Melec

AL- Series PCI Master

AL2-01v1/PCI
Instructions Manual
(For designers' use)

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.

Introduction

This instructions manual explains the handling of "AL-　　Series PCI Master AL2-01v1/PCI", 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

<div align="center">Contents</div>   PAGE

The main parts which revised by this manual

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.
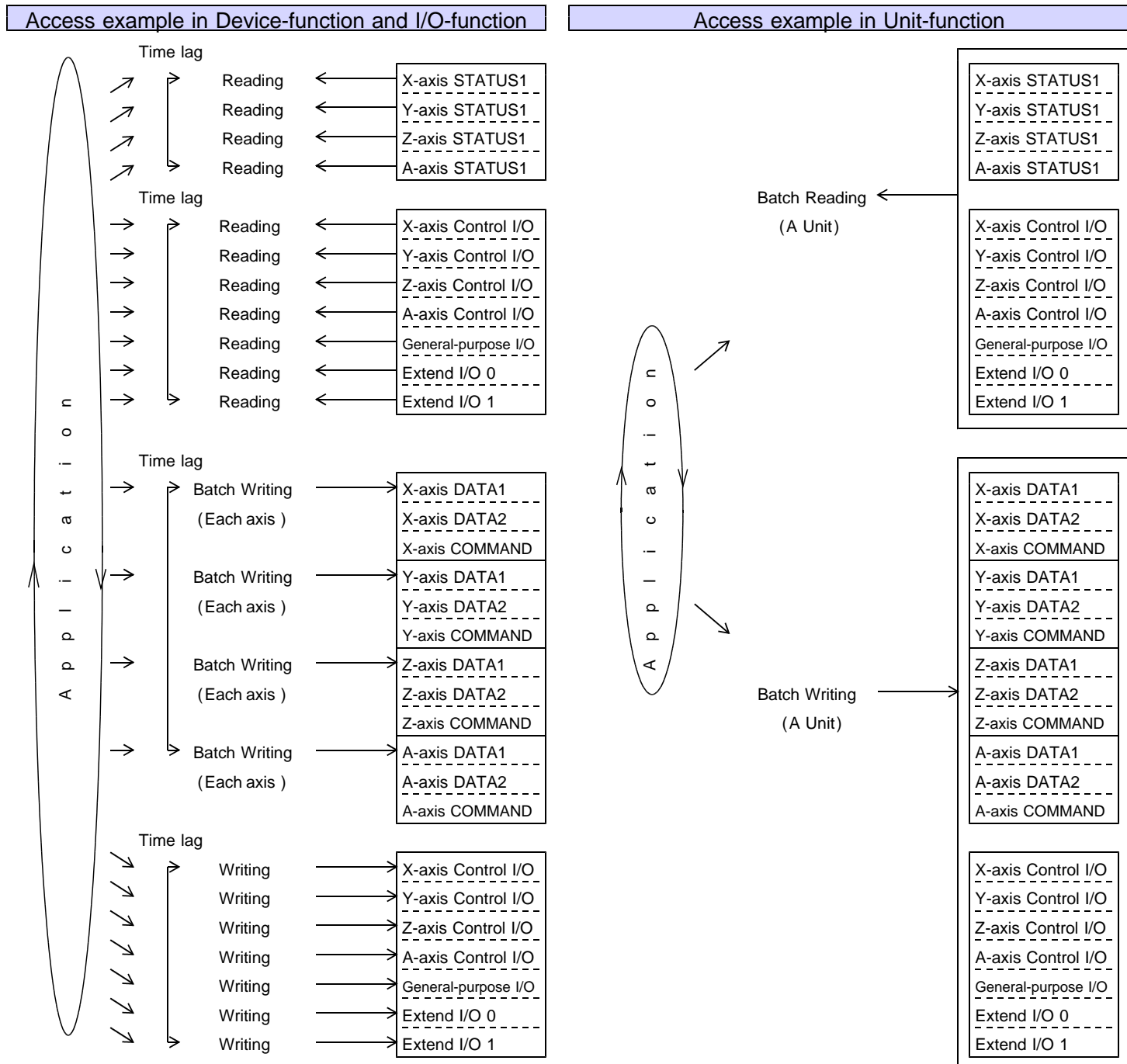
The AL- series is an insulation type high-speed serial communications of 20 Mbps/50 m or 10 Mbps/100 m. As a result, the saving wiring for the personal computer system can be attempted by the performance（ratio of our company）that equals a board controller so far.

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.

AL2-01v1/PCI is a version up product with the AL2-01/PCI upward compatibility.

The status of four axis batch reading and the command of four axis batch execution by the Unit-function became 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.

