

HITACHI

Basic Manual of Hitachi NE-S1 series inverter

Thank you for purchasing the Hitachi NE-S1 series inverter.

Please read this document and QRG(Quick Reference Guide), and understand perfectly how to handle properly and the safety cautions of the product before operation, for safety and proper usage.

Note that this Manual is intended for each product and should be delivered to the end user of the inverter.

NT341BX

Safety precautions

Be sure to read this Instruction Manual and appended documents thoroughly before installing, operating the inverter.

Maintenance and service items in this manual are only caution related items. Read QRG (Quick Reference Guide) carefully before starting the maintenance and service. (QRG can be downloaded from our website.)

In the Instruction Manual, safety instructions are classified into two levels, namely WARNING and CAUTION.

 **WARNING** : Indicates that incorrect handling may cause hazardous situations, which may result in serious personal injury or death.

 **CAUTION** : Indicates that incorrect handling may cause hazardous situations, which may result in moderate or slight personal injury or physical damage alone.

Note that even a  **CAUTION** level situation may lead to a serious consequence according to circumstances. Be sure to follow every safety instruction, which contains important safety information. Also focus on and observe the items and instructions described under "Notes" in the text.

CAUTION

Many of the drawings in the Instruction Manual show the inverter with covers and/or parts blocking your view being removed. Do not operate the inverter in the status shown in those drawings. If you have removed the covers and/or parts, be sure to reinstall them in their original positions before starting operation, and follow all instructions in the Instruction Manual when operating the inverter.

1. Installation

CAUTION

- Install the inverter on a non-flammable surface, e.g., metal. Otherwise, you run the risk of fire.
- Do not place flammable materials near the installed inverter. Otherwise, you run the risk of fire.
- When carrying the inverter, do not hold its top cover. Otherwise, you run the risk of injury and damage by dropping the inverter.
- Prevent foreign matter (e.g., cut pieces of wire, sputtering welding materials, iron chips, wire, and dust) from entering the inverter. Otherwise, you run the risk of fire.
- Install the inverter on a structure able to bear the weight specified in the Instruction Manual. Otherwise, you run the risk of injury due to the inverter falling.
- Install the inverter on a vertical wall that is free of vibrations. Otherwise, you run the risk of injury due to the inverter falling.
- Do not install and operate the inverter if it is damaged or its parts are missing. Otherwise, you run the risk of injury.
- Install the inverter in a well-ventilated indoor site not exposed to direct sunlight. Avoid places where the inverter is exposed to high temperature, high humidity, condensation, dust, explosive gases, corrosive gases, flammable gases, grinding fluid mist, or salt water. Otherwise, you run the risk of fire.
- The inverter is precision equipment. Do not allow it to fall or be subject to high impacts, step on it, or place a heavy load on it. Doing so may cause the inverter to fail.

2. Wiring

WARNING

- Be sure to ground the inverter. Otherwise, you run the risk of electric shock or fire.
- Commit wiring work to a qualified electrician. Otherwise, you run the risk of electric shock or fire.
- Before wiring, make sure that the power supply is off. Otherwise, you run the risk of electric shock or fire.
- Perform wiring only after installing the inverter. Otherwise, you run the risk of electric shock or injury.
- The inverter must be powered OFF before you change any of the slide switch settings. Otherwise, you run the risk of electric shock or injury.

CAUTION

- Make sure that the voltage of AC power supply matches the rated voltage of your inverter. Otherwise, you run the risk of injury or fire.
- Do not input single-phase power into the 3-phase inverter. Otherwise, you run the risk of fire.
- Do not connect AC power supply to any of the output terminals (U, V, and W). Otherwise, you run the risk of injury or fire.
- NE-S1 series inverter do not have terminals for braking resistor. Do not connect the resistor. Otherwise there is a risk of fire.
- Connect an earth-leakage breaker to the power input circuit. Otherwise, you run the risk of fire.
- Use only the power cables, earth-leakage breaker, and magnetic contactors that have the specified capacity (ratings). Otherwise, you run the risk of fire.
- Do not use the magnetic contactor installed on the primary and secondary sides of the inverter to stop its operation.
- Tighten each screw to the specified torque. No screws must be left loose. Otherwise, you run the risk of fire.
- Before operating slide switch in the inverter, be sure to turn off the power supply. Otherwise, you run the risk of electric shock and injury.
- Please make sure that earth or ground screw is tighten properly and completely.
- First, check the screws of output terminal (U, V and W) are properly tighten, and then tighten the screws of input terminal (R,S and T)

3. Operation

 **WARNING**

- While power is supplied to the inverter, do not touch any terminal or internal part of the inverter, check signals, or connect or disconnect any wire or connector. Otherwise, you run the risk of electric shock or fire.
- Be sure to close the top cover before turning on the inverter power. Do not open the top while power is being supplied to the inverter or voltage remains inside. Otherwise, you run the risk of electric shock.
- Do not operate switches with wet hands. Otherwise, you run the risk of electric shock.
- While power is supplied to the inverter, do not touch the terminal of the inverter, even if it has stopped. Otherwise, you run the risk of injury or fire.
- If the retry mode has been selected, the inverter will restart suddenly after a break in the tripping status. Stay away from the machine controlled by the inverter when the inverter is under such circumstances. (Design the machine so that human safety can be ensured, even when the inverter restarts suddenly.) Otherwise, you run the risk of injury.
- Do not select the retry mode for controlling an elevating or traveling device because output free-running status occurs in retry mode. Otherwise, you run the risk of injury or damage to the machine controlled by the inverter.
- If an operation command has been input to the inverter before a short-term power failure, the inverter may restart operation after the power recovery. If such a restart may put persons in danger, design a control circuit that disables the inverter from restarting after power recovery. Otherwise, you run the risk of injury.
- Prepare the additional emergency stop switch in addition to the stop key of the integrated operator and/or the optional operator. Otherwise, there is a danger of injury.
- If an operation command has been input to the inverter before the inverter enters alarm status, the inverter will restart suddenly when the alarm status is reset. Before resetting the alarm status, make sure that no operation command has been input.
- While power is supplied to the inverter, do not touch any internal part of the inverter or insert a bar in it. Otherwise, you run the risk of electric shock or fire.
- Run/Stop/Reset is integrated in one button, before you press the button, please make sure that the machine(facility) can be operated. Otherwise, you run the risk of injury or damage to the machine controlled by the inverter.

 **CAUTION**

- Do not touch the heat sink, which heats up during the inverter operation. Otherwise, you run the risk of burn injury.
- The inverter allows you to easily control the speed of motor or machine operations. Before operating the inverter, confirm the capacity and ratings of the motor or machine controlled by the inverter. Otherwise, you run the risk of injury.
- Install an external brake system if needed. Otherwise, you run the risk of injury.
- When using the inverter to operate a standard motor at a frequency of over 60 Hz, check the allowable motor speeds with the manufacturers of the motor and the machine to be driven and obtain their consent before starting inverter operation. Otherwise, you run the risk of damage to the motor and machine.
- During inverter operation, check the motor for the direction of rotation, abnormal sound, and vibrations. Otherwise, you run the risk of damage to the machine driven by the motor.
- Regardless Run command setting(A002/A202) if the key is pressed, the inverter starts running. Therefore, if you selected Run command such as operator or terminal, please handle the key after you made sure that the machine/facility can be operated safely.

4. Maintenance, inspection, and parts replacement

 **WARNING**

- Before inspecting the inverter, be sure to turn off the power supply and wait for 10 minutes or more. Otherwise, you run the risk of electric shock. (Before inspection, confirm that the Charge lamp on the inverter is off.)
In case the power indication of the operator does not turn ON after power-up, inverter may be damaged. In that case, the inspection must be done after waiting two hours or more of the power OFF. Otherwise there is a danger of electric shock and/or injury.
- Commit only a designated person to maintenance, inspection, and the replacement of parts.
(Be sure to remove wristwatches and metal accessories, e.g., bracelets, before maintenance and inspection work and to use insulated tools for the work.) Otherwise, you run the risk of electric shock and injury.

5. Others

 **CAUTION**

- Do not discard the inverter with household waste. Contact an industrial waste management company in your area who can treat industrial waste without polluting the environment.

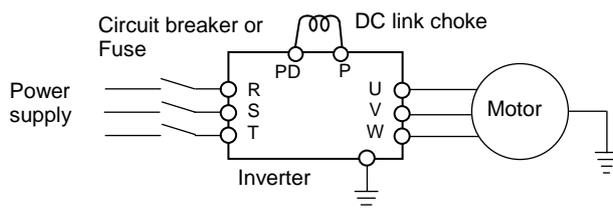
 **WARNING**

- Never modify the inverter. Otherwise, you run the risk of electric shock and injury.
Do not discard the inverter with household waste. Contact an industrial waste management company in your area who can treat industrial waste without polluting the environment.

