

# FRENIC MEGA



**Maximum Engineering for Global Advantage**

3-phase 400V 0.4 to 630kW

High Performance Multifunctional Inverter





## The performance reaching the peak in the industry

FRENIC-MEGA is a high performance, multifunctional inverter Fuji Electric has developed by gathering the best of its technologies.

Now it is ready to answer your needs.

### Maximum Engineering for Global Advantage

What is FRENIC-MEGA and what are the advantages?

- Able to drive induction and permanent magnet synchronous motors
- Built-in EMC filter as standard
- Ability to handle up to 3 simultaneous option cards
- Keypad with a USB connector
- Built-in braking transistor up to 22kW (standard) and 160 kW (option)
- Safety enable input
- Full network support
- 4 complete motor maps

### Improved control performance

Motor control methods: PG vector control, sensorless vector control, dynamic torque vector control, and V/f control.

Improved performance of current response and speed response (vector control)

Improved durability in overload operation

- HD (high duty) spec: 200% for 3 sec / 150% for 1 min
- LD (low duty) spec: 120% for 1 min

### Lower maintenance

Maintenance warning output signal

Use of parts with a longer life cycle

## Best vector control for the general-purpose inverter in its class

### Maximizing the performance of a general-purpose motor by using closed loop vector control

Effective in providing highly accurate control for applications such as offset printing, hoisting, winding and wire drawing

- Speed control range: 1:1500
- Speed response: 100Hz
- Speed control accuracy:  $\pm 0.01\%$
- Current response: 500Hz
- Torque accuracy:  $\pm 10\%$

### Maximizing the performance of a general-purpose motor Sensorless vector control

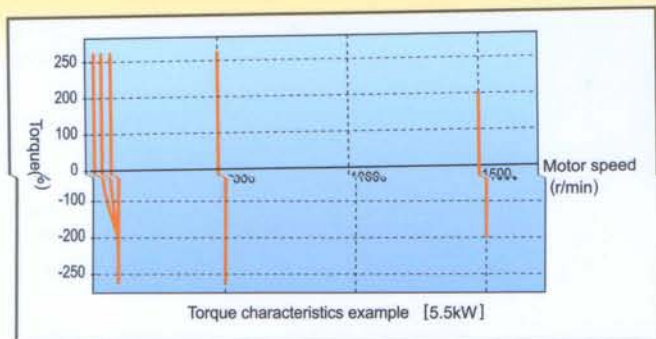
Useful for applications which require a high starting torque, such as mixers, extruders and conveyors

- Speed control range: 1:200
- Speed response: 20Hz
- Speed control accuracy:  $\pm 0.5\%$

- Current response: 500Hz
- Torque accuracy:  $\pm 10\%$
- Zero speed torque:  $\pm 20\%$

### Fuji's original dynamic torque vector control has further evolved

Dynamic torque vector control has been improved to achieve a high starting torque of 200% even at a low-speed rotation of 0.3Hz. This is a new method introduced by Fuji Electric.



### Permanent magnet synchronous motor control

FRENIC-MEGA can drive permanent magnet synchronous motors, both sensorless (open loop) and with speed feedback (closed loop).

### Improved durability during overload condition

The inverter performs short-time acceleration and deceleration with the maximum capacity by achieving better time rating of the overload ratings compared with our previous models. This improves the operation efficiency of the equipment such as a cutting machine or conveyors.

Overload capability: 200% for 3 sec. and 150% for 1 min.

The standard model is available in two specifications concerning the operation load.

Classification	Overload current rating	Major use
HD (High duty) spec	200% for 3 sec, 150% for 1 min	Operation under heavy load
LD (Low duty) spec	120% for 1 min	Operation under light load

### Expanded capacity for the brake circuit built-in models

A brake circuit is built in the 22kW or smaller models as a standard feature. These inverters are suitable to be used in machines with regenerative load such as vertical conveyance machines. The 7.5kW or smaller models also incorporate a braking resistor

From 30kW to 160kW models in 400V series built-in brake circuit can be manufactured on request.

