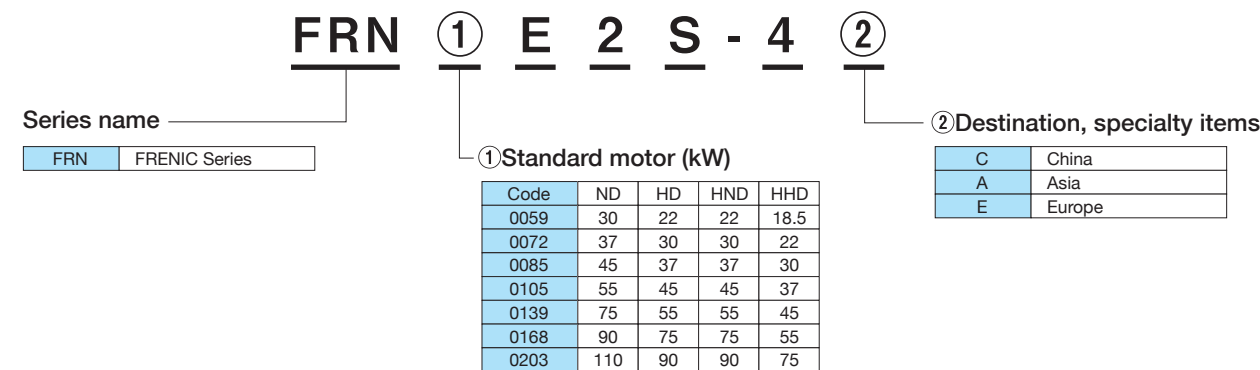
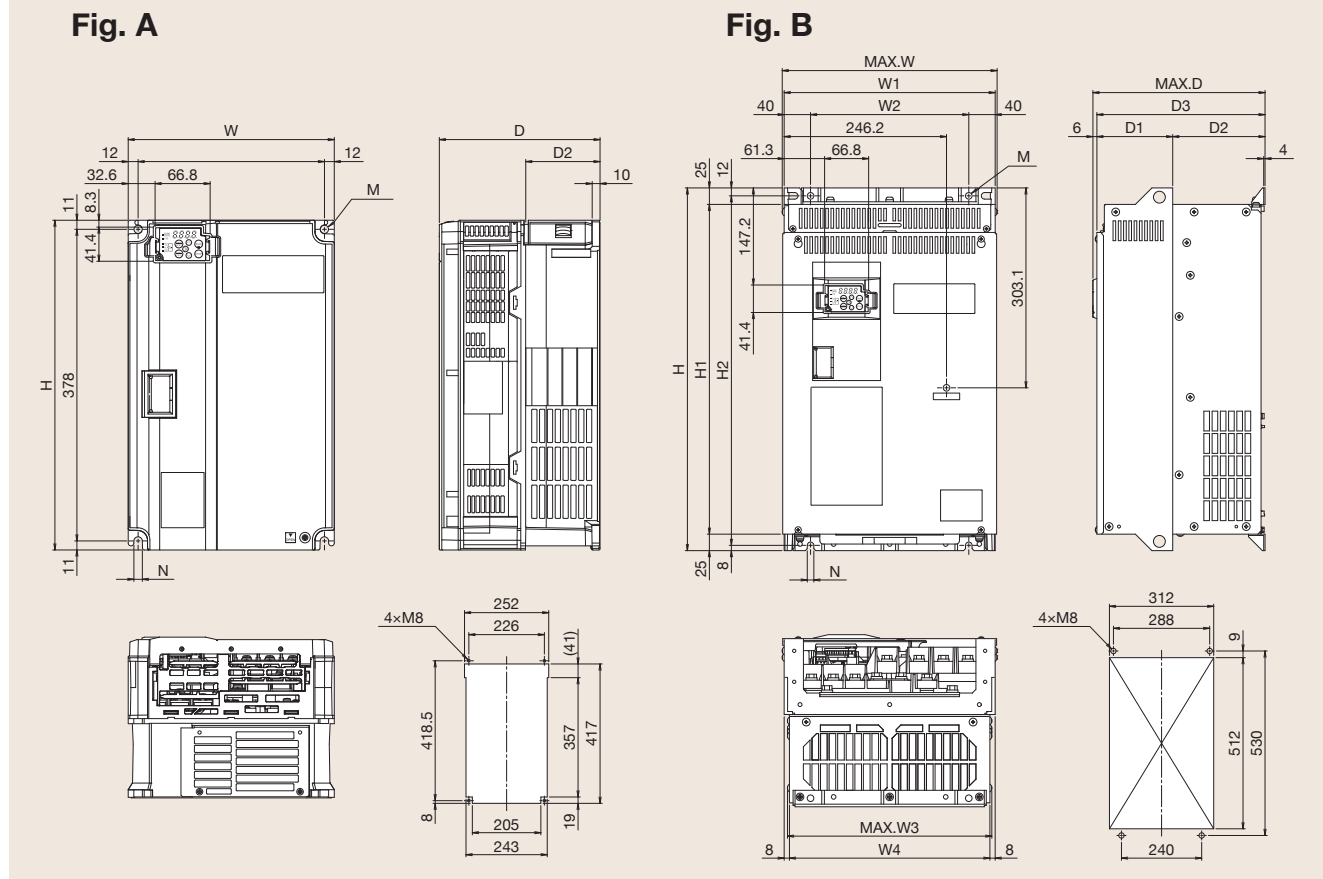