Access example in Device-function and I/O-function	Access example in Unit-function

Time lag

- Reading ← X-axis STATUS1
- Reading ← Y-axis STATUS1
- Reading ← Z-axis STATUS1
- Reading ← A-axis STATUS1

Time lag

- Reading ← X-axis Control I/O
- Reading ← Y-axis Control I/O
- Reading ← Z-axis Control I/O
- Reading ← A-axis Control I/O
- Reading ← General-purpose I/O
- Reading ← Extend I/O 0
- Reading ← Extend I/O 1

Time lag

- Batch Writing（Each axis）→ X-axis DATA1 / X-axis DATA2 / X-axis COMMAND
- Batch Writing（Each axis）→ Y-axis DATA1 / Y-axis DATA2 / Y-axis COMMAND
- Batch Writing（Each axis）→ Z-axis DATA1 / Z-axis DATA2 / Z-axis COMMAND
- Batch Writing（Each axis）→ A-axis DATA1 / A-axis DATA2 / A-axis COMMAND

Time lag

- Writing → X-axis Control I/O
- Writing → Y-axis Control I/O
- Writing → Z-axis Control I/O
- Writing → A-axis Control I/O
- Writing → General-purpose I/O
- Writing → Extend I/O 0
- Writing → Extend I/O 1

Application

Batch Reading（A Unit）←
- X-axis STATUS1
- Y-axis STATUS1
- Z-axis STATUS1
- A-axis STATUS1

- X-axis Control I/O
- Y-axis Control I/O
- Z-axis Control I/O
- A-axis Control I/O
- General-purpose I/O
- Extend I/O 0
- Extend I/O 1

Batch Writing（A Unit）→
- X-axis DATA1
- X-axis DATA2
- X-axis COMMAND
- Y-axis DATA1
- Y-axis DATA2
- Y-axis COMMAND
- Z-axis DATA1
- Z-axis DATA2
- Z-axis COMMAND
- A-axis DATA1
- A-axis DATA2
- A-axis COMMAND

- X-axis Control I/O
- Y-axis Control I/O
- Z-axis Control I/O
- A-axis Control I/O
- General-purpose I/O
- Extend I/O 0
- Extend I/O 1

AL2-01v1/PCI is a master for the AL- series that can do the direct insertion to the slot of PCI bus.

The user controls the motor controller and I/O etc. of the AL- series by this master.

It conforms to PCI bus specification R2.2.

The shape is universal short card size（140 mm × 60 mm） of a PCI bus standard.

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	
PCI Master	AL2-01v1/PCI	Melec Inc.	1	For PCI bus	（Main Unit）

1-3. Example of system configuration
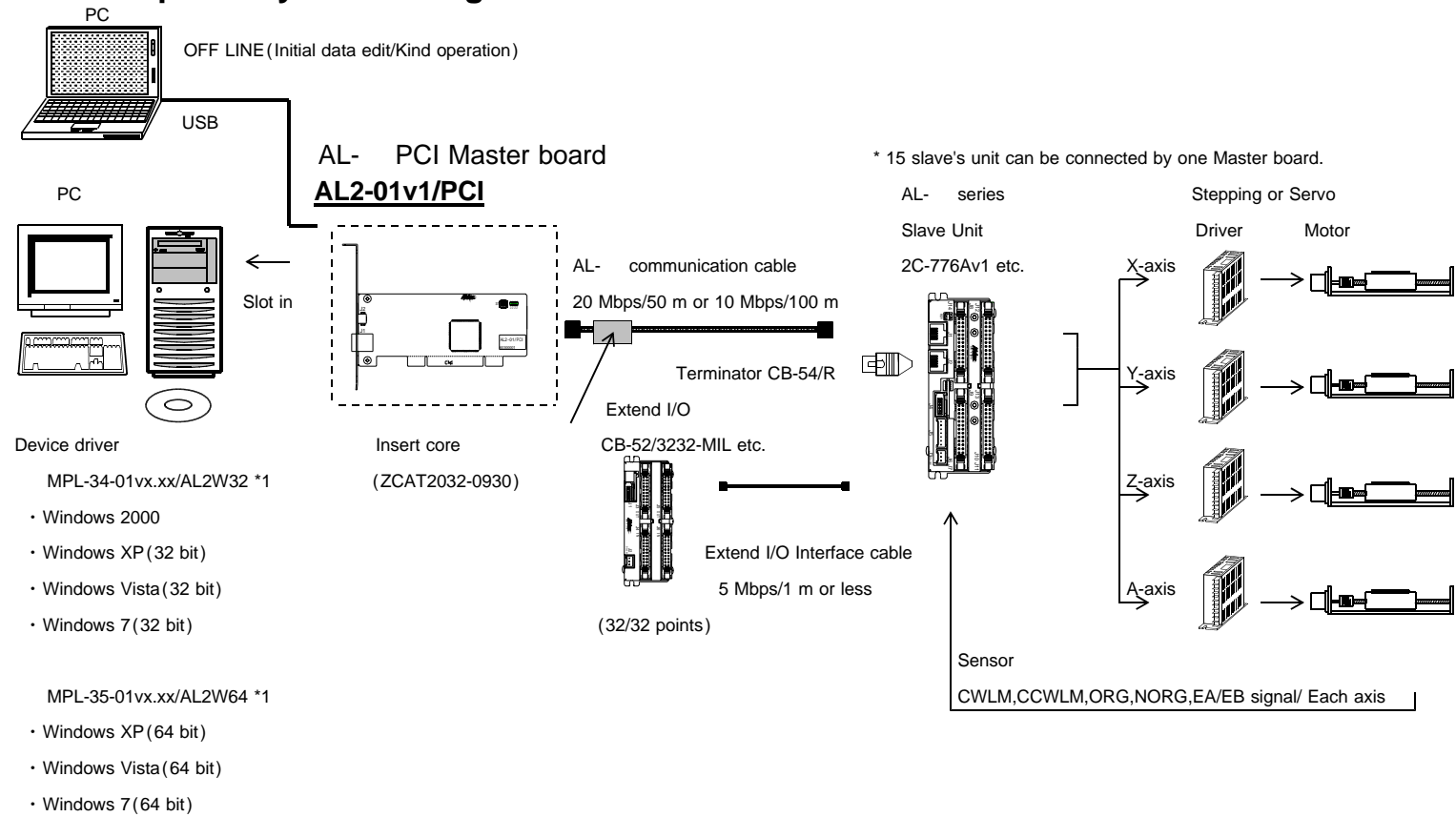
*1 Version No. … Please confirm the latest version of vx.xx at the manual of the device driver.