### Dedicated brake control function

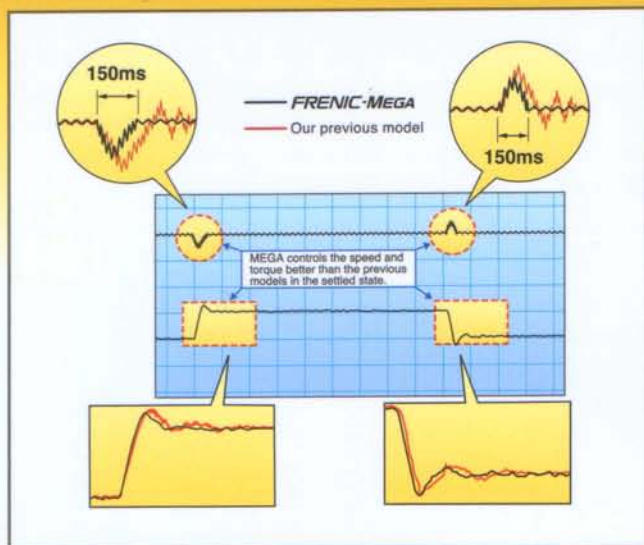
Torque values are now included in the brake releasing conditions, which ensures that motor torque is generated, and therefore brake signal is more reliable.

### Improved reaction to the fluctuation of impact load

When a large load fluctuation occurs, the inverter provides the fastest torque response in its class. It controls the flux to minimize the fluctuation in the motor speed while sup-

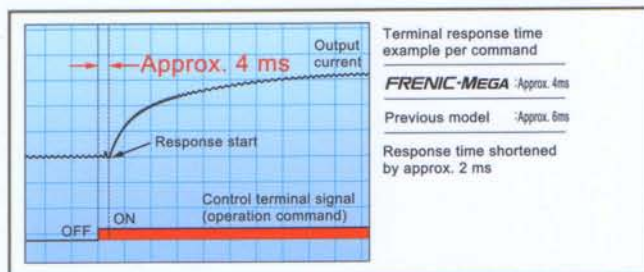


pressing the vibration. This function is best suited for the equipment that requires stable speed such as a cutting machine.



### Quicker response to the operation commands

The terminal response to the operation commands has had an established reputation. FRENIC-MEGA has further shortened this response time, achieving the industry-top response time. This function is effective in shortening the time per cycle and effective for use in the process including frequent repetitions.



## Double rating

### HD (High Duty) Specification

- Overload capacity 150% 1min 200% 3s
- Inverter capacity = Motor capacity
- General use

### LD (Low Duty) Specification

- Overload capacity 120% 1min
- The motor capacity can be one size larger than the inverter capacity
- For application with light load (fans, pumps or centrifugal machines)

## Support for simple maintenance and Improved working efficiency

### Basic keypad TP-E1U

Built-in USB port (mini B connector): allows easy connection of a personal computer equipped with loader software.

Able to save:

- 1 complete function data set.
- Inverter operation data.

When this keypad is connected to the inverter, all the Loader software features can be used:

- Editing, comparing, and copying the function code data
- Real-time operation monitor
- Alarm history (indicating the latest four alarms)
- Maintenance information
- Real time trace
- Historical trace



Can be disconnected from the inverter and used standalone, connecting the keypad to a personal computer equipped with loader software (using USB connection), allowing to check the data saved in the keypad away from the factory site (office).

