e-Front runners

FRENIC-Eco

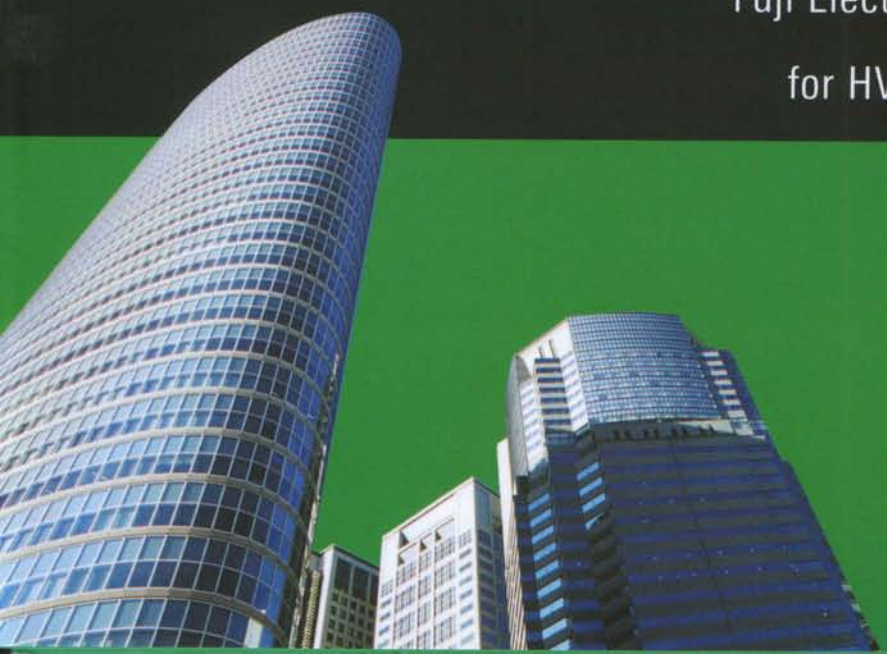
Fuji Electric frequency inverter

for HVAC and pump control

0.75 – 500kW

3-phase 400V

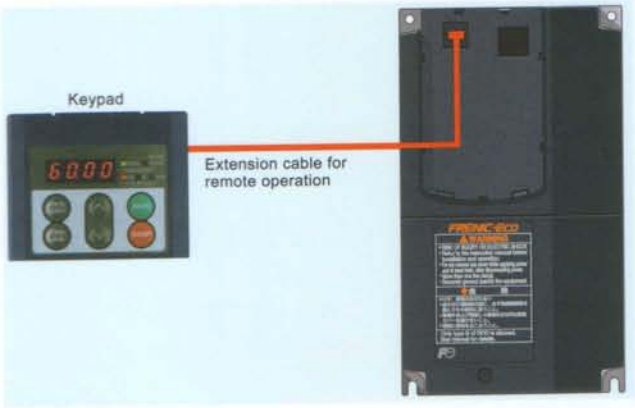
IP20/00 & IP54



FLEXIBLE THROUGH OPTIONS

Remote operation is possible by using extension cable

The keypad can be remotely connected to the inverter through an extension cable.



Network/Fieldbus connectivity

Compatible with various open buses such as DeviceNet, PROFIBUS-DP, LonWorks network, Modbus Plus CC-Link, Metasys, etc.
A standard RS485 communication port (Modbus RTU) is provided. With an additional RS485 communication card (optional), up to two ports can be installed.

Inverter loader software (option free of charge)

as option is available on Windows-basis which simplifies setting of function codes and data management.