Cautions for UL and cUL

(Standard to comply with : UL508C,CSA C22.2 No.14-05)

Wiring diagram of inverter



- a) Maximum surrounding air temperature rating of 50°C.
- b) Solid State motor overload protection reacts with max. 150 % of FLA.
- c) Suitable for use on a circuit capable of delivering not more than 100,000 rms Symmetrical Amperes, 240 Volts Maximum.
- d) Drive has no provision for motor over temperature protection. Motor over temperature protection is required at end application.
- e) Protected by J, CC, G or T Class Fuses. or when protected by a circuit breaker having an interrupting rating not less than 100,000 rms symmetrical amperes, 240 Volts maximum.
- f) Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes.
- g) Drive has no provision for motor over temperature protection. Motor over temperature protection required at end application.
- h) Use 60/75°C CU wire only.
- i) Tightening torque and wire range as shown in the table below.

Model No.	Required Torque (N.m)	Wire Range (AWG)
NES1-002S	0.8~1.0	16~14
NES1-004S	0.8~1.0	16~14
NES1-007S	1.8	14~12
NES1-015S	1.8	12~10
NES1-022S	1.8	10
NES1-002L	0.8~1.0	16~14
NES1-004L	0.8~1.0	16~14
NES1-007L	0.8~1.0	16~14
NES1-015L	1.8	14
NES1-022L	1.8	12

- j) Distribution fuse and circuit breaker size marking is included in the manual to indicate that the unit shall be connected with a Listed Cartridge Nonrenewable fuse or Inverse time circuit breaker, rated 600 VAC with the current ratings as shown in the table below:

Model No.	Fuse		Circuit Breaker	
	Type	Maximum Rating	Type	Maximum Rating
NES1-002S	Class J, CC, G or T	10 A	Inverse Time	15 A
NES1-004S		20 A		
NES1-007S		30 A		30 A
NES1-015S				
NES1-022S				
NES1-002L*	Class J, CC, G or T	10 A	Inverse Time	15 A
NES1-004L*		15 A		
NES1-007L*				
NES1-015L				
NES1-022L		20 A		20 A

* In case of using Circuit Breaker, an additional 5 A external protector is needed.

Supplement of Cautions for UL and cUL

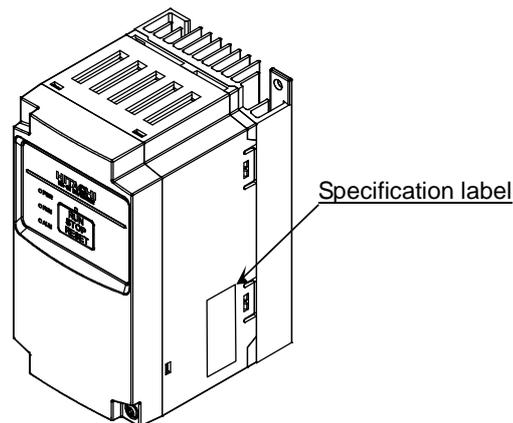
Note (* mark) of item j): When a breaker is used in NES1-002L/004L/007L, a breaker of 15A and a protector (breaker) of 5A in series is additionally required by the NEC(National Electrical code) standard un US.

1.1 Inspection at unpacking

Please check the followings after unpacking.

Please contact Hitachi if there are any problems such as noted below on the product.

- (1) Any damage during transportation?
- (2) Basic manual (English and Japanese) are packed together with the product?
- (3) The product is the one you ordered (check with the specification label)



Model name (NES1-002SB example)		HITACHI INVERTER			
Input	Freq. Voltage Phase Current	Model: NES1-002SB			
		Input : 50Hz, 60Hz		200-240 V 1Ph	3.1 A
		50Hz, 60Hz		V 3Ph	A
Output	Freq. Volt. & phase Current	Output : 0.5-400Hz 200-240 V 3Ph 1.4 A			
Manufacturing number		MFG No. 2616200716000001		Date: 1206	
		Hitachi Industrial Equipment Systems Co., Ltd.		NE18158-001	

Example of the specification label

1.2 Basic Manual (This document)

This Basic manual is for NE-S1 series inverters.

Read this manual carefully for the proper operation of the product. Please keep this manual for future usage.

Please refer to QRG for the further detailed information. QRG can be downloaded from our website.

HP address: <http://www.hitachi-ies.co.jp/english/products/inv/nes1/index.htm>

When you use any options, please refer to the manual of each option.

1.3 In case of contact

When contacting the store or vendor where you bought the product or Hitachi directly, please provide the following information.

- (1) Model name of the inverter
- (2) Manufacturing number
- (3) When you bought the product
- (4) Contents of your inquiry
 - Damaged portion and condition, and else

1.4 Warranty Terms

The warranty period under normal installation and handling conditions shall be two (2) years from the date of manufacture, or one (1) year from the date of installation, whichever occurs first. The warranty shall cover the repair or replacement, at Hitachi's sole discretion, of ONLY the inverter that was installed.

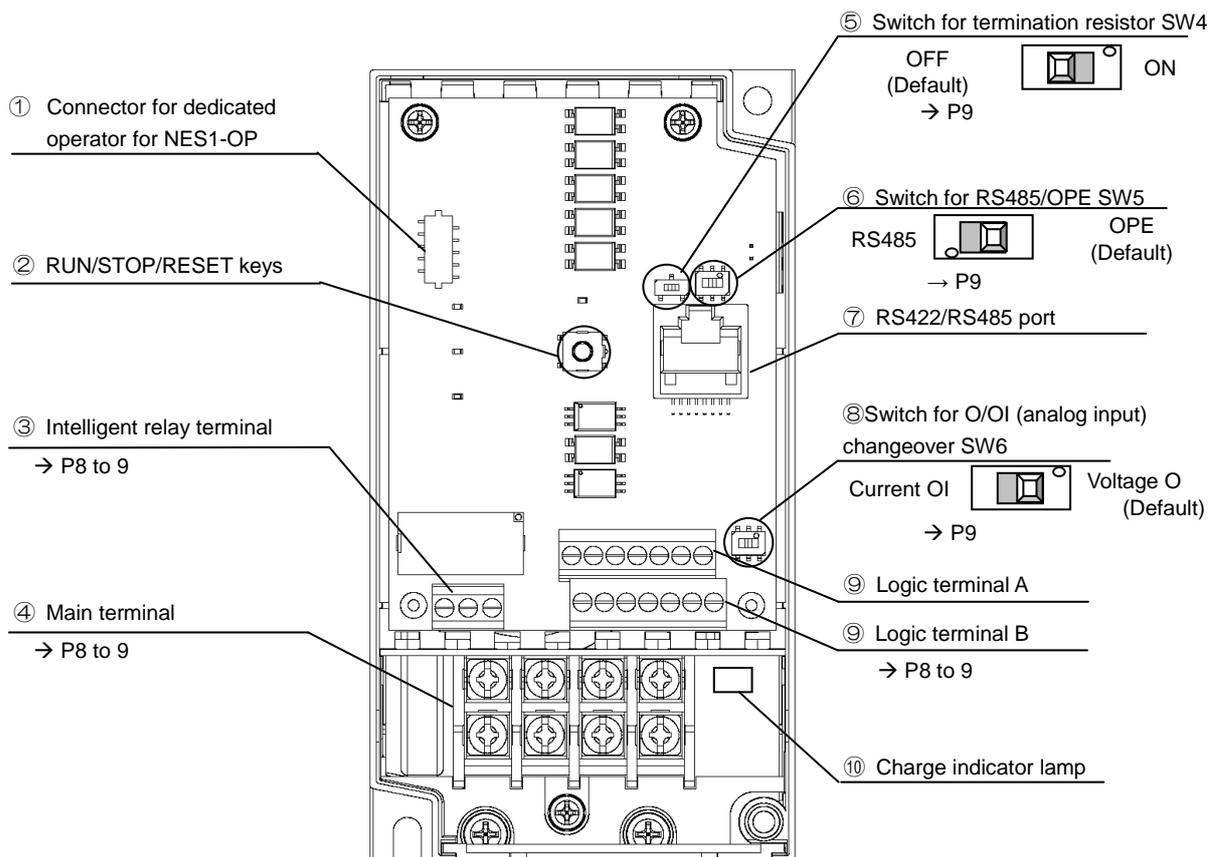
1. Service in the following cases, even within the warranty period, shall be charged to the purchaser:

- a. Malfunction or damage caused by mis-operation or modification or improper repair
- b. Malfunction or damage caused by a drop after purchase and transportation
- c. Malfunction or damage caused by fire, earthquake, flood, lightening, abnormal input voltage, contamination, or other natural disasters

2. When service is required for the product at your work site, all expenses associated with field repair shall be charged to the purchaser.

3. Always keep this manual handy; please do not lose it. Please contact your Hitachi distributor to purchase replacement or additional manuals.