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 --

Power supply relay board	Controller	Controller with built-in driver		General-purpose I/O （Extend type and Slave type）		
CB-55-01/PS-T35	2C-771v1	2CD-7710v1/ADB5F30	2CD-7713v1/GDB5F40	CB-53/1616-MIL	2CB-01v1/3232-MIL	2CB-02v1/1616-MIL
4-distribution output of DC 24 V 1 A/terminal （3.5 A in total）	4-axes For stepping or simple servo	2-axes for 5-phase stepping motor 0.75 A/phase	2-axes for 5-phase stepping motor 1.4 A/phase	Extend type In: 16-points Out: 16-points	Slave type In: 32-points Out: 32-points	Slave type In: 16-points Out: 16-points

1-4. Function block diagram
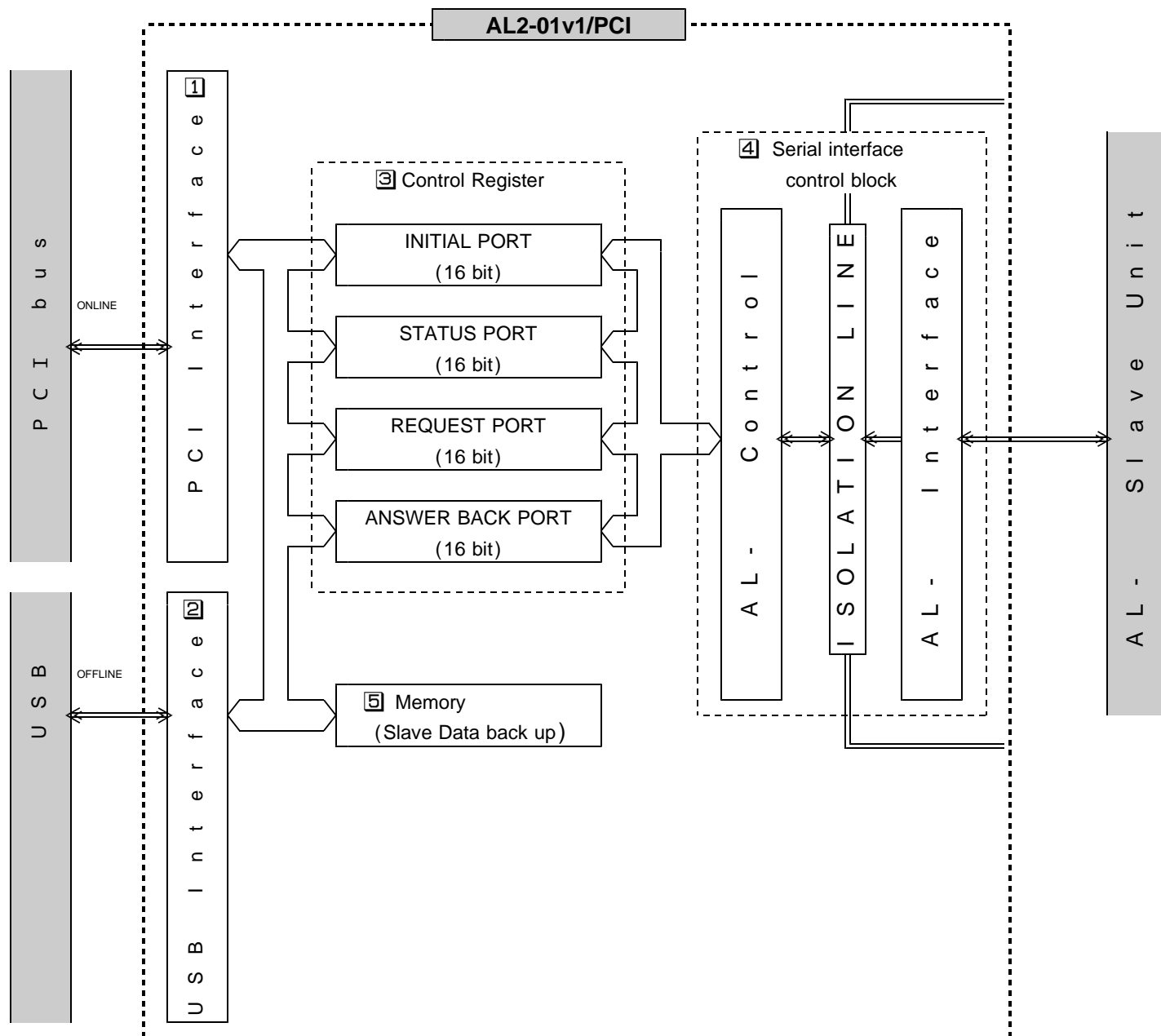
① ONLINE（PCI bus）interface part
  This is an interface block with PCI bus.

