Fuji Electric

Innovating Energy Technology

Fuji Medium-voltage IGBT Inverters

FRENIC4600FM5e

24D1-E-0004

Environment-friendly inverters.

Fuji medium-voltage IGBT inverter FRENIC4600FM5e is used for direct variable-speed control of medium-voltage motors, and greatly raises the efficiency and power factor, stabilizes motor operation and conserves energy.

Compact design for space saving

- The industry's smallest-class inverter achieved by significant panel size reduction

Ideal inverter for power sources and motors

- The multi-phase diode rectifier system reduces harmonics on the power source side.
- Due to the use of Fuji Electric's unique multi-level PWM control system, the switching surge is reduced and existing motors (standard ones) can be operated.

High-efficiency and high-power factor

- The use of a multi-phase diode, full-wave rectifier provides a high-power factor (95% or more) on the power source.
- The elimination of output transformers for operation has improved total efficiency (approx. 97%).
- Fuji Electric's original multi-level PWM control has reduced the IGBT switching loss.

High-reliability

- Higher equipment reliability is achieved by reducing the number of inverter cells by using a single-phase, 3-level inverter, etc..
- Stable operation is maintained despite load fluctuations, by the simple sensor-less vector control function.
- The control device has a 32-bit MPU for quick response and high-accuracy.

Contributes to energy saving

- A substantial energy saving is achieved by variable-speed control of a square-law reduced torque load such as a fan or pump.

Easy maintenance

- The inverter is air-cooled, requiring no cooling water.
- Start/stop operation, parameter setting, fault display and data monitoring are performed from the touch panel with simple loader functions.
- Simple, built-in auto-tuning functions facilitate testing and adjustment.
- Fault diagnoses are easily performed.
- A dry-type input transformer is adopted.

Simple circuit configuration

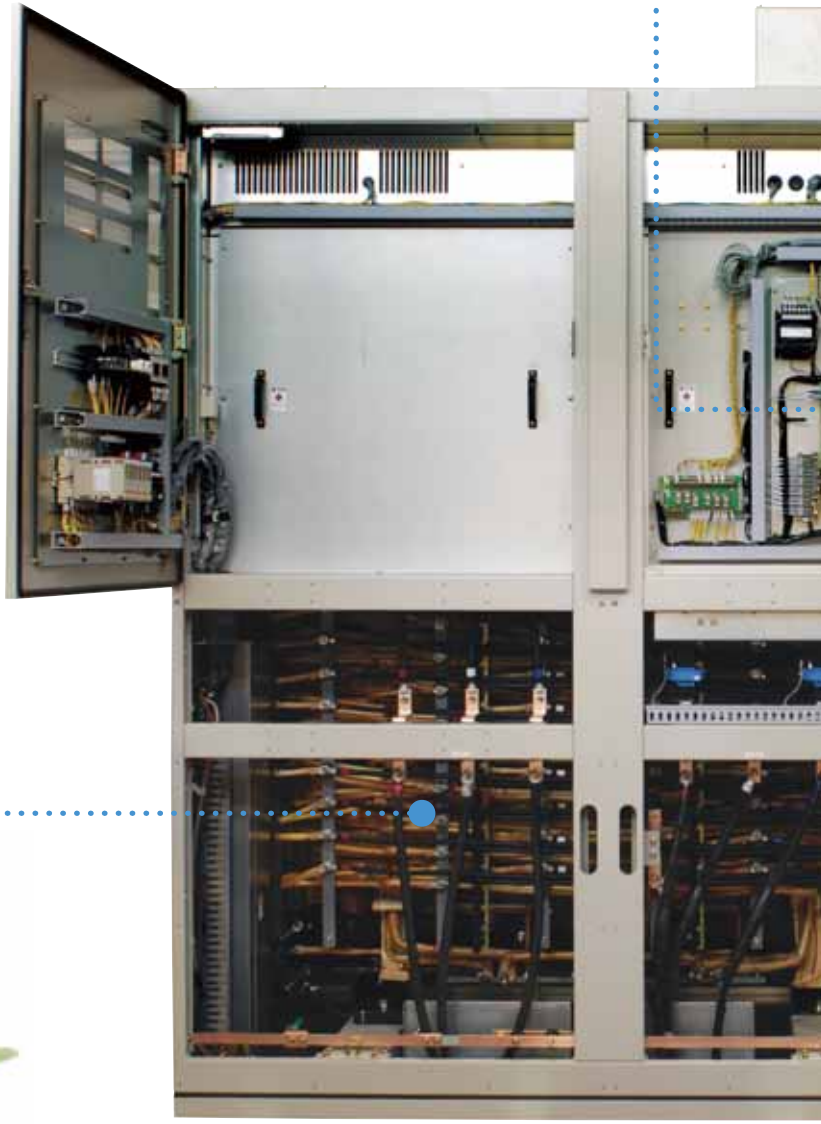
High-reliability and simple-maintenance inverters utilizing the latest power electronics such as 3-level inverter, mounting of special MPU and no need for harmonic filter/power-factor regulating capacitor.

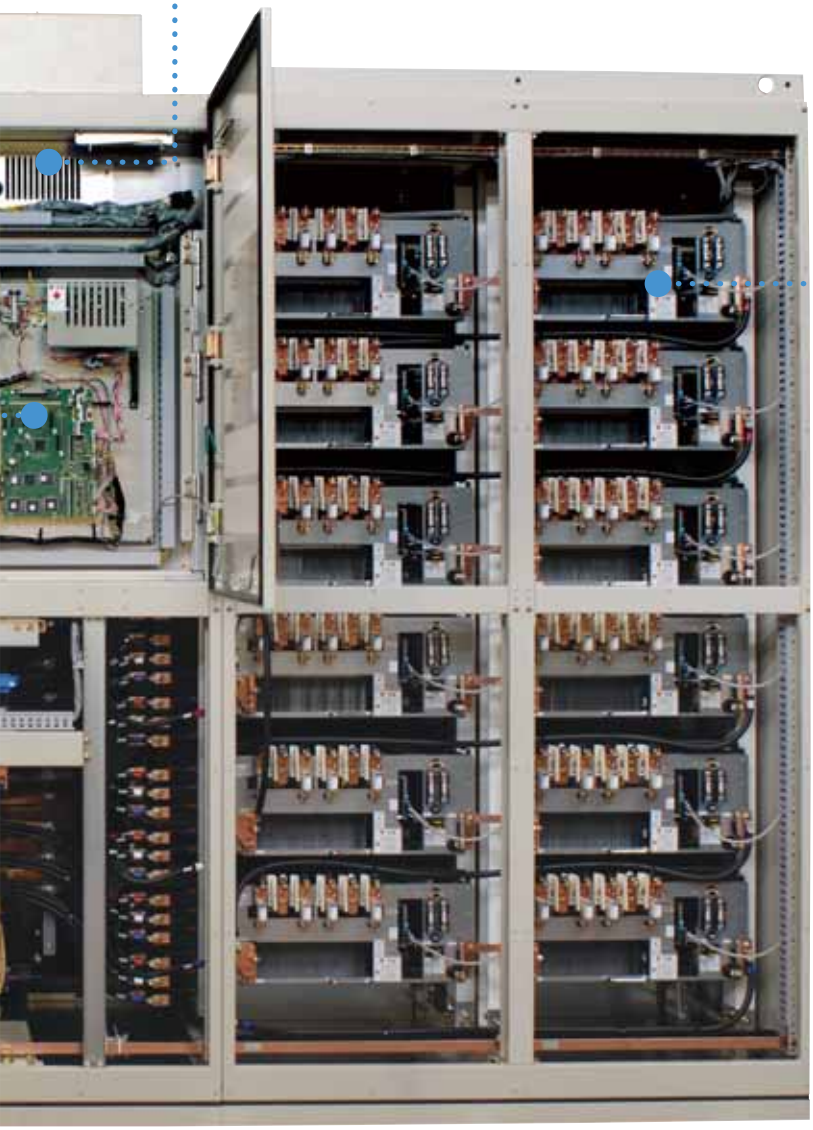
Master control PC board

- Mounting of a 32-bit MPU, and a special MPU in the voltage and current detection system offers a quick response and high accuracy.
- Incorporation of a simple sensor-less vector control function enables inverters to maintain stable operation irrespective of load fluctuation even without a speed sensor.
- Vector control with a speed sensor is available (as an option) for equipment having high speed and torque accuracy requirements.

