MITSUBISHI ELECTRIC

Energy Measuring Unit

Model EMU4-BD1-MB
EMU4-HD1-MB

User's Manual (Digest)

If you are considering using this unit for special purpose such as nuclear power plants, aerospace, medical care or passenger vehiclesplease refer to our sales representative.

・Before using this unit, please read both this manual and Details carefully and pay attention to safety to handle this unit correctly.
・Make sure that the end users read this manual and then keep the manual in a safe place for future reference.

ABOUT MANUALS
You can download User's manual (Details) of this unit from the following site.
http://www.mitsubishielectric.co.jp/haisei/ivs/downloads/handling.htm

1. Features

(1) This Energy Measuring Unit can measure various types of electric quantity such as voltage, current, electric power and electric energy.

(2) The measurement data can also be transmitted to superior monitoring systems through MODBUS® RTU communication.
(3) In addition to the provision for measuring the quantity of electricity, the unit has two external input ports supporting both pulse input and contact input by way of switching (EMU4-HD1-MB).
With pulse input set, you can measure the production volume or the utility other than electricity, such as water, gas and air.
With contact input set, you can monitor status or alarm and measure the operating time of facility or the operating power.

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2. Checking package contents

This following items for this device and included in package. Check that no items are missing.
(1) Energy Measuring Unit x1 (2) User's Manual (Digest) x1

3. Safety Precautions

3.1 Precautions for Operating Environment and Conditions

This unit is premised on being used in pollution degree 2* environment. When used in higher pollution degree, protect this unit from pollution on another device side to be incorporated.
Over voltage category of measuring circuit in this unit is CAT II*, and that of auxiliary power circuit (MA, MB) is CAT II*.
Do not use this product in the places listed below. Failure to follow the instruction may cause malfunctions and a life decrease of product.

・Places the Ambient temperature exceeds the range -5 - +55°C.
・Altitude exceeds 1000m.
・Places in strong electromagnetic field or places large amounts of external noise exist.
・Places exposed to direct sunlight
・Places exposed to rain or water drop.
・Places the average daily temperature exceeds 35°C.
・Dust, corrosive gas, saline and oil smoke exist.
・Vibration and impact exceed the specifications.
・Places metal fragments or conductive substance are flying.
・Places the Relative humidity exceeds the range 30-85% or places with dewfall.

This unit is the open type device, which are designed to be housed within another device for prevention of electric shock. House this unit within the device such as the control panel before use.
For the precautions for the compliance of the system incorporating this unit with the EMC Directives, refer to the User's Manual (Details).
*: For the definition of the pollution degree and the over voltage category, refer to EN61010-1/2010.

3.2 Matters concerning the precaution before use

・Use the unit in the specified usage environment and conditions.
・The setting of this unit (phase system, primary voltage and primary current, sensor type) is necessary before use it. Please refer to User's Manual (Details) about each setting method.

3.3 Installation and Wiring Precautions

Any person who is involved in the installation and the wiring of this unit should be fully competent to do this work.