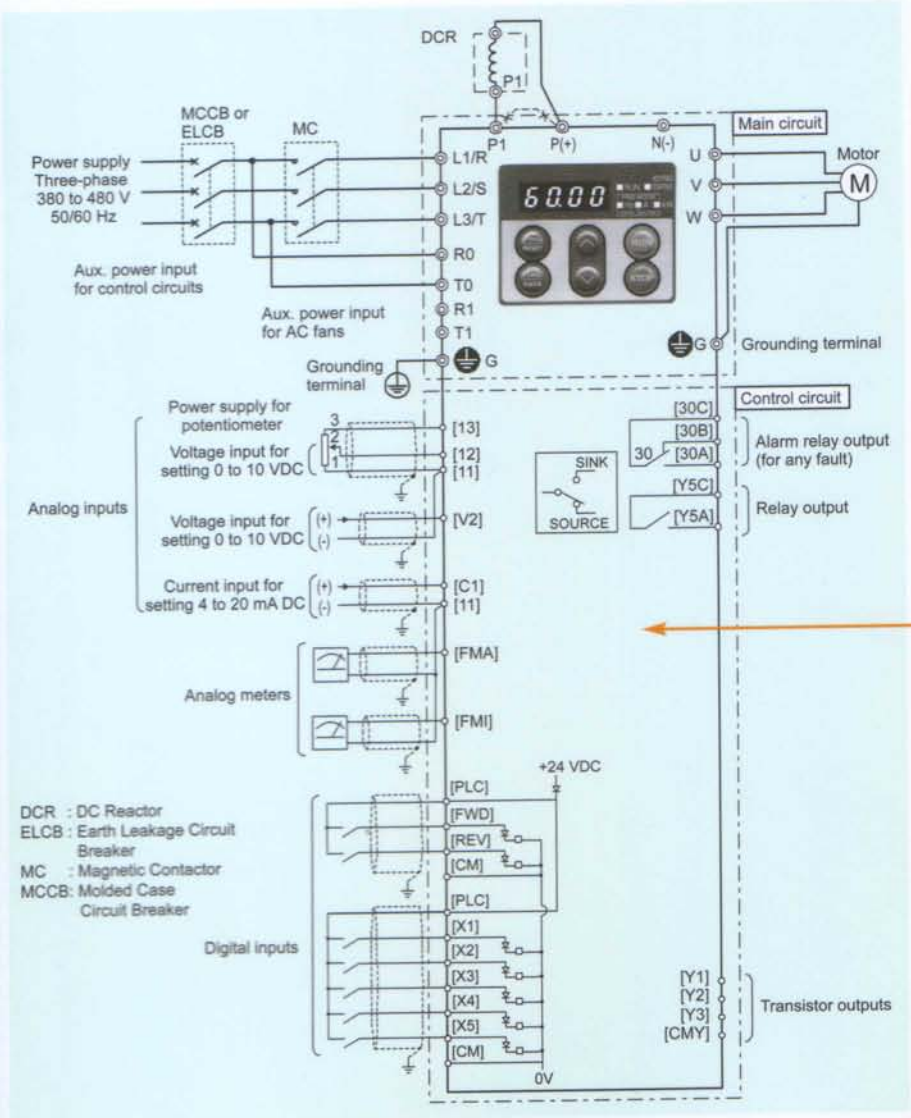
External cooling attachment

An external cooling attachment (Option for 30kW or smaller, Standard for 37kW or larger) allows you to mount the inverter in such a way that the heat sink assembly may be exposed to the outside of the cabinet. This greatly reduces heat radiated inside your enclosure.

Relay Output card

This card is used to expand the number of outputs (3 additional relay outputs).

BASIC WIRING DIAGRAM (for running the inverter with terminal commands)



Notes

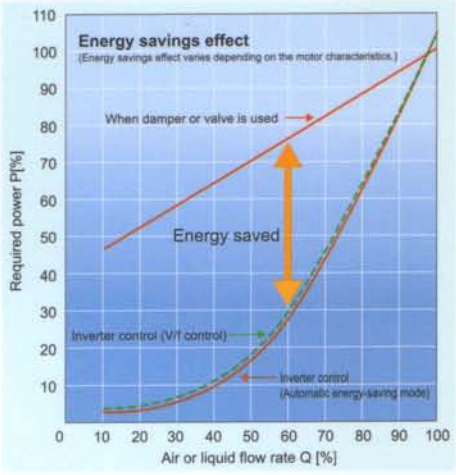
- Sink/Source digital input connections selectable by a switch.
- PID-Control: Terminal 12 (0 to 10V): Pressure command
- PID-Control: Terminal C1 (Sensor Output: 4 to 20mA): Feedback Sensor

Relay Output card, Fieldbus card, RS485 communication card

CONTRIBUTION TO ENERGY-SAVING

Automatic energy-saving operation function

In addition to the motor loss, the inverter loss is also kept to a minimum with the FRENIC-Eco when applied to fans or pumps.