Input multiplex-winding transformer

- Harmonic current on the power source side is low due to a multiplex configuration of the secondary winding.
- The use of a multi-phase diode rectification system enables harmonic current that conforms to the IEEE standard.
- Harmonic filters and power factor improving capacitors are not needed.
- Because a dry-type input transformer is used in the panel, external cabling work between the input transformer and inverter panel is no longer necessary.





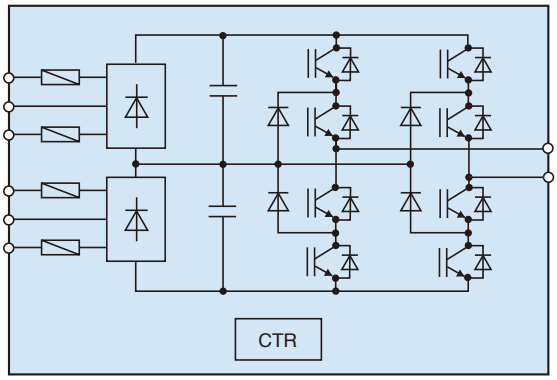
6.6kV 1,540kVA

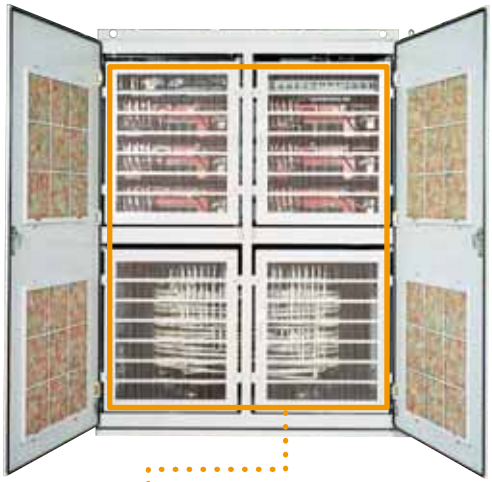
Cooling fan

- Air-cooled inverters make maintenance easy.

Inverter cell

- The number of inverter cells has been substantially reduced by adopting a single-phase, 3-level inverter design.
- Each inverter cell alone can be replaced easily, because the controller, diodes, IGBT elements and DC intermediate capacitor are combined into an integral body.





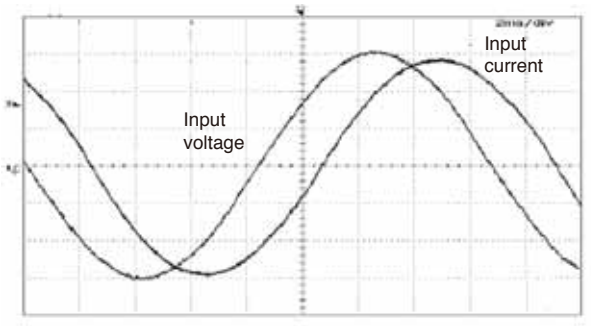
When requested, protection covers can be provided inside the inverter panel (as an option). Protection covers will protect from unexpected contact with live metal parts of the main circuit.

Clean power input

Substantial reduction of harmonic current on power source side

Due to progress in power electronics, semiconductors have recently been used for industrial electrical equipment and household electrical appliances in order to enhance convenience and ease of operation. However, due to harmonic currents generated from such equipment and appliances, the voltage of the power system is often distorted and many troubles occur in equipment connected to the power system. However, because the use of equipment containing power electronics will increase, measures for suppressing harmonics need to be improved.
FRENIC4600FM5e suppresses the harmonics by using a multi-phase diode rectification system, thereby substantially reducing the generation of harmonics in comparison with previous models.
The harmonic generation level stipulated in IEEE-519 (1992) is satisfied.
This inverter is ideal for power sources.

■Current waveform on power source side



■Harmonic current content (6.6kV)

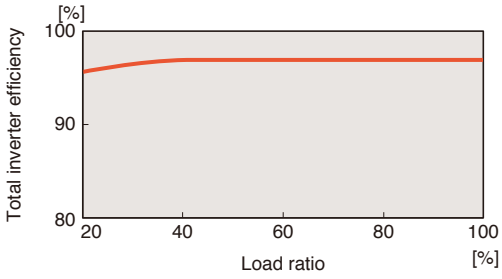
Order	5th	7th	11th	13th	17th	19th	23rd	25th	35th	37th
IEEE value [%]	4.00	2.86	1.83	1.49	1.14	1.02	0.87	0.80	0.80	0.80
Measured value (*) [%]	0.58	1.0	0.20	0.32	0.75	0.54	0.06	0.24	0.58	0.27

(*): Example value from our full load test

Total inverter efficiency as high as approximate 97% (at full load)

- Because an output transformer is unnecessary, inherent losses are eliminated.
- Multi-level PWM control minimizes switching loss.
- Because the harmonic current on the power source side is reduced, the primary winding of the input transformer has a reduced loss due to the harmonics.

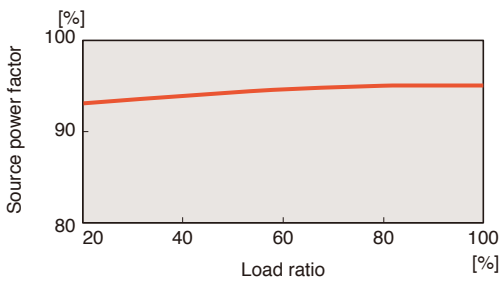
■Total inverter efficiency curve (including input transformer)



Source power factor as high as 95% or more (at full load)

- Due to full-wave rectification with multi-phase diodes, operation is allowed with the source power factor (power factor on power source side) set at a high level.
- A phase advancing capacitor and a DC reactor for improving the source power factor are unnecessary.
- A smaller power capacity suffices for inverter operation.

■Source power factor curve



Note: The efficiency and power factor data on this page are calculated by assuming that a 315kW motor is operated at the rated speed with a 3.3kV-input, 390kVA-output inverter. The data on efficiency is obtained using Fuji Electric's standard 4-pole motor.

Friendly to machines

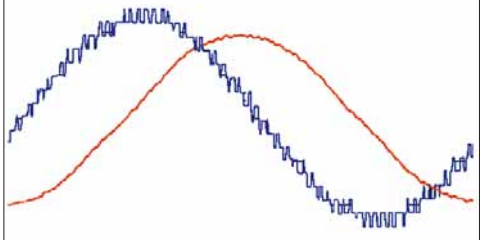
If a harmonic current component is contained in the inverter output current, a torque ripple occurs on the output shaft of a motor. A torque ripple means a change in rotational speed or a large vibration if the frequency of the torque ripple matches the natural frequency of the mechanical system and torque ripple is large.

In FRENIC4600FM5e, the harmonic component on the output side is extremely small due to the multi-level (max. 17 levels) PWM control and the main component of torque ripple is at around the carrier frequency (several kHz). Therefore, torque ripple hardly affects the machine side.

Friendly to motors

- The multi-level PWM control provides an almost sinusoidal output current waveform, thus reducing motor torque ripple.
- Because the output current is almost sinusoidal, a motor suffers less loss due to harmonics.
- The multi-level (max. 17 levels) PWM control minimizes switching surge and thereby reduces stress on the motor.
- There is no need to reduce motor capacity due to inverter drive.
- There is no need for special cables, etc. due to inverter drive.
- This inverter is applicable not only to a square-law reduced torque load, but also to a constant torque load such as an extruder.
- For driving a large-capacity motor in a system that has a small power capacity, voltage fluctuation, etc. due to the starting current of a motor will cause problems. However, because the starting current can be suppressed by the soft start of this inverter, operation can be performed.

