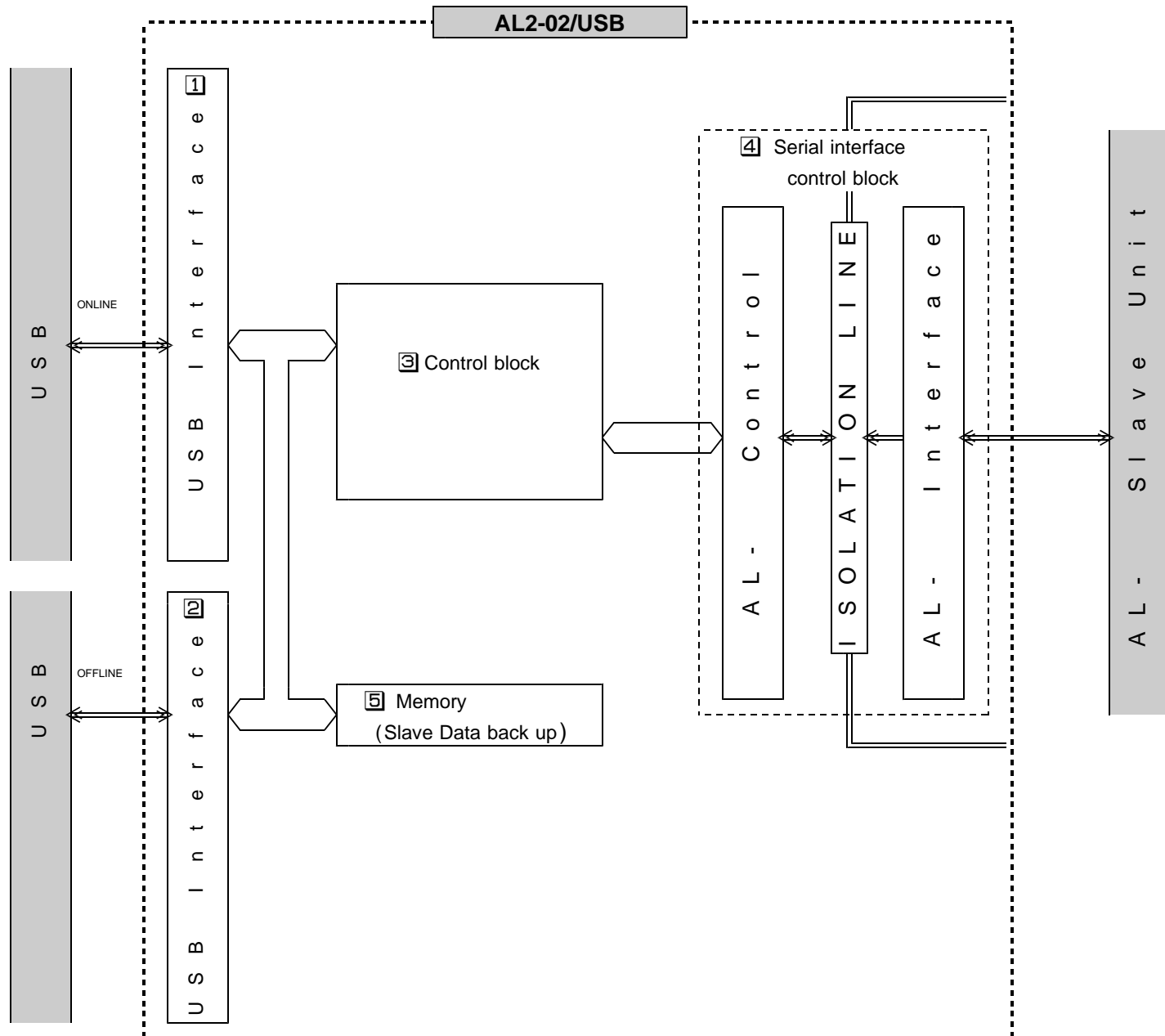
\*1 Version No. ... Please confirm the latest version of vx.xx at the manual of the device driver.

- AL- series prepared connectable cables easily.  
Please refer to the "connection / others" instruction manual for details of connection of the AL- series.

#### Example of other AL- series

Master	Controller	Controller with built-in driver		General-purpose I/O (Extend type and Slave type)		
AL2-01v1/PCI  • Master for PCI	2C-771v1  • 4-axes • For stepping or simple servo	2CD-7710v1/ADB5F30  • 2-axes for 5-phase stepping motor • 0.75 A/phase	2CD-7713v1/GDB5F40  • 2-axes for 5-phase stepping motor • 1.4 A/phase	CB-53/1616-MIL  • Extend type • In: 16-points • Out: 16-points	2CB-01v1/3232-MIL  • Slave type • In: 32-points • Out: 32-points	2CB-02v1/1616-MIL  • Slave type • In: 16-points • Out: 16-points

**1-4. Function block diagram**



**1** ONLINE (USB) interface part

This is an interface block with USB.

ONLINE (USB) is an universal serial bus port used when controlling from the user application.

**2** OFFLINE (USB) interface part

This is an interface block with USB.

Setting and easy operation of each slave can be done by the application software for initialization.

\* ONLINE and OFFLINE cannot be controlled at the same time.

Execute it after stopping the application from ONLINE when you control from OFFLINE.

**3** Control block

This is a control block between USB and the serial communications.

**4** Serial interface control block

This department is control block for AL- serial communication.