Analog input monitor

Analog signals can be sent to the inverter to allow status monitoring of peripheral equipment and issuance of commands to peripheral equipment.

Cooling fan ON/OFF control function

The inverter's cooling fan can be stopped for noise reduction and energy savings whenever the motor is stopped.

SIMPLE OPERATION

Quick setup menu

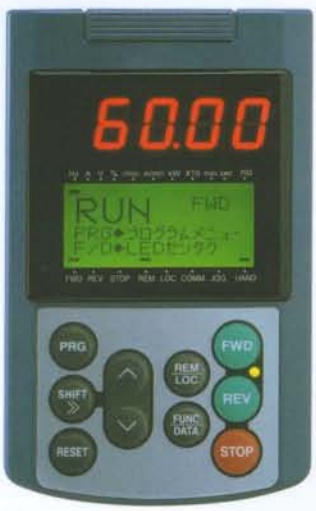
Up to 19 frequently used or important function codes can be defined for quick setup in order to shortcut operation and management.

Standard keypad capable of remote operation with optional extension cable

Data can be easily copied to the second or more inverters with the code copying function.

Multi-function keypad (option)

A backlit LCD is installed to allow simple set up through interactive data entry. Function codes can be added or deleted to or from the 19 function codes within the quick setup function.



Multi-function keypad with built-in copy-function

Because the optional multi-function keypad is provided with a built-in copy function, data can be easily copied to the second inverters without requiring individual setups.

EASY MAINTENANCE AND MANY PROTECTIVE FUNCTIONS

The lifetime of the main circuit capacitor can be estimated.

Because the capacitor's life compared with its initial value can be checked, the replacement timing of the main circuit capacitor can be determined.

A long-life cooling fan is provided.

Use of a long-life cooling fan (design life: 61000 hours for models smaller than 5.5kW); 40000 hours for models higher than 7.5 and up to 30kW [at ambient temperature: 40°C]) reduces replacement work

Cumulative running time is recorded and displayed.

The inverter records and displays the cumulative "motor running time" and "inverter running time" (PC board capacitor running time, cooling fan running time), so that they can be used to determine machine and inverter maintenance.

It is possible to output lifetime forecast signal to the transistor output.

This signal is output when the main circuit capacitors in the DC bus circuit, the electrolytic capacitors on the PC boards or the cooling fans are nearing the end of their service life.

The alarm history for the 4 latest alarms is recorded.

Detailed information from back as far as the latest 4 alarms can also be checked.

Protective function against phase loss in input/output

is possible upon start-up and operation.

Protective function for grounding fault

Protection is provided for an overcurrent caused by a grounding fault.

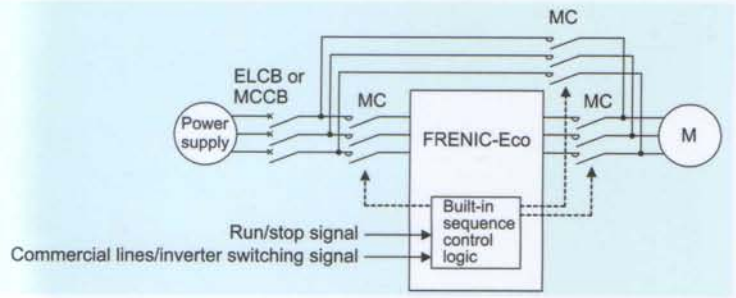
Protection of motor with PTC thermistor

In addition to the protection of the motor with an electronic thermal relay, a PTC thermistor can be used for motor protection.

FULL CAPABILITIES FOR HVAC AND PUMP CONTROL

Line/inverter switching

Frenic ECO inverter is provided with additional control supply inputs. This allows to switch the power source of the controlled motor between commercial power and inverter output. Two types of sequences are available: integrated standard and the auto-switching upon occurring an inverter alarm.