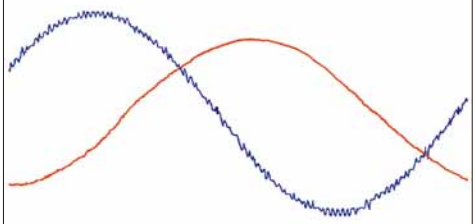
Output voltage and current waveforms at 3.3kV output



: output voltage waveform

: output current waveform

Output voltage and current waveforms at 6.6kV output

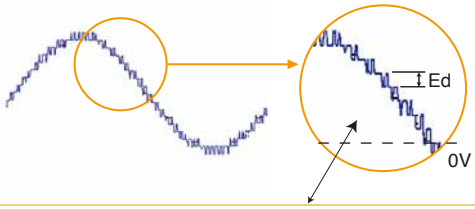


Note

Surge voltage and multi-level output

The output voltage waveform of a PWM inverter is a DC chopping voltage (called "pulse voltage = surge voltage") whose amplitude is determined by voltage Ed of the DC intermediate circuit. When this surge voltage of inverter output is applied to a motor through a cable, the voltage is reflected repeatedly between the motor terminal and inverter terminal.
A sharp overvoltage higher than the inverter output voltage is thus generated at the motor terminal, which may cause dielectric breakdown of the winding.
Fuji Electric's medium-voltage inverter suppresses the DC intermediate voltage level so as to realize an output voltage waveform at 9 levels in the 3kV class and at 17 levels in the 6kV class. As a result, the overvoltage generated at the motor terminal can be suppressed.

Output voltage waveform (9 levels) in 3kV class



In the 3kV class Fuji Electric's medium-voltage inverter, the output voltage changes in 9 steps (corresponding to 9 levels) within 1/4 cycle. The voltage value of one step equals the DC intermediate circuit voltage Ed. Therefore, for the same voltage output, a larger number of steps means a smaller voltage value at one step. Thus, Fuji Electric's inverter can also reduce the surge voltage appearing at the motor terminal and thereby moderate the stress applied to the motor.

Main circuit configuration

Main circuit configuration

Fig. 1 Main circuit configuration of 3.3kV type

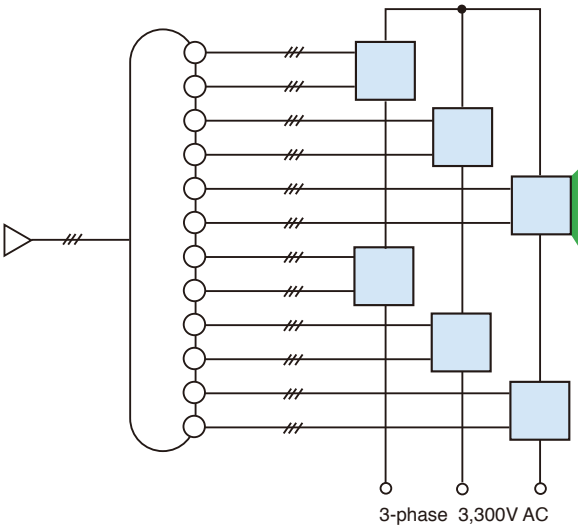
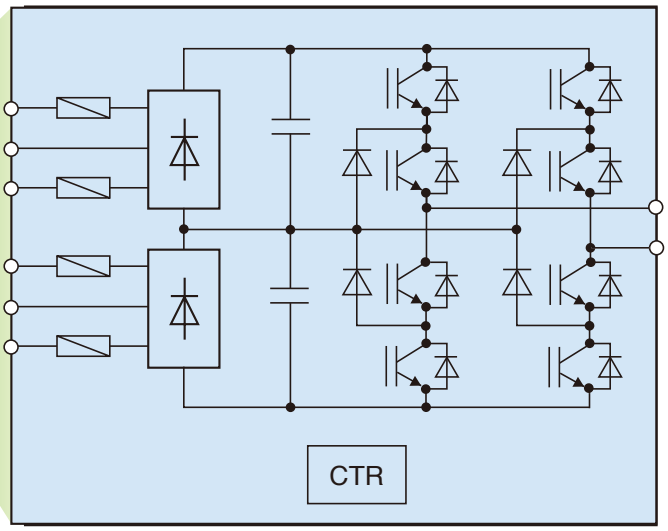


Fig. 2 Internal configuration of inverter cell



Principle of operation

FRENIC4600FM5e consists of an input transformer and 6 inverter cells in case of the 3kV type as shown in Fig. 1 (the 6kV type has 12 inverter cells.).
One inverter cell consists of a single-phase, 3-level inverter and can receive an output voltage of 953V.
As shown in Fig. 1, the 3kV type obtains a phase voltage of about 1,900V by connecting 2 inverter cells vertically and a star connection of the vertical cell pairs can generate a line voltage of about 3,300V.
Use of the single-phase, 3-level inverter doubles the output voltage obtainable from one cell when compared with a single-phase, 2-level inverter. Therefore, an output voltage of 3.3 or 6.6kV can be obtained by using a smaller number of inverter cells. (See Figs. 3 and 4.)

Fig. 3 3-level voltage output

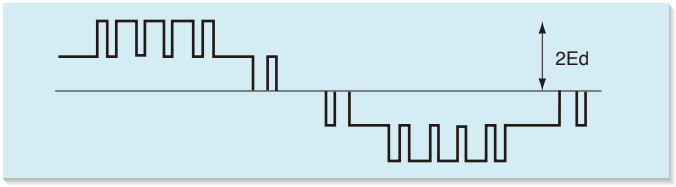
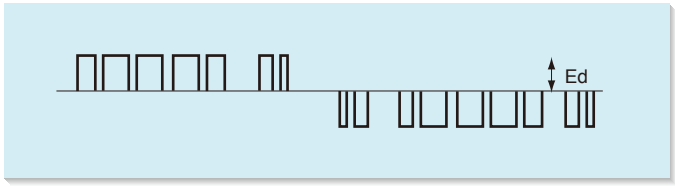


Fig. 4 2-level voltage output



Ed: DC intermediate circuit voltage

Commercial power supply bypass circuit

●Changeover to the starting circuit by commercial power supply can be made by installing a bypass circuit (option) on the inverter output side.
In this configuration, motor drive power supply is duplicated, and changeover between commercial power supply and inverter operation is allowed for running a motor at the rated speed. (See Fig. 5.)

Synchronizing and parallel off function

●Shockless switching between inverter operation and commercial power operation allowed by phase control according to system voltage. (See Fig. 6.)
(Synchronizing/parallel off function: option)
An optional electric reactor must be installed on the output side of the inverter to enable this function.

Restart after momentary power interrupt function

●In the event of a voltage drop due to a momentary power interruption, the operation processing pattern can be selected according to the application.

1. Selection of major fault at voltage drop due to momentary power interruption
The inverter is stopped in the major fault status and the motor is set in the free run status.

2. Selection of restart under free run (option)
Inverter operation is stopped and the motor is set in the free run status. Upon power recovery, the motor under deceleration in free run or under stop is automatically accelerated again through a speed search function.

3. Selection of continuing operation at voltage drop due to momentary power interruption (option)
Inverter operation is continued without setting the motor in the free run status even when a voltage drop due to a momentary power interruption occurs. As soon as line voltage is recovered, the motor is accelerated again back to the operating speed.

Notes:
(1) A voltage drop due to a momentary power interruption will be detected at 85% or less of the rated voltage.
(2) Operation can be continued within 300ms at a voltage drop due to a momentary power interruption (option).