⚠ Danger	・Shut off the external power supply for the unit in all phases before installing or wiring. Failure to do so may cause an electric shock or damage of this unit.
⚠ Caution	・Work under the electric outage condition when installing and wiring. Failure to do so may cause electric shock, a failure of the unit, a fire etc. ・When tapping or wiring, take care not to entering any foreign objects such as chips and wire pieces into this unit. ・Check the connection diagram when wiring. Wrong wiring may cause failure of the unit, a fire or electric shock. ・For protection against noise, **transmission lines and input/output lines shall not be placed close to or bound together with the power lines and high-voltage lines.** ・Strip the wires with proper length. Overlong stripping length may cause short to next wire. Shorter stripping length may cause contact failure. ・Take care not to short to next terminal by a filament. (Do not plate the wires with solder.) ・Do not connect more than two wires to one terminal of a terminal block for preventing loose contact and wires dropout. ・Use appropriate size of electric wires. If inappropriate size of electric wire is used, it may cause a fire due to generated heat. ・Tighten the screw within the specified torque. Under tightening can cause drop of the screw, short circuit or malfunction. Over tightening can damage the screw and/or unit, resulting in drop, short circuit or malfunction. ・After tightening the screws, be sure to check all the screws tightened. Loose screw may cause malfunction of the unit, a fire or electric shock. ・Be sure to attach the terminal cover to prevent electric shock. ・Use the crimp-type terminal appropriated for the size of electric wires. If inappropriate crimp-type terminal is used, a wire breakage or a contact failure may occur, which may cause a device malfunction, a failure, a burnout or a fire. ・FG terminal must be grounded according to the D-type ground (ground resistance is not exceed 100Ω). High-voltage protective element is mounted between MA and FG, MB and FG. When applied high voltage, for example during a commercial frequency withstand voltage test, protective element works to short between MA and FG, MB and FG. ・Do not directly touch any conductive part of the unit. Doing so can cause electric shock, failure or malfunction of the unit. ・When using this product, make sure to use it in combination with current sensor (EMU-CT50/CT100/CT250/CT400/CT600, EMU2-CT5 and EMU2-CT5-4W).Please not to exceed the rating of this product for input of current sensor. For further details, please refer to current sensor manual to maintain the functionality and the accuracy of this product. ・The dedicated current sensor (EMU-CT50/CT100/CT250/CT400/CT600) is used only for low voltage circuit. It cannot be used for a high voltage circuit. EMU2-CT5 and CT5-4W should be used with the secondary side (5A) of transformer transfixed. If it is connected with a high-voltage circuit by mistake, it may cause a burnout of the device and a fire. It is critically dangerous. For the allowable maximum voltage of current sensor, refer to User's manual (Details) 13 "Option devices" (1) Specifications. ・The dedicated current sensor has a polarity (directionality). Be careful about it when installing the unit. ・The wires to be connected to this unit shall be placed in a duct or fixed together by cramping. If the electric wires are not placed in the duct or cramped together, loosen wires or their movement or careless stretch may cause a breakage of the unit or wire or a malfunction due to poor contact of electric wires. ・If the wires connected to this unit are strongly pulled off, it may cause a malfunction or a breakage to the unit or the wire. ・Do not exceed the specified voltage when doing an insulation resistance test and a commercial frequency withstand voltage test. ・To prevent persons with little knowledge about electric equipment from electric shock, panel must be taken either following measure. Lock the panel so that only those who get an education about electric equipment and have sufficient knowledge can unlock, or shut off power supply automatically by opening the panel. Cover the dangerous part of this unit.

3.4 Precautions for Use

⚠ Caution	・Use this unit within the ratings specified in this manual. If it is used outside the ratings, it may cause not only malfunction or failure but also fire burnout. ・Do not disassemble or modify this unit. It may cause failure, malfunction, injury or fire. ・Do not touch the live part such as connection terminal. It may cause electric shock, electric burn injury or burnout of the device. If any exposed conductor is found, stop the operation immediately, and take an appropriate action such as isolation protection.

3.5 Maintenance Precautions

・Use a soft dry cloth to clean off dirt of the unit surface. Do not let a chemical cloth remain on the surface for an extended period of time nor wipe the surface with thinner or benzene.
・Check for the following items to use this unit properly for long time.
(1) Daily maintenance
(a) No damage on this unit (b) No abnormality with LCD (c) No abnormal noise, smell or heat
(2) Periodical maintenance (Once every 6 months to 1 year)
・No looseness with installation and wire connection

⚠ Caution	Do periodical maintenance under the electric outage condition. Failure to do so may cause electric shock, failure of the unit or a fire. Tighten the terminal regularly to prevent a fire. In case a display unit is attached to a sensor unit, get off the display unit during maintaining or tightening terminals.

3.6 Storage Precautions

To store this unit, turn off the power and remove wires, and put it in a plastic bag.
For long-time storage, avoid the following places. Failure to follow the instruction may cause a failure and reduced life of the unit.

・Places the Ambient temperature exceeds the range -10 - +60°C.
・Places the Relative humidity exceeds the range 30-85% or places with dewfall.
・Dust, corrosive gas, saline and oil smoke exist.
・Places the average daily temperature exceeds 35°C.
・Vibration and impact exceed the specifications.
・Places exposed to rain, water drop or direct sunlight.
・Places metal fragments or conductive substance are flying.

3.7 Disposal Precautions

When disposing of this unit, treat it as industrial waste.

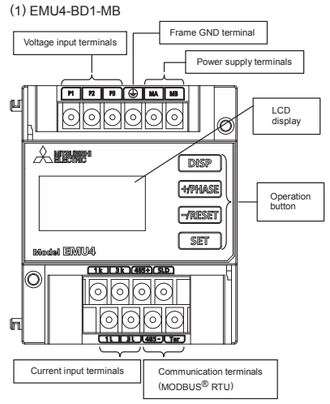
3.8 About packaging materials and this manual

For reduction of environment load, packaging materials are produced with cardboard, and this manual is printed on recycled paper.