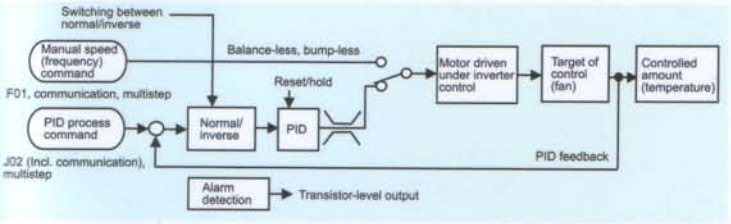


Basic speed control

The speed setpoint is commanded from a PLC or a process controller to the inverter.

Full PID control functions

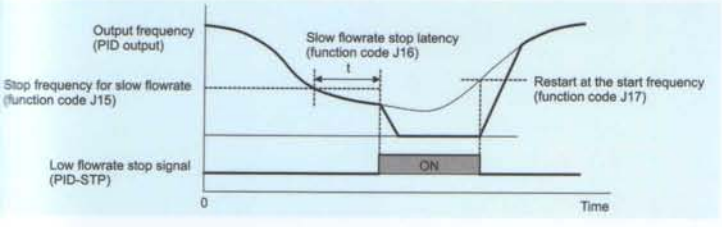
Frenic ECO has a powerful PID control provided with features that ease the adjustments:



- deviation alarm/absolute value alarm output
- balance-less and bump-less switching that automatically adjusts the actual frequency against the frequency command
- anti-reset wind-up function for the prevention of overshooting in the PID control
- PID output limiter
- integration hold/reset signals

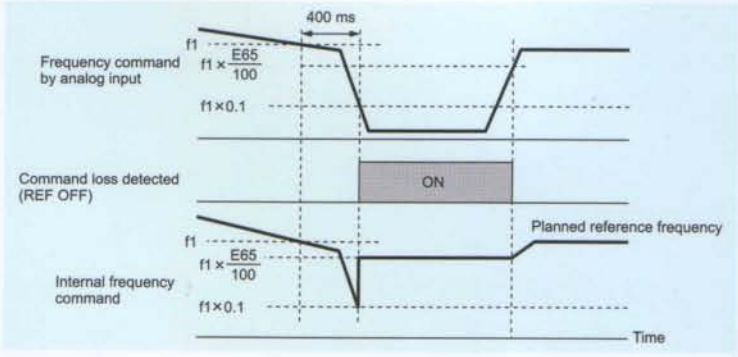
Sleep function with low limiter

A function for stopping the fan or pump at speeds lower than the lower limit is provided to assure the minimum speed. The function can be used also to stop at a low water flow.



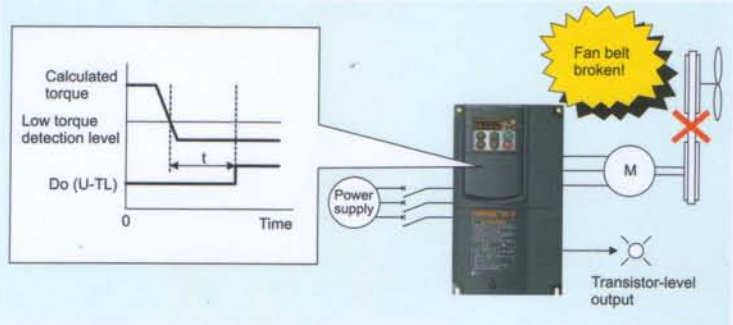
Command loss detection

The analog frequency command is monitored and when an abnormal condition is detected, an alarm signal is output. If this happens in a critical system such as an air conditioner for an important facility the system will be stopped or will continue its operation at the specified speed.



Low output torque detection

A low output torque detection signal is asserted in the event of sudden decrease in torque as a result of an abnormal condition such as the belt being broken between the motor and the load (e.g., a belt-driven fan).



Continued operation upon momentary power failure

The inverter automatically restarts upon recovery from momentary power failure without stopping the motor.
You can choose under three possibilities:

- Starting at the frequency at momentary power failure occurrence;
- Starting at 0Hz;
- Operation continues at a lower frequency while using the kinetic energy obtained from the inertia of the load at momentary power failure;

Switching among remote/panel/independent inverter operation modes

Through frequency setting 1 and frequency setting 2, run/stop command 1 and run/stop command 2, and local operation (keypad operation), the remote/panel/independent inverter operation modes can be selected for both operation commands and frequency commands.