Fig. 5 Power system diagram

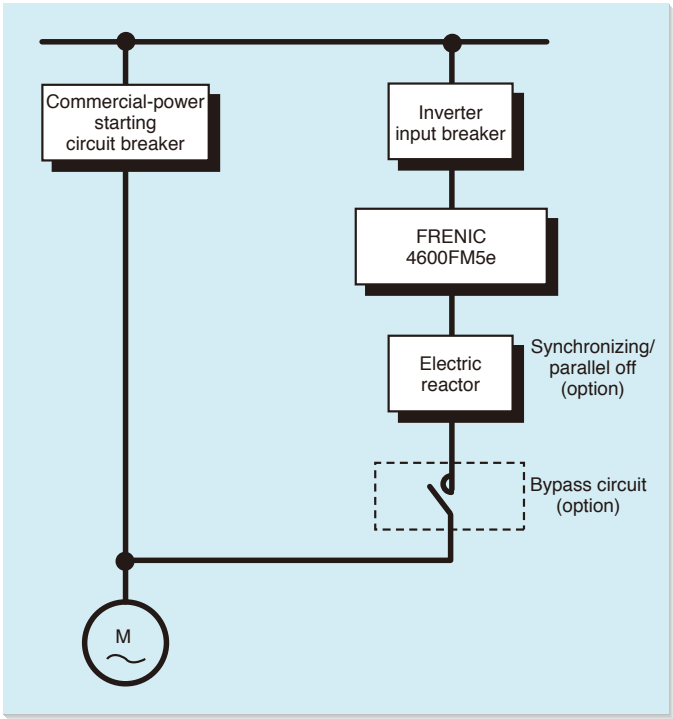
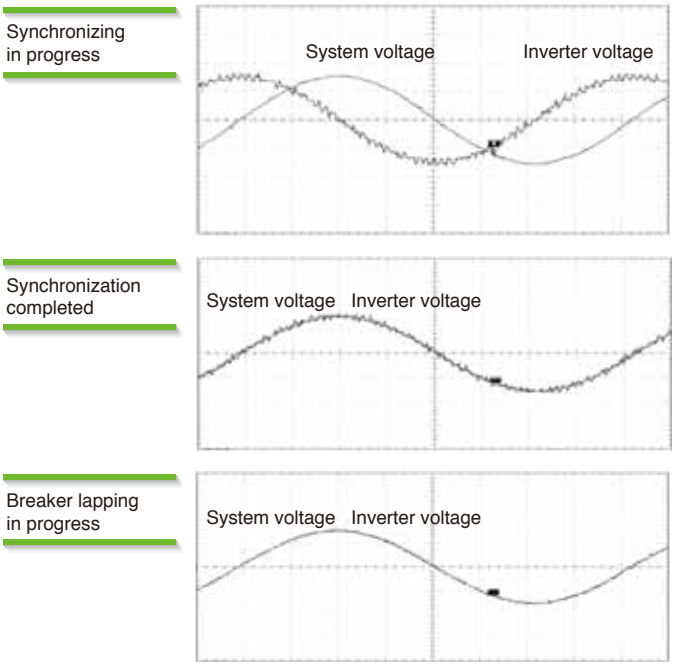


Fig. 6 Synchronization/parallel off waveform



Data setting and monitoring

Operation and monitoring simplified by the touch panel equipped with LCD

LED monitor

Under load running:
Displays the number of revolutions.

At tripping:
Flashing "Err" is displayed.

LCD monitor

Displays various information including operation data, set data and fault data.

UP and down key

Used for changing data No. and values of data setting.

Program key

Used for moving to the monitor screen.

Shift key (digit shift)

Used for shift the position of the cursor from one digit to another in order to change data.

Reset key

At tripping: Releases the stop status due to tripping.
Under programming: Returns to the previous layer.

Run key

Stop key

Function/data selection key

Used for selecting display data, moving to data changing mode, and saving data.

Display description of the touch panel

No.	Description	Number of items
1	Current, voltage and frequency at present (*)	7
2	Parameter setting items	About 320
3	Di/Do status display	7
4	Controller RAM data	About 80
5	Ai/Ao status display	11
6	Sent/received data	About 20
7	Cause of fault	20
8	Present time, operation time	3

(*): Displays 7 items on the 2-image screen.

Other functions

●Fault history

Displays a chronological record of 100 faults with the cause and the date and time of occurrence.

●Trip data display

Displays the sampling values of internal data and bit data ON/OFF status in the event of a fault.

●Save of set data, load, and comparison

The set data can be saved in the EPROM of the touch panel.
The saved data can also be loaded and compared with other saved data.

Large LCD touch panel (option)

This is a setting and monitoring tool for facilitating operation and monitoring on a 10.4-inch LCD.

Main functions of LCD touch panel

- Inverter start/stop
- Setting, change and indication of control parameters
- Bar graph display of actual value data
- Indication of fault cause (First fault/detailed indication)
- Trend display
- Test run, etc.

Notes:
(1) The LCD unit can be mounted on the panel face (at the position where the touch panel is mounted in page 9).
(2) The display language is Japanese or Chinese.

DDC loader for a maintenance tool (option)

Although maintenance and adjustment can be performed from the touch panel mounted on the panel face, an optional DDC loader is available as a maintenance/adjustment tool. The DDC loader using a notebook computer is easy to use because of its interactive mode.

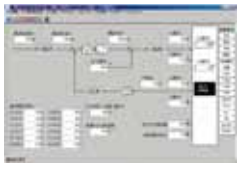
Main functions of maintenance tool

- Setting, change, indication and saving of control parameters
- Running status display
  Block diagram display, actual value indication, internal data listing
- Indication of fault cause
  First fault, detailed indication, trace-back data
- Test run


Internal data indication window


Data setting window


Operation monitoring window


Operation monitoring window


Trend data window

Standard specifications

Standard specifications (VT specifications: For square reduction torque)

●Three-phase 3 kV series; Overload capacity: 105% 1 min, 120% 1 min (At cold start, at cooling fin temperature of 40°C or lower)

Type	Input voltage [kV]	Rated capacity [kVA]	Rated current [A]	Maximum current (when overloaded) [A]*1	Applicable motor maximum output [KW]*2	Main circuit insulation class	Main circuit standard rated short-circuit current [kA 1s]	Control power source capacity [kVA]	Fan capacity [kVA]	
FRN46–1FA–3□□30–0350□	3.0	350	68	72	285	3B	8.0	0.5	1.5	
FRN46–1FA–3□□33–0390□	3.3	390			315					
FRN46–1FA–3□□30–0500□	3.0	500	98	103	400	3B	8.0	0.5	1.5	
FRN46–1FA–3□□33–0560□	3.3	560			450					
FRN46–1FA–3□□30–0700□	3.0	700	134	141	560	3B	8.0	0.5	3.0	
FRN46–1FA–3□□33–0770□	3.3	770			610					
FRN46–1FA–3□□30–1050□	3.0	1050	202	212	840	3B	8.0	0.5	4.0	
FRN46–1FA–3□□33–1150□	3.3	1150			920					
FRN46–1FA–3□□30–1350□	3.0	1350	262	275	1100	3B	8.0	0.5	4.0	
FRN46–1FA–3□□33–1500□	3.3	1500			1200					
FRN46–1FA–3□□30–1600□	3.0	1600	306	321	1280	3B	12.5	0.5	4.5	
FRN46–1FA–3□□33–1750□	3.3	1750			1400					
FRN46–1FA–3□□30–2350□	3.0	2350	459	482	1930	3B	25.0	0.5	5.5	
FRN46–1FA–3□□33–2600□	3.3	2600			2100					
FRN46–1FA–3□□30–3200□	3.0	3200	612	643	2570	3B	25.0	0.5	9.5	
FRN46–1FA–3□□33–3500□	3.3	3500			2800					
FRN46–1FA–3□□30–4750□	3.0	4750	918	964	3850	3B	25.0	0.5	15.5	
FRN46–1FA–3□□33–5200□	3.3	5200			4200					

*1: At an output frequency of 25 Hz or less, the output current is limited. (At a frequency of 0.2 Hz, the current is 70% of rated current.)
*2: The applicable motor maximum output is the reference value of Fuji Electric's standard 4-pole motors.