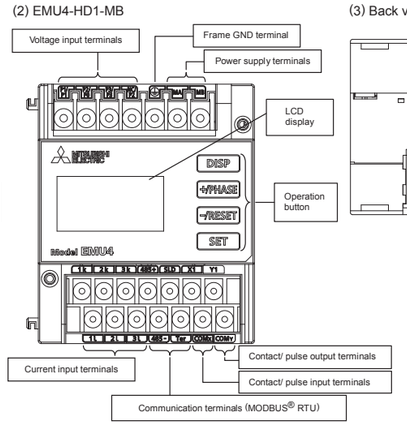
4. Name and function of each part

4.1 Name of each part

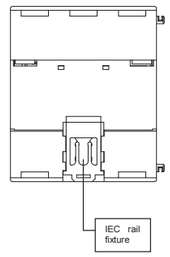
(1) EMU4-BD1-MB



(2) EMU4-HD1-MB



(3) Back view



Names of signals of terminal block (EMU4-BD1-MB)

Terminal symbol	Description
P1、P2、P3	Connect the voltage input wire for the measurement circuit.
⏚	Connect to ground (D type ground).
MA、MB	Connect the auxiliary power supply.
1k、1L、3k、3L	Connect the secondary output of the dedicated current sensor connected to the measurement circuit's current wire.
485+、485-	Connect the communication wire (MODBUS® RTU).
SLD	Connect to ground (D type ground).
Ter	Connect the "485-" terminal (the unit at end of the link).

Names of signals of terminal block (EMU4-HD1-MB)

Terminal symbol	Description
P1/P1、P2/P0、P3/P3、NC/P2	Connect the voltage input wire for the measurement circuit.
⏚	Connect to ground (D type ground).
MA、MB	Connect the auxiliary power supply.
1k、1L、2k、2L、3k、3L	Connect the secondary output of the dedicated current sensor connected to the measurement circuit's current wire.
485+、485-	Connect the communication wire (MODBUS® RTU).
SLD	Connect to ground (D type ground).
Ter	Connect the "485-" terminal (the unit at end of the link).
X1、COMx	Connect the contact/ pulse input wire.
Y1、COMy	Connect the contact/ pulse output wire.

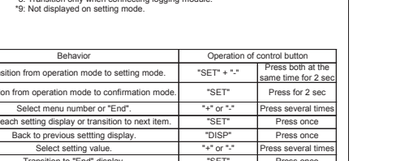
4.2 Functions of operation buttons

Control buttons have many functions as below.

Meaning of symbol: ○ (Press), □ (Press more than 1 sec), ◎ (Press more than 2 sec), - (Press both at the same time)

Mode	Operation	Name of Button SET	-/RESET	+/PHASE	DISP	Event
Operation Mode					○	Change measurement items
				○		Change phase
			○			Change harmonic order (at harmonic display)
			◎			Clear alarm (at alarm generation display with alarm keeping)
		◎				Transition to confirmation mode
		◎	◎			Transition to setting mode
	Contact display		◎			Clear contact latch
	Integrated value display		◎	◎		Transition to preset display
		◎	◎	◎		Transition to reset display of all data
Setting mode / Confirmation mode		○				Enter setting menu
	Menu display		○ (□)	○ (□)		Moving up or down of menu number (Move at fast speed when pressing more than 1sec)
	Setting mode / Setting display	○				Change of setting items (forward) Transition to setting menu number (at final setting item)
			○ (□)	○ (□)		Moving up or down of setting value (Move at fast speed when pressing more than 1sec)
					○	Change setting items (backward) Transition to setting menu number (at beginning setting item)
		□				Back to setting menu
	Confirmation mode / Setting display	○				Change setting items (forward) Transition to setting menu number (at final setting item)
					○	Change setting items (backward) Transition to setting menu number (at beginning setting item)
		□				Transition to setting menu
	Confirmation display of setting reflection	○				At "END" display, memorize changed setting and transition to operation mode At "CANCEL" display, throw away changed setting and transition to operation mode
			○	○		Moving up or down of setting value
		◎			◎	Reset setting values to factory default (only effective at CANCEL display)

4.3 Functions of LCD



No.	Indicator	Description
1	Measured value	Display measured value digitally.
2	Measured item	Display measured item displayed on indicator No.1.
3	Communication	Light when connecting communication unit.
4	Energy Measurement	Light when measuring electric energy (consumption).
5	Setting	Indicator SET lights on setting mode. Indicator SET lights on confirmation mode.