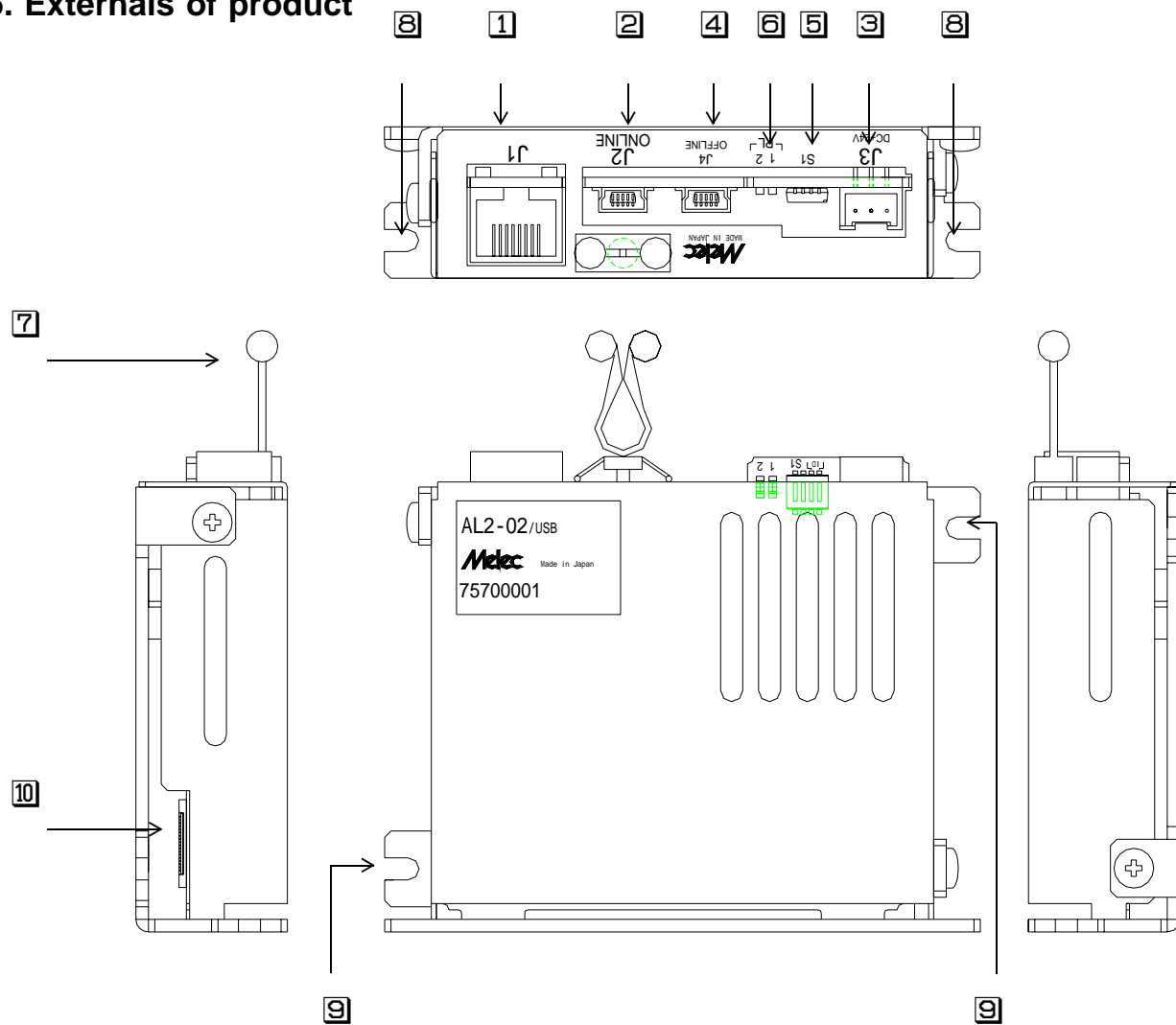
The AL- serial communications interface department is insulated with +24 V power supply and internal power supply of AL2-02/USB.

**5** Memory

The initial data of each slave unit by the application software for initialization is stored on the memory in master.

When the Initial-data-transfer-function is executed, master automatically sets the initial data to each slave unit.

**1-5. Externals of product**



- ① J1 ----- This is a shield connector of the RJ-45 type to connect with the slave unit of the AL- series.  
The terminator of the AL- communication is installing in this master by fixation.
- ② J2 ----- This is a USB connector connected with the personal computer at ONLINE (user application control).  
(mini B type)
- ③ J3 ----- This is a connector connected for power supply +24 V of the main unit.
- ④ J4 ----- This is a USB connector connected with the personal computer at OFFLINE (support application control).  
(mini B type)
- ⑤ S1 ----- This is a dip switch to set for USB to be able to recognize the USB number.  
This switch number must set for it not to overlap when two master are installed in PC.
- ⑥ PL1, PL2 ---- These are LED for the monitor.
  - PL1 (Red) ... This LED lights when master detected abnormality of hard or abnormality of the AL- communication. This display is maintained even if it switches to OFFLINE.
  - PL2 (Green) ... This LED lights when the access from ONLINE is possible.  
This LED is turned off when there is a control right on the OFFLINE side.
- ⑦ Cable clamp - The USB cable pinching by this clamping is prevented from coming off.
- ⑧ Base install -- These are installation hole when the main unit is installed in the vertical direction. (two places)  
-ation part Use the M3 screw.  
Moreover, it is possible to install it in the DIN rail with a exclusive use DIN attachment lug.  
Please refer to the connection/other manual for details.
- ⑨ Base install -- These are an installation hole when the main body is horizontally installed. (two places)  
-ation part Use the M3 screw.
- ⑩ JP1 ----- This is a connector for adjustment of the main unit.  
Do not connect anything.