●Three-phase 6 kV series; Overload capacity: 105% 1 min, 120% 1 min (At cold start, at cooling fin temperature of 40°C or lower)

Type	Input voltage [kV]	Rated capacity [kVA]*3	Rated current [A]	Maximum current (when overloaded) [A]*1	Applicable motor maximum output [KW]*2	Main circuit insulation class	Main circuit standard rated short-circuit current [kA 1s]	Control power source capacity [kVA]	Fan capacity [kVA]	
FRN46–1FA–6□□60–2360□	6.0	2360	227	238	1900	6B	8.0	0.5	7.5	
FRN46–1FA–6□□66–2600□	6.6	2600			2000					
FRN46–1FA–6□□60–2700□	6.0	2700	265	275	2200	6B	8.0	0.5	7.5	
FRN46–1FA–6□□66–3000□	6.6	3000			2400					
FRN46–1FA–6□□60–3200□	6.0	3200	306	321	2560	6B	12.5	0.5	7.5	
FRN46–1FA–6□□66–3500□	6.6	3500			2800					
FRN46–1FA–6□□60–4000□	6.0	4000	385	462	3200	6B	12.5	0.5	13.5	
FRN46–1FA–6□□66–4400□	6.6	4400			3500					
FRN46–1FA–6□□60–4700□	6.0	4700	459	482	3860	6B	25.0	0.5	13.5	
FRN46–1FA–6□□66–5200□	6.6	5200			4160					
FRN46–1FA–6□□60–6400□	6.0	6400	612	643	5140	6B	25.0	0.5	18.5	
FRN46–1FA–6□□66–7000□	6.6	7000			5500					
FRN46–1FA–6□□60–9500□	6.0	9500	918	964	7700	6B	25.0	0.5	31.0	
FRN46–1FA–6□□66–X500□	6.6	10500			8300					

*1: At an output frequency of 25 Hz or less, the output current is limited. (At a frequency of 0.2 Hz, the current is 70% of rated current.)
*2: The applicable motor maximum output is the reference value of Fuji Electric's standard 4-pole motors.
*3: For 2300 kVA or less, refer to the catalog for FRENIC4600FM5d (RC 92-52).

	Outline drawing	Outline dimensions							Approx. mass [kg]
		A(Full width) [mm]	B(Transformer panel) [mm]	C(Converter panel) [mm]	D(Control output panel) [mm]	E(Fan section) [mm]	F(Depth) [mm]	G(Maintenance space) [mm]	
	Fig.1	2000	—	1500	500	458	1000	1300	2000
		2300	—	1800	500	458	1100	1300	3000
		2300	—	1800	500	520	1200	1300	4100
	Fig.2	3000	2100	900	—	59	1300	1300	4500
		3400	2300	1100	—	455	1400	1300	6200
		3500	2300	1200	—	455	1400	1300	7000
	Fig.4	3600	2200	1400	—	455	1400	1500	8100
	Fig.6	6800	2300	3600	900	455	1400	1500	12300
	Fig.8	10900	5200	4800	900	600	1900	1800	26000

	Outline drawing	Outline dimensions							Approx. mass [kg]
		A(Full width) [mm]	B(Transformer panel) [mm]	C(Converter panel) [mm]	D(Control output panel) [mm]	E(Fan section) [mm]	F(Depth) [mm]	G(Maintenance space) [mm]	
	Fig.3	4800	2400	2400	—	455	1400	1300	10200
		4800	2400	2400	—	455	1400	1300	10200
		4800	2400	2400	—	455	1400	1300	11200
	Fig.5	8400	2300	1400	1000	455	1400	1500	17900
		8400	2300	1400	1000	455	1400	1500	17900
	Fig.7	12900	2400	3600	900	455	1400	1500	24500
	Fig.9	21800	5600	4800	1000	600	1800	1800	51000

Standard specifications

Standard specifications (CT specifications : Constant torque application)

Three-phase 3kV series; Converter overload capacity: Rated current, 150% of CT applicable continuous current (motor protection) 1 min

Type	Input voltage [kV]	Rated capacity [kVA]	Rated current [A]	CT applicable capacity [kVA]	CT applicable continuous current [A]	Maximum current (when overloaded) [A]	CT applicable motor maximum output [KW]*1	Main circuit insulation class	Main circuit standard rated short-circuit current [kA 1s]
FRN46–1□A–3□□30–0250□	3.0	350	68	250	48	72	185	3B	8.0
FRN46–1□A–3□□33–0275□	3.3	390		275			200		
FRN46–1□A–3□□30–0350□	3.0	500	98	350	68	103	265	3B	8.0
FRN46–1□A–3□□33–0390□	3.3	560		390			300		
FRN46–1□A–3□□30–0490□	3.0	700	134	490	94	141	355	3B	8.0
FRN46–1□A–3□□33–0540□	3.3	770		540			400		
FRN46–1□A–3□□30–0730□	3.0	1050	202	730	141	212	560	3B	8.0
FRN46–1□A–3□□33–0800□	3.3	1150		800			630		
FRN46–1□A–3□□30–0950□	3.0	1350	262	950	183	275	710	3B	8.0
FRN46–1□A–3□□33–1045□	3.3	1500		1045			800		
FRN46–1□A–3□□30–1110□	3.0	1600	306	1110	214	321	900	3B	12.5
FRN46–1□A–3□□33–1220□	3.3	1750		1220			1000		
FRN46–1□A–3□□30–1670□	3.0	2350	459	1670	321	482	1320	3B	25.0
FRN46–1□A–3□□33–1830□	3.3	2600		1830			1500		
FRN46–1□A–3□□30–2220□	3.0	3200	612	2220	428	643	1700	3B	25.0
FRN46–1□A–3□□33–2450□	3.3	3500		2450			1900		
FRN46–1□A–3□□30–3340□	3.0	4750	918	3340	643	964	2650	3B	25.0
FRN46–1□A–3□□33–3670□	3.3	5200		3670			3150		

*1: The applicable motor maximum output is the reference value of Fuji Electric's standard 4-pole motors.

Three-phase 6kV series; Converter overload capacity: Rated current, 150% of CT applicable continuous current (motor protection) 1 min

Type	Input voltage [kV]	Rated capacity [kVA]*2	Rated current [A]	CT applicable capacity [kVA]	CT applicable continuous current [A]	Maximum current (when overloaded) [A]	CT applicable motor maximum output [KW]*1	Main circuit insulation class	Main circuit standard rated short-circuit current [kA 1s]
FRN46–1□A–6□□60–1900□	6.0	2360	238	1900	159	238	1320	6B	8.0
FRN46–1□A–6□□66–2000□	6.6	2600		2000			1500		
FRN46–1□A–6□□60–2200□	6.0	2700	275	2200	186	275	1600	6B	8.0
FRN46–1□A–6□□66–2400□	6.6	3000		2400			1700		
FRN46–1□A–6□□60–2560□	6.0	3200	321	2560	214	321	1800	6B	12.5
FRN46–1□A–6□□66–2800□	6.6	3500		2800			1900		
FRN46–1□A–6□□60–3200□	6.0	4000	462	3200	269	462	2250	6B	12.5
FRN46–1□A–6□□66–3500□	6.6	4400		3500			2360		
FRN46–1□A–6□□60–3860□	6.0	4700	482	3860	321	482	2800	6B	25.0
FRN46–1□A–6□□66–4160□	6.6	5200		4160			3000		
FRN46–1□A–6□□60–5140□	6.0	6400	643	5140	428	643	3750	6B	25.0
FRN46–1□A–6□□66–5500□	6.6	7000		5500			4250		
FRN46–1□A–6□□60–7700□	6.0	9500	964	7700	643	964	5300	6B	25.0
FRN46–1□A–6□□66–8300□	6.6	10500		8300			6200		

*1: The applicable motor maximum output is the reference value of Fuji Electric's standard 4-pole motors.
*2: For 2300 kVA or less, refer to the catalog for FRENIC4600FM5d (RC 92-52).