5. Procedures for setting

*1: On confirmation mode, transition to operation mode.
*2: Transition only when selecting "SP" for "Primary current (VT)".
(For 3P4W, only special voltage is available when using VT.)
*3: Transition only when selecting "SP" for "Primary current 15A)".
*4: Setting available for EMU4-HD1-MB only.
*5: Transition only when selecting "CO.P." for "Contact/pulse input on or off".
*6: Transition only when selecting "PLS" for "Contact/pulse output on or off".
*7: Transition only when selecting "on" for "Display CO2 or not".
*8: Transition only when connecting logging module.
*9: Not displayed on setting mode.

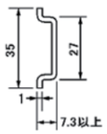
Symbol	Behavior	Operation of control button	
	Transition from operation mode to setting mode.	"SET" + "-"	Press both at the same time for 2 sec
	Transition from operation mode to confirmation mode.	"SET"	Press for 2 sec
	Select menu number or "End".	"+" or "-"	Press several times
	Enter each setting display or transition to next item.	"SET"	Press once
	Back to previous settting display.	"DISP"	Press once
No display	Select setting value.	"+" or "-"	Press several times
	Transition to "End" display.	"SET"	Press once
	Memorize changed setting and transition to operation mode.	"SET"	Press once
	Select "CANCEL".	"+" or "-"	Press once
	Cancel change of setting value.	"SET"	Press once
	Skip other items during setting.	"SET"	Press for 1 sec
	Reset setting values to factory default.	"SET"	Press once

<Note>
For details of setting menu 1, 2, 3, 4, 5 and 6, refer to User's manual (Details).

6. Attachingand removing the unit

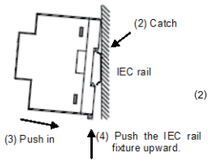
6.1 Mounting on IEC rail

・Applicable IEC rail (35mm)

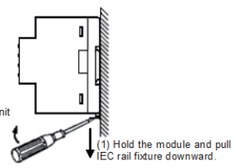


・Mounting

(1) Pull IEC rail fixture downward.



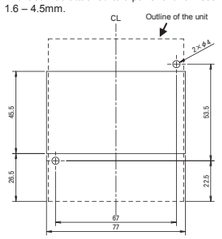
・Removing



6.2 Mounting on the panel

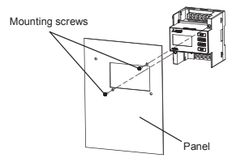
・Dimensions of hole panel

The panel hole dimensions are as shown below. And it can be attached to a panel of thickness 1.6 – 4.5mm.



・Mounting

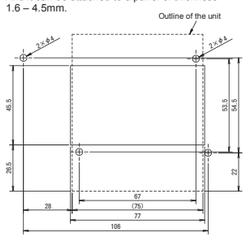
Attached to the panel with screws (2 pcs).
Tightening torque : 0.63N・m



Recommended screws	cross recessed head screw with captive washer and flat washer M3×10 2pcs

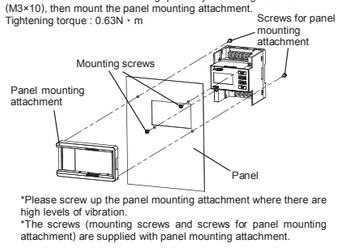
・Dimensions of hole panel

The panel hole dimensions are as shown below. And it can be attached to a panel of thickness 1.6 – 4.5mm.



・Mounting

Mount the module to mounting plate by mounting screws (M3×10), then mount the panel mounting attachment.
Tightening torque : 0.63N・m



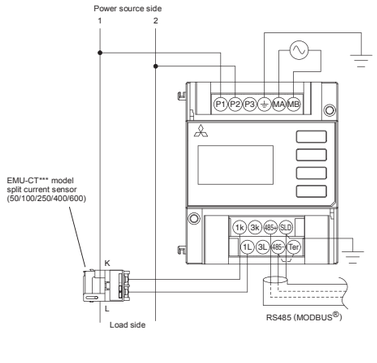
*Please screw up the panel mounting attachment where there are high levels of vibration.
*The screws (mounting screws and screws for panel mounting attachment) are supplied with panel mounting attachment.