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 OFLINE cannot be controlled at the same time.
     Execute it after stopping the application from ONLINE when you control from OFFLINE.

③ Control Register part
  These are register that controls between PCI bus or the USB and the serial communications block.
  When it is used in the Windows device driver environment, this Control Register need not be considered.
   INITIAL PORT   ---------- This is a port to initialize for the master and all slave units.
   STATUS PORT   ---------- This is a port to read the status of master.
   REQUEST PORT   -------- This is a port that demands the function to make the master or the slave unit
                  execute it.
   ANSWER BACK PORT --- This is a port to read the response data from master or the slave unit.

④ Serial interface control block
   This department is control block for AL-   serial communication.
    The AL-   serial communications interface department is internally insulated with the PC power supply.

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
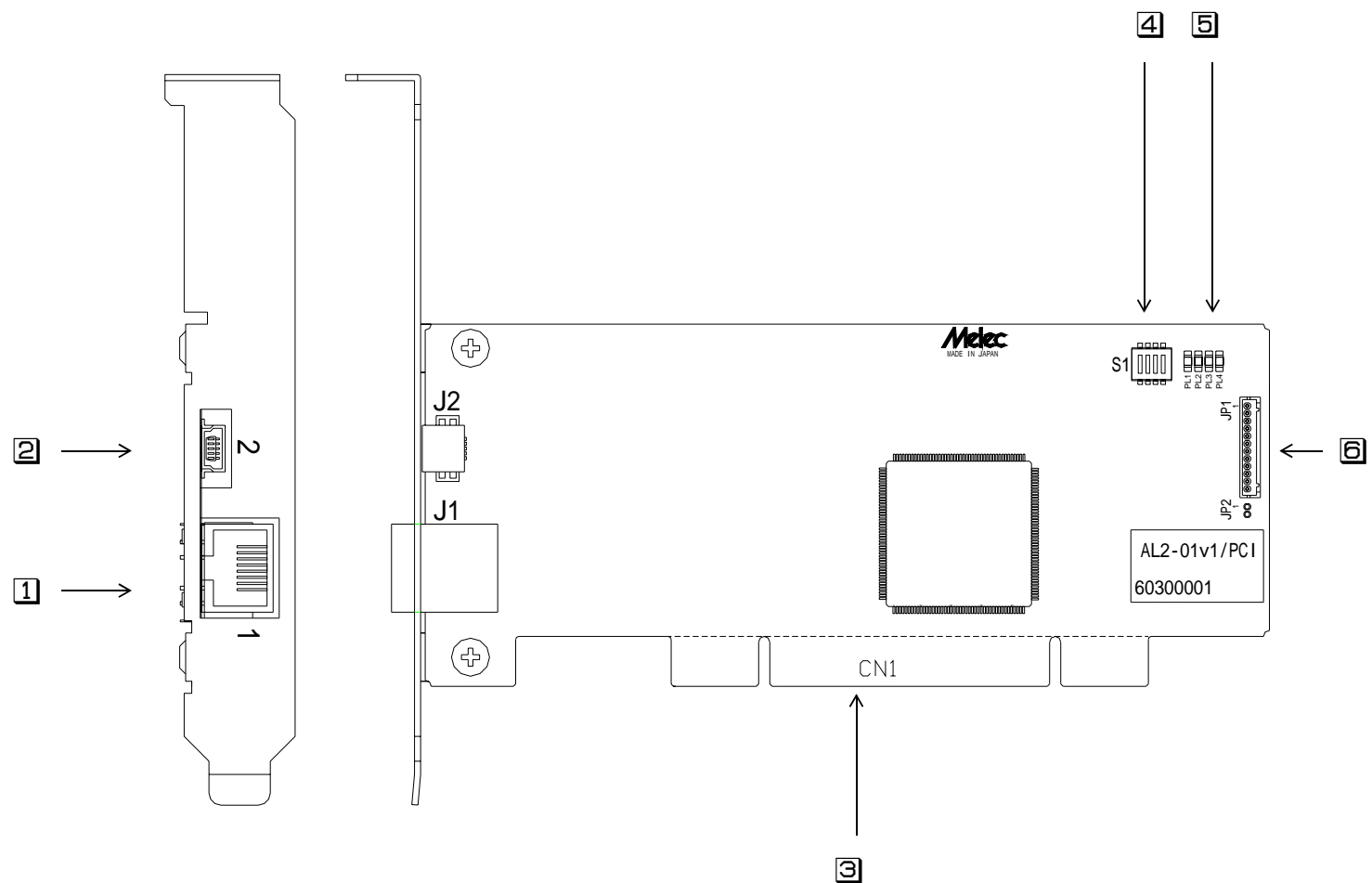
1 J1 ‐‐‐‐‐‐‐‐‐ This is a shield connector of the RJ-45 type to connect with the slave unit of the AL-   series.
The terminator of the AL-   communication is installing in this master by fixation.