2. Name of each portion (removed front cover)



Name	Description
① Connector for dedicated operator for NES1-OP	Dedicated operator for NE-S1 (NES1-OP) can be connected on this connector.
② RUN/STOP/RESET key	Push key for run, stop and reset operation.
③ Intelligent relay terminal	Output terminal for intelligent relay (1 from c contact).
④ Main terminal	For connecting power supply, motor output and DC reactor.
⑤ Switch for termination resistor	Switch for integrated termination resistor (100Ω) for RS485. Integrated resistor of 100Ω is connected when switched ON.
⑥ Switch for RS485/OPE	Changeover switch for RS422/RS485 communication setting.
⑦ RS422/RS485 port	Connector for RS485 external operator or PC software (RJ45 jack)
⑧ Switch for O/OI (analog input) changeover	Voltage input (O) or current input (OI) can be selected using this switch.
⑨ Logic terminal A,B	Terminal for connecting input/output signals (digital/analog) for the inverter control.
⑩ Charge lamp	Turns ON when the internal DC bus voltage is 45V or more. In case of wiring, maintenance or else, please be sure to check that this lamp is turned OFF after waiting 10 minutes of power OFF.

Note 1) Refer to page 13 for the description of the display and key operation.

Note 2) Position of ⑩charge lamp depends on the model. Refer to page 11 for the details.

Note 3) Pay attention when operating by PC via ⑦RS422/RS485 port, as the operation can also be done from the panel of the inverter.

Note 4) Be sure to turn power OFF when connecting or disconnecting the operator such as OPE-SRmini,OPE-S,WOP to the ⑦RS422/RS485 port.

3. Cautions for installation

①Caution during transportation

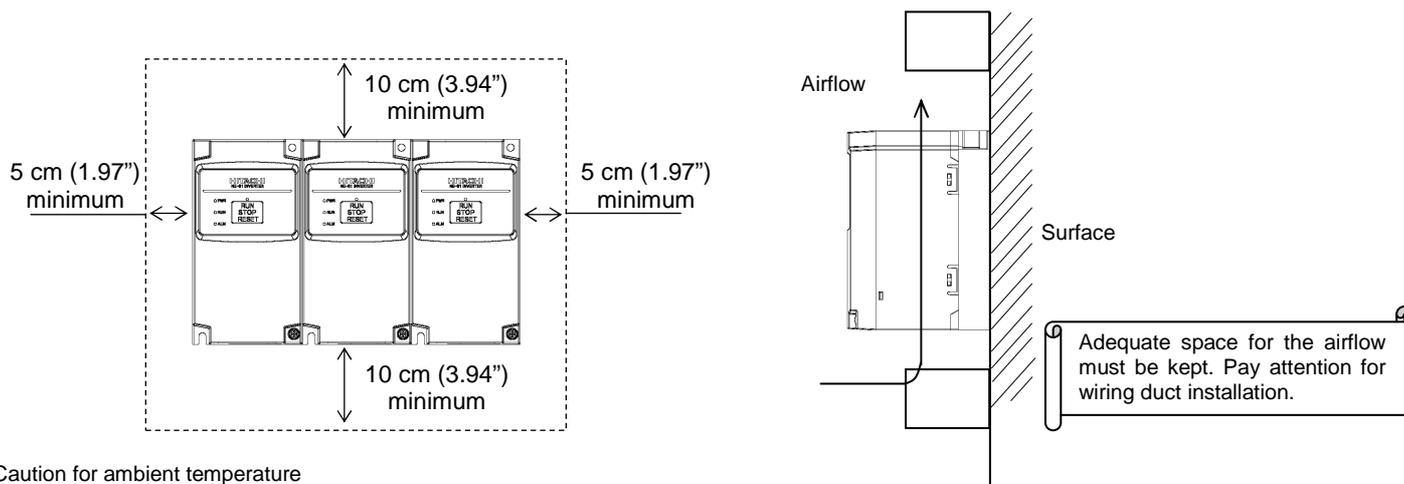
Please pay attention when carrying the product as it is covered by a plastic case.

Especially, do not put pressure onto the front cover and terminal cover. Otherwise there is a risk of damaging the product.

Please do not use products that are damaged, and/or lacking components.

② Ensure Adequate Ventilation

To summarize the caution messages – you will need to find a solid, non-flammable, vertical surface that is in a relatively clean and dry environment. In order to ensure enough room for air circulation around the inverter to aid in cooling, it is recommended to maintain the specified clearance and the inverter specified in the below diagram.



③ Caution for ambient temperature

Verify ambient temperature at installation site is within the standard specification range (-10~50°C). Measure ambient temperature 5cm from the bottom center of inverter main body and confirm that it is within the allowable temperature range.

Using the inverter at higher temperature than allowable temperature may result in shortening of lifetime of inverter (especially of electrolytic capacitors). A derating curve is shown on QRG (Please refer to the website.)

④ Do not install the inverter in such places as high temperature, high humidity, or prone to condensation.

Use the inverter within the allowable humidity range (20~90%RH) described in standard specifications.

Especially, please use it in place where no condensation occurs. If condensation occurs and beading is generated inside the inverter, electronic parts are short-circuited each other to cause a failure. Also, please avoid installing it in direct sunlight.

⑤ Caution for installation environment

Please avoid installing the inverter in such places where dust, corrosive gas, explosive gas, flammable gas, mist of grinding fluid, or salt pollution, etc. exists.

Invasion of dust, dirt etc. into the inverter may cause a failure. So, when you use it in dusty place by necessity, please devise a countermeasure such as putting it into a closed type chassis.

CAUTION

-Reduction of the carrier frequency or using bigger kW model is required if depends on the load or ambient.

WARNING

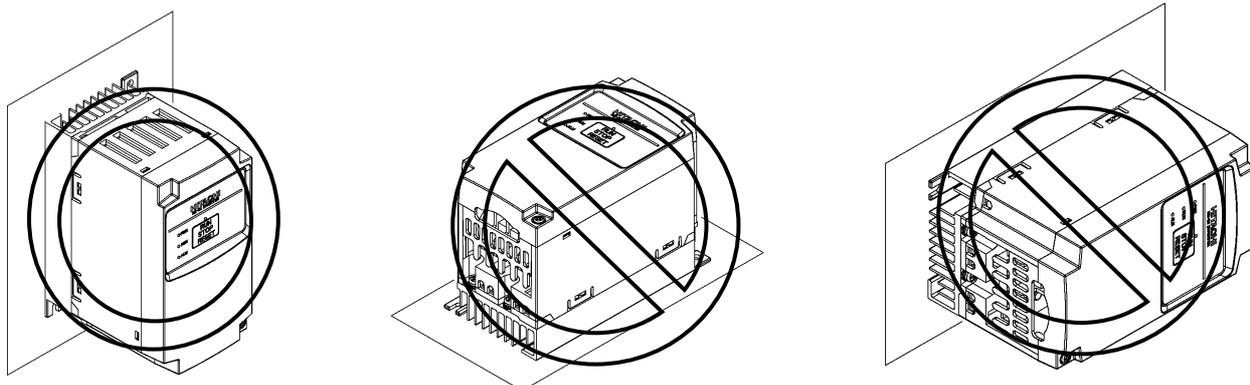
- Do not open the front cover during operation.

⑥ Cautions for installation direction

Surface of the installation must be no vibration, and should be capable of holding the weight of the product. And the product must be fixed to the surface with proper screws in a vertical direction. Be sure to screw using all the screw holes for the installation.

(002L/SB,004L/SB,007LB : 2 positions, 007SB,015L/SB,022L/SB : 4 positions)

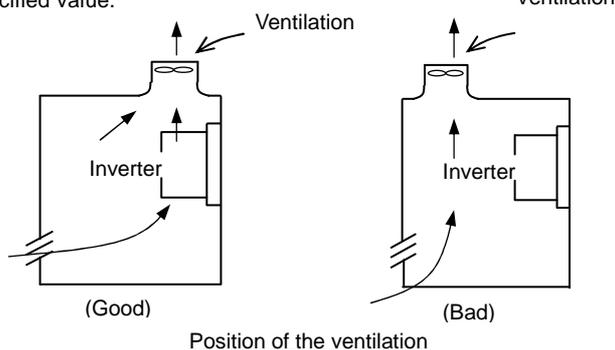
There is a risk of performance failure, and/or breakdown when the product is not installed vertical direction.



⑦ Cautions for installation into the cabinet

Please pay attention to the location of the ventilation holes of the inverter and the cabinet, in case of side-by-side installation and using ventilation fan.

cooling performance of the inverter highly depends on the location of the holes. Please pay high attention to the ambient temperature of the inverter to be less than the specified value.