Various frequency setting methods

The best method can be selected for the frequency setting according to the frequency signal to be used.
Keypad operation (and keys), analog input (4-20mA, 0-5V, 0-10V), 8-step multi-step frequency (step 0 to 7) setting, UP/DOWN operation, communication, etc.

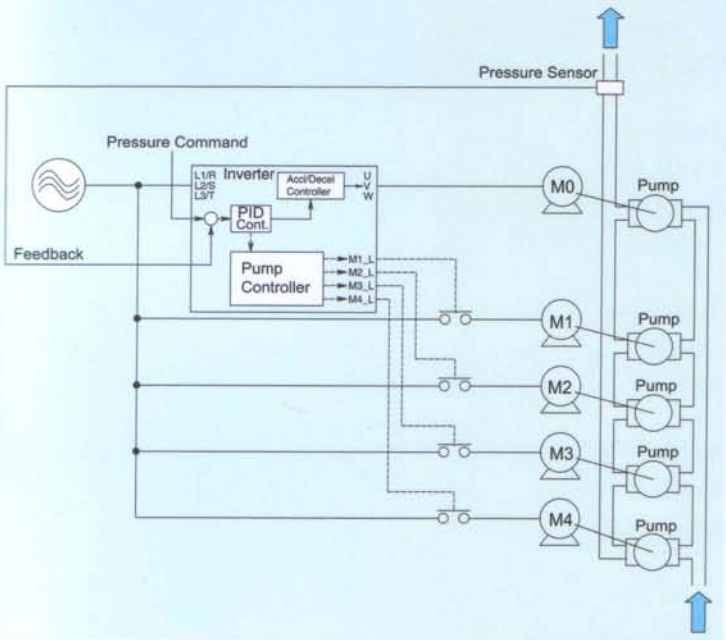
Motor pick-up during idling

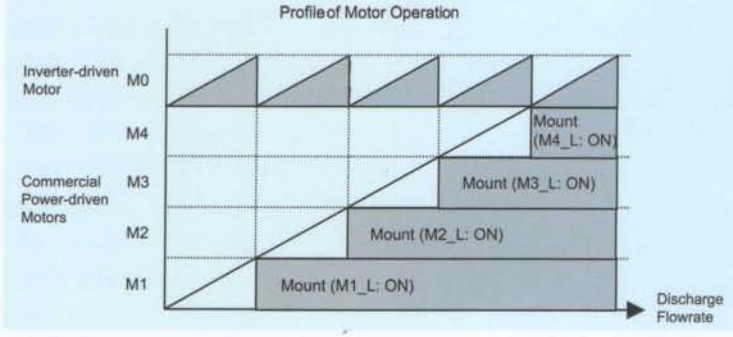
If the motor runs due to natural convection or other similar situations, you can use the pick-up function to start smoothly.

Multi Pump Cascade control:

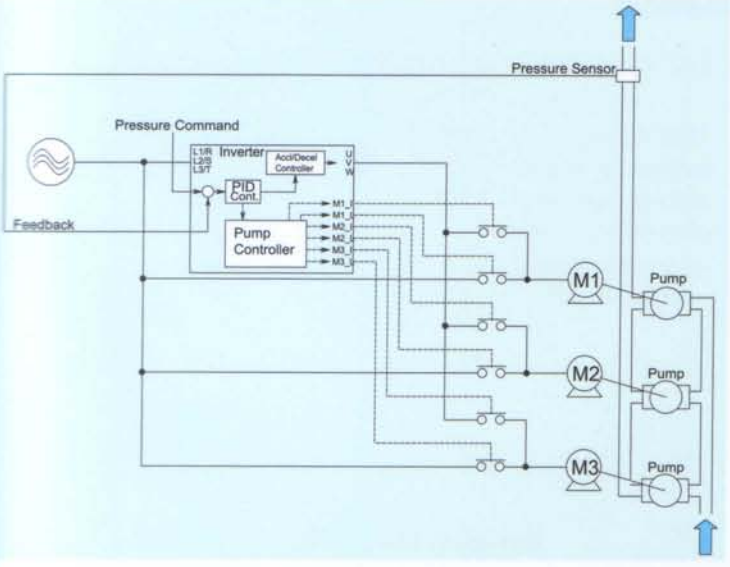
Dynamic rotation of pump motors. There are two alternatives to control more than one pump.