	Control power source capacity [kVA]	Fan capacity [kVA]	Outline drawing	Outline dimensions							Approx. mass [kg]
				A(Full width) [mm]	B(Transformer panel) [mm]	C(Converter panel) [mm]	D(Control output panel) [mm]	E(Fan section) [mm]	F(Depth) [mm]	G(Maintenance space) [mm]	
	0.5	1.5	Fig.1	2000	—	1500	500	458	1000	1300	2000
	0.5	1.5		2300	—	1800	500	458	1100	1300	3000
	0.5	3.0		2300	—	1800	500	520	1200	1300	4100
	0.5	4.0	Fig.2	3000	2100	900	—	59	1300	1300	4500
	0.5	4.0		3400	2300	1100	—	455	1400	1300	6200
	0.5	4.5		3500	2300	1200	—	455	1400	1300	7000
	0.5	5.5	Fig.4	3600	2200	1400	—	455	1400	1500	8100
	0.5	9.5	Fig.6	6800	2300	3600	900	455	1400	1500	12300
	0.5	15.5	Fig.8	10900	5200	4800	900	600	1900	1800	26000

	Control power source capacity [kVA]	Fan capacity [kVA]	Outline drawing	Outline dimensions							Approx. mass [kg]
				A(Full width) [mm]	B(Transformer panel) [mm]	C(Converter panel) [mm]	D(Control output panel) [mm]	E(Fan section) [mm]	F(Depth) [mm]	G(Maintenance space) [mm]	
	0.5	7.5	Fig.3	4800	2400	2400	—	455	1400	1300	10200
	0.5	7.5		4800	2400	2400	—	455	1400	1300	10200
	0.5	7.5		4800	2400	2400	—	455	1400	1300	11200
	0.5	13.5	Fig.5	8400	2300	1400	1000	455	1400	1500	17900
	0.5	13.5		8400	2300	1400	1000	455	1400	1500	17900
	0.5	18.5	Fig.7	12900	2400	3600	900	455	1400	1500	24500
	0.5	31.0	Fig.9	21800	5600	4800	1000	600	1800	1800	51000

Standard specifications

Dimensions

●Description of code symbol (VT)

FRN46 – 1 F A – 665 60 – 1000 A

Basic code symbol

Code	Product category
FRN46-1	FRENIC4600FM5e

Control system

Code	Control system
F	VT specifications (V/F simple sensorless vector)

Input voltage and frequency

Code	Input voltage and frequency	Code	Input voltage and frequency
305	3.0kV 50Hz	605	6.0kV 50Hz
306	3.0kV 60Hz	606	6.0kV 60Hz
335	3.3kV 50Hz	665	6.6kV 50Hz
336	3.3kV 60Hz	666	6.6kV 60Hz

Auxiliary power source

Code	Auxiliary power source
A	Control power source: Single-phase 200 V or 220 V Fan power source: Three-phase 200 V or 220 V
Z	Other

Output capacity

Code	Output capacity
0250 to 0970	250 to 970kVA
1000 to 9500	1000 to 9500kVA
X500	10500kVA

For details, see individual specifications.

Output voltage

Code	Output voltage	Code	Output voltage
30	3.0kV	60	6.0kV
33	3.3kV	66	6.6kV

●Description of code symbol (CT)

FRN46 – 1 C A – 665 60 – 1000 A

Basic code symbol

Code	Product category
FRN46-1	FRENIC4600FM5e

Control system

Code	Control system
C	CT specifications (V/F simple sensorless vector)
S	CT specifications (sensorless vector)
V	CT specifications (vector with sensor)

Input voltage and frequency

Code	Input voltage and frequency	Code	Input voltage and frequency
305	3.0kV 50Hz	605	6.0kV 50Hz
306	3.0kV 60Hz	606	6.0kV 60Hz
335	3.3kV 50Hz	665	6.6kV 50Hz
336	3.3kV 60Hz	666	6.6kV 60Hz

Auxiliary power source

Code	Auxiliary power source
A	Control power source: Single-phase 200 V or 220 V Fan power source: Three-phase 200 V or 220 V
Z	Other

Output capacity

Code	Output capacity
0250 to 0970	250 to 970kVA
1000 to 9500	1000 to 9500kVA
X500	10500kVA

For details, see individual specifications.

Output voltage

Code	Output voltage	Code	Output voltage
30	3.0kV	60	6.0kV
33	3.3kV	66	6.6kV

Dimensions

Front maintenance structure

Fig. 1 3.3kV: 390, 560, 770kVA

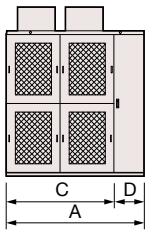


Fig. 2 3.3kV: 1150, 1500, 1750kVA

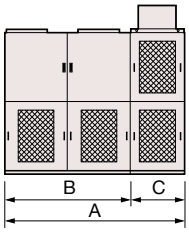
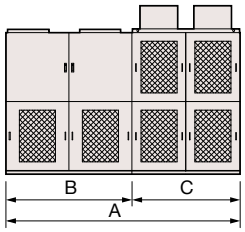
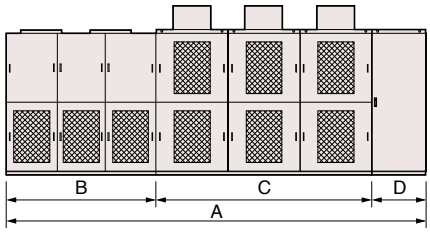


Fig. 3 6.6kV: 2600, 3000, 3500kVA



Front/rear maintenance structure

Fig. 6 3.3kV: 3500kVA



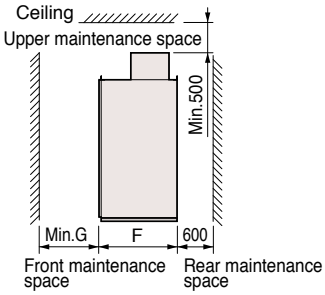
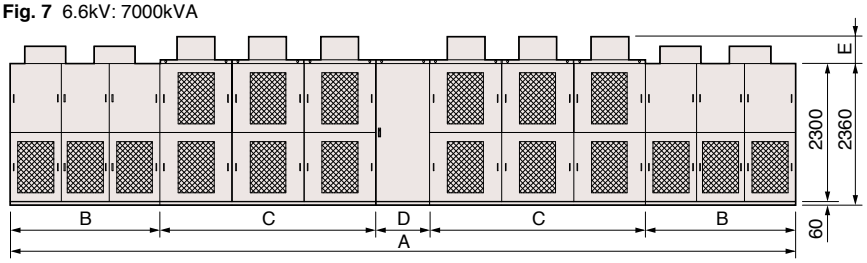
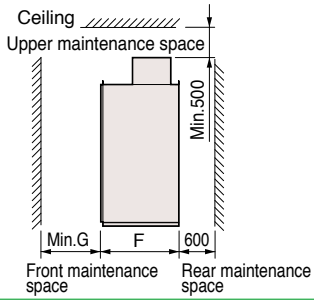


Fig. 7 6.6kV: 7000kVA





Notes: For 6.6 kV 470, 570, 670, 780, 960, 1120, 1320, 1540, 1750, 2000, 2300 kVA, refer to the catalog for FRENIC4600FM5d(RC 92-52).

Outline dimensions

Fig. 4 3.3kV: 2600kVA

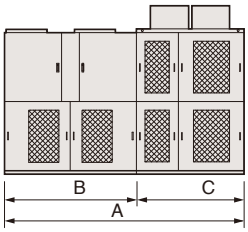
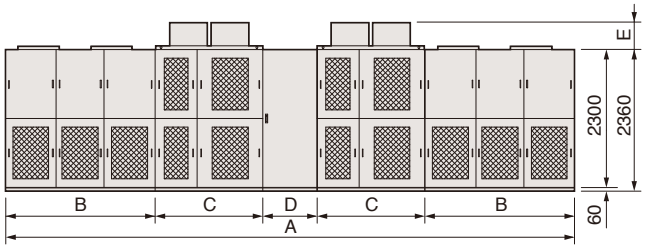


Fig. 5 6.6kV: 4400, 5200kVA



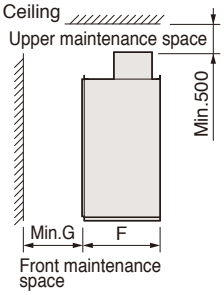
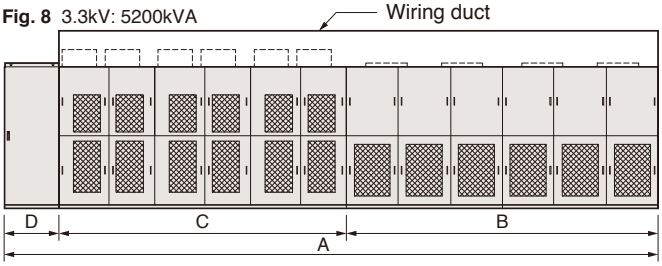