⑧ Watt Loss

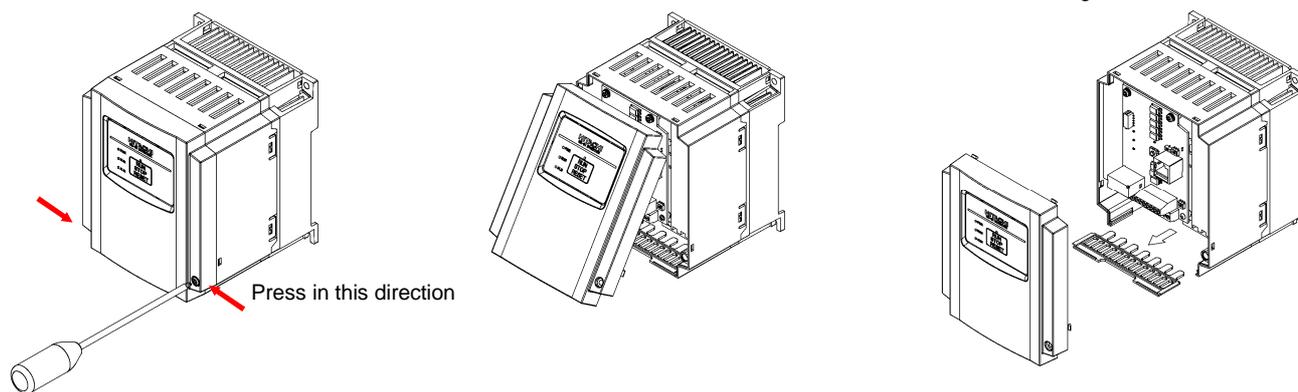
1-ph./3-ph. 200V class

Model name	002S/L	004S/L	007S/L	015S/L	022S/L
Watt Loss (100% load)(W)	22	30	48	79	104
Efficiency at rated load(%)	90	93	94	95	95.5

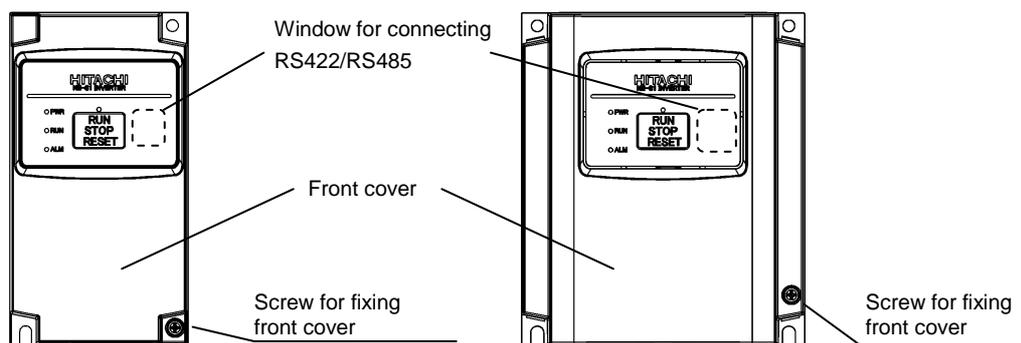
4.1 How to attach and remove the front cover

(1) How to remove

- ① Loosen up the screw
- ② remove the cover by pressing the bottom side of the cover to the direction shown below.
- ③ Move the wiring plate like shown below in case of wiring.



Screw for fixing the front cover is located at right-bottom side



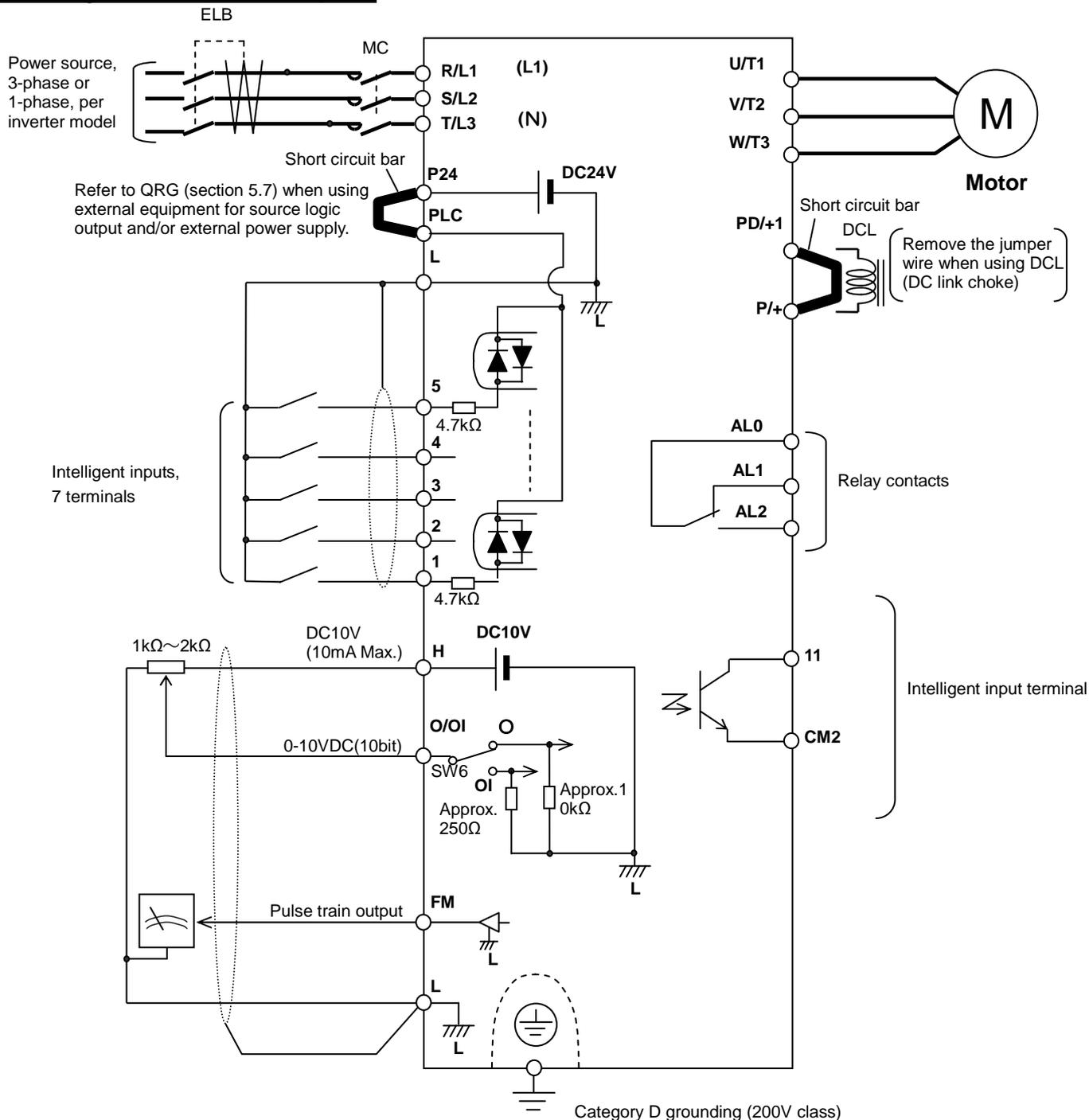
(2) It is necessary to make window on the front cover when using remote operator (OPE-S/SR/SBK/SRmini, WOP), Modbus-RTU, or PC software (ProDriveNext). See above for the position of the window.

- Be sure to make window after removing the front cover.
- There are cutouts at the window, so it can be removed easily by pressing up side and bottom side of the window alternatively.
- The window cannot be restored if it is once opened. Please use commercially supplied RJ45 connector cap or the like if necessary.

(3) How to attach

- Press the front cover to the main body until there is a click sound.
- Do not tighten the screw too much.

4.2 Wiring and terminal description



Note 1) Above shows an example of voltage (O) input. Changeover of SW6 must be done in case of current (OI) input. (Refer to page 9).

(1) Mains terminal description

Symbol	Name	Description
R/L1(L1)	Power input terminals	Connect power supply - Use [L1] and [N] terminal in case of 1-ph. 200V power supply
S/L2		
T/L3(N)		
U/T1	Power output terminals	Connect 3-ph. motor
V/T2		
W/T3		
PD/+1	DC link choke connection terminal	First, remove the short circuit bar between PD/+1 and P/+ terminal. Then connect optional DC link choke for improving the input harmonics.
P/+		
G(⊕)	Earth terminal	To make grounding. Be sure to make this grounding to avoid electric shock, and for improving the EMC performance. The terminal is located on the heatsink.