2 J2 ‐‐‐‐‐‐‐‐‐ This is USB connector to connect with the PC at OFFLINE. （mini B type）

3 CN1 ‐‐‐‐‐‐‐ This is a board edge connector to insert in the slot of PCI bus. （5 V/3.3 V universal type）

4 S1 ‐‐‐‐‐‐‐‐‐ This is a dip switch to set for PCI to be able to recognize the board number.
This switch number must set for it not to overlap when two master are installed in PC.

5 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（PCI bus）is possible.
　　　　　　　　　　　　　　　　　　　This LED is turned off when there is a control right on the OFFLINE（USB）side.

　　　　　　　　PL3,PL4　　　… It is unused.

6 JP1, JP2 ‐‐‐‐ This is a connector for adjustment of the main unit.
Do not connect anything.

Specifications

2-1. General specifications

No.	Item	Specifications
1	Supply voltage	DC +5 V ± 5
2	Power consumption	1.2 A or less
3	Operating ambient temperature and humidity	0　　　　45 80　　RH or less（without dew condensation）
4	Storage temperature and humidity	0　　　　55 80　　RH or less（without dew condensation）
5	Installation environment	Inside a well-ventilated cabinet installed indoor, free from direct sunlight. Not exposed to corrosive and flammable gasses, and not affected by oil mist, dust, salt, iron powder, water, and chemicals. Not subject to constant vibration or excessive shock. Not affected by electromagnetic noise caused by power equipment. Free of radioactive materials and magnetic fields, and not in vacuum.
6	Dimensions	140 × 60 × 17（mm）：It doesn't contain the attachment lug.
7	Weight	Approx. 0.1 kg

2-2. PCI specifications

No.	Item	Specifications
1	Conforming standard	PCI Local Bus Specification Rev 2.2
2	Bus interface	32 bit bus, 33 MHz clock 5 V/3.3 V signal system（universal） The supply of +5 V power supply is needed from the bus slot.
3	Interrupt	Unused
4	System resource	I/O area: 128 bytes + 256 bytes
5	Number that can be installed	Two pieces

2-3. Communication specifications

No.	Item	Specifications
1	AL-　interface	Conformity standard　　　　: RS485（Insulation type） Transmission protocol　　　: Protocol for AL-　communication Slave connection number　:1　　15 slave（slave address setting range: H' 1　　H' F） Wiring distance/baud rate　: 100 m（10 Mbps）/ 50 m（20 Mbps）
2	USB interface	Conformity standard　　　　: USB2.0 Baud rate　　　　　　　　 : FULL SPEED（12 Mbps） Wiring distance　　　　　　: 5 m or less USB connector　　　　　　 : mini B

2-4. Master specifications

| No.	Item	Specifications
1	Connected confirmation of slave	Reading of slave information The slave type connected now can be read.
2	Error detection of AL-communication	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. Clear of error total number The value in which the error total number is counted can be cleared to 0. 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.
3	Initialize	Auto transmission of initialization The master carries out initialization for all slaves automatically when user carries out an Environment-set-function to a master. 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.
4	Backup	The backup can easily edit the parameter of each slave from USB by initialization editing soft ware 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.
5	ONLINE/OFFLINE Function	As for the master board, access are possible from ONLINE（PCI）and OFFLINE（USB）. 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.

* 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.

2-5. Input and output signal table
(1) Serial communication connector(J1)

1 2 3 4 5 6 7 8
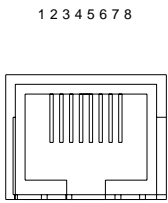
Connector　　　　　　　:RJ-45（Shield type)
Recommended cable　:KB-STP-　　L　　　　: length (　30 m or less)
　　　　　　　　　　　　　　（Made by Sanwa Supply: It is not an accessory.)

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	I	+V	Power supply for AL-　communication (+6 V)
5	I	-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(J2)
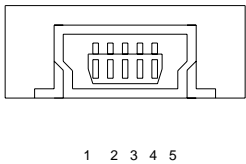
Connector　　　　　　: mini B type
Recommendation cable: KU-AMB5　　　　　　: length (　5 m or less)
　　　　　　　　　　　　　（Made by Sanwa Supply: It is not an accessory.)

1　2　3　4　5

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" .