7. How to wire

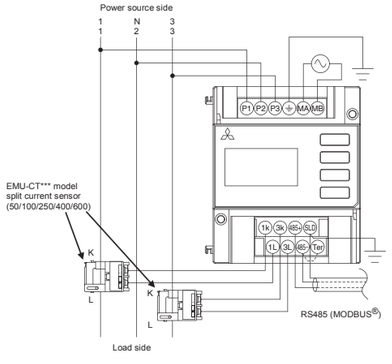
7.1 Wiring

Follow the wiring diagram for external connections of this unit.
When using this unit, current sensor (EMU-CT50/CT100/CT250/CT400/CT600, EMU2-CT5 or EMU2-CT5-4W) is necessary.

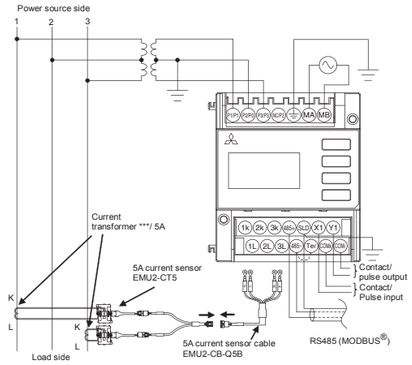
1P2W (for low voltage circuit)



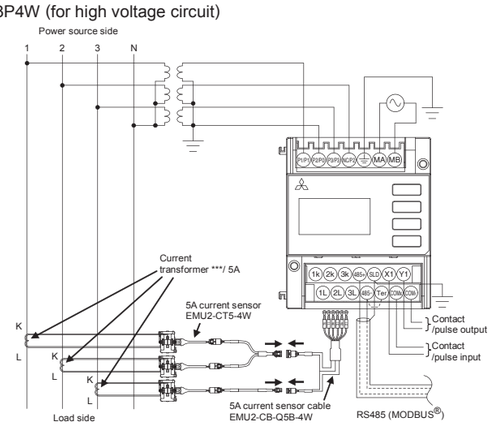
1P3W/3P3W (for low voltage circuit)



3P3W (for high voltage circuit)



3P4W (for high voltage circuit)



⚠ Caution	・For protection against noise, transmission lines and input/output lines shall not be placed close to or bound together with the power lines and high-voltage lines. Keep distance as below between them. (except for the terminal block)

Condition	distance
High-voltage line 600V or less	300mm or longer
Other high-voltage line	600mm or longer

・For the actual usage, connect the FG terminal to ground. (D-type ground: Type 3) Connect it directly to the ground terminal.
・Do not connect to FG terminal during the insulation resistance test and pressure test.

7.2 How to connect wires

・Use appropriate crimp-type terminal.
・Use electric wires as below, and tighten the terminal screws by the torque as below.

【EMU4-BD1-MB】

	Applicable wire	Tightening torque	Recommended crimp-type terminal
Power supply terminals, voltage input terminals	AWG24 - 16 (single wire / stranded wire)	0.8 N・m	For M3 screw of external diameter below 5.6mm
Current input terminals, input/ output terminals	AWG22 - 14 (single wire / stranded wire)	0.5 - 0.6N・m	For M3 screw of external diameter below 5.6mm

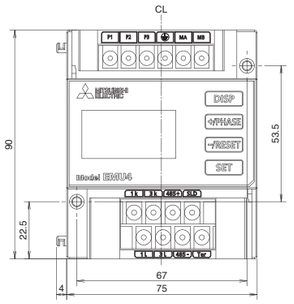
【EMU4-HD1-MB】

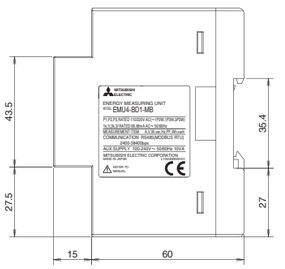
	Applicable wire	Tightening torque	Recommended crimp-type terminal
Power supply terminals, voltage input terminals	AWG26 - 14 (single wire / stranded wire)	0.8 - 1.0 N・m	For M3.5 screw of external diameter below 5.6mm
Current input terminals, input/ output terminals	AWG22 - 14 (single wire / stranded wire)	0.5 - 0.6N・m	For M3 screw of external diameter below 5.6mm

・Make sure that before connecting the cable, the orientation of the current sensor is correct for attachment. K to L is the correct direction.
K: power source side, L: load side
・EMU-CT50/100/250/400/600 is used only for low voltage circuit. (Maximum voltage: 460V) It cannot be used for a high voltage circuit. EMU2-CT5 and EMU2-CT5-4W should be used with the secondary side (5A) of transformer transfixed. If they are used for the circuit directly, they should be used under 200V. (Maximum voltage: 260V)
・Maximum voltage of the circuit connected to this unit directly is 260V for EMU4-BD1-MB, or 277 / 480V for EMU4-HD1-MB. For the circuit over this voltage, use the transformer. Using the transformer, primary voltage is configurable up to 6600V.
・When screwing the terminals at both ends of the terminal block, be careful not to touch the projection of the terminal block cover.
・For MODBUS® communication wiring, recommended to have the extra length wires about 200mm (When extended to B / NET transmission from MODBUS® communication, use of MODBUS® communication wiring is possible).