### Multifunction Keypad TP-G1-J1

#### Features

- LED and LCD display
- Function description in clear text (multi languages)
- Able to save 3 complete function sets
- Compatible with FRENIC Eco and FRENIC Multi
- Menu 0 can be defined
- I/O Check menu
- Operation monitor menu
- Communications debug menu





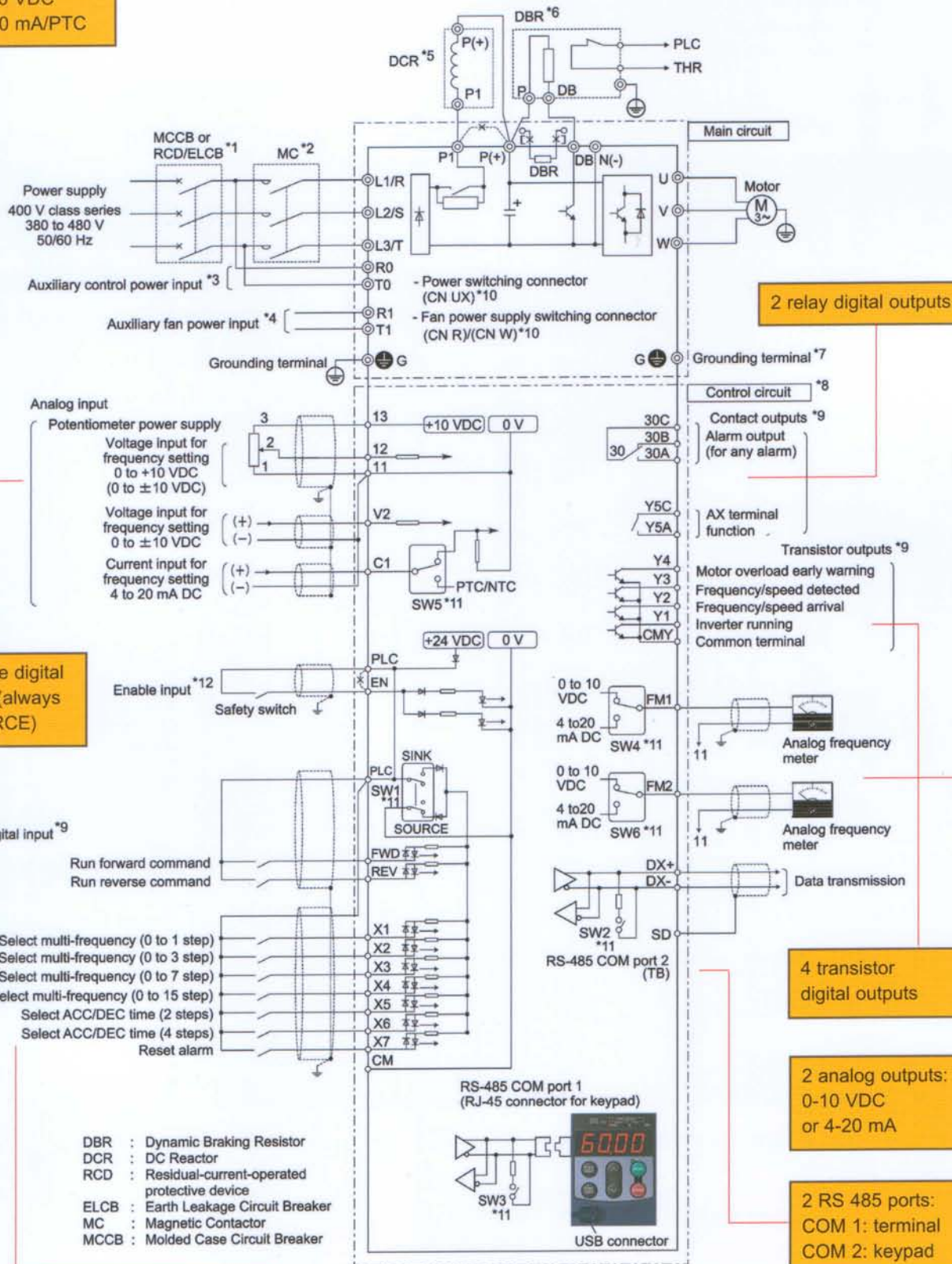
# Wiring diagram

3 analog inputs:

1:  $\pm 10$  VDC

2:  $\pm 10$  VDC

3: 4-20 mA/PTC



9 digital inputs  
(SINK or SOURCE  
configurable)

X7: Pulse train  
digital input (std,  
100 kpps)



## Prolonged service life and improved life judgment function

### Designed life 10 years

For the various consumable parts inside the inverter, their designed lives have been extended to 10 years, which also reduces maintenance downtime.