2-6. Outside dimensions

General tolerance ± 0.5 mm or less
Externals tolerance ± 1 mm or less
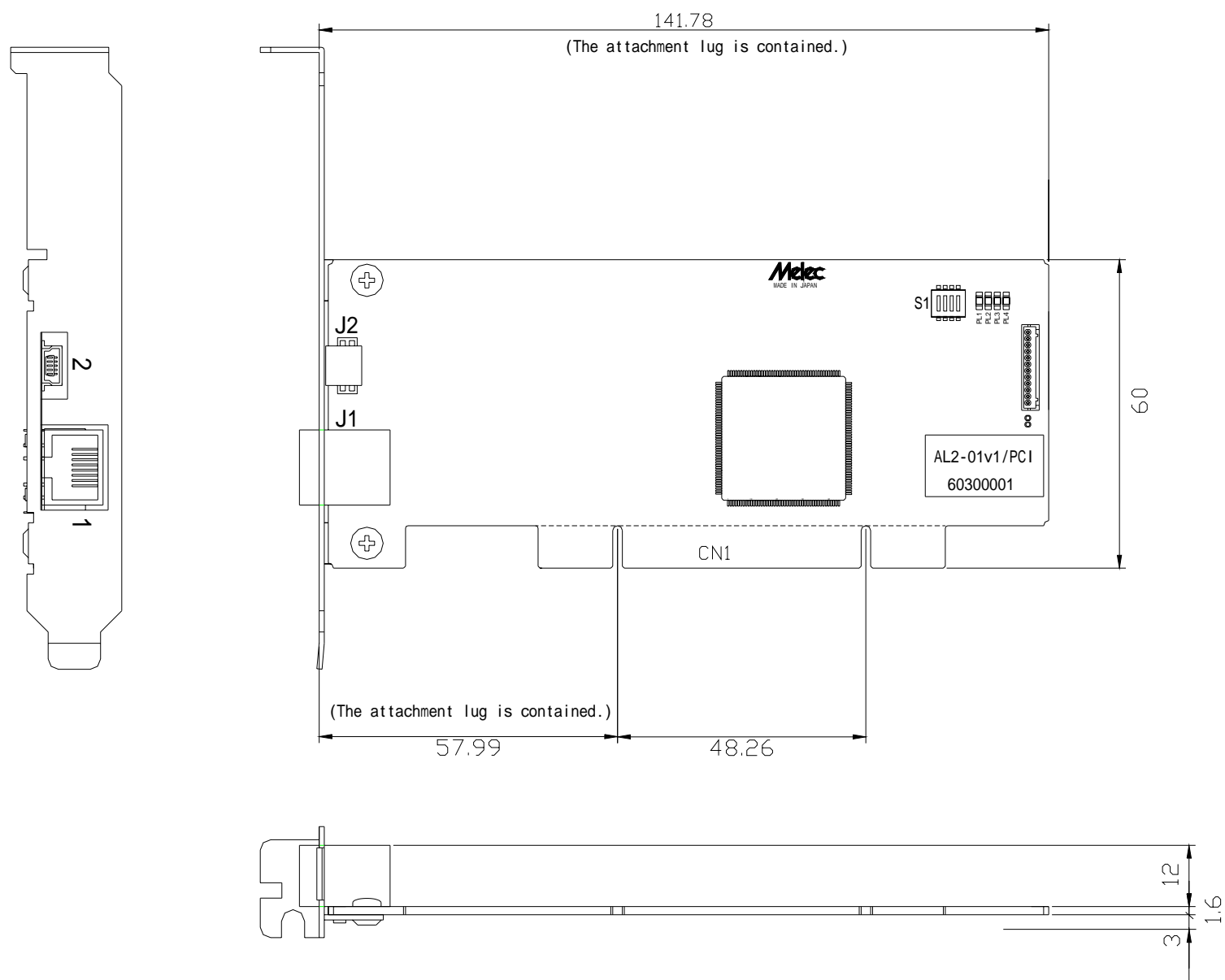
Setting
3-1. Setting of board number (S1)

Before integrating the AL2-01v1/PCI into the PC, set the switch(S1).
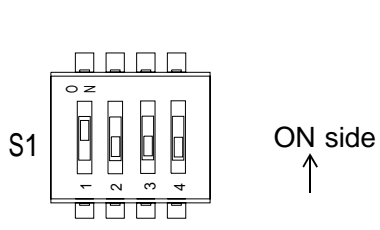(By default (When the shipment from the factory), the dip switch is board number 0.)
When the AL2-01v1/PCI are used at one more, assign board numbers such a way that no numbers are duplicated.
The following figure shows an example in which board number 1 is assigned.

Board No.	Switch No.			
	4	3	2	1
0	OFF	OFF	OFF	OFF
1	OFF	OFF	OFF	ON
Set is prohibited.	OFF	OFF	ON	OFF
Set is prohibited.	ON	OFF	ON	ON
Set is prohibited.	ON	ON	ON	ON

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

AL2-01v1/PCI 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 AL2-01v1/PCI, 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.

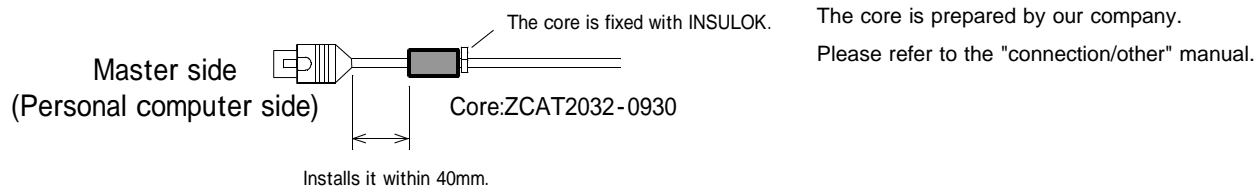## Connection
4-1. Connection of AL-   communication system

⚠ QAUTION	Operation not anticipated may cause damage of the machine and the product. To prevent the malfunction by the noise, the AL- communications cable recommends recommended cable.