Fig. 8 3.3kV: 5200kVA



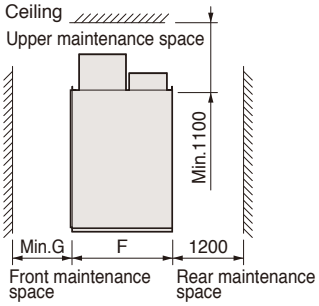
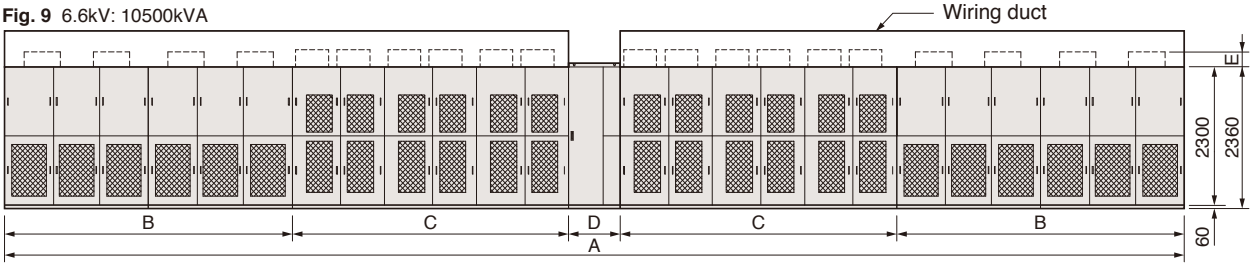


Fig. 9 6.6kV: 10500kVA

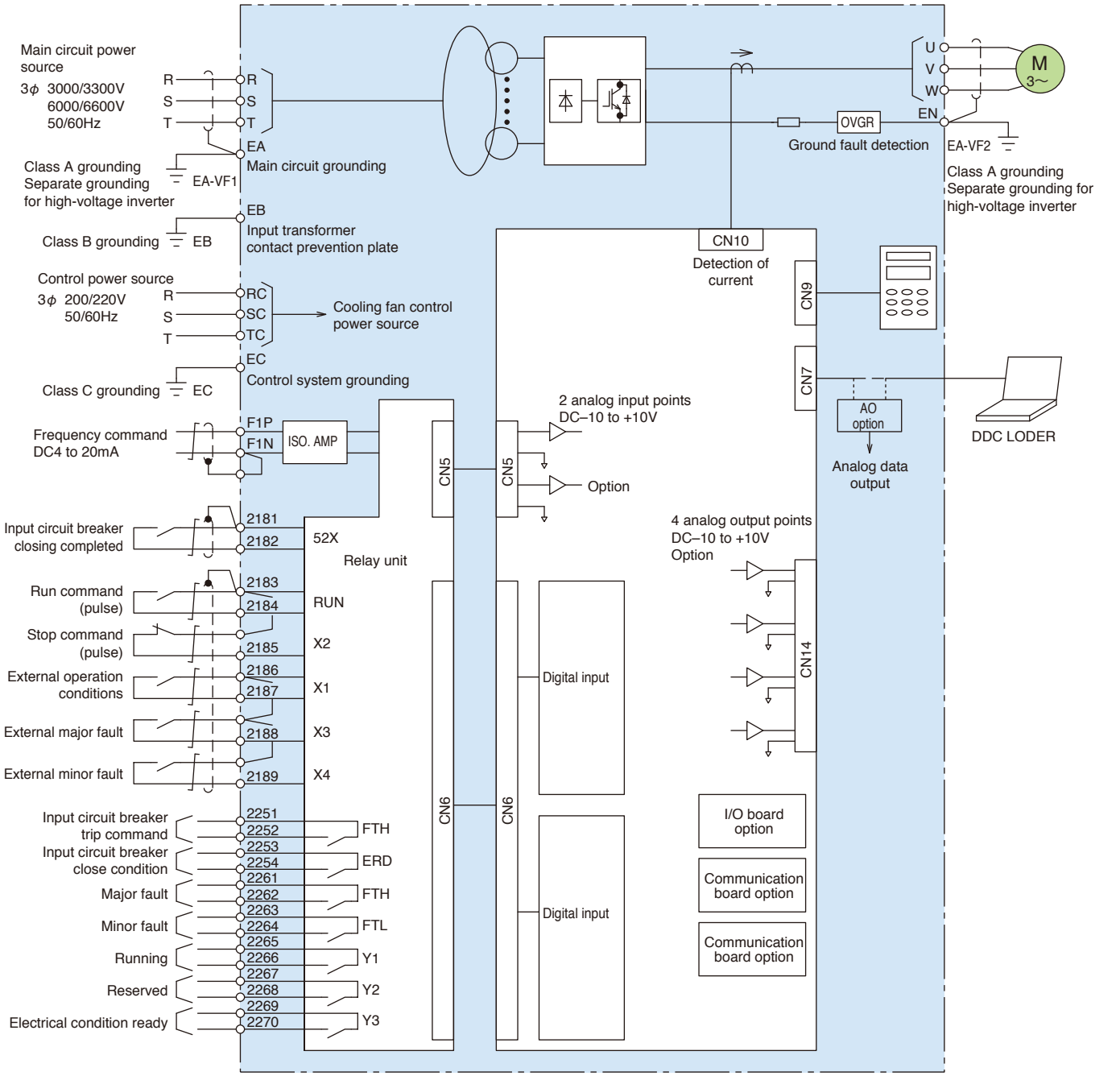


Standard interface

Input side		
Main circuit power source	3-phase 3000, 3300, 6000, 6600 V; 50 or 60 Hz	
Control power source	Single-phase 200 or 220 V, 50 or 60 Hz (10 kV: Single-phase 220 V, 50 Hz)	
Fan power source	3-phase 200 or 220 V, 50 or 60 Hz (10 kV: 3-phase 380 V, 50 Hz)	
Frequency setting	0 to 10V/0 to 100%	Input impedance 1MΩ
	or 4 to 20 mA, 0 to 100%	Input impedance 250MΩ
Run command	Closed for run ("a" contact)	Dry contact
Stop command	Open for stop ("b" contact)	
External operation conditions	Closed when ready ("a" contact)	
Input circuit breaker closing completed	Closed when turned on ("a" contact)	
Output side		
Electrical condition ready	Closed when electrical condition ready ("a" contact)	Dry contact (contact capacity: AC 250 V, 2 A; DC 30 V, 3 A)
Running	Closed during operation ("a" contact)	
Major fault	Closed at major fault ("a" contact)	
Minor fault	Closed at minor fault ("a" contact)	
Input circuit breaker close condition	Closed when electrical condition ready ("a" contact)	
Input circuit breaker trip command	Closed at major fault ("a" contact)	
Analog signal (optional)*	0 to 10V	Load resistance 10 kΩ or more
	4 to 20mA	Load resistance 750 Ω or less

*) The analog output signal is selectable (output current, output voltage, output frequency, etc).

Standard connection diagram



Common specifications

Common specifications

Input	Main circuit	3-phase 3000, 3300, 6000, 6600 V; 50 or 60Hz
	Auxiliary power source	Control power source: Single-phase 200 or 220 V, 50 or 60 Hz; Fan power source: 3-phase 200 or 220 V, 50 or 60 Hz
	Cell control power source	Supplied from AC main circuit (supplied from secondary side of input transformer)
	Allowable power source variation	Voltage: ±10%; Frequency: ±5%
Control system	Control system	V/f constant control with simple sensorless vector control, vector control, and sensorless vector control are available. (Must be selected when ordering.)
	Output frequency	Control range: 0.2 Hz to 50 or 60 Hz (option: up to 120 Hz); Accuracy: ±0.5% relative to maximum frequency (for analog frequency standard input); Resolution: 0.005%
	Acceleration, deceleration time	0.1～5500s
	Main control functions	Current limit, stall prevention, jump frequency setting, deceleration to prevent overvoltage, restart after momentary power interruption (optional)
	Protection functions	Overcurrent, main circuit fuse blown, overvoltage, undervoltage, CPU fault, cooling fan stop
	Transmission functions (optional)	T-link, PROFIBUS-DP, Modbus
Structure	Panel	Steel panel, self-standing, enclosed; Protection rating: IP20 (Other rating optional); Cooling method: Forced ventilation with ceiling fan
	Paint finish color	Munsell 5Y7/1 (interior and exterior)
Ambient *1 conditions	Temperature	Ambient temp.: 0 to +40°C; Storage temp.: –10 to +60°C; Transport temp.: –10 to +70°C (+60 to +70°C: Within 24 h)
	Humidity	85% RH max. (non-condensing)
	Installation location	Indoor; Site altitude: Up to 1000 m above sea level; Acceleration vibration: up to 4.9 m/s^2 (10 to 50 Hz) Atmosphere: General environment free from corrosive gas, dust, flammable or explosive gas
Applicable standard		JIS, JEM, JEC

*1: To use this inverter unit at an ambient temperature of +40°C or more, at an altitude of 1,000 m or more, derating is required. Contact us.
Note 1) Regenerative braking is not provided.
Note 2) For this inverter unit, a separate dedicated input circuit breaker is required.

Protection functions

Item	Description	Touch panel display	Related function code
Overcurrent	This status is detected if the peak value of output current exceeds the overcurrent operation level. Although this function varies depending on the ripple rate (differs depending on motor constant) because of momentary operation, it means that current larger than approximately 200% of inverter rated current (in terms of effective value) is flowing.	OC	
Inverter overload	This status is detected if output current overload is detected (current that exceeds the inverter rated current is flowing continuously).	OLINV	
Motor overload	This status is detected if output current that exceeds the overload setting is flowing continuously for more than the set time.	OLM	No.169[No.358], No.170[No.359], No.171[No.360], No.173
Overfrequency, overspeed	This status is detected if the inverter output frequency or the revolving speed exceeds 120% of the rating.	OS	No.173
ACR CPU error	This error is output if any CPU interrupt for ACR does not occur for certain period.	A CPU	
Pulse distribution error	This error is output if the CPU for pulse distribution that controls the output pulse or its peripheral circuit is abnormal and the watchdog timer (WDT) is activated.	PDU	
Analog frequency setting error	This error is output if the analog frequency setting drops drastically. During momentary power interruption and within 100 ms after momentary power interruption, this fault is not detected.	AI	No.89, No.90
Motor starting jam	The starting jam is detected if the inverter output frequency is less than the setting and the output current detected value (calculated for the motor) is continuously over the set value for more than the set time.	MLK	No.176[No.367], No.177[No.368] No.178[No.369]
Momentary power interruption	This status is output if momentary power interruption of the DDC control power source (the voltage is less than 85% of power source voltage for more than 20 ms) occurs during motor operation.	PWRL	No.284
System momentary power interruption	This status is output if momentary power interruption of the system power source (the value is less than the set value of setting No. 295 for more than 4 ms) occurs during motor operation.	MPWRL	No.284
System power interruption fault	This fault is detected if the system power source drops less than the set value of momentary power interruption during motor operation and the momentary power interruption continues for more than the set time.	MLPWR	No.290, No.295, No.284, No.293

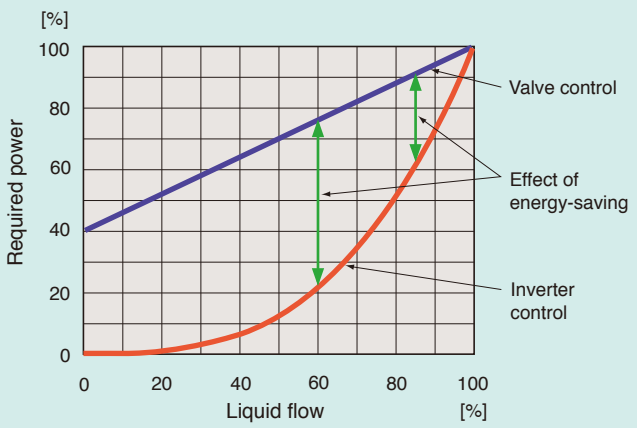
Item	Description	Touch panel display	Related function code
Power interruption fault	This fault is displayed if momentary power interruption of the DDC control power source (the voltage is less than 85% of power source voltage) occurs during motor operation and the momentary power interruption continues for more than the set time.	LPWRL	No.293, No.290, No.297, No.284
Circuit breaker switching fault	This fault is detected if both the inverter and the commercial circuit breaker are on for more than 1 second during synchronizing and parallel off operation.	MCLAP	No.173
Synchronizing jam	This fault is detected if phase focusing with the commercial power source does not complete synchronizing within 20 s after output of the synchronizing command during synchronizing and parallel off operation.	SYNC	
Flying start fault	This fault is detected if the number of retries during a speed search fault at the start-up of the inverter exceeds the retry limit setting.	RTRY	No.195, No.196
External minor fault	This fault is output if some minor fault is input from an external sequence.	FTB	
External major fault	This fault is output if some major fault is input from an external sequence.	FTA	
External intermediate fault	This fault is output if some intermediate fault is input from an external sequence.	FTC	
Ground fault	This fault is detected if the ground fault detecting relay is activated.	OVG	No.173
Fan and temperature major fault	This fault is detected if an inverter panel fan fault and transformer overheating (major fault) occur.	FANH	
Fan and temperature minor fault	This fault is detected if an inverter panel fan fault and transformer overheating (minor fault) occur.	FANL	
Printed circuit board temperature error	This error is detected if the temperature of the control printed circuit board exceeds 60°C.	OTDDC	
Transformer overheating major fault	This fault is detected if transformer overheating (major fault) occurs.	TRTMP	
Optical link error	This error is detected if an optical link carrying multiplex transmission causes an error.	LINK	
Modbus error	This fault is activated if a Modbus logic error (address error, parity error, etc.) occurs or transmission stops for more than the set time. (Detected only during Modbus interlock operation and when the MC-RN on conditions are satisfied.)	MOD	No.377, No.174
PSB card error	This error is activated after an emergency stop if "PSB error" is set at the status flag of the PROFIBUS transmission board (PSB). (Detected only during PLC interlock operation and when the MC-RN on conditions are satisfied.)	PSB	No.174
PROFIBUS error	This error is activated if transmission stops for more than 100 ms in the PROFIBUS. (Detected only during PLC interlock operation and when the MC-RN on conditions are satisfied.)	PROFI	No.174
MICREX error	This error is activated if the "TER: Transmission error" bit in data received from PLC is 1. (Detected only during PLC interlock operation and when the MC-RN on conditions are satisfied.)	MICRX	No.174
Upper transmission system error	This error is activated if the P(E) link healthy bit delivered from the MPU of IFC (transmission repeater) to the DLA of IFC is "0". (Detected only during PLC interlock operation and when the MC-RN on conditions are satisfied.)	IFC	No.174
DLA error	This error is activated if "DLA error" is set at the status flag of the D-LINE transmission board (DLA). (Detected only during PLC interlock operation and when the MC-RN on conditions are satisfied.)	DLA	No.174
D-LINE (T-LINK) error	This error is activated if transmission stops for more than 100 ms on the D-LINE/T-LINK. (Detected only during PLC interlock operation and when the MC-RN on conditions are satisfied.)	DLINE	No.174
Cell DC fuse blown	This status is output if the inverter DC main circuit fuse in a cell is blown. For individual confirmation, check the operation display in the unit.	DCF	
Cell main circuit overvoltage	This status is output if the DC main circuit voltage in each inverter cell is too high.	OV	
Main circuit overvoltage in cell deceleration	This status is output if the DC main circuit voltage is too high during inverter deceleration operation.	OVDEC	
Cