High-Resolution Analog Input Board for PCI

AD16-16(PCI)EV

* Specifications, color and design of the products are subject to change without notice.

This product is PCI-compliant interface boards that convert analog input signals to digital data (performing analog-to-digital conversion). This product carries high-capacity buffer memory for 16M data for analog input, allowing background sampling to be performed in a variety of trigger conditions. This product also has one analog output channel, four channels for TTL level digital input, and four channels for TTL level digital output.
This product is the high-precision type that performs A-D conversion at a conversion speed of 10μsec/ch and a resolution of 16-bit.
Windows/Linux driver is supported with this product.

This product is partly improved from the past analog E series; it is an upward-compatible product. Basically, this product can therefore be used in the same way as the analog E series. This product is different in specification from the E series. The difference point is shown in “Differences between past analog E and this product”.

*The contents in this document are subject to change without notice.
*Visit the CONTEC website to check the latest details in the document.
*The information in the data sheets is as of July, 2024.

Features

Resolution : 16-bit, combination speed : 10μsec/ch

This product is the high-precision type that performs A-D conversion at a conversion speed of 10μsec/ch and a resolution of 16-bit.
The product has analog input 16ch, analog output 1ch, digital input/output (TTL level: four each), and a counter (32-bit, TTL level 1ch). In addition, the analog input can be set to single-end input 16ch or differential input 8ch, while the counter is commonly used as the digital input/output.

Equipped with high-capacity buffer memory for 16M data and a variety of sampling control functions

FIFO or RING buffer memory for 16M data, allowing sampling to be performed as a background task independent of the processing power of the PC.
Capable of starting and stopping sampling not only by software commands but depending on the strength of an analog signal (via conversion data comparison) or by detection of a TTL level signal (external trigger).

Sixteen single-ended channels or eight differential channels (Analog input function)

These boards allow either single-ended or differential input mode that is selected with on-board jumpers. The order of channels subject to signal conversion can be preset in the dedicated register. Using an optional unit, a board can increase the maximum number of input channels (up to 32 channels) and perform simultaneous sampling.

Mixed on-board channels for analog output and digital I/O

One channel for analog output, four channels for TTL level digital input, and four channels for TTL level digital output mixed on the board.

Compact PCI short-size board with a wealth of advanced functions Abundant optional units

Providing a variety of options available for extending the functions, including buffer amplifier, simultaneous sampling, insulation & current/thermocouple input, low pass filter, and cables.

Supported to the data logger software [C-LOGGER]

Supporting the data logger software [C-LOGGER] that enables the graph display of recorded signal data, file saving, and dynamic transfer to the spreadsheet software program “Excel”

Plug-ins for the dedicated libraries, the board also supports MATLAB and LabVIEW.

We offer a dedicated library [ML-DAQ], which allows you to use this product on MATLAB by the MathWorks as well as another dedicated library [VI-DAQ], which allows you to use the product on LabVIEW.
These dedicated libraries are available, free of charge (downloadable), on our web site.

Specification

Specification

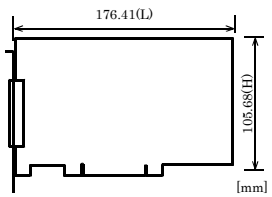
Item	Specification
Analog input	
Isolated specification	Unisolated
Type	Single-Ended Input or Differential Input (Jumper setup)
Number of input channels	16ch (Single-Ended Input) 8ch (Differential Input)
Input range	Bipolar ±10V, ±5V or Unipolar 0 - +10V, 0 - +5V (Jumper setup)
Absolute max. input voltage	±20V
Input impedance	1MΩ or more
Resolution	16-bit
Non-Linearity error *1*2*3	±5LSB
Conversion speed	10μsec/ch (Max.)
Buffer memory	16M data FIFO or 16M data RING (Software setup)
Conversion start trigger	Software/Conversion data compare/External trigger
Conversion stop trigger	Settings include data save complete/conversion data compare/ External trigger/Software
Analog output	
Isolated specification	Unisolated
Number of output channel	1ch
Output range	Bipolar ±10V / Unipolar 0 - +10V (Jumper setup)
Output current ability	±5mA
Output impedance	1Ω or less
Resolution	16-bit
Non- Linearity error *1	±3LSB
Conversion speed	10μsec/ch (Max.)
Digital I/O	
Number of input channels	Unisolated input 4ch (TTL level, A counter control input and common use are possible at a jumper.)
Number of output channels	Unisolated input 4ch (TTL level, Selection of a counter output is possible at a jumper.)
Counter	
Counter device	i8254 equivalent
Counter clock	Internal (4MHz) or External signal
I/O address	Any 32-byte boundary
Interrupt	Errors and various factors, One interrupt request line as INTA
Power consumption *4	+5V 1000 mA (Max.)
Bus specification	32-bit, 33MHz, Universal key shapes supported *5
Bus specification	176.41(L) x 105.68(H)
Interface connectors	
CN1	D-SUB 37-Pin female connector #4-40UNC
CN2	16-pin Pin-header
Weight	150g

*1 When the environment temperature is near 0°C or 50°C, the non-linearity error may become larger.
*2 At the time of the source use of a signal which built in the high-speed operational amplifier.
*3 An error of about 0.02% of the maximum range value may occur with an unisolated bipolar setting of ±5 V or an unisolated unipolar setting of 0 - +5 V.
*4 If an external device requires this AD16-16(PCI)EV board to supply +5VDC from the CN1 or CN2 connectors, the power consumption of this board will be bigger than what this specification has defined. The maximum current supplied by the bus is 3A.
*5 This board requires +5V power supply from expansion slots (it does not operate in the environment of only +3.3V power supply).

Installation Environment Requirements

Item	Specification
Operating ambient temperature	0 - +50°C
Operating ambient humidity	10 - 90%RH (No condensation)
Floating dust particles	Not to be excessive
Corrosive gases	None
Standard	VCCI Class A, FCC Class A, CE Marking (EMC Directive Class A, RoHS Directive), UKCA

Board Dimensions



The standard outside dimension (L) is the distance from the end of the board to the outer surface of the slot cover.

Support Software

Windows version of analog I/O driver API-AIO(WDM)

The API-AIO(WDM) / API-AIO(98/PC) is the Windows version driver library software that provides products in the form of Win32 API functions (DLL). Various sample programs such as Visual Basic and Visual C++, etc and diagnostic program useful for checking operation is provided.
You can download the updated version from the CONTEC's Web site. For more details on the supported OS, applicable language and new information, please visit the CONTEC's Web site.

Linux version of analog I/O driver API-AIO(LNX)

The API-AIO(LNX) is the Linux version driver software which provides device drivers (modules) by shared library and kernel version. Various sample programs of gcc are provided.
You can download the updated version from the CONTEC's Web site. For more details on the supported OS, applicable language and new information, please visit the CONTEC's Web site.

Data Logger Software C-LOGGER

C-LOGGER is a data logger software program compatible with our analog I/O products. This program enables the graph display of recorded signal data, zoom observation, file saving, and dynamic transfer to the spreadsheet software "Excel". No troublesome programming is required.
CONTEC provides download services to supply the updated drivers. For details, refer to the C-LOGGER Users Guide or our website.

Data acquisition VI library for LabVIEW VI-DAQ

This is a VI library to use in National Instruments LabVIEW. VI-DAQ is created with a function form similar to that of LabVIEW's Data Acquisition VI, allowing you to use various devices without complicated settings.
See the CONTEC's Web site details and download of VI-DAQ.

Cable & Connector

Cable (Option)

Flat Cable with 37-Pin D-SUB Connector at One End
: PCA37P-1.5 (1.5m)

Shield Cable with 37-Pin D-SUB Connector at One End
: PCA37PS-0.5P (0.5m)
: PCA37PS-1.5P (1.5m)

Shielded Cable with 37-pin D-SUB connectors at either ends
: PCB37PS-0.5P (0.5m)
: PCB37PS-1.5P (1.5m)

Shielded Cable with Connector on both sides for 15-pin D-Type Connector
: PCB15PS-1.5P (1.5m) *1

Coaxial Cable for Single-ended Inputs (16 channels)
: PCC16PS-1.5 (1.5m)
: PCC16PS-3 (3m)

2 Wires Shielded Cable for Differential Inputs (8 channels)
: PCD8PS-1.5 (1.5m)
: PCD8PS-3 (3m)

Conversion Cable (16-Pin to 15-Pin) with Bracket (150mm)
: DT-E3

*1 For FTP-15 only

Accessories

Accessories (Option)

BNC Terminal Unit (for analog input 16ch)	: ATP-16E *1
Buffer Amplifier Box for Analog Input Boards (16ch type)	: ATBA-16E *1
General Purpose Terminal (M3 x 15P)	: FTP-15 *2
Screw Terminal Unit (M3 x 37P)	: EPD-37A *1 *3
Screw Terminal Unit (M3.5 x 37P)	: EPD-37 *1
General Purpose Terminal (M3 x 37P)	: DTP-3C *1
Screw Terminal (M2.5 x 37P)	: DTP-4C *1
16 Channel Simultaneous Sample & Hold Board	: ATSS-16A *1
8ch- Isolated Expansion Accessory Board for Analog Input	: ATII-8C *1
8ch- Isolated Expansion Accessory Board for Analog Input	: ATII-8A *1
Low Pass Filter Accessory for Analog Input	: ATLF-8A*1
16CH Multiplexer Sub-Board for AD12-16(PCI)EV and AD16-16(PCI)EV	: ATCH-16A(PCI)

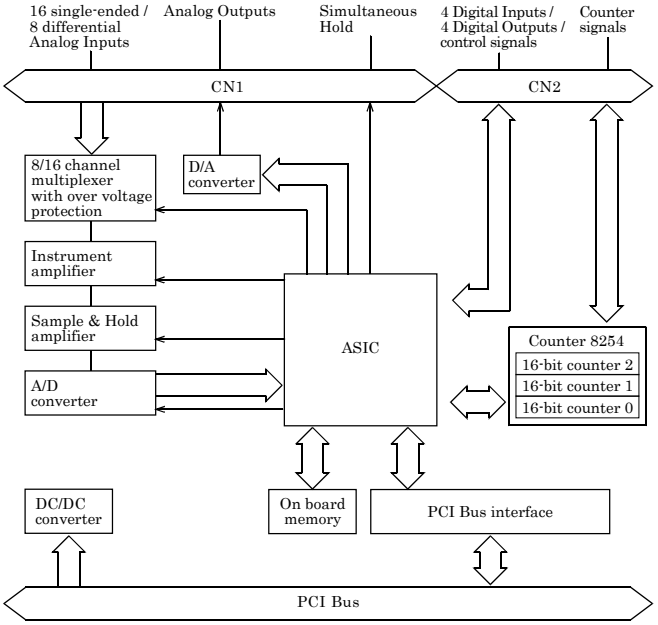
*1 A PCB37PS -*P optional cable is required separately. (0.5m is recommended.)
*2 A DT/E2 and PCB15P-1.5 optional cable is required separately.
*3 "Spring-up" type terminal is used to prevent terminal screws from falling off.

* Check the CONTEC's Web site for more information on these options.

Packing List

Board [AD16-16(PCI)EV] …1
Please read the following … 1

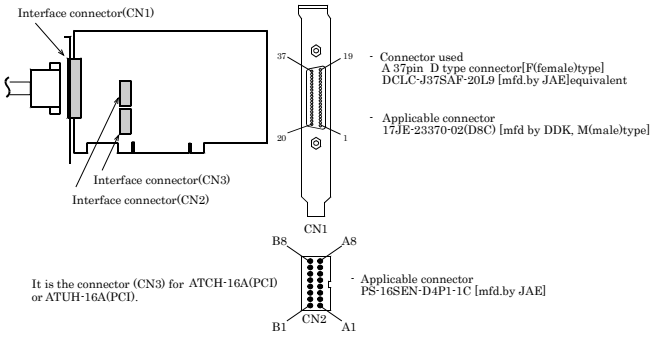
Block Diagram



How to connect the connectors

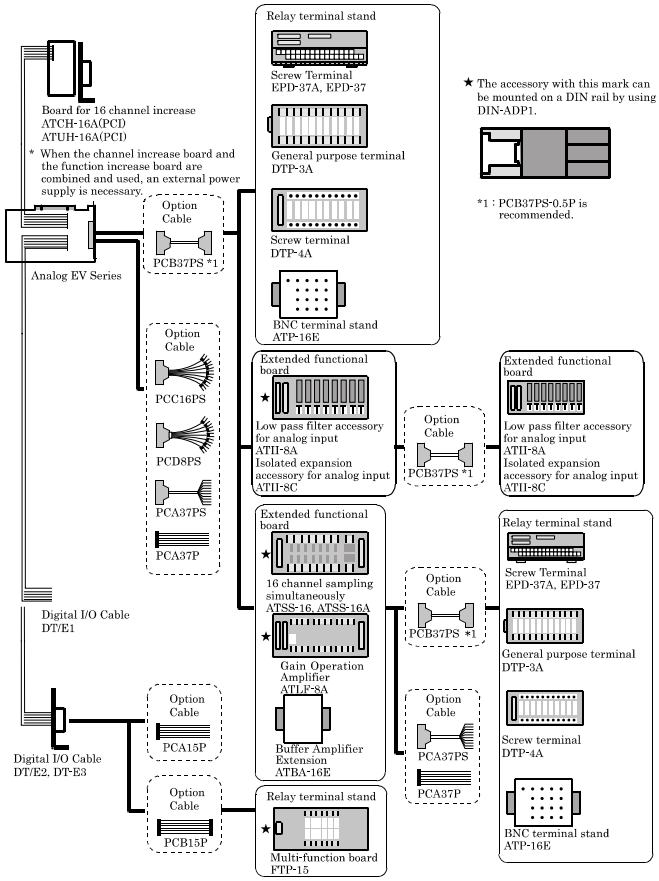
Connector shape

To connect an external device to this board, plug the cable from the device into the interface connector (CN1, CN2) shown below.
The board has two interface connectors: the analog I/O connector (CN1: 37-pin female D-SUB connector) and the control signal connector (CN2: 16-pin pin-header) for digital input/output and counter control.



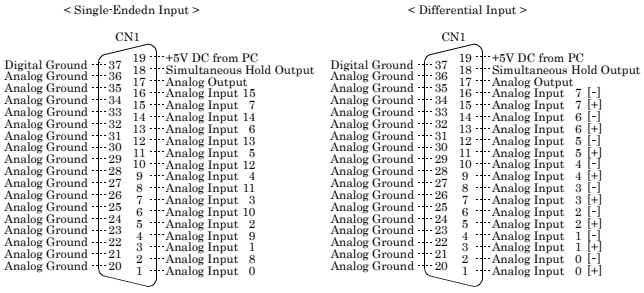
* Please refer to this page for more information on the supported cable and accessories.

Examples of Connecting Options



Connector Pin Assignment

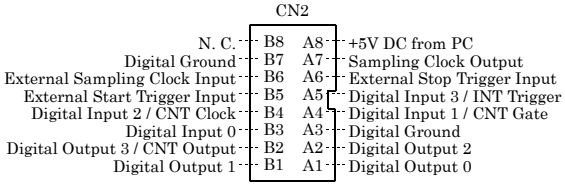
Pin Assignment of CN1



Analog Input 0 - Analog Input 15	Analog input signals in single-ended input mode. The numbers correspond to channel numbers.
Analog Input 0[+] - Analog Input 7[+]	Analog input signals in differential input mode. The numbers correspond to channel numbers.
Analog Input 0[-] - Analog Input 7[-]	Analog input signals in differential input mode. The numbers correspond to channel numbers.
Analog Output	Analog output signal
Analog Ground	Analog ground common to analog I/O signals.
Simultaneous Hold Output	Control signal for simultaneous sampling unit ATSS-16, ATSS-16A available as an option.
+5V DC from PC	Supplies 2A of current at +5 V. The total with CN2 A8 pin should be within 2A.
Digital Ground	Digital ground common to "Simultaneous Hold Output" and "+5V DC from PC".

⚠ CAUTION
- Do not connect any of the outputs and power outputs to the analog or digital ground. Neither connect outputs to each other. Doing either can result in a fault.
- If analog and digital ground are shorted together, noise on the digital signals may affect the analog signals. Accordingly, analog and digital ground should be separated.