（1）Core connection of AL-   communications cable
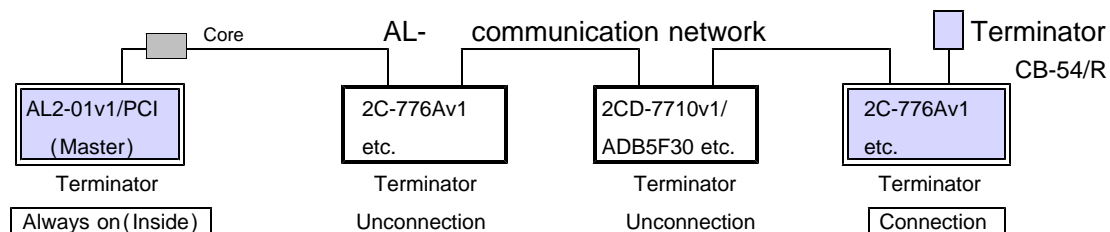
Please install the core in the master side. And, the personal computer system including the AL -   communication is made to operated with stability.

The core is fixed with INSULOK.

Master side
(Personal computer side)

Core:ZCAT2032-0930

Installs it within 40mm.

The core is prepared by our company.
Please refer to the "connection/other" manual.

（2）Connection of terminator

AL2-01v1/PCI mounts the terminator of the AL-   communication, is connected, and the setting is unnecessary.
It is necessary to install AL2-01v1/PCI to the AL-   communication network edge.
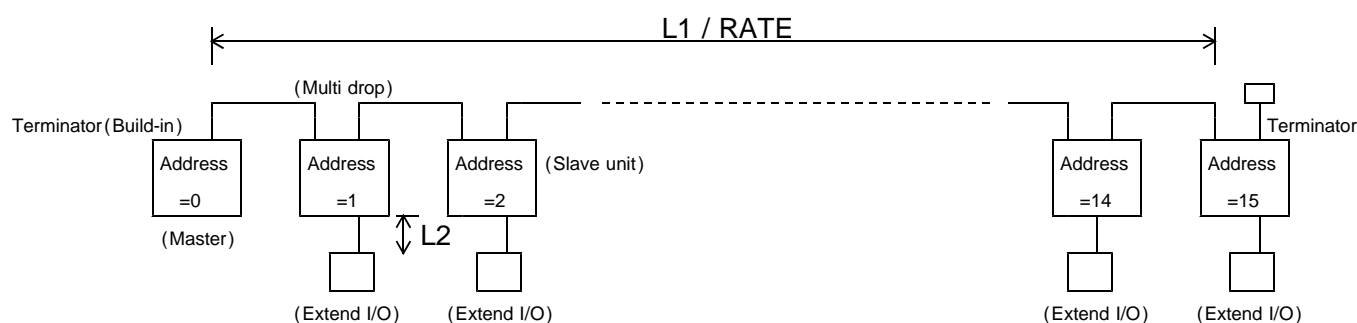Connect terminator（CB-54/R）with the slave unit arranged on the AL-   communication network edge.
Do not connect the terminator with other equipment.

Core   AL-   communication network   Terminator
CB-54/R

AL2-01v1/PCI (Master)	2C-776Av1 etc.	2CD-7710v1/ ADB5F30 etc.	2C-776Av1 etc.
Terminator	Terminator	Terminator	Terminator
Always on（Inside）	Unconnection	Unconnection	Connection

（3）Wiring distance of AL-   communication

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

L1 / RATE

Terminator（Build-in）   (Multi drop)   Terminator

| Address =0 | Address =1 | Address =2 | (Slave unit) | Address =14 | Address =15 |
(Master)   L2

(Extend I/O)   (Extend I/O)   (Extend I/O)   (Extend I/O)

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.

OFFLINE

As for AL2-01v1/PCI, the access from ONLINE（PCI bus）and OFFLINE（USB port）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（USB ）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	Microsoft Windows 7（32 bit version） Microsoft Windows Vista（x86 version） Microsoft Windows XP（32 bit version） Microsoft Windows 2000 Professional SP4
Support model	IBM PC/AT Compatible DOS/V
Communication specification	USB 2.0（FULL SPEED: 12 Mbps） mini B type