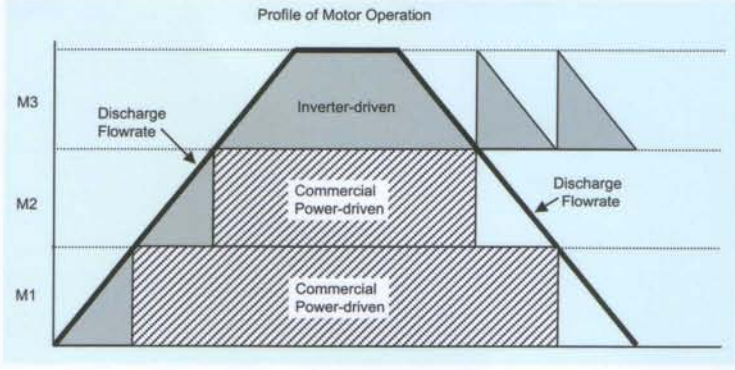
- With a fixed inverter-driven motor: Allows you to control up to 5 pumps. Any flow rate between 0 and 500 % is possible.





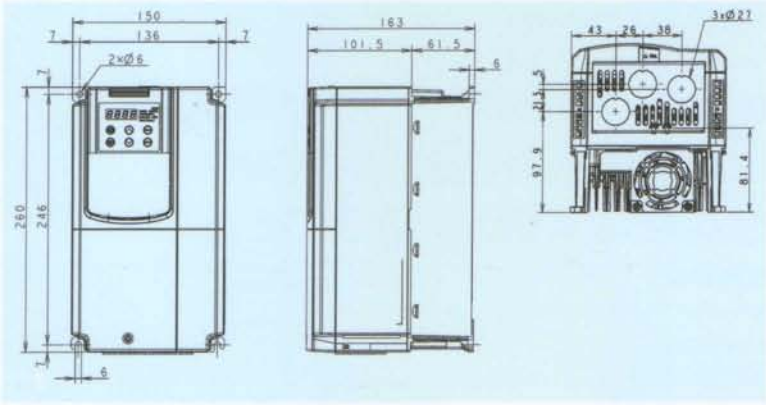
- With a floating inverter-driven motor: Allows you to control up to 3 pumps. Any flow rate between 0 and 300 % is possible.