Pin Assignment of CN2



Digital Input 0	Digital input signal. The numbers correspond to input bits.
Digital Input 1 /CNT Gate	Digital input signal. Also serving as the counter gate control input signal. The numbers correspond to input bits.
Digital Input 2 /CNT Clock	Digital input signal. Also serving as the clock input signal. The numbers correspond to input bits.
Digital Input 3 /INT Trigger	Digital input signal. Also serving as the interrupt input signal. The numbers correspond to input bits.
Digital Out 0 to Digital Out 2	Digital output signal. The numbers correspond to output bits.
Digital Out 3 to CNT Output	Digital output signal. Capable of being jumper-switched to serve as the counter output signal. The numbers correspond to output bits.
External Start Trigger Input	External trigger input for starting analog input sampling.
External Stop Trigger Input	External trigger input for stopping analog input sampling.
External Sampling Clock Input	External sampling clock input signal for analog input.
Sampling Clock Output	Sampling clock output signal
+5V DC from PC	Supplies 1A of current at +5 V. The total with CN1 19 pin should be within 2A.
Digital Ground	Digital ground common to the digital signals and "+5V DC from PC".
N.C.	No connection to this pin.

⚠ CAUTION
- Do not connect any of the outputs and power outputs to the analog or digital ground. Neither connect outputs to each other. Doing either can result in a fault.
- If analog and digital ground are shorted together, noise on the digital signals may affect the analog signals. Accordingly, analog and digital ground should be separated.

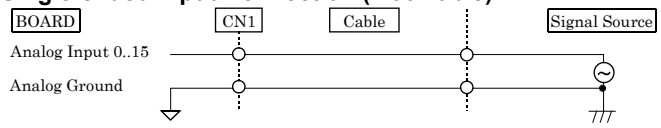
Analog Input Signal Connection

There are two analog input modes: the Single-ended input and the Differential input. Here we give some examples of analog input connections by using flat cable or shield cable.

Single-ended Input

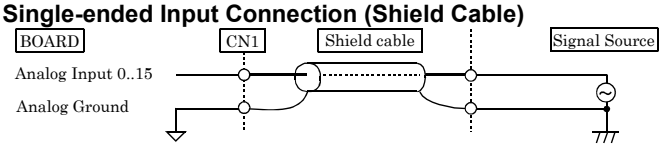
The following figure shows an example of flat cable connection. Each signal source is connected to one analog input channel and the signal common to analog ground pin of CN1.

Single-ended Input Connection (Flat Cable)



The following figure shows an example of shield cable connection. When the distance between the signal source and the board is long or you want to increase the noise tolerance, a shield cable is suggested. Connect the signal by the core wire and common signal by the shield braids.

Single-ended Input Connection (Shield Cable)

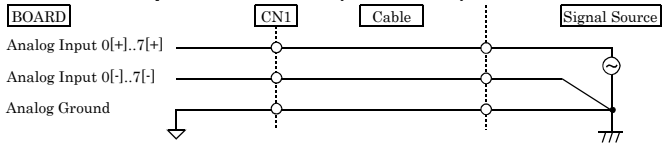


⚠ CAUTION
- If the signal source contains over 100kHz signals, the signal may effect the cross-talk noise between channels.
- If the board and the signal source receive noise or the distance between the board and the signal source is too long, data may not be input properly.
- An input analog signal should not exceed the maximum input voltage (relate to the board analog ground). If it exceeds the maximum voltage, the board may be damaged.
- Connect all the unused analog input channels to analog ground.
- If you use it, make sure that output impedance of input signal source is 50Ω or less. 50Ω or more, recommends you to add ATBA-16E between input signal source and board.

Differential Input

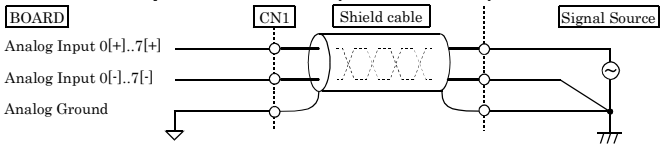
The following figure shows an example of flat cable connection. Each signal source is connected to a [+] pin of analog input channel and the signal common of this source to the [-] pin of this input channel of CN1. In addition, the signal common must be connected to the pin of the analog ground of CN1 by a third wire.

Differential Input Connection (Flat Cable)



The following figure shows an example of 2-wire shielded cable connection. When the distance between the signal source and the board is long or you want to increase the noise tolerance, a shield cable connection is preferred. Each signal source is connected to a [+] pin of analog input channel and the signal common of this source to the [-] pin of this input channel of CN1. In addition, the signal common must be connected to the pin of the analog ground of CN1 by the shielded braids.