8. Dimensions

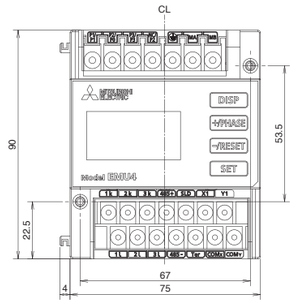
●EMU4-BD1-MB

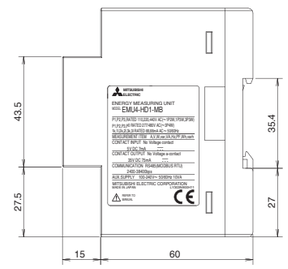




●EMU4-HD1-MB

Unit [mm]





9. Specifications

Item			Specifications	
Model			EMU4-BD1-MB	EMU4-HD1-MB
Phase-wire system			single-phase 2-wire / single-phase 3-wire / three-phase 3-wire	single-phase 2-wire / single-phase 3-wire / three-phase 3-wire / three-phase 4-wire
Measurement item			Electric energy (consumption, regeneration), Current, Current demand, Voltage, Electric power, Electric power demand, Reactive power, Power factor, Frequency, Reactive energy, Operating time	Electric energy (consumption, regeneration), Current, Current demand, Voltage, Electric power, Electric power demand, Reactive power, Apparent power, Power factor, Frequency, Harmonic current, Harmonic voltage, Reactive energy, Periodic electric energy, Pulse count value, Operating time, Equivalent CO_2
Rating	Voltage circuit	single-phase 2-wire, three-phase 3-wire	110V, 220V AC	110V, 220V, 440V AC
		single-phase 3-wire	AC110V (b/w 1- and 2-side, 2- and 3-side), AC220V（b/w 1- and 3-side）	AC110V (b/w 1- and 2-side, 2- and 3-side), AC220V（b/w 1- and 3-side）
		three-phase 4-wire	Non-compliant	Min: AC63.5V/110V, Max: AC277V/480V
	Current circuit		50A, 100A, 250A, 400A, 600A AC (The dedicated split type current sensor is used. Each value refers to the current at the primary side of the current sensor) 5A AC (The dedicated split type current sensor is used. 5A current sensor is used together with the current transformer (CT), and the primary-side current is configurable up to 6000A.)	
	Frequency		50Hz-60Hz	
Auxiliary power supply rating			100-240V AC (+10%, -15%), 50Hz-60Hz	
Measurable circuit count			1 circuit	
External input	Input signal type		None	No voltage a-contact 1 input
	Rated input voltage/current			5V DC 7mA
External output	Output signal type		None	No voltage a-contact 1 output
	Rated open/close voltage/current			35V DC 75mA or 24V AC 75mA（Power factor = 1）
Operating temperature			-5 - +55℃ (Under the conditions indicated in section 3.1)	
Operating humidity			30 - 85%RH (No condensation)	
Storage temperature			-10 - +60℃	
Operating altitude			1000m or below	
Standard			EMC: EN61326-1: 2006 LVD: EN-61010-1: 2010	
Product life expectancy			10 years (Under the conditions indicated in section 3.1)	

10. Warranty

・The charge-free warranty is effective until the earlier of 1 year after the date of your purchase or 18 months after manufacturing. Repair shall be charged for the case failures occur due to your intent or fault even during the charge-free warranty period.
・Our company shall not be liable to compensate for any loss arising from events not attributable to our company, opportunity loss and lost earning of the customer due to failure of the product, and loss, secondary loss, accident compensation, damage to other products besides our products and other operations caused by a special reason regardless of our company's predictability.

⚠ Caution	If an abnormal sound, bad-smelling smoke, fever break out from this unit, switch it off promptly and don't use it

11. Customer Service

Please contact us at the following locations.

1-8 Midori-cho, Fukuyama-shi, Hiroshima, 720-8647, Japan
Phone: +81-84-926-8142