(2) Control terminal description

Category	Symbol	Name	Description	Electrical characteristics	
Analog	Power supply	L	Common for input signals	Common for internal control power supply, digital inputs/outputs, analog inputs/outputs	
		H	Power supply for external potentiometer	DC10V power supply. Used with variable resistor for O input.	Max.10mA withdraw
	Freq. set	O/OI	Analog voltage (Use SW6 for selection)	Frequency set via DC0~10V input	Input impedance=apprx.10kΩ Allowable range; -0.3~+12VDC
			Analog current (Use SW6 for selection)	Frequency set via 0~20mA Parameter adjustment should be done in case of 4~20mA	Input impedance=apprx.250Ω Allowable range; 0~24mA
Digital	Power supply	L	Common of digital and analog Inputs	Common for internal control power supply, digital inputs, analog inputs/outputs	
		P24	Power supply for digital inputs	DC24V power supply for dry contact input. (Common terminal in case of source logic)	Max.100mA output
		PLC	Power supply terminal for input terminals	Sink logic : connected to P24 Source logic : connected to L Remove the jumper wire when using external power supply for controlling the dry contact inputs (Refer to "QRG"5.7)	

Category	Symbol	Name	Description	Electrical characteristics		
Digital	Input	Contact	5	Intelligent input terminals	Select 5 functions from 35 available functions when can be assigned to any terminal 1 to 5. Sink or source logic can be selected. Refer to section 7.3 of "QRG" for the details	
			4			
			3			
			2			
			1			
	Output	Open-collector	11	Intelligent output terminals	One function from 28 available functions can be assigned. Refer to section 7.3 of "QRG" for the details	Open collector output Between 11 and CM2 - Voltage drop during ON=4V or less - Max. allowable voltage = 27V - Max allowable current = 50mA
			CM2	Common for intelligent output terminals	Common for the terminal 11.	Max. allowable current = 100mA
		Relay	AL0 AL1 AL2	Intelligent relay outputs	One function from 28 available functions can be assigned. (1-c contact) Refer to section 7.3 of "QRG" for the details.	Max. contact capacity AL1-AL0 : AC250V, 2A(resistive),0.2A(inductive) AL2-AL0 : AC250V, 1A(resistive),0.2A(inductive) Min. contact capacity AC100V, 10mA DC5V, 100mA

(3) Changeover switch description

Refer to page 5 for the location of the switches.



- Adjustment of the switch must be done during power off. Otherwise there is a risk of electric shock.
- Power ON must be done after closing the front cover. Do not open the front cover during power up, or when there is a remaining voltage. There is a risk of electric shock.

Symbol	Name	Description
SW4	Termination resistor selection switch	Select able/disable of the termination resistor of RS485 port (RJ45)
		OFF (left side) Termination resistor (100Ω) Disable (Default)
		ON (right side) Termination resistor (100Ω) Able
SW5	RS485/OPE(RS422) selection switch	Select depending on the options and communication method, connected to RS422/RS485 port.
		OFF(right side) For operator (OPE-S/SR/SBK/SRmini),ProDriveNext (Default)
		ON(left side) For RS485 communication (Modbus-RTU)
SW6	Analog input (O/OI) selection switch	OFF (left side) Current input (0~20mA) OI
		ON (right side) Voltage input (0~10Vdc) O (Default)

4.3 Mains wiring

(1) Cautions on wiring

Be sure to confirm that the charge lamp is turned OFF before the wiring work.

Once it is powered up, there will be a remaining voltage at the DC bus capacitor for a certain period regardless the motor operation.

Wiring work must be done 10 minutes after the power off, and after confirming the safety of personnel.

In case the power indication of the operator does not turn ON after power-up, inverter may be damaged. In that case, the inspection must be done after waiting two hours or more of the power OFF. Otherwise there is a danger of electric shock and/or injury.

① Mains input terminals (R/L1,S,T/N)

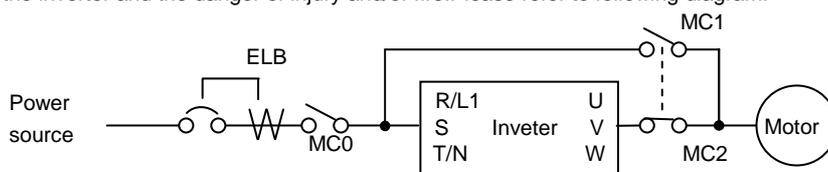
- Use earth leakage breaker (ELB) for protection between power supply and input terminals (R/L1,S,T/N).
- The ELB is recommended to have bigger capability for the high frequency sensitivity, so to avoid malfunction.

Distance between inverter and motor	Cutoff current of ELB
100m or less	30mA
300m or less	100mA
800m or less	200mA

[Rough indication of earth leakage current] 30mA/km : use CV cable with metallic tube. Leakage current will be approximately 8 times more when using H-IV cable.

Therefore, it is recommended to use one class bigger capability of the ELB. Previously mentioned "leakage current" is based on the RMS value of fundamental wave, excluding harmonic current.

- There is a possibility that the malfunction or failure of the customer's system when the protection circuit of the inverter is activated. Please use magnetic contactor to shutoff the inverter power supply.
- Do not turn power ON and OFF by the magnet contactor at the primary side or secondary side of the inverter to start and stop the motor. Use operation command (FW, RV) from the control input terminal in case of using external signal.
- Do not use the 3-ph input type with single phase input (phase loss). Otherwise there is a risk of inverter failure. Single phase input to the 3 phase type inverter will result in a undervoltage, overcurrent, or will result in a damage of the inverter. [DC bus capacitor will be charged even under phase loss and it is dangerous. Refer to "(1) Cautions for wiring" for the wiring.]
- There is a risk of breakdown of the internal converter module, and/or shortening drastically the lifetime of DC bus capacitors due to an increase of the ripple current. Especially, if high reliability is required on the system, use AC reactor between power supply and inverter. And if severe weather, such as thunderstorms is expected, use appropriate lightning protection equipment.
 - Unbalance at the input voltage (3% or more)
 - Impedance of the power supply is 10 times or more, and 500kVA or more
 - Rapid change is voltage is expected
- (Example)
 - 2 or more inverters are connected at the same net with short cable.
 - Inverter is connected in parallel with the thyristor equipment with short cable.
 - Phase advancing capacitor is switching on a same net
- Frequency of the power ON/OFF must be once/3 minutes or longer interval. There is a danger of inverter failure.
- An inverter run by a private power generator may overheat the generator or suffer from a deformed output voltage waveform of the generator. Generally, the generator capacity should be five times that of the inverter (kVA) in a PWM control system or six times greater in a PAM control system.
- In the case of important equipment, to shorten the non-operational time of inverter failure, please provide a backup circuit by commercial power supply or spare inverter.
- In case of commercial power source switching functionality, mechanical interlock the MC1 & MC2 contacts with each others is required. Otherwise you may damage the inverter and the danger of injury and/or fire. Please refer to following diagram.



② Inverter output terminals (U, V, and W)

- Use larger gauge cable leads than the specified applicable cable for the wiring of output terminals to prevent the output voltage drop between the inverter and motor. Especially at low frequency output, a voltage drop due to cable resistance will cause the motor torque to decrease.
- Do not connect a phase-advanced capacitor or surge absorber on the output side of the inverter. If connected, the inverter may trip or the phase-advanced capacitor or surge absorber may be damaged.
- If the cable length between the inverter and motor exceeds 20 m (especially in the case of 400 V class models), the stray capacitance and inductance of the cable may cause a surge voltage at motor terminals, resulting in a motor burnout. A special filter to suppress the surge voltage is available. If you need this filter, contact your supplier or local Hitachi Distributor.
- When connecting multiple motors to the inverter, connect a thermal relay to the inverter output circuit for each motor.
- The RC rating of the thermal relay must be 1.1 times as high as the rated current of the motor. The thermal relay may go off too early, depending on the cable length. If this occurs, connect an AC reactor to the output of the inverter.

③ DC reactor connection terminals (PD and P)

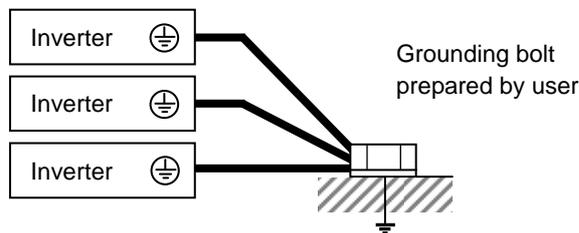
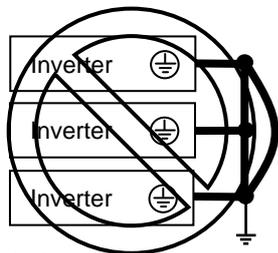
- Use these terminals to connect the optional DC power factor reactor (DCL).
As the factory setting, terminals P and PD are connected by a jumper. Remove this to connect the DCL.
- The cable length between the inverter and DCL must be 5 m or less.

Remove the jumper only when connecting the DCL.

If the jumper is removed and the DCL is not connected, power is not supplied to the main circuit of the inverter, and the inverter will not operate.

④ Inverter ground terminal (G⊕)

- Be sure to ground the inverter and motor to prevent electric shock.
- According to the Electric Apparatus Engineering Regulations, connect 200 V class models to grounding electrodes constructed in compliance with type-D grounding (conventional type-III grounding with ground resistance of 100Ω or less) or the 400 V class models to grounding electrodes constructed in compliance with type-C grounding (conventional special type-III grounding with ground resistance of 10Ω or less).
- Use a grounding cable thicker than the specified applicable cable, and make the ground wiring as short as possible.
- When grounding multiple inverters, avoid a multi-drop connection of the grounding route and formation of a ground loop, otherwise the inverter may malfunction.