Differential Input Connection (Shield Cable)



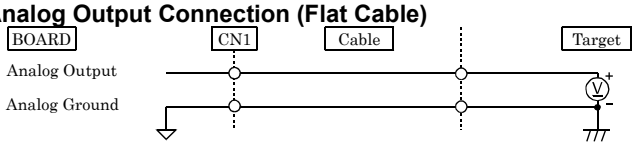
⚠ CAUTION

- If the signal source contains over 100kHz signals, the signal may effect the cross-talk noise between channels.
- The input data would be uncertain if the analog ground is not connected.
- If the board and the signal source receive noise or the distance between the board and the signal source is too long, data may not be input properly.
- The input voltage from the [+] input or [-] input should not exceed the maximum input voltage (based on the board analog ground). If it exceeds the maximum voltage, the board may be damaged.
- Because the input data will be uncertain if the [+] pin or the [-] pin of CN1 is not connected, all the unused input pins of CN1 should be connected to the analog ground, AGND.
- If you use it, make sure that output impedance of input signal source is 50Ω or less. 50Ω or more, recommends you to add ATBA-16E between input signal source and board.

Analog Output Signal Connection

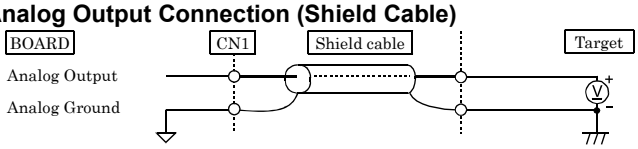
This section shows how to connect the analog output signal by using a flat cable or a shielded cable.
The following figure shows an example of flat cable connection. Connect the signal source and ground to the CN1 analog output.

Analog Output Connection (Flat Cable)



If the distance between the signal source and the board is long or if you want to increase the noise tolerance, a shield cable connection is strongly recommended.

Analog Output Connection (Shield Cable)



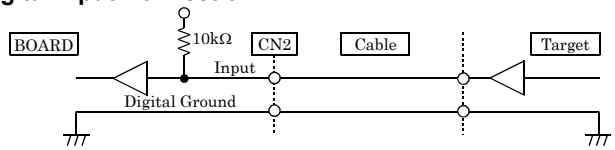
⚠ CAUTION

- If the board or the connected wire receives noise, or the distance between the board and the target is long, data may not be outputted properly.
- For analog output signal, the current capacity is ±5mA (Max.). Check the specification of the connected device before connecting the board.
- Do not short the analog output signal to analog ground, digital ground, and/or power line. Doing so may damage the board.

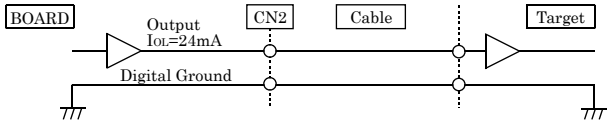
Digital I/O signals and Control signals Connection

The digital I/O signals and the control signals are interfaced through the connector CN2. User can use an optional cable DT/E1 or DT/E2 or DT-E3 (with bracket and a 15-pin D type female connector) to connect these signals to your external devices.
All the digital I/O signals and control signals are TTL level signals.

Digital Input Connection



Digital Output Connection



⚠ CAUTION

Do not short the output signals to analog ground, digital ground, and/or power line. Doing so may damage the board.

Differences between past analog E and this product

This product is a product that partially improves a past analog E series, and the upper compatibility goods of the analog E series. Therefore, the same usage as the E series can be basically done.
There are some differences in specifications as shown below.

Past E Series : AD16-16(PCI)E
This product : AD16-16(PCI)EV

	AD16-16(PCI)E	AD16-16(PCI)EV
I/O address	Any 16-byte boundary	Any 32-byte boundary
Analog input range	Jumper setting	Jumper setting (The setting different from old goods)
Analog output range	Jumper setting	Jumper setting (The setting different from old goods)
Buffer memory *1	256K Word FIFO or 256K Word RING	16M data FIFO or 16M data RING *1
Analog output non-linearity error	±2LSB	±3LSB
Power consumption	+5V 1100mA (Max.)	+5V 1000 mA (Max.)
Interrupt signal resource setting	Set to select whether to use jumper JP12	Automatically set by PC
PCI bus specification	32-bit, 33MHz, 5V key shapes supported	32-bit, 33MHz, Universal key shapes supported
Physical Dimension (mm)	176.41(L) x 106.68(H)	176.41(L) x 105.68(H)

*1 It is necessary to correct the application because the capacity of the buffer memory is different when replacing it from old goods.