- Main circuit capacitor: 10 years
- Electrolytic capacitor on PCB: 10 years
- Cooling fan: 10 years

The parts life is estimated on condition that the inverter is used at an ambient air temperature of 40°C and under the load rate of 100%(HD spec) or 80%(LD spec).

### Full support of life warnings

The inverter is loaded with the functions for facilitating the maintenance of the equipment.

## Consideration for environment

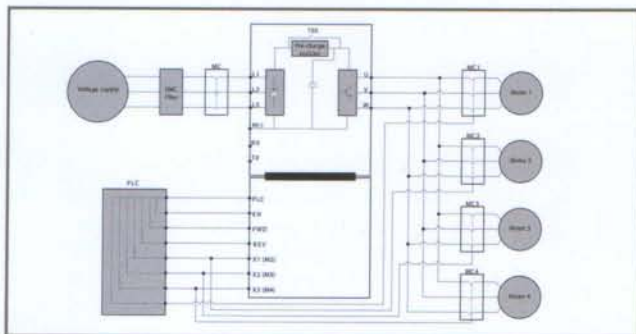
### Enhanced resistance to environmental impact

Resistance to the environmental impact has been enhanced compared with conventional inverters.

- (1) Enhanced durability of the cooling fan, reducing environmental impact
- (2) Adoption of copper bars plated with nickel (Ni) or tin (Sn)

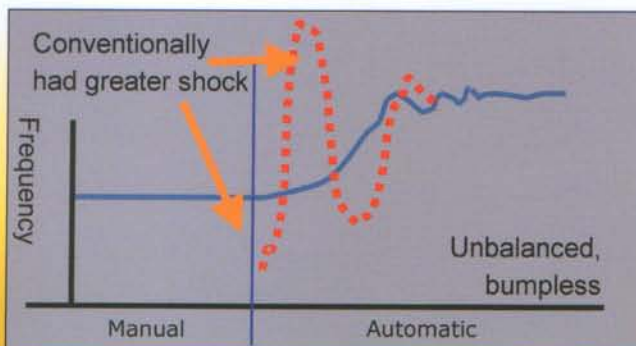
## 4 complete motor maps

Each motor (1-4), can be configured by its own function group, and the control mode for each motor (1-4) can be selected independently. Each motor can also be tuned independently.