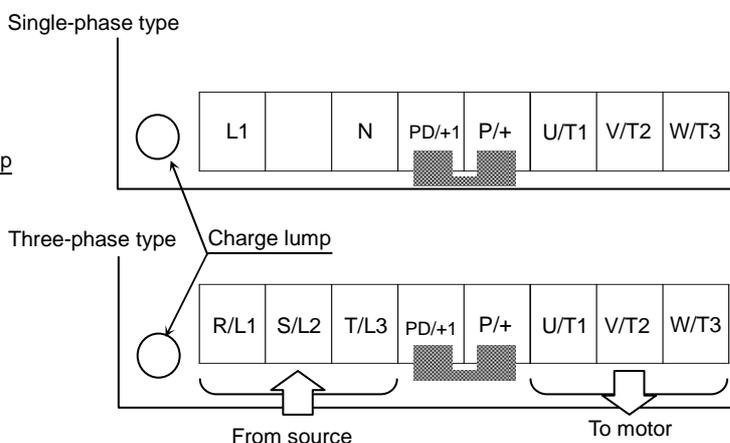
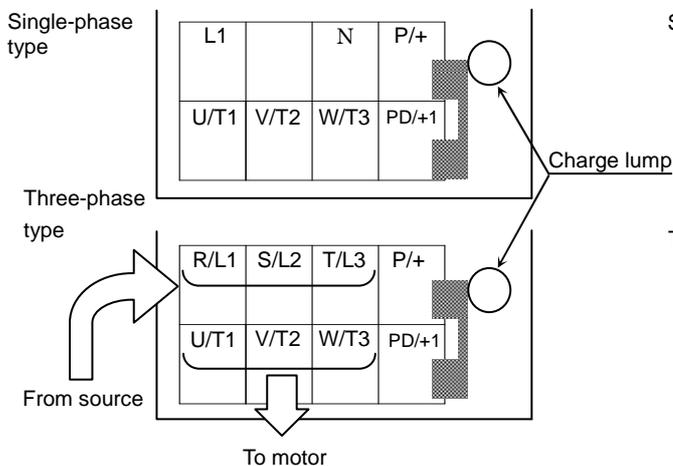
(2) Layout of main circuit terminals

The figures below show the terminal layout on the main circuit terminal block of the inverter.

The main circuit terminal block opens a faceplate and wires it.

Single-phase 200V 0.2 to 0.4kW
 Three-phase 200V 0.2 to 0.75kW

Single-phase 200V 0.75 to 2.2kW
 Three-phase 200V 1.5, 2.2kW



(4) Wiring and Accessories

The table below lists the specifications of cables, crimp terminals, and terminal screw tightening torques for reference.

Input Voltage	Motor output (kW)	Applicable inverter model NES1-	Wiring			Accessories Note1)		
			Gauge of power line cable (mm ²) Note3) Note4)	Size of terminal screw (Terminal width (mm))	Tightening torque (N·m)	Earth-leakage breaker (ELB) Note2)Note5)	Magnetic contactor (MC) Note2)	Fuse (UL-rated, class J,600V) Note6)
1-phase 200V	0.2	002SB	AWG14 (2.0)	M3.5 (7.6)	1.0	EX30 (5A)	H10C	10A
	0.4	004SB	AWG14 (2.0)	M3.5 (7.6)	1.0	EX30 (10A)	H10C	10A
	0.75	007SB	AWG14 (2.0)	M4 (10)	1.4	EX30 (15A)	H10C	15A
	1.5	015SB	AWG10 (5.5)	M4 (10)	1.4	EX30 (20A)	H20	20A
	2.2	022SB	AWG10 (5.5)	M4 (10)	1.4	EX30 (20A)	H20	30A
3-phase 200V	0.2	002LB	AWG16 (1.25)	M3.5 (7.6)	1.0	EX30 (5A)	H10C	10A
	0.4	004LB	AWG16 (1.25)	M3.5 (7.6)	1.0	EX30 (10A)	H10C	10A
	0.75	007LB	AWG16 (1.25)	M3.5 (7.6)	1.0	EX30 (10A)	H10C	15A
	1.5	015LB	AWG14 (2.0)	M4 (10)	1.4	EX30 (15A)	H10C	15A
	2.2	022LB	AWG14 (2.0)	M4 (10)	1.4	EX30 (20A)	H20	20A

- Note 1)The peripheral equipment described here is applicable when the inverter connects a standard Hitachi 3-phase, 4-pole squirrel-cage motor.
 Note 2)Select breakers that have proper capacity. (Use breakers that comply with inverters.) Select above proper ELB capacity following above table for the 1pc inverter. Only 1 inverter must be supplied by the above proper ELB.
 Note 3)If the power line exceeds 20m, cable that is thicker than the specified applicable cable must be used for the power line.
 Note 4)Use copper electric wire (HIV cable) of which the maximum allowable temperature of the insulation is 75°C.
 Note 5)Use earth-leakage breakers (ELB) to ensure safety.
 Note 6)To comply UL, use either ELB/or FUSE which is specified by UL for the Power supply for the inverter.
 Note 7)The ground or earthed line should be a larger gauge than electric supply wire diameter used in the power line.

5.1 Confirmation before power up the inverter

Please confirm the followings before operation.

- (1) Connection of the power input (R,S,T, L1,N) and motor (U/T1, V/T2, W/T3) is correctly connected. Otherwise there is a risk of inverter failure.
- (2) There must be no incorrect-connection of the control wiring. Otherwise there is a risk of inverter failure.
- (3) Earth grounding is properly connected. Otherwise there is a risk of electric shock.
- (4) There is no ground fault other than earth grounding terminal. Otherwise there is a risk of inverter failure.
- (5) There must be no short circuit such as wire strands or chips etc., there must be no tools left inside the inverter. Otherwise there is a risk of inverter failure.
- (6) There must be no short circuit or ground fault at the output side. Otherwise there is a risk of inverter failure.
- (7) Front cover must be closed. Otherwise there is a risk of inverter failure.

5.2 Changing parameters

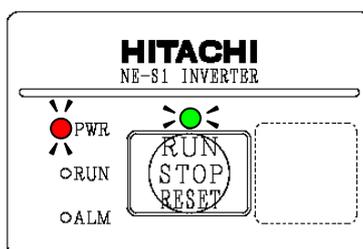
One of the following is required when changing parameters on NE-S1 series inverters.

- (1) Dedicated operator (NES1-OP)
The operator (NES1-OP) is used with integration onto the inverter. It is not possible to use the operator external with cable.
- (2) Digital operator (OPE-SRmini,OPE-S/SR/SBK)
Digital operator can be used with connector cable (ICS-1,3) and connected to the RS422/RS485 port (RJ45) in the inverter. Turn the changeover switch to the operator side (OFF side) in that case (See page 9). Refer to the manual for each operator for the detailed information.
- (3) 5-line LCD operator (WOP)
WOP having serial number of "16918938000081" or later (2011/07 production) is applied to NE-S1 series inverter. (English only)
WOP can be used with connector cable (ICS-1,3) and connected to the RS422/RS485 port (RJ45) in the inverter. Turn the changeover switch to the operator side (OFF side) in that case (See page 9). Refer to the manual for WOP for the detailed information.
- (4) PC programming tool (ProDriveNext)
ProDriveNext Version "1.2.33.000" and later is applied to the NE-S1 series inverter.
PC can be used with connector cable (ICS-1,3) and connected to the RS422/RS485 port (RJ45) in the inverter. Turn the selection switch to the operator side (OFF side) in that case (See page 9). Refer to the manual for ProDriveNext for the detailed information.

NOTE: It is necessary to turn power off to store the changed data.

5.3 Power up the inverter

- (1) Power up the inverter after confirming the items shown in above section 5.1.
- (2) Confirm the LED is emitting like shown below.
 - Standard panel : Confirm that both PWR lamp and Key valid lamp are emitting
 - Dedicated operator (NES1-OP) : Confirm that the PWR lamp is emitting. Display will be the one set by b038 (Initial display selection). "0.00(output frequency monitor)" will be displayed under default condition.
- (3) Refer to section "5.4 Operating the inverter" and set required parameters. And then refer to section "5.5 Motor operation".

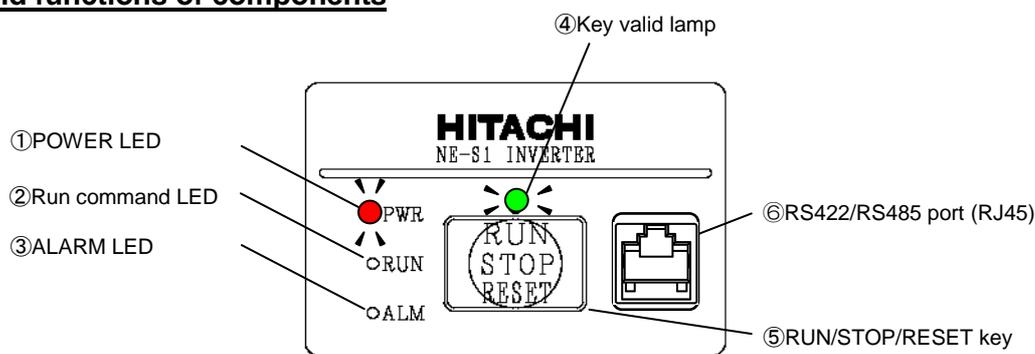


Standard panel

Note 1) It will take around 1.5 seconds for the inverter to be ready(each LED emits). Please take in account this delay in case of an application , for which this delay will be important.