## 2 . Specifications

### 2-1. General specifications

No.	Item	Specifications
1	Supply voltage	DC +24 V ± 10 %
2	Power consumption	70 mA or less
3	Operating ambient temperature and humidity	<ul style="list-style-type: none"> <li>• 0 ~ + 40</li> <li>• 80 % RH or less (without dew condensation)</li> </ul>
4	Storage temperature and humidity	<ul style="list-style-type: none"> <li>• 0 ~ + 55</li> <li>• 80 % RH or less (without dew condensation)</li> </ul>
5	Installation environment	<ul style="list-style-type: none"> <li>• Inside a well-ventilated cabinet installed indoor, free from direct sunlight.</li> <li>• Not exposed to corrosive and flammable gasses, and not affected by oil mist, dust, salt, iron powder, water, and chemicals.</li> <li>• Not subject to constant vibration or excessive shock.</li> <li>• Not affected by electromagnetic noise caused by power equipment.</li> <li>• Free of radioactive materials and magnetic fields, and not in vacuum.</li> </ul>
6	Dimensions	W24 × H76.1 × D94.4 (mm) <ul style="list-style-type: none"> <li>• Vertical direction installation: pitch 88 (mm), two points</li> <li>• Horizontal direction installation: 88 × 54 (mm), two points</li> </ul>
7	Weight	Approx. 0.15 kg

### 2-2. Communication specifications

No.	Item	Specifications
1	USB interface	<ul style="list-style-type: none"> <li>• Conformity standard : USB2.0</li> <li>• Baud rate : FULL SPEED (12 Mbps)</li> <li>• Wiring distance : 5 m or less</li> <li>• USB connector : mini B type</li> <li>• connection number : 2 unit *1</li> </ul>
2	AL- interface	<ul style="list-style-type: none"> <li>• Conformity standard : RS485 (Insulation type)</li> <li>• Transmission protocol : Protocol for AL- communication</li> <li>• Slave connection number : 1 ~ 15 slave               <ul style="list-style-type: none"> <li>• Master address: H' 0 fixation</li> <li>• Slave address setting range: H' 1 ~ H' F)</li> </ul> </li> <li>• Wiring distance/baud rate : 100 m (10 Mbps) / 50 m (20 Mbps)</li> </ul>

\*1 It is USB connection number of ONLINE sides that can be connected from one PC.  
 Connected number of OFFLINE sides is one.



### 2-3. Master specifications

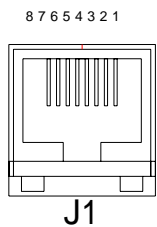
No.	Item	Specifications
1	Connected confirmation of slave	<ul style="list-style-type: none"> <li>• Reading of slave information The slave type connected now can be read.</li> </ul>
2	Error detection of AL-communication	<ul style="list-style-type: none"> <li>• Reading of error total number The error total number detected in the AL- communication after the power supply is turned on can be read. It is possible to use it for the evaluation of the communication environment. When retrying is detected, it counts as an error. The error total number can be counted 65535 times or less. More than it do not update a count.</li> <li>• Clear of error total number The value in which the error total number is counted can be cleared to 0.</li> <li>• Retry It is a function to evade the stagnation of the entire system by retrying it when the influence of the noise etc. is given to AL- communications. The number of retrying is set by an Environment-set-function. When retrying is made effective and the communication abnormality is detected, retrying is automatically executed. The setting of retrying is possible by the range from 0 (non-retry) to 3.</li> </ul>
3	Initialize	<ul style="list-style-type: none"> <li>• Auto transmission of initialization The master carries out initialization for all slaves automatically when user carries out an Environment-set-function to a master.</li> <li>• Interlock When an Environment-set-function is executed from the application, master executes initialization (a request) to each slave. The slave product of the AL- series doesn't accept other requests until the initial-request sent from master is received after the power supply is turned on. When other requests are received, an initial error is returned. As a result, master notifies the application the answer back. When the internal logic on the slave side was reset by the power failure etc. momentarily, operation by the improper data can be stopped. Please execute to master an Environment-set-function, after turning on slave's power supply.</li> </ul>
4	Backup	<ul style="list-style-type: none"> <li>• The backup can easily edit the parameter of each slave from USB by initialization editing software by the OFFLINE, and a master can back up the edited parameter (Initial data). The initial data which a master backs up transmit a message for each slave at the time of the practice of the Initial-data-transmission-function automatically.</li> </ul>
5	ONLINE/OFFLINE Function	<ul style="list-style-type: none"> <li>• As for the master, access are possible from ONLINE (user application) and OFFLINE (support application). The OFFLINE is a adjustment tool to offer the application that the function used USB to enable machine adjustment without the application program development of the user immediately for.</li> </ul>

\* ONLINE and OFFLINE cannot be controlled at the same time.

Execute it after stopping the application from ONLINE when you control from OFFLINE.

\* Please refer to each slave unit manual about the specification of the slave unit executed by master.

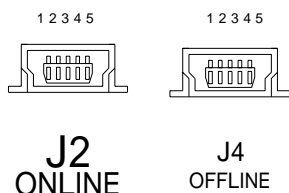
**2-4. Input and output signal table**  
**(1) Serial communication connector(J1)**



Connector :RJ-45(Shield type)  
Recommended cable :KB-STP- L : length (~ 30 m or less)  
(Made by Sanwa Supply: It is not an accessory.)