Type

How to read the model number



External diagram



Series	Inverter type	Fig	Dimensions (mm)													
			W	W1	W2	W3	W4	H	H1	H2	D	D1	D2	D3	M	N
Three-phase 400V	FRN0059E2S-4 □	A	250	-	-	-	-	400	-	-	195	105	90	-	2x φ10	10
	FRN0072E2S-4 □		326.2	320	240	310.2	304	550	530	500	261	140	255			
	FRN0085E2S-4 □		361.2	355	275	345.2	339	615	595	565	276	155	270			
	FRN0105E2S-4 □						675	655	625							
	FRN0139E2S-4 □						740	720	690							
	FRN0168E2S-4 □															

When running general-purpose motors

**Driving a 400V general-purpose motor**  
When driving a 400V general-purpose motor with an inverter using extremely long cables, damage to the insulation of the motor may occur. Use an output circuit filter (OFL) if necessary after checking with the motor manufacturer. Fuji's motors do not require the use of output circuit filters because of their reinforced insulation.

**Torque characteristics and temperature rise**  
When the inverter is used to run a general-purpose motor, the temperature of the motor becomes higher than when it is operated using a commercial power supply. In the low-speed range, the cooling effect will be weakened, so decrease the output torque of the motor. If constant torque is required in the low-speed range, use a Fuji inverter motor or a motor equipped with an externally powered ventilating fan.

**Vibration**  
When the motor is mounted to a machine, resonance may be caused by the natural frequencies, including that of the machine. Operation of a 2-pole motor at 60Hz or more may cause abnormal vibration.  
\* Study use of tie coupling or dampening rubber.  
\* It is also recommended to use the inverter jump frequencies control to avoid resonance points.

**Noise**  
When an inverter is used with a general-purpose motor, the motor noise level is higher than that with a commercial power supply. To reduce noise, raise carrier frequency of the inverter. High-speed operation at 60Hz or more can also result in more noise.

When running special motors

**Explosion-proof motors**  
When driving an explosion-proof motor with an inverter, use a combination of a motor and an inverter that has been approved in advance.

**Brake motors**  
For motors equipped with parallel-connected brakes, their braking power must be supplied from the primary circuit (commercial power supply). If the brake power is connected to the inverter power output circuit (secondary circuit) by mistake, problems may occur.  
Do not use inverters for driving motors equipped with series-connected brakes.

**Geared motors**  
If the power transmission mechanism uses an oil-lubricated gearbox or speed changer/reducer, then continuous motor operation at low speed may cause poor lubrication. Avoid such operation.

**Single-phase motors**  
Single-phase motors are not suitable for inverter-driven variable speed operation. Use three-phase motors.



NOTES

Environmental conditions

**Installation location**  
Use the inverter in a location with an ambient temperature range of -10 to 50°C. The inverter and braking resistor surfaces become hot under certain operating conditions. Install the inverter on nonflammable material such as metal. Ensure that the installation location meets the environmental conditions specified in "Environment" in inverter specifications.