5.4 Names and functions of components

Standard panel



Name	Description
①POWER LED	- Turns on (red) during inverter is powered up
②Run command LED	- Turns on (green) during inverter operation. (This turns ON either Run command is given, or the inverter is giving out power. Therefore it keeps turning on during 0 Hz driving, or keeps turning on during deceleration period even after the run command is OFF.
③ALARM LED	- Turns on (red) when the inverter is in trip status. - Refer to section 6.8 of QRG how to reset the trip status.
④Key valid lamp	- Turns on (green) when the RUN/STOP/RESET is ready. It turns off when there is a RUN command. If the run command is being given from the RUN/STOP/RESET key, the lamp is being on during deceleration period even after the run command is OFF. While Run command is given such as FW(RV) terminal,if "RUN/STOP/RESET key" was pressed, even Run command is OFF, the "Key valid lamp" is OFF until inverter is Stopped.
⑤RUN/STOP/RESET key	- Makes inverter run, stop and reset. RUN/STOP/RESET key is set default and it can be made invalid by the key sensitivity selection (C151) to "no". - It restores from the trip state if the inverter is in trip state. - If the ModBus communication is selected, it can be temporary changed to an external operator mode if the inverter is powered up with pressing the RUN/STOP/RESET key and keep it pressing 5seconds,and take off from the key.. Changeover switch must be changed later on. Note 1)
⑥RS422/RS485 port (RJ45)	- This is a port for external operator, Modbus connection, or ProDriveNext (RS485/operator changeover switch must be operated) before Power ON. In case of Modbus communication, it is necessary to set the changeover switch and parameter (C070). Display of NES1-OP will be according to the parameter set of b150 continuously, if the external operator is connected while the dedicated operator (NES1-OP) is integrated. Note2)

Note 1) It is necessary to set changeover switch and the parameter C070 for releasing the Modbus communication. If the parameter C070 is set to ModBus, external operator via the RS45 jack cannot be used.

Note 2) Connecting to the RJ45 jack must be done during the inverter power off.

5.5 Motor operation

Both "Run command" and "frequency command" is necessary to run the motor. Motor does not run if one of each is missing. For example, motor will not run when a run command is given, but a frequency command is 0Hz. Additionally, the motor will not run if a FRS (free run stop) signal (and the like) is being given.

NE-S1 series inverter has following way to set the RUN command and frequency command. (This is an example of sink logic and uses internal control power supply.)

Driving method in the default : 5.5.1 →

5.5.1 Driving with the standard panel

RUN/STOP/RESET key on the standard operation panel is effective regardless of the setting of the driving order method(A002). Thus, the following operation method (1) to (3) is possible without an option if it is an initial value.

(1) Method to perform driving in RUN/STOP/RESET key and perform frequency setting in Multispeed select

This is the operation method using Run command is given by "RUN/STOP/RESET key" & Frequency setting is given by Fixed value such as 20/40/60Hz, Accel&Decel time is 10 seconds. If you don't need to change parameters such as Accel&Decel time, the optional Operator is not required.) To use the set Freq. setting, use the Multi-speed default frequency setting (1=60Hz),(2=40Hz),(3=20Hz).

■ Setup

Function Name	Code	Data	Note
Input [3] function	C003	02(CF1)	Default
Input [4] function	C004	03(CF2)	

The initial value of Acceleration/ Deceleration time is 10sec.

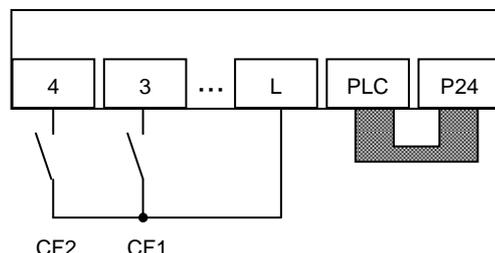
Please change the following parameters as needed.

Function Name	Code	Setting Range	Note
Acceleration time	F002	0.00 to 3600sec.	Default : 10 sec.
Deceleration time	F003	0.00 to 3600sec.	Default : 10 sec.

※One of the following is required when changing parameters on NE-S1 series inverters.

- ① Dedicated operator (NES1-OP) ② Digital operator ③ 5-line LCD operator
- ④ Modbus ⑤ PC programming tool (ProDriveNext)

■ Control circuit terminals wiring



■ Example of use(default)

	Intelligent input terminal [3]	Intelligent input terminal [4]
60Hz order	OFF	ON
40Hz order	ON	OFF
20Hz order	ON	ON

(2) Method to perform driving in RUN/STOP/RESET key and perform frequency setting in speed potentiometer

This is the operation method using Run command is given by "RUN/STOP/RESET key" & Frequency setting is given by analog input such as H-O-L voltage, Accel&Decel time is 10 seconds. If you don't need to change parameter such as Accel&Decel time, the optional Operator is not required.) Below diagram is to set the external Freq. setting connecting H-O-L volume to supply O-L voltage.

■ Setup

Function Name	Code	Data	Note
Frequency source	A001	01(Control circuit terminals)	Default

The initial value of Acceleration/ Deceleration time is 10sec.

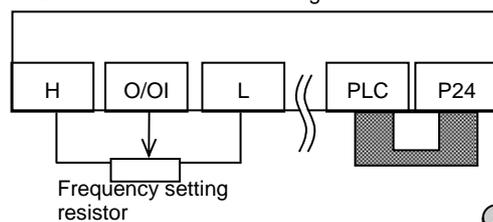
Please change the following parameters as needed.

Function Name	Code	Setting Range	Note
Acceleration time	F002	0.00 to 3600 sec.	default : 10 sec.
Deceleration time	F003	0.00 to 3600 sec.	default : 10 sec.

※One of the following is required when changing default parameters on NE-S1 series inverters.

- ② Dedicated operator (NES1-OP) ② Digital operator ③ 5-line LCD operator
- ④ Modbus ⑤ PC programming tool (ProDriveNext)

■ Control circuit terminals wiring



Note)
The above is a method to perform analog input(O/OI) by voltage input. It is necessary for SW6 on the board to be set for voltage input(default). →P9

(3) Method to perform driving in FW/RV terminal and perform frequency setting in volume resistor

This is the operation method using Run command is given by intelligent input terminal such as FW(RV) function & Frequency setting is given by analog input such as O-L voltage. If you don't need to change such as Accel&Decel time, optional Operator is not required.) Below diagram is to set the external Freq. setting connecting H-O-L volume to supply O-L voltage.

■ Setup

Function Name	Code	Data	Note
Frequency source	A001	01(Control circuit terminals)	Default
Run command source	A002	01(Control circuit terminals)	Default
Input [1] function	C001	00(FW)	Default
Input [2] function	C002	01(RV)	

The initial value of Acceleration/ Deceleration time is 10sec.

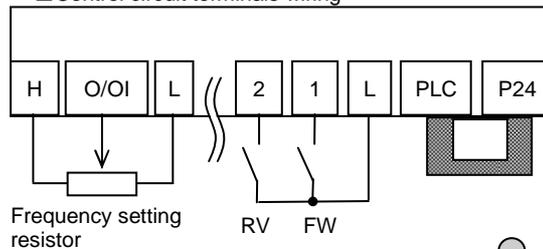
Please change the following parameters as needed.

Function Name	Code	Setting Range	Note
Acceleration time	F002	0.00 to 3600 sec.	Default : 10 sec.
Deceleration time	F003	0.00 to 3600 sec.	Default : 10 sec.

※One of the following is required when changing default parameters on NE-S1 series inverters.