* 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 AL2-01v1/PCI 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,
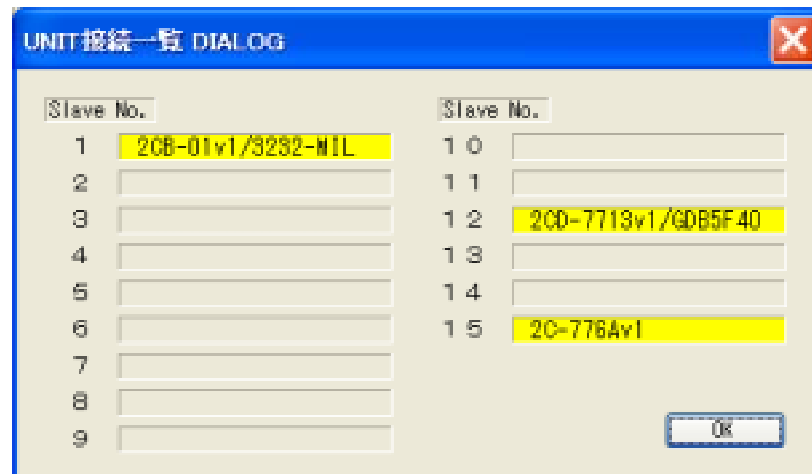 and MAP-19 application.

5-2. OFFLINE specification
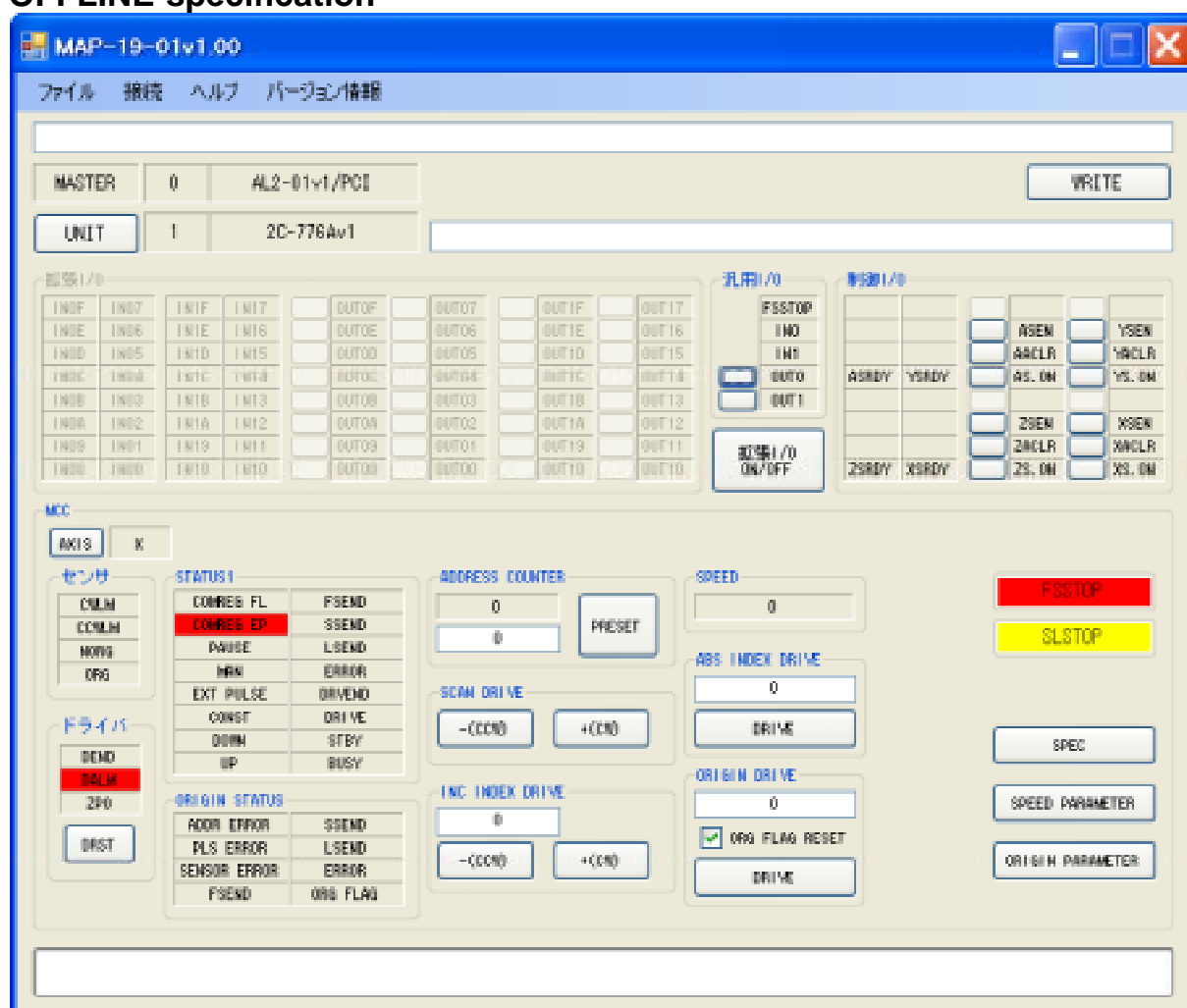
The backup data of master

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.

Maintenance

⚠ QAUTION	Incorrect handling may lead to an electric shock. Inspection and maintenance need to be conducted by an expert engineer only. Before inspecting and maintaining this product, turn off the power.

⚠ QAUTION	An electric shock, injuries, and fire may be caused. Do not make repair and modification such as product disassembly and parts replacement.

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 + 45	Thermometer
	Check whether ambient and intra-device humidifies 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	