No.	Direction	Signal name	Description
1	-	N.C	Connection is prohibited.
2	-	N.C	Connection is prohibited.
3	I/O	+AL	+ side input/output signal of the serial data(line driver positive logic)
4	O	+V	Power supply for AL- communication (+6 V)
5	-	-V	GND for AL- communication (0 V)
6	I/O	-AL	- side input/output signal of the serial data (line driver negative logic)
7	-	N.C	Connection is prohibited.
8	-	N.C	Connection is prohibited.

**(2) USB communication connector(for ONLINE: J2, for OFFLINE: J4)**



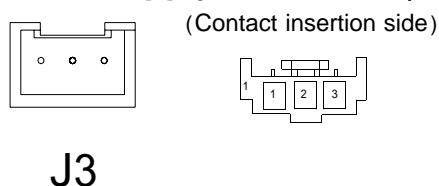
Connector : mini B type  
Recommendation cable: KU-AMB5 : length (~ 5 m or less)  
(Made by Sanwa Supply: It is not an accessory.)

No.	Direction	Signal name	Description
1	-	VCC	USB bus power supply
2	I/O	-DATA	- side input/output signal of USB communication
3	I/O	+DATA	+ side input/output signal of USB communication
4	-	N.C	Connection is prohibited.
5	-	S.G	GND of USB communication

**Reference**

For more information about a cable preparing in the AL- series and a recommended cable, refer to the instruction manual of "connection / others" .

**(3) Power supply connector(J3)**



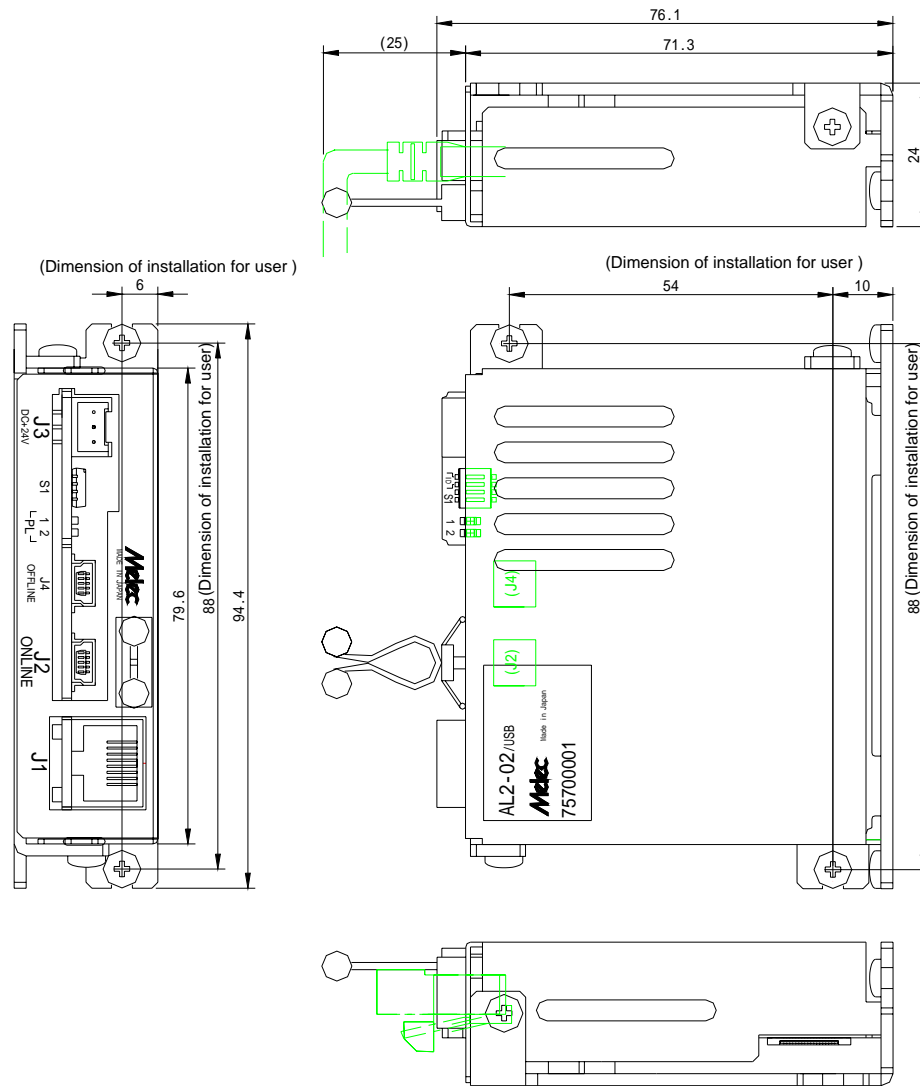
Connector : 53426-0310 (Molex)  
Conformity connector : 51103-0300 (Molex: accessories)  
Conformity contact : 50351-8100 (Molex: accessories)  
Conformity crimp tool : 57295-5000 (Molex)  
Acceptable wire : AWG28 ~ AWG22  
(Coating 1.15 ~ 1.8)  
Conformity cable : CE-76/003C10-51103  
(1 m: It is not an accessories.)

No.	Direction	Signal name	Description
1	I	+24 V	DC +24 V power supply
2	-	GND	GND of +24 V power supply
3	-	F.G	Frame GND is connected with case.