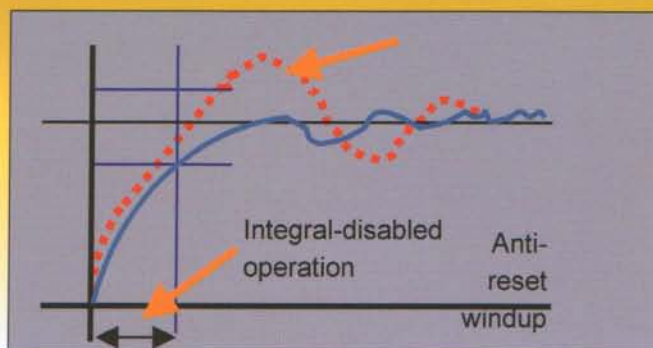


## Complete PID control functions

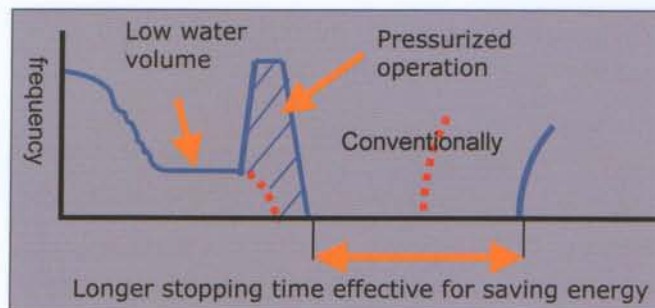
### 1. Unbalanced, bumpless function



### 2. Anti-reset windup function has been added



### 3. Stops operation at a low water volume



## Servo lock function

- The inverter holds the position of the motor shaft
- Only available when using speed feedback (closed loop)
- To activate servo lock function, a digital input programmed with (LOCK) function must be active
- The inverter can indicate servo lock completion by a digital output programmed with (PSET) function

## Loader Software

- Efficient data management: editing, comparing or copying function code data: managing function code data
- Test run, motor auto-tuning: aid and startup
- Operation monitor, real-time and historical tracing, failure monitor, multi-monitor: aid for maintenance and defect analysis
- Operation on Windows 2000 and XP guaranteed

## Fieldbus Options

- ProfiBus DP interface
- CANopen interface
- DeviceNet interface
- T-Link interface
- SX Bus interface
- CC-link interface
- Etc.



# EMC filter built-in type

EMC filter built-in type				Main body external dimensions (mm)														Panel cutout dimensions (mm)							
Power supply voltage	Nominal applied motor(kW)	Inverter type	Fig	W	W1	W2	W3	W4	H	H1	H2	D	D1	D2	D3	M	N	W'	W1'	W2'	H'	H1'	H2'	M'	
3-phase 400V	0.4	FRN0.4G1E-4E	A	110								130		17	41.5										
	0.75	FRN0.75G1E-4E	A													56.5									
	1.5	FRN1.5G1E-4E	B									145	113	32		2×Ø6	6								
	2.2	FRN2.2G1E-4E	B	150					260																
	4.0	FRN4.0G1E-4E	B																						
	5.5	FRN5.5G1E-4E	C													138.7									
	7.5	FRN7.5G1E-4E	C	220																					
	11	FRN11G1E-4E	C														2×Ø10	10							
	15	FRN15G1E-4E	D										195	105	90										
	18.5	FRN18.5G1E-4E	D	250					400							136.5									
	22	FRN22G1E-4E	D																						
	30	FRN30G1E-4E	E																						
	37	FRN37G1E-4E	E	326.2	320	240	310.2	304	550	530	500	261.3			140	255			312	288	240	530	512		
	45	FRN45G1E-4E	E						615	595	565		115				2×Ø10	10							4×M8
	55	FRN55G1E-4E	E	361.2	355	275	345.2	339	675	655	625	276.3			155	270			347	323	275	595	577	9	
	75	FRN75G1E-4E	E									720	690							275		720	702		
	90	FRN90G1E-4E	E						500.6	740												710	685		4×M8
	110	FRN110G1E-4E	E	535.8													315								
	132	FRN132G1E-4E	E		530	430	506.4		500									2×Ø15	15	510	430	430		12.5	
	160	FRN160G1E-4E	E	536.4						1000	970	939.5	366.3	180			360								6×M8
	200	FRN200G1E-4E	E	686.4	680	580	656.4	650.6										3×Ø15		660	580	580			
	220	FRN220G1E-4E	E																						
	280	FRN280G1E-4E	E																						
	315	FRN315G1E-4E	E																						
	355	FRN355G1E-4E	E																						
	400	FRN400G1E-4E	E																						
	500	FRN500G1E-4E	E																						
	630	FRN630G1E-4E	E																						