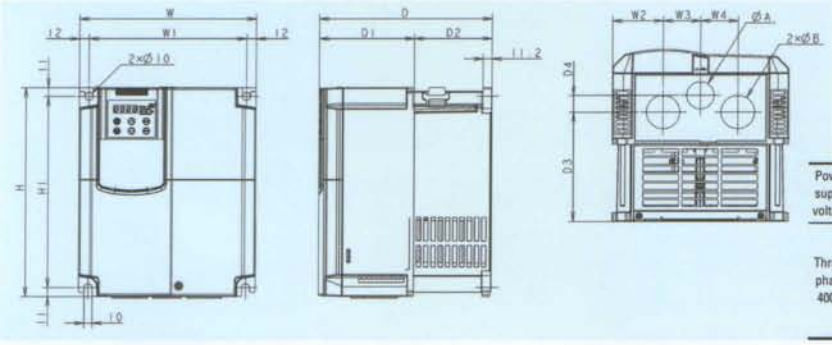
EXTERNAL DIMENSIONS

Main body of inverter 0.75 to 5.5kW



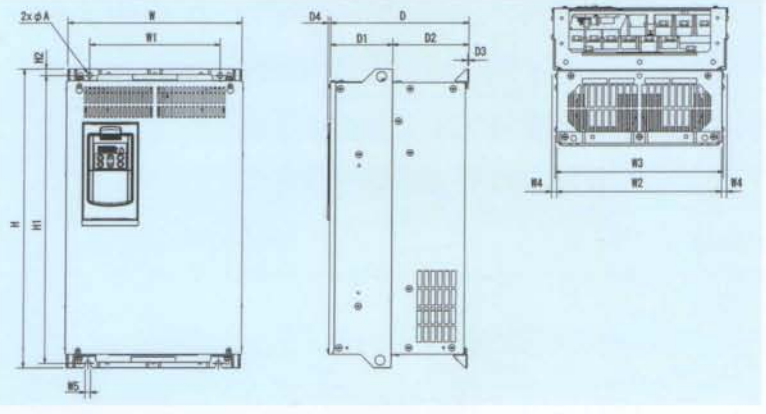
Power supply voltage	Type
Three-phase 400 V	FRN0.75F1S-4E
	FRN1.5F1S-4E
	FRN2.2F1S-4E
	FRN4.0F1S-4E
	FRN5.5F1S-4E

Main body of inverter 7.5 to 30kW



Power supply voltage	Type	Dimensions (mm)													
		W	W1	W2	W3	W4	H	H1	D	D1	D2	D3	D4	fA	fB
Three-phase 400 V	FRN7.5F1S-4E	220	196	63,5	46,5	46,5	260	238	215	118,5	96,5	141,7	16	27	34
	FRN11F1S-4E														
	FRN15F1S-4E											136,7	21	34	42
	FRN18.5F1S-4E	250	226	67	58	58	400	378		85	130	166,2	2		
	FRN22F1S-4E														
	FRN30F1S-4E			-	-	-						-	-	-	-

Main body of inverter 37 to 220kW



Power supply voltage	Type	Dimensions (mm)														
		W	W1	W2	W3	W4	W5	H	H1	H2	D	D1	D2	D3	D4	fA
Three-phase 400 V	FRN37F1S-4E	320	240	304	310,2	8	10	550	530	12	255	115	140	4	4,5	10
	FRN45F1S-4E															
	FRN55F1S-4E	355	275	339	345,2			615	595		270		155		6	
	FRN75F1S-4E															
	FRN90F1S-4E							740	720		300	145				
	FRN110F1S-4E															
	FRN132F1S-4E	530	430	503	509,2	13,5	15		710	15,5	315	135	180			15
	FRN160F1S-4E															
	FRN200F1S-4E							1000	970		360	180				
	FRN220F1S-4E															

Main body of inverter 280 to 500kW

[graphics and table will follow soon]

Note: For IP54 dimensions please contact Fuji Electric.

STANDARD SPECIFICATIONS

Three-phase 400V series (0.75 to 55kW)

Item				Specifications													
Type (FRN_ _ _F1S-4E)				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	0.75	1.5	2.2	4.0	5.5	7.5	11	15	18.5	22	30	37	45	55
Output ratings	Rated capacity (kVA)		*2	1.9	2.8	4.1	6.8	9.5	12	17	22	28	33	44	54	64	80
	Rated voltage (V)		*3	Three-phase, 380, 400 V/50 Hz, 380, 400, 440, 460 V/60 Hz (with AVR function)													
	Rated current (A)		*4	2.5	3.7	5.5	9.0	12.5	16.5	23	30	37	44	59	72	85	105
	Overload capability			120% of rated current for 1 min													
	Rated frequency			50, 60 Hz													
Input ratings	Phases, voltage, frequency	Main power supply		Three-phase, 380 to 480 V, 50/60 Hz											Three-phase, 380 to 440 V/50 Hz Three-phase, 380 to 480 V/60 Hz		
		Auxiliary control power input		Single-phase, 380 to 480 V, 50/60 Hz											Single-phase, 380 to 440 V/50 Hz Single-phase, 380 to 480 V/60 Hz		
		Auxiliary fan power input	*5	None													*10
	Voltage/frequency allowance			Voltage: +10 to -15% (Voltage unbalance: 2% or less)*9, Frequency: +5 to -5%													
	Rated current (A) *6	(with DCR)		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)		3.1	5.9	8.2	13.0	17.3	23.2	33.0	43.8	52.3	60.6	77.9	94.3	114	140
	Required power supply capacity (kVA)		*7	1.2	2.2	3.1	5.3	7.4	10	15	20	25	30	40	48	58	71
Braking	Torque (%)		*8	20										10 to 15			
	DC braking			Starting frequency: 0.0 to 60.0 Hz, Braking time: 0.0 to 30.0 s, Braking level: 0 to 60%													
DC reactor (DCR)				Option													
Applicable safety standards				UL508C, C22.2 No.14, EN50178:1997 (Applying)													
Enclosure (IEC60529)				IP20, UL open type										IP00, UL open type			
Cooling method				Natural cooling		Fan cooling											
Mass (kg)				3.1	3.2	3.3	3.4	3.4	5.8	6.0	6.9	9.4	9.9	11.5	23	24	33