- ① Dedicated operator (NES1-OP) ② Digital operator ③ 5-line LCD operator
- ④ Modbus ⑤ PC programming tool (ProDriveNext)

■ Control circuit terminals wiring



Note)
The above is a method to perform analog input(O/OI) by voltage input. It is necessary for SW6 on the board to be set for voltage input(default). →P9

6.1 Specifications

Item		Three-phase 200V class Specifications					Single-phase 200V class Specifications				
WJ200 inverters, 200V models		002L	004L	007L	015L	022L	002S	004S	007S	015S	022S
Applicable motor size Note1)	kW	0.2	0.4	0.75	1.5	2.2	0.2	0.4	0.75	1.5	2.2
	HP	1/4	1/2	1	2	3	1/4	1/2	1	2	3
Rated capacity(kVA)	200V	0.4	0.9	1.3	2.4	3.4	0.4	0.9	1.3	2.4	3.4
	240V	0.5	1.0	1.6	2.9	4.1	0.5	1.0	1.6	2.9	4.1
Rated input voltage		Three-phase: 200V-15% to 240V +10%, 50/60Hz ±5%					Single-phase: 200V-15% to 240V +10%, 50/60Hz ±5%				
Rated output voltage Note2)		3-phase: 200 to 240V (proportional to input voltage)									
Rated output current (A)		1.4	2.6	4.0	7.1	10.0	1.4	2.6	4.0	7.1	10.0
Cooling method		Self-cooling			Force ventilation		Self-cooling			Force ventilation	
Braking (capacitive feedback) Note3)		Approx.50%			Approx.20 to 40%		Approx.50%			Approx.20 to 40%	
Weight	(kg)	0.7	0.8	0.9	1.2	1.3	0.7	0.8	0.9	1.2	1.3
	(lb)	1.6	1.8	2.0	2.7	2.9	1.6	1.8	2.0	2.7	2.9

Common specification

項 目		仕 様
Protective housing (JIS C 0920,IEC60529)		IP20
Control	Control method	Sinusoidal Pulse Width Modulation (PWM) control
	Output frequency range Note4)	0.1 to 400 Hz
	Frequency accuracy Note5)	Digital command: ±0.01% of the maximum frequency Analog command: ±0.2% of the maximum frequency (25°C ± 10°C)
	Frequency setting resolution	Digital input: 0.01 Hz Analog input: Maximum output frequency/1000
	Volt./Freq. characteristic	V/f control (constant torque, variable torque)
	Overload capacity	150%/60 seconds
	Acceleration/deceleration time	0.01 to 3,600.0 seconds (in linear or curved pattern)、2nd motors setting is possible
Input signal	Freq. setting	External signal : adjustable resistor / 0 to +10 VDC /0 to 20 mA, Modbus、 Option operator、 Dedicated operator
	RUN/STOP Order	External digital input signal(3-wire input possible), Modbus Option Operator、 Dedicated Operator
	Intelligent input terminal	5terminals
	Analog input	1terminal(O/OI terminal : Voltage input10bit/0 to 10V, Current input : 10bit/0 to 20mA selected with a selection switch)
Output signal	Intelligent output terminal	5 open-collector output terminals, 1 relay (1 from c-contact) output terminal
	Pulse Output	1terminal
connection	RS-422	RJ45 Connector ,(Common with RS485 : selecting it with a selection switch)Option Operator,ProDriveNext
	RS-485	RJ45 Connector ,(Common with RS422 : selecting it with a changeover switch)Modbus-RTU
General specification	Temperature Note6)	Operating (ambient): -10 to 50°C, / Storage: -20 to 65°C
	Humidity	20 to 90% humidity (non-condensing)
	Vibration	5.9m/s ² (0.6G), 10 to 55 Hz
	Location	Altitude 1,000m or less, indoors (no corrosive gasses or dust)
	Standards Compliance	UL、 CE、 c-UL、 c-tick

Note1) The applicable motor refers to Hitachi standard 3-phase motor (4p). When using other motors, care must be taken to prevent the rated motor current (50/60Hz) from exceeding the rated output current of the inverter.

Note2) The output voltage decreases as the main supply voltage decreases (except when using the AVR function). In any case, the output voltage cannot exceed the input power supply voltage.

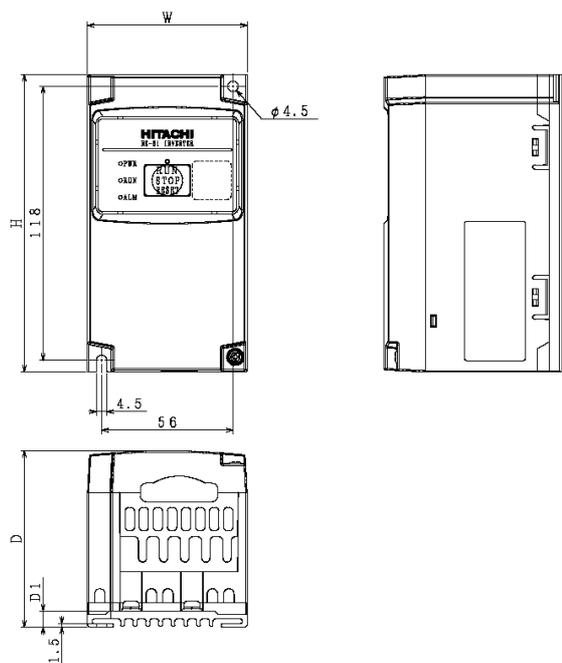
Note3) The braking torque via capacitive feedback is the average deceleration torque at the shortest deceleration (stopping from 50/60Hz as indicated). It is not continuous regenerative braking torque. The average deceleration torque varies with motor loss. This value decreases when operating beyond 50Hz.

Note4) To operate the motor beyond 50/60Hz, consult the motor manufacturer for the maximum allowable rotation speed.

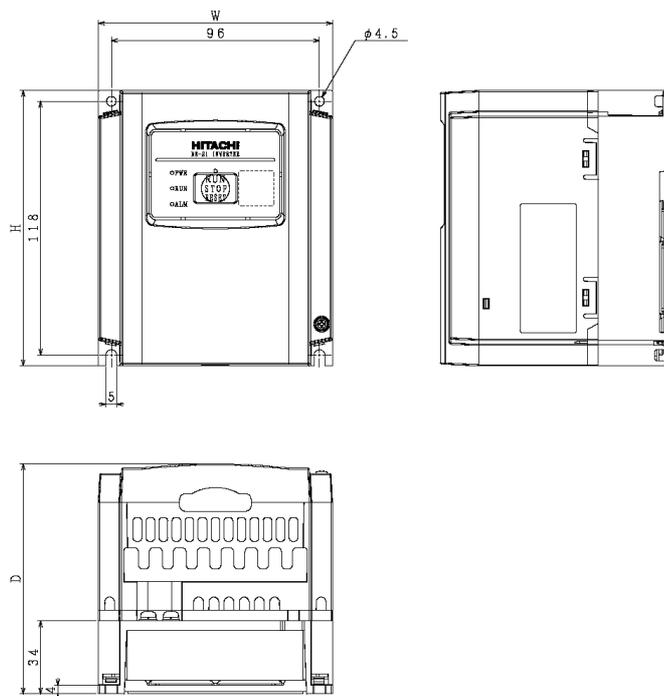
Note5) To get motor stabilized operation, inverter output Frequency might exceeds preset maximum Freq.(A004/A204) by 2Hz in maximum.

Note6) Derating curve is shown on QRG (Refer to section 12.3 of QRG).

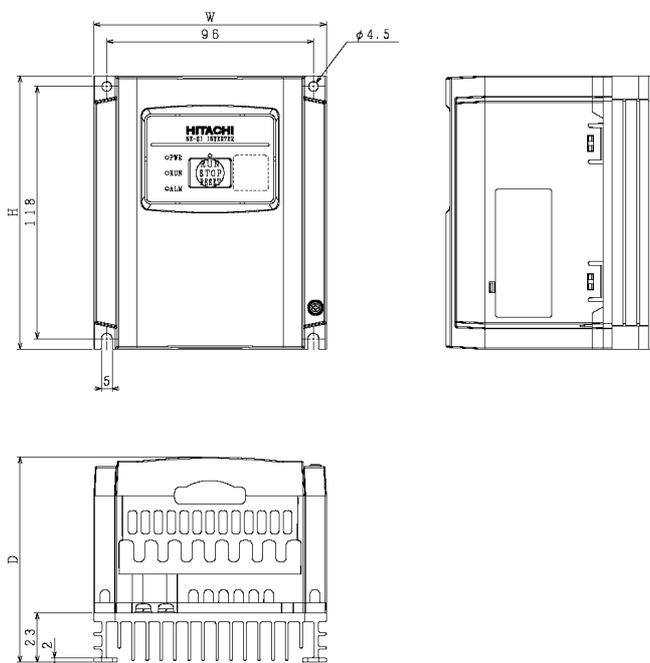
6.2 Dimensions



Model	W (mm)	H (mm)	D (mm)	D1 (mm)
NES1-002SB	68	128	76	7
NES1-004SB			91	21.5
NES1-002LB			76	7
NES1-004LB			91	21.5
NES1-007LB			115	46



Model	W (mm)	H (mm)	D (mm)
NES1-015SB	108	128	107
NES1-022SB			125
NES1-015LB			107
NES1-022LB			125



Model	W (mm)	H (mm)	D (mm)
NES1-007SB	108	128	96

SUITABILITY FOR USE

Hitachi Industrial Equipment Systems shall not be responsible for conformity with any standard, codes, or regulations that apply to the combination of products in the customer's application or use of the products.

Take all necessary steps to determine the suitability of the product for the Systems, machines, and equipment with which it will be used. Please know and observe all prohibitions of use applicable to the products.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE HITACHI INDUSTRIAL EQUIPMENT SYSTEMS PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

See also product catalogs

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