Available soon

Available soon

Fig.A

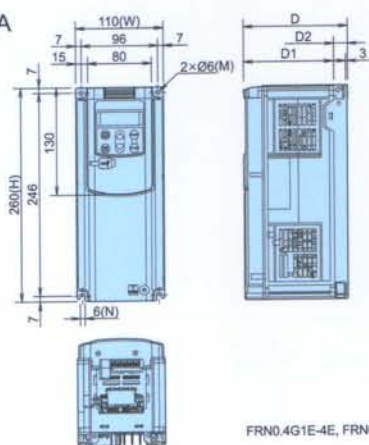


Fig.B

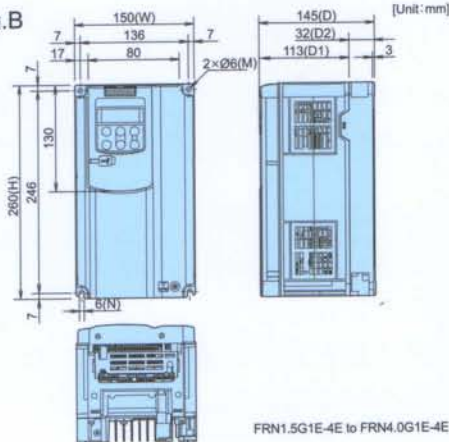


Fig.C

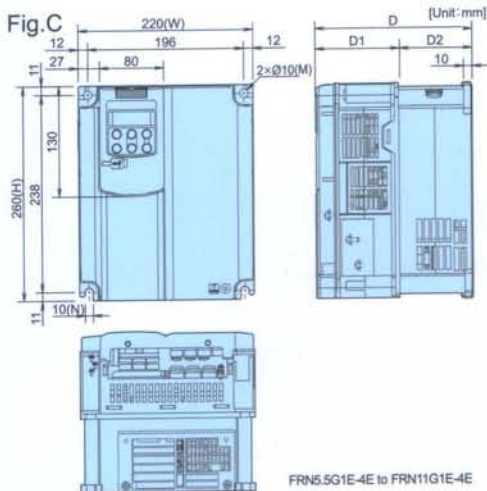


Fig.D

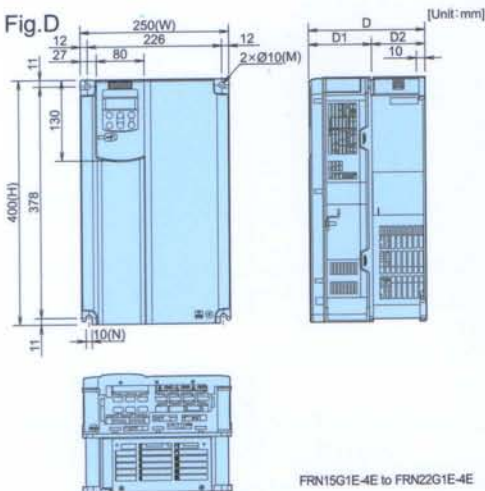
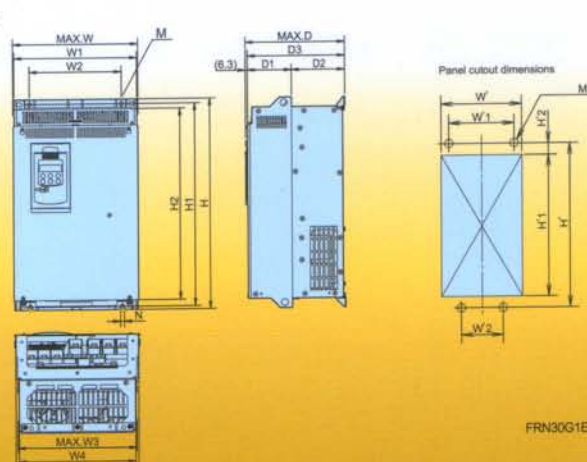


Fig.E



FRN30G1E-4E to FRN75G1E-4E



## Standard Specifications 3ph 400V series

(0.4 to 55kW)