Combination with peripheral devices

**Installing a molded case circuit breaker (MCCB)**  
Install a recommended molded case circuit breaker (MCCB) or an earth leakage circuit breaker (ELCB) in the primary circuit of each inverter to protect the wiring. Ensure that the circuit breaker capacity is equivalent to or lower than the recommended capacity.

**Installing a magnetic contactor (MC) in the output (secondary) circuit**  
If a magnetic contactor (MC) is mounted in the inverter's secondary circuit for switching the motor to commercial power or for any other purpose, ensure that both the inverter and the motor are fully stopped before you turn the MC on or off. Remove the surge killer integrated with the MC.

**Installing a magnetic contactor (MC) in the input (primary) circuit**  
Do not turn the magnetic contactor (MC) in the primary circuit on or off more than once an hour as an inverter fault may result. If frequent starts or stops are required during motor operation, use FWD/REV signals.

**Protecting the motor**  
The electronic thermal facility of the inverter can protect the general-purpose motor. The operation level and the motor type (general-purpose motor, inverter motor) should be set. For high-speed motors or water-cooled motors, set a small value for the thermal time constant to protect the motor. If you connect the motor thermal relay to the motor with a long cable, a high-frequency current may flow into the wiring stray capacitance. This may cause the relay to trip at a current lower than the set value for the thermal relay. If this happens, lower the carrier frequency or use the output circuit filter (OFL).

**Discontinuance of power-factor correcting capacitor**  
Do not mount power factor correcting capacitors in the inverter (primary) circuit. Use a DC REACTOR to improve the inverter power factor. Do not use power factor correcting capacitors in the inverter output circuit (secondary). An overcurrent trip will occur, disabling motor operation.

**Discontinuance of surge killer**  
Do not mount surge killers in the inverter output (secondary) circuit.

**Reducing noise**  
Use of a filter and shielded wires are typical measures against noise to ensure that EMC Directives are met.

**Measures against surge currents**  
If an overvoltage trip occurs while the inverter is stopped or operated under a light load, it is assumed that the surge current is generated by open/close of the phase-advancing capacitor in the power system.  
We recommend connecting a DC REACTOR to the inverter.

**Megger test**  
When checking the insulation resistance of the inverter, use a 500V megger and follow the instructions contained in the Instruction Manual.

Wiring

**Wiring distance of control circuit**  
When performing remote operation, use twisted shielded wire and limit the distance between the inverter and the control box to 20m.

**Wiring length between inverter and motor**  
If long wiring is used between the inverter and the motor, the inverter will overheat or trip as a result of overcurrent (due to high-frequency current flowing into the stray capacitance). Ensure that the wiring is shorter than 50m. If this length must be exceeded, lower the carrier frequency or mount an output circuit filter (OFL).

**Wiring size**  
Select cables with a sufficient capacity by referring to the current value or recommended wire size.

**Wiring type**  
Do not use multicore cables that are normally used for connecting several inverters and motors.

**Grounding**  
Securely ground the inverter using the grounding terminal.

Selecting inverter capacity

**Driving general-purpose motor**  
Select an inverter according to the applicable motor ratings listed in the standard specifications table for the inverter. When high starting torque is required or quick acceleration or deceleration is required, select an inverter with a capacity one size greater than the standard.

**Driving special motors**  
Select an inverter that meets the following condition: Inverter rated current > Motor rated current.

Transportation and storage

When transporting or storing inverters, follow the procedures and select locations that meet the environmental conditions according to the inverter specifications.

High Performance Inverter  
**FRENIC-Ace** *New*



The next generation inverters has arrived  
Introducing our New Standard Inverter!



Enjoy a full range of applications

The standard inverter for the next generation, the FRENIC-Ace can be used in almost any type of application—from fans and pumps to specialized machinery.

Nominal applied motor [kW]	3-phase 400V series							
	ND rating		HD rating		HND rating		HHD rating	
	Model	Rated output current	Model	Rated output current	Model	Rated output current	Model	Rated output current
18.5								
22			FRN0059E2S-4 □	45A	FRN0059E2S-4 □	45A	FRN0059E2S-4 □	39A
30	FRN0059E2S-4 □	59A	FRN0072E2S-4 □	60A	FRN0072E2S-4 □	60A	FRN0072E2S-4 □	45A
37	FRN0072E2S-4 □	72A	FRN0085E2S-4 □	75A	FRN0085E2S-4 □	75A	FRN0085E2S-4 □	60A
45	FRN0085E2S-4 □	85A	FRN0105E2S-4 □	91A	FRN0105E2S-4 □	91A	FRN0105E2S-4 □	75A
55	FRN0105E2S-4 □	105A	FRN0139E2S-4 □	112A	FRN0139E2S-4 □	112A	FRN0139E2S-4 □	91A
75	FRN0139E2S-4 □	139A	FRN0168E2S-4 □	150A	FRN0168E2S-4 □	150A	FRN0168E2S-4 □	112A
90	FRN0168E2S-4 □	168A	FRN0203E2S-4 □	176A	FRN0203E2S-4 □	176A	FRN0203E2S-4 □	150A
110	FRN0203E2S-4 □	203A						
Rating condition	Overload current rating Max. ambient temp. 120% -1min 40°C		Overload current rating Max. ambient temp. 150% -1min 40°C		Overload current rating Max. ambient temp. 120% -1min 50°C		Overload current rating Max. ambient temp. 150% -1min, 200% -0.5sec 50°C	
Application	Fans, pumps							
	Wire drawing							
	Vertical conveyance							
	Winding machines							
	Printing machines							

Note: The 3-phase 400V 0.1 - 15 kW, 132 kW - 220 kW, 3-phase 200V series, and single-phase 200V will be released shortly

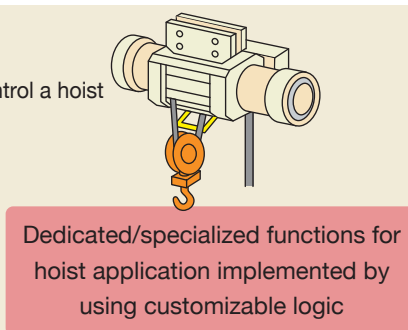
## Customizable logic

Customizable logic function is available as a standard feature. FRENIC-Ace has built-in customizable logic functions with a maximum of 100 steps\* including both digital and analog operation functions, giving customers the ability to customize their inverters—from simple logic functions to full-scale programming. Fuji also has plans to offer programming templates for wiringdrawing machines, hoists, spinning machines, and other applications so that the FRENIC-Ace can be used as a dedicated purpose inverter.

### Example: Hoist crane application

Programming the FRENIC-Ace main unit with the required logic for control a hoist

- (1) Set speed program
- (2) Reset the alarm using the push-button switch
- (3) Mechanical limit switch function
- (4) Detect load
- (5) Automatic speed drive when no load detected
- (6) Overload stop function



\* 200 steps planned for upcoming version upgrade

## Superior flexibility (coming soon)

FRENIC-Ace has readily available interface cards and various types of fieldbus / network to maximize its flexibility.

Option	Installation type
PG interface (5V) card PG interface (12/15V) card	Optional control terminal block 
DeviceNet communication card CC-Link communication card PROFIBUS-DP communication card EtherNet/IP communication card ProfNet-RT communication card CANopen communication card Digital input/output interface card Analog input/output interface card	Optional front face keypad mount 

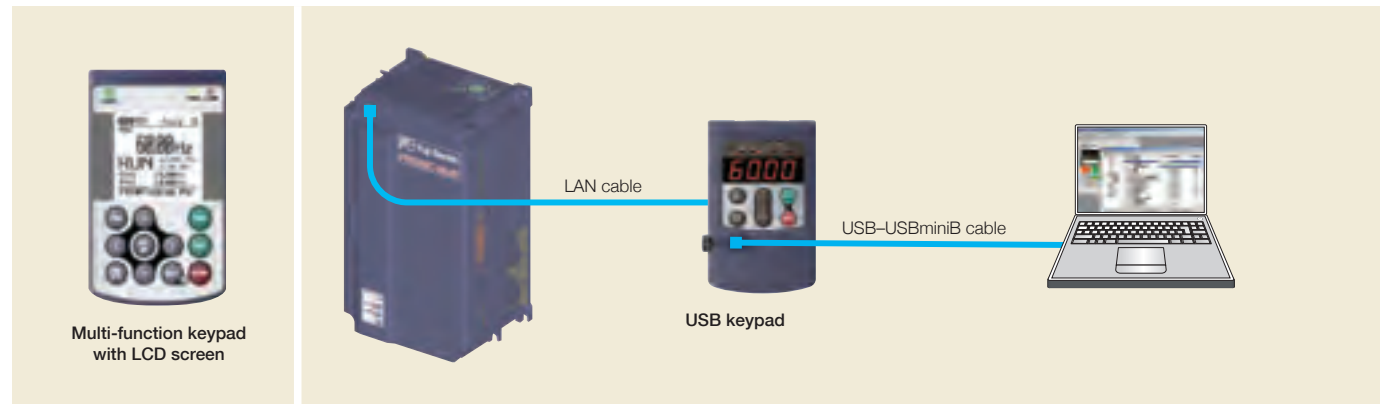
## Wide variety of functions as a standard feature

- Sensorless dynamic torque vector control
- Motor vector control with PG (coming soon / with optional card)
- Synchronous motor with sensorless vector control (coming soon)
- 2-channel on-board RS485 communications port
- Standard CANopen compatibility
- Removable keypad device
- Removable control terminal block board

## Multi-function keypad (option)

FRENIC-Ace has two different multi-function keypads available

- Multi-function keypad with LCD display: Enhanced HMI functionality (coming soon)
- USB keypad: Connect to a computer for more efficient operation (set-up, troubleshooting, maintenance, etc)



## Functional Safety

FRENIC-Ace is equipped with STO functional safety function as a standard. Therefore out put circuit magnetic contactors are not required for safe stop implementation. Enhanced standard features position FRENIC-Ace ahead of its class (Safety input: 2CH, output: 1CH).

### Complies with (pending)

EN ISO 13849-1:2008, Cat.3 / PL=e	IEC/EN 61800-5-2: 2007 SIL3 (Safety feature: STO)
IEC/EN 60204-1: 2005/2006 Stop category 0	IEC/EN 62061: 2005 SIL3
IEC/EN 61508-1 to -7: 2010 SIL3	

## 10 years Lifetime design

FRENIC-Ace components have a design life of ten years. A longer maintenance cycle also helps reduce running costs.

Design life	Main circuit capacitor	
	Electrolytic capacitors on PCB	10 years*
Life conditions	Cooling fan	10 years*
	Ambient temperature	+40°C (104°F)
Load rate	100% (HHD specifications)	80% (HND/HD/ND specifications)

\* ND specifications have a rated current two sizes higher than HHD specifications, so the life is 7 years.

## Standards

### RoHS Directive

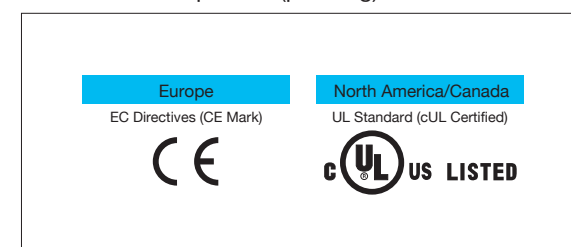
Standard compliance with European regulations that limit the use of specific hazardous substances (RoHS)

<Six hazardous substances>	Lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyl (PBB), polybrominated biphenyl ether (PBDE)
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<About RoHS>	Directive 2002/95/EC, issued by the European Parliament and European Council, limits the use of specific hazardous substances in electrical and electronic devices.
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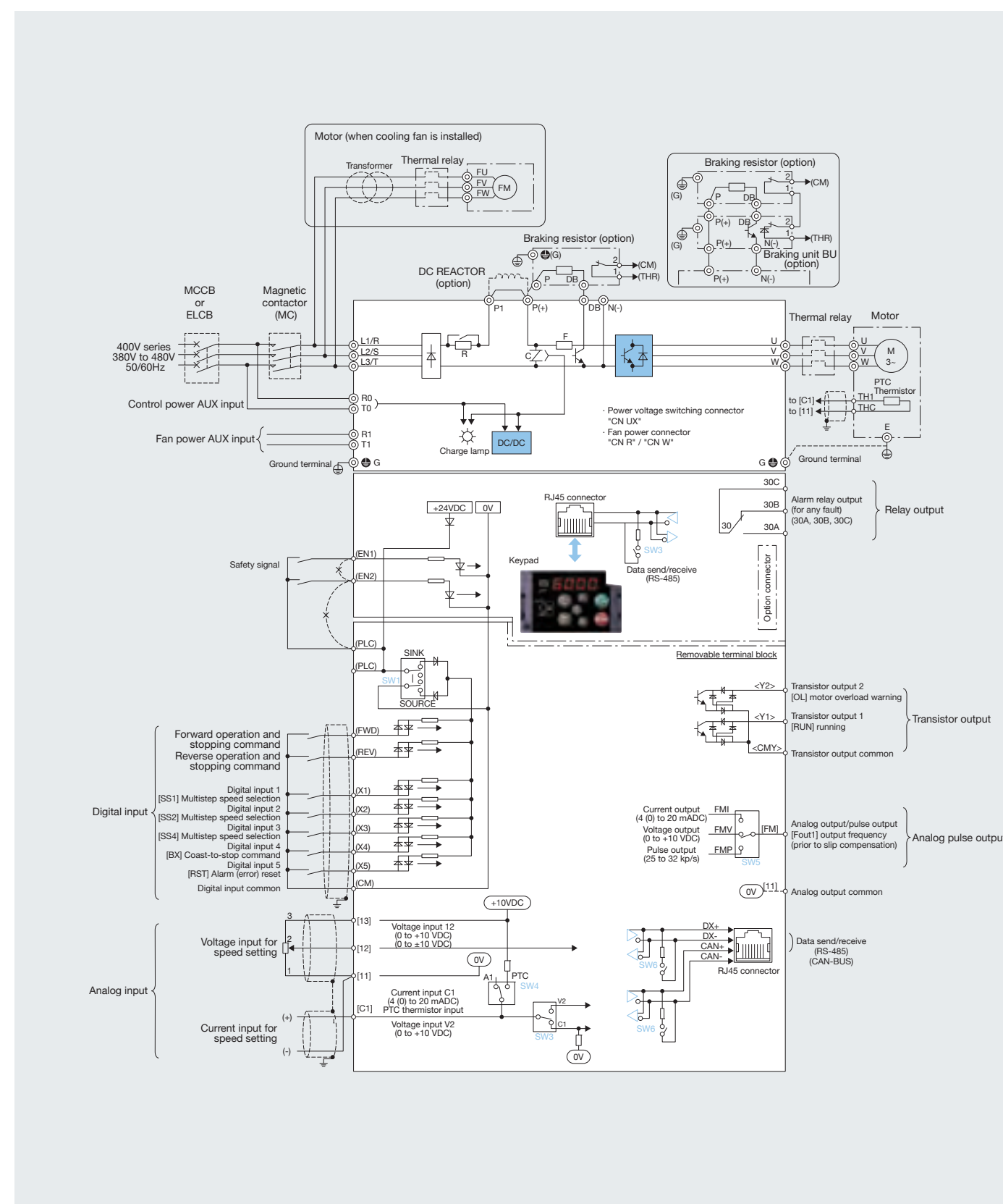
## Global compliance

### Standard compliance (pending)



## Basic wiring diagram

### Standard terminal block board model



This wiring diagram is to be used as a reference only when using standard terminal block model. When wiring your inverter and/or before applying power, please follow always the connection diagrams and the relevant information written in the User's Manual.

## Standard specifications

Item	Specifications									
	Type	FRN□□□□E2S-4□	0059	0072	0085	0105	0139	0168	0203	
Nominal applied motor [kW] (*1)	ND	30	37	45	55	75	90	110		
	HD	22	30	37	45	55	75	90		
	HND	22	30	37	45	55	75	90		
	HHD	18.5	22	30	37	45	55	75		
Rated capacity [kVA] (*2)	ND	45	55	65	80	106	128	155		
	HD	34	46	57	69	85	114	134		
	HND	34	46	57	69	85	114	134		
	HHD	30	34	46	57	69	85	114		
Voltage [V] (*3)	Three-phase 380-480V (with AVR function)									
	ND	59.0	72.0	85.0	105	139	168	203		
	HD	45.0	60.0	75.0	91.0	112	150	176		
	HND	45.0	60.0	75.0	91.0	112	150	176		
Rated current [A] (*4)	HD	39.0	45.0	60.0	75.0	91.0	112	150		
	HND	39.0	45.0	60.0	75.0	91.0	112	150		
	HHD	39.0	45.0	60.0	75.0	91.0	112	150		
	ND	150% of rated output current -1 min								
Overload current rating	ND, HND	120% of rated output current -1 min								
	HHD	150% of rated output current -1 min, 200% -0.5s								
Main power (phase, voltage, frequency)	3-phase 380 to 480V, 50Hz/60Hz								3-phase 380 to 440V, 50Hz	
									3-phase 380 to 480V, 60Hz	
Voltage/frequency variation	Voltage: +10 to -15% (Voltage unbalance: 2% or less (*7)), Frequency: +5 to -5%									
	ND	77.9	94.3	114	140	—	—	—	—	—
Rated current (no DCR) [A] (*5)	HD	60.6	77.9	94.3	114	140	—	—	—	
	HND	60.6	77.9	94.3	114	140	—	—	—	
	HHD	52.3	60.6	77.9	94.3	114	140	—	—	
	ND	57.0	68.5	83.2	102	138	164	201		
Rated current (with DCR) [A] (*5)	HD	42.2	57.0	68.5	83.2	102	138	164		
	HND	42.2	57.0	68.5	83.2	102	138	164		
	HHD	35.5	42.2	57.0	68.5	83.2	102	138		
	ND	39	47	58	71	96	114	139		
Required power supply capacity (with DCR) [kVA] (*6)	HD	29	39	47	58	71	96	114		
	HND	29	39	47	58	71	96	114		
	HHD	25	29	39	47	58	71	96		
	ND	12%							5 to 9%	
Braking torque [%] (*7)	HD	15%							7 to 12%	
	HND	15%							7 to 12%	
	HHD	20%							10 to 15%	
	ND									
DC braking	Starting frequency: 0.1 to 60.0Hz, Braking time: 0.0 to 30.0s.									
	Braking level: 0 to 100% (HHD specifications), 0 to 80% (HND/HD specifications), 0 to 60% (ND specifications)									
Braking transistor	Standard					Optional				
	Optional					Standard				
Braking resistor	Optional					Standard				
	Standard					Optional				
DC reactor (DCR)	ND	Optional							Standard	
	HD, HND	Optional							Standard	
Protective structure (IEC60529)	IP20 closed type, UL open type					IP00 open type, UL open type				
	Fan cooled					Fan cooled				
Cooling system	Fan cooled					Fan cooled				
	Weight [kg]	9.5	10	25	26	30	33	40		

\*1 "Nominal applied motor" refers to the use of a Fuji Electric 4-pole standard motor.  
 \*2 "Rated capacity" refers to 440V rating.  
 \*3 Cannot output voltage higher than the power supply voltage.  
 \*4 Must be reduced if carrier frequency (function code F26) is higher than the following settings.  
 ND/HHD: Model FRN0059E2S-4□ or higher 4 kHz  
 HND: Model FRN0059E2S-4□; 10kHz: FRN0072E2S-4□ to FRN0168E2S-4□; 6 kHz: FRN0203E2S-4□; 4 kHz  
 HHD: Model FRN0059E2S-4□ to FRN0168 E2S-4□; 10kHz: FRN0203 E2S-4□; 6 kHz  
 \*5 With a power supply of 500 kVA (if the inverter capacity is over 50 kVA, then 10 times inverter capacity), indicates the calculated value when connected to a %X=5% power supply. When the applied motor has a capacity of 75kW or higher, use a DC reactor.  
 \*6 When DC reactor is connected  
 \*7 Average braking torque value for the motor alone (varies depending on motor efficiency).  
 \*8 Voltage unbalance [%] = (Max. voltage [V] - Min. voltage [V])/Three-phase average voltage [V] × 67 (see IEC/EN 61800-3). Use AC reactor (ACR, optional) for unbalance rates between 2% and 3%.