Three-phase 400V series (75 to 500kW)

Item				Specifications												
Type (FRN_ _ _F1S-4E)				75	90	110	132	160	200	220	280	315	355	400	450	500
Nominal applied motor (kW)			*1	75	90	110	132	160	200	220	280	315	355	400	450	500
Output ratings	Rated capacity (kVA)		*2	105	128	154	182	221	274	316	396	445	495	563	640	731
	Rated voltage (V)		*3	Three-phase, 380, 400 V/50 Hz, 380, 400, 440, 460 V/60 Hz (with AVR function)												
	Rated current (A)		*4	139	168	203	240	290	360	415	520	585	650	740	840	960
	Overload capability			120% of rated current for 1 min												
	Rated frequency			50, 60 Hz												
Input ratings	Phases, voltage, frequency	Main power supply		Three-phase, 380 to 440 V, 50 Hz or Three-phase, 380 to 480 V, 60 Hz												
		Auxiliary control power input		Single-phase, 380 to 480 V, 50/60 Hz												
		Auxiliary fan power input	*5	Single-phase, 380 to 440 V/50 Hz Single-phase, 380 to 480 V/60 Hz												
	Voltage/frequency allowance			Voltage: +10 to -15% (Voltage unbalance: 2% or less)*9, Frequency: +5 to -5%												
	Rated current (A) *6	(with DCR)		138	164	201	238	286	357	390	500	559	628	705	789	881
		(without DCR)		—	—	—	—	—	—	—	—	—	—	—	—	—
	Required power supply capacity (kVA)		*7	96	114	140	165	199	248	271	347	388	435	489	547	611
Braking	Torque (%)		*8	10 to 15												
	DC braking			Starting frequency: 0.0 to 60.0 Hz, Braking time: 0.0 to 30.0 s, Braking level: 0 to 60%												
DC reactor (DCR)				Standard												
Applicable safety standards				UL508C, C22.2 No.14, EN50178:1997 (Applying)												
Enclosure (IEC60529)				IP00, UL open type												
Cooling method				Fan cooling												
Mass (kg)				34	42	45	63	67	96	98						

*1 Fuji 4-pole standard motor

*2 Rated capacity is calculated by assuming the output rated voltage as 440 V for three-phase 400 V series.

*3 Output voltage cannot exceed the power supply voltage.

*4 An excessively low setting of the carrier frequency may result in the higher motor temperature or tripping of the inverter by its overcurrent limiter setting. Lower the continuous load or maximum load instead. (When setting the carrier frequency (F26) to 1 kHz, reduce the load to 80% of its rating.)

*5 Use [R1, T1] terminals for driving AC cooling fans of an inverter powered by the DC link bus, such as by a high power factor PWM converter. (In ordinary operation, the terminals are not used.)

*6 Calculated under Fuji-specified conditions.

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

*8 Average braking torque (Varies with the efficiency of the motor.)

*9 Voltage unbalance (%) = $\frac{\text{Max. voltage (V) - Min. voltage (V)}}{\text{Three-phase average voltage (V)}} \times 67$ (IEC61800-3 (5.2.3))

If this value is 2 to 3%, use an AC reactor (ACR).

*10 Single-phase, 380 to 440 V/50 Hz or Single-phase, 380 to 480 V/60 Hz

e-Front runners

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