Item		Specifications															
Type (FRN□□□G1E-4E)		0.4	0.75	1.5	2.2	4.0	5.5	7.5	11	15	18.5	22	30	37	45	55	
Nominal applied motor [kW] (*1) HD		0.4	0.75	1.5	2.2	4.0	5.5	7.5	11	15	18.5	22	30	37	45	55	
Nominal applied motor [kW] (*1) LD		—	—	—	—	—	7.5	11	15	18.5	22	30	37	45	55	75	
Output ratings	Rated capacity [kVA] (*2)	1.1	1.9	2.8	4.1	6.8	10	14	18	24	29	34	45	57	69	85	
	Rated voltage [V] (*3)	Three-phase 380 to 480V (with AVR)															
	Rated Current [A] HD	1.5	2.5	4	5.5	9	13.5	18.5	24.5	32	39	45	60	75	91	112	
	Rated Current [A] LD	—	—	—	—	—	16.5	23	30.5	37	45	60	75	91	112	150	
	Overload capability	150% for 1min, 200% for 3.0s															
Rated frequency [Hz]		50, 60Hz															
Input ratings	Main circuit power Phases, voltage, frequency	Three-phase 380 to 480V, 50/60Hz															
	Auxiliary control power input Phases, voltage, frequency	—		Single-phase 380 to 480V, 50/60Hz													
	Auxiliary power input for fan Phases, voltage, frequency (*5)	—															
	Voltage, frequency variations	Voltage:+10 to -15% (Voltage unbalance:2% or less (*6)) Frequency:+5 to -5%															
	Rated current [A] (*7) HD	with DCR	0.85	1.6	3.0	4.5	7.5	10.6	14.4	21.1	28.8	35.5	42.2	57.0	68.5	83.2	102
		without DCR	1.7	3.1	5.9	8.2	13.0	17.3	23.2	33	43.8	52.3	60.6	77.9	94.3	114	140
	Required power supply capacity [kVA] (*8) HD	with DCR	0.6	1.2	2.1	3.2	5.2	7.4	10	15	20	25	30	40	48	58	71
Rated current [A] (*7) LD	with DCR	—	—	—	—	—	14.4	21.1	28.8	35.5	42.2	57.0	68.5	83.2	102	138	
	without DCR	—	—	—	—	—	23.2	33.0	43.8	52.3	60.6	77.9	94.3	114	140	—	
Required power supply capacity [kVA] (*8) LD	with DCR	—	—	—	—	—	10	15	20	25	30	40	48	58	71	96	
Braking	Torque [%] (*9)	150%		100%					20%					10 to 15%			
	Braking transistor	Built-in															
	Min. ohmic value [Ω]	200		180		96		64		48		32		24		16	
	Torque [%]	180%		180%		180%		180%		180%		180%		180%		—	
	Built-in braking resistance	720Ω	470Ω	160Ω				80Ω				—					
	Braking time[s]	5s															
		%ED	5	3	5	3	2	3	2	—							
DC injection braking		Starting frequency:0.0 to 60.0Hz, Braking time: 0.0 to 30.0s, Braking level:0 to 100%															
EMC filter		EMC standard compliance: Category C3 is only emission and 2nd Env. is immunity. (EN61800-3:2004)															
DC reactor (DCR) (*10)		Optional															
Applicable safety standards		UL508C, C22.2No.14, EN50178:1997															
Enclosure (IEC60529)		IP20(IEC60529) closed type, UL open type (UL 50)											IP00 open type, UL open type				
Cooling method		Natural cooling				Fan cooling											
Weight/Mass [kg]		1.8	2.1	2.7	2.9	3.2	6.8	6.9	6.2	10.5	10.5	11.2	26	27	32	33	

(75 to 630kW)