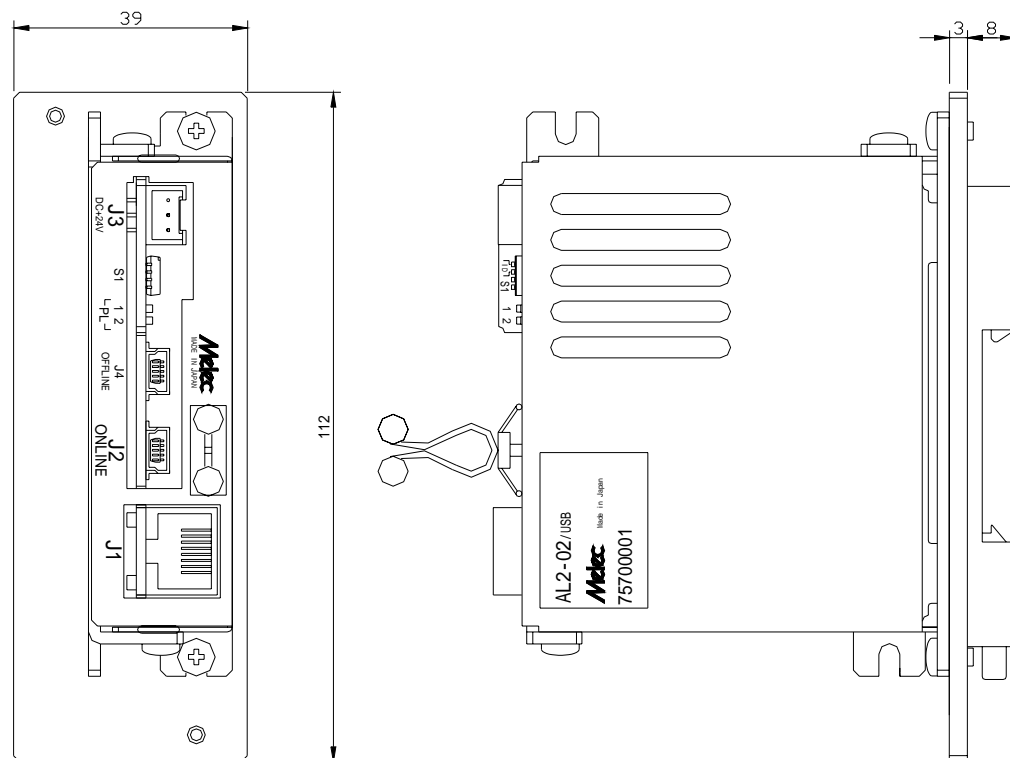
## 2-5. Outside dimensions

General tolerance  $\pm 0.5$  mm or less

Externals tolerance  $\pm 1$  mm or less



When DIN attachment lug (CP-14v1/AT2) is installed.



### 3 . Setting

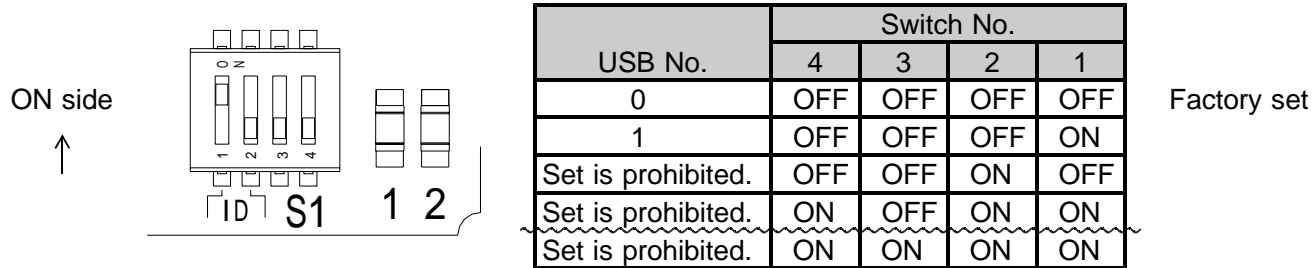
#### 3-1. Setting of USB number (S1)

The USB number of this product is allocated by dip switch S1.

(By default (When the shipment from the factory), the dip switch is USB number 0.)

When the AL2-02/USB are used at one more, assign USB numbers such a way that no numbers are duplicated.

The following figure shows an example in which USB number 1 is assigned.



- When turning on power, the setting of dip switch(S1) becomes effective.  
Set switch while turning off the power supply.  
And, turn on the power supply after the setting change.

#### 3-2. Setting of AL- communication

AL2-02/USB does the following setting of AL- communications by executing Environment-set-function unlike the switch setting done with other slave units.

##### (1) Address setting of the AL- series

The master address is H' 0 fixation.

And, please set not to overlap the address of each slave unit.

##### (2) Baud rate setting of the AL- series

As for the AL- communication baud rate, 10 Mbps/100 m or 20 Mbps/50 m can be selected.

To transmission rate to set in AL2-02/USB, please set the transmission rate of all slave units connected on AL- communication.

##### (3) Retry number setting of the AL- series

The setting of retrying is possible by the range from 0 (non retry) to 3.

The address of the slave unit, the transmission rate setting become effective at the time of power supply injection.

Please turn on the power supply again without fail.

And to the master execute an Environment-set-function after these setting changes.

Please refer to the device driver manual for Windows for details of function specification.

#### 3-3. Setting of Extend Communication


When the Extend-unit is used, the address setting of the Extend-unit and the hard setting of the baud rate setting etc. are unnecessary.

The Extend-unit is controlled by an Extend-unit-communication-set-function and an Extend-unit-communication-control-function.

Please refer to the details of function specifications at a device driver instruction manual for Windows.

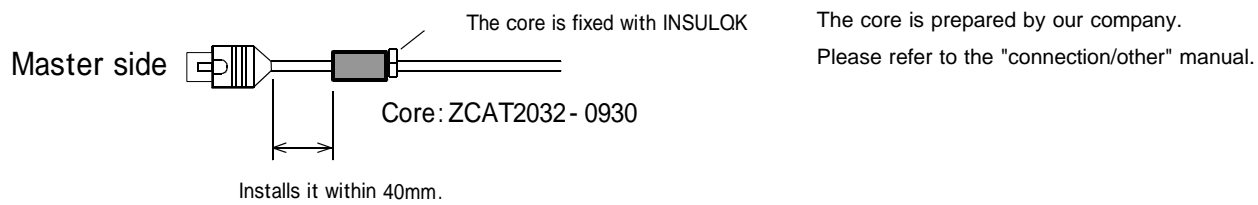
## 4 . Connection

### 4-1. Connection of AL- communication system

 <b>CAUTION</b>	<p>Operation not anticipated may cause damage of the machine and the product.</p> <p>To prevent the malfunction by the noise, the AL- communications cable recommends recommended cable.</p>
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#### (1) Core connection of AL- communications cable

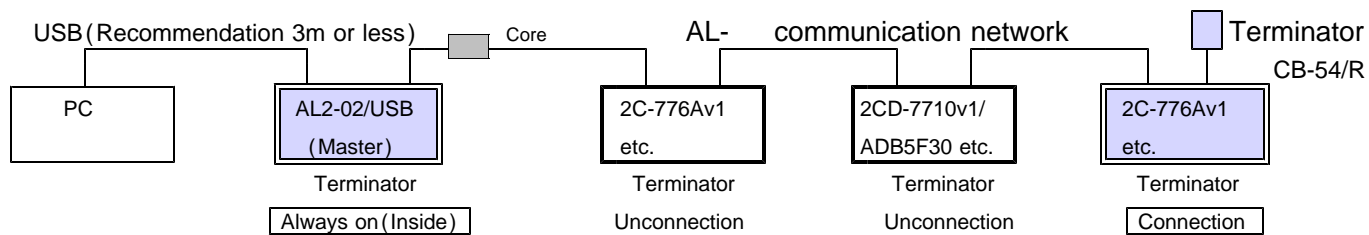
Please install the core in the mastering side. As a result, the personal computer system including AL communications is operated by stability.



#### (2) Connection of terminator

AL2-02/USB mounts the terminator of the AL- communication, is connected, and the setting is unnecessary. It is necessary to install AL2-02/USB to the AL- communication network edge.

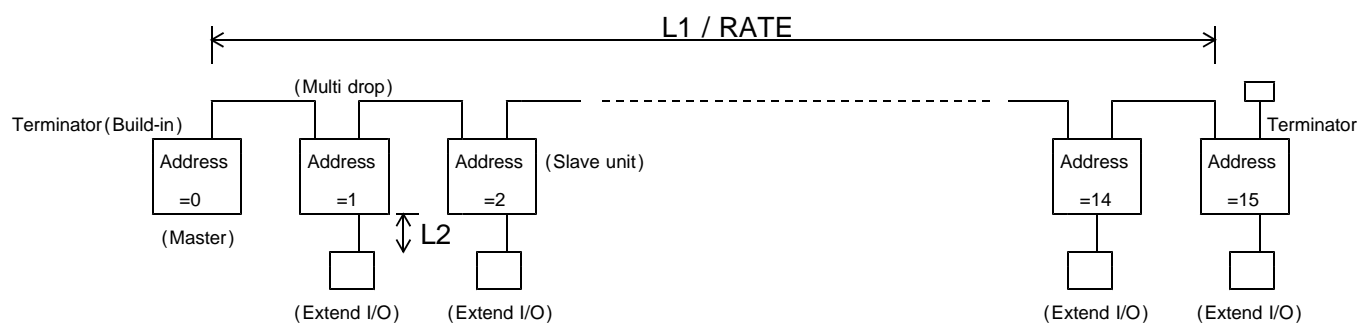
Connect terminator (CB-54/R) with the slave unit arranged on the AL- communication network edge. Do not connect the terminator with other equipment.



#### (3) Wiring distance of AL- communication

The total wiring distance of the AL- communications cable is the following range including the multidrop wiring.

- The USB communications cable is within recommend 3m (max. 5m).
- The wiring distance of Extend I/O doesn't relate to AL- communication baud rate (RATE).
- The wiring distance of Extend I/O from each slave is within 1 m.



AL- communication baud rate and wiring distance

Wiring distance	RATE	
	10 Mbps	20 Mbps
L1 (AL- communication)	100 m or less	50 m or less
L2 (Extend I/O communication)	1 m or less	

The number of slaves that can be connected directly with the AL- communication are 15 units or less. Extend I/O that can be extended directly from the slave unit is not included in the number of slaves.

#### (4) Power supply and slave power supply for communication

The AL- communication power supply of each slave unit is supplied from the AL- master through the communications cable so that the entire AL- communication network should not become unstable when the power supply on each slave unit side is intercepted.

The reconnection of communications can be done by executing Environment-Function to the master when the power supply of the main unit on the slave side is obstructed.

## 5 . OFFLINE

As for AL2-02/USB, the access from ONLINE and OFFLINE is possible.

Confirming the operation of each axis of each slave unit and the I/O signal can do immediately without the user program by the OFFLINE application software that our company offers.

\* ONLINE and OFFLINE cannot be controlled at the same time.

Execute it after stopping the application from ONLINE when you control from OFFLINE.

### 5-1. Support environment of OFFLINE

Item	MAP-19-01vx.xx (Initial data edit software for AL- series)
Support OS	<ul style="list-style-type: none"> <li>• Microsoft Windows 7 (32 bit version)</li> <li>• Microsoft Windows Vista (x86 version)</li> <li>• Microsoft Windows XP (32 bit version)</li> <li>• Microsoft Windows 2000 Professional SP4</li> </ul>
Support model	<ul style="list-style-type: none"> <li>• IBM PC/AT Compatible</li> <li>• DOS/V</li> </ul>
Communication specification	<ul style="list-style-type: none"> <li>• USB 2.0 (FULL SPEED: 12 Mbps)</li> <li>• mini B type</li> </ul>

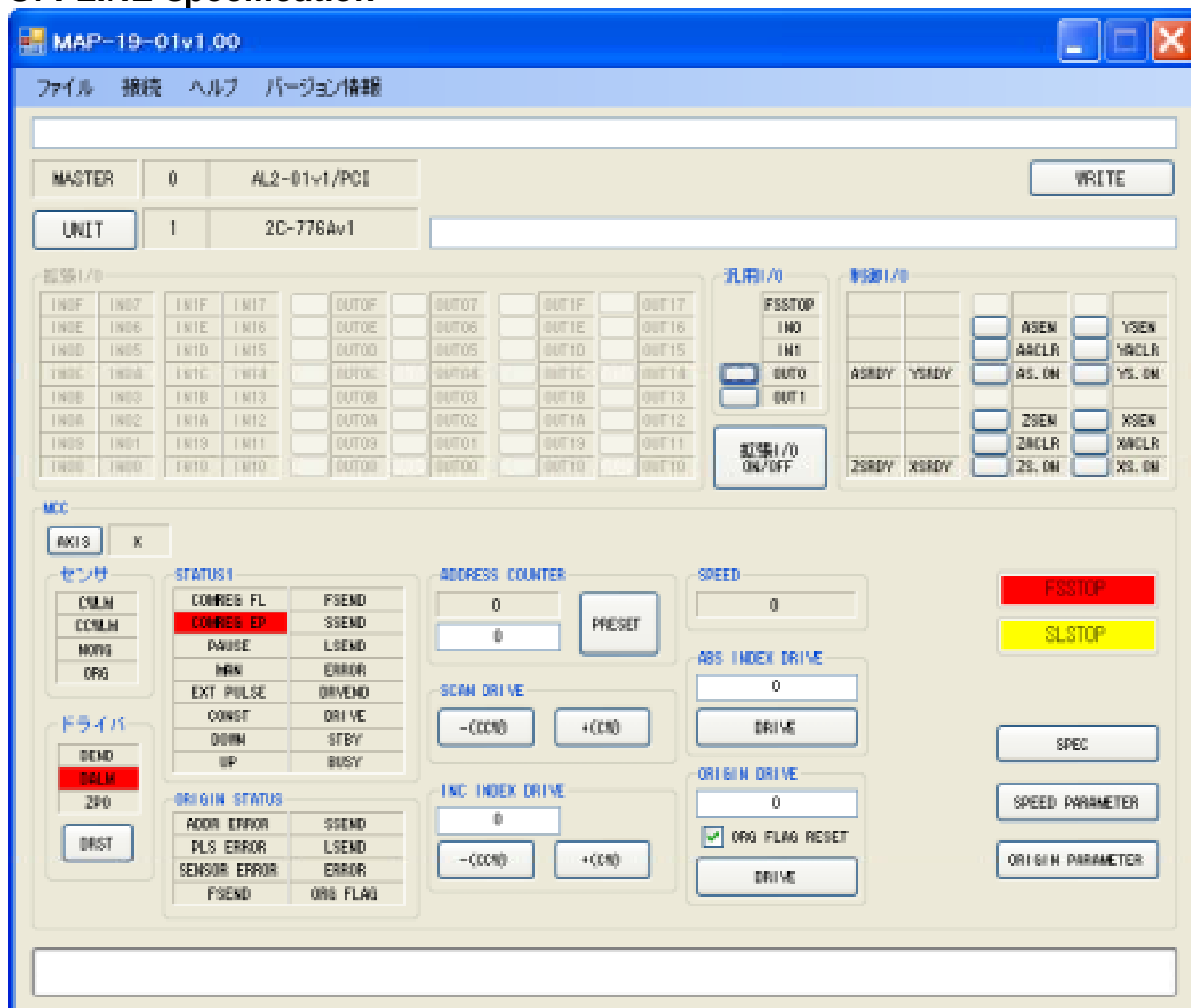
\* The exclusive use USB driver is necessary to operation from OFFLINE with USB.

Install the USB driver attached to device driver MPL-34-01vx.xx/AL2W32 or MPL-35-01vx.xx/AL2W64 for Windows of AL2-02/USB beforehand.

\* Please download initial data edit software MAP-19-01vx.xx being offered from our homepage to the application software for OFFLINE.

\* Version No. ... Please confirm the latest version of vx.xx at the manual of the device driver, and MAP-19 application.

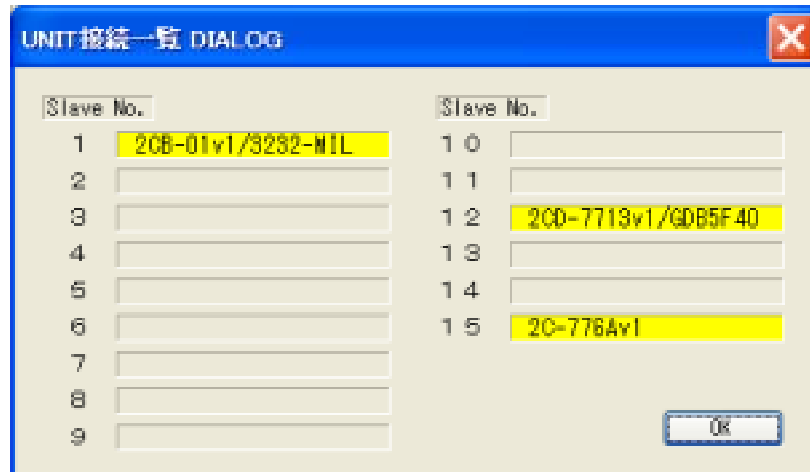
### 5-2. OFFLINE specification



The backup data of master

- The data of the specified file can be written to master.
- It is possible to read out data from the master.  
 Moreover, data can be preserved by .AL2DAT(TEXT) file format.
- Data can be printed.

The connection status of the slave unit connected with master can be confirmed.



When the unit-number is specified, general-purpose I/O and Control I/O of the unit input is displayed. Moreover, the level of the output can be reversed by clicking general-purpose I/O and Control I/O output button.

After the unit-number is specified, the communication of Extend I/O unit can be turned on and off with the ON/OFF button of Extend I/O unit.

- When Extend I/O communication is turned on, Extend I/O input status is displayed.
- The level of the output can be reversed by clicking Extend I/O output button.

When the Extend communication is turned off with the output turned on, the output maintains the current state.

The following can be displayed by specifying the unit and the axis.

- STATUS1 PORT of each axis of unit.
- Value of ADDRESS COUNTER.
- Present speed under output.
- Status of input of sensor.

Each data of specified SPEC INITIALIZE of the axis, SPEED PARAMETER, and ORIGIN PARAMETER is displayed as the data that a present master stores.

It is possible to set it directly to master with each button of SPEC INITIALIZE, SPEED PARAMETER and ORIGIN PARAMETER as backup data of the specified axis.





The axis of the specified unit can execute each drive by clicking each button of ORIGIN DRIVE, SCAN DRIVE, INC INDEX DRIVE, and ABS INDEX DRIVE.

Moreover, the address counter is preset an arbitrary value.

The drive can be stopped with the FSSTOP button (immediate stop) or the SLSTOP button (deceleration stop) while executing the drive.

## 6 . Maintenance

 <b>CAUTION</b>	<p>Incorrect handling may lead to an electric shock.</p> <p>Inspection and maintenance need to be conducted by an expert engineer only.          Before inspecting and maintaining this product, turn off the power.</p>
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 <b>CAUTION</b>	<p>An electric shock, injuries, and fire may be caused.</p> <p>Do not make repair and modification such as product disassembly and parts replacement.</p>
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### 6-1. Maintenance and inspection

#### (1) Cleaning method

To use the product in a favorable condition, conduct cyclic cleaning as follows.

- During the cleaning of the connector terminal plating part, wipe it with a dry, soft cloth.
- If stain is not removed by the dry wiping, soak a cloth in a solution in which neutral detergent is diluted, wring it out, and wipe off the stain with it.
- Do not use a high-volatile solvent such as benzene and thinner, and a wipe.  
 This may deteriorate gold plating by transformation and oxidation.

#### (2) Inspection method

To use the product in a favorable condition, conduct periodic inspection.

Usually conduct the inspection every six months or every year.

To use the product in an extremely hot and humid or dusty environment, shorten the inspection interval.

Inspection item	Inspection details	Criteria	Inspection method
Environment state	Check whether ambient and intra-device temperatures are appropriate.	0 ~ + 40	Thermometer
	Check whether ambient and intra-device humidities are appropriate.	10 % ~ 80 % RH (without dew condensation)	Hygrometer
	Check whether dust is deposited.	No dust	Visual check
Installation state	Check whether the product is firmly secured.	Not loose (6 kg·cm)	Torque wrench
	Check whether connectors are completely inserted.	Not loose and removed	Visual check
	Check whether cables are to be removed.	Not loose and removed	Visual check
	Check whether connecting cables are to be broken.	Appearance is normal.	Visual check

#### (3) Replacement method

If the product becomes faulty, repair it immediately because the entire device system may be affected.

To make the repair smoothly, a spare product should be prepared.

- To prevent an accident such as an electric shock during replacement, stop the device and turn off the power.
- If poor contacting is assumed, wipe contacts with a clean cotton cloth that is wet with industrial alcohol.
- Take a record of switch settings during replacement and return them to their state before the replacement.
- After the replacement, confirm that the new product is normal.
- For the faulty product replaced, have it repaired by returning it to the company with a report indicating as much details on the failure as possible.

### 6-2. Saving and disposal

#### (1) Saving method

Save the product in the following environment.

- Indoor (Place in which the product is not in the path of direct sunlight.)
- Place at ambient temperature and humidity within the specifications.
- Place free of corrosive and inflammable gases.
- Place free of dust, dirt, salt, and iron powder.
- Place free of direct vibration and shock to the product body.
- Place free of water, oil, and chemicals droplets.
- Place where a person cannot ride or put objects on the product.

#### (2) Disposal method

Handle the product as industrial waste.



The main parts which revised by this manual

Parts	Content
None	

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### **Technical Service**

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### **Sales and Service**

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