Item		Specifications													
Type (FRN□□□G1E-4E)		75	90	110	132	160	200	220	280	315	355	400	500	630	
Nominal applied motor [kW] (*1) HD		75	90	110	132	160	200	220	280	315	355	400	500	630	
Nominal applied motor [kW] (*1) LD		90	110	132	160	200	220	280	355	400	450	500	630	710	
Output ratings	Rated capacity [kVA] (*2)	114	134	160	192	231	287	316	396	445	495	563	731	891	
	Rated voltage [V] (*3)	Three-phase 380 to 480V (with AVR)													
	Rated Current [A] HD	150	176	210	253	304	377	415	520	585	650	740	960	1170	
	Rated Current [A] LD	176	210	253	304	377	415	520	650	740	840	960	1170	1370	
	Overload capability	150% for 1min, 200% for 3.0s													
	Rated frequency [Hz]	50, 60Hz													
Input ratings	Main circuit power Phases, voltage, frequency	Three-phase 380 to 440V/50Hz Three-phase 380 to 480V/60Hz													
	Auxiliary control power input Phases, voltage, frequency	Single-phase 380 to 480V, 50/60Hz													
	Auxiliary power input for fan Phases, voltage, frequency (*5)	Single-phase 380 to 440V/50Hz Single-phase 380 to 480V/60Hz													
	Voltage, frequency variations	Voltage: +10 to -15% (Voltage unbalance: 2% or less (*6)) Frequency: +5 to -5%													
	Rated current [A] (*7) HD	with DCR 138	164	201	238	286	357	390	500	559	628	705	881	1115	
	without DCR —	—	—	—	—	—	—	—	—	—	—	—	—	—	
Braking	Required power supply capacity [kVA] (*8) HD	with DCR 96	114	140	165	199	248	271	347	388	436	489	611	773	
	Rated current [A] (*7) LD	with DCR 164	210	238	286	357	390	500	628	705	789	881	1115	1256	
	without DCR —	—	—	—	—	—	—	—	—	—	—	—	—	—	
	Required power supply capacity [kVA] (*8) LD	with DCR 114	140	165	199	248	271	347	436	489	547	611	773	871	
	Torque [%] (*9)	10 to 15%													
	Braking transistor	—													
Braking	Min. ohmic value [Ω]	—													
	Torque [%]	—													
	DC injection braking	Starting frequency: 0.0 to 60.0Hz, Braking time: 0.0 to 30.0s, Braking level: 0 to 100%													
EMC filter		EMC standard compliance: Category C3 is only emission and 2nd Env. is immunity. (EN61800-3:2004)													
DC reactor (DCR) (*10)		Standard accessory													
Applicable safety standards		UL508C, C22.2No.14, EN50178:1997													
Enclosure (IEC60529)		IP00 open type, UL open type													
Cooling method		Fan cooling													
Weight/Mass [kg]		42	62	64	103	103	144	144							

(\*1) Fuji's 4-pole standard motor

(\*2) Rated capacity is calculated by assuming the output rated voltage as 220V for three-phase 200V series and 440V for three-phase 400V series.

(\*3) Output voltage cannot exceed the power supply voltage.

(\*4) The auxiliary power input is used as an AC fan power input when combining the unit such as high power factor PWM converter with power regenerative function. (Generally not used.)

(\*5) Interphase voltage unbalance ratio [%] = (max. voltage [V] - min. voltage [V]) / 3-phase average voltage [V] × 67 (See IEC61800-3.) Use the DC reactor (ACR: optional) when used with 2 to 3 % of unbalance ratio.

(\*6) The value is calculated on assumption that the inverter is connected with a power supply capacity of 500kVA (or 10 times the inverter capacity if the inverter capacity exceeds 50kVA) and %X is 5%.

(\*7) Obtained when a DC reactor (DCR) is used.

(\*8) Average braking torque obtained by use of a motor. (Varies with the efficiency of the motor.)

(\*9) The 55kW DC reactor (DCR) is optional with HD spec. and is provided as a standard accessory with LD spec.

# *Quality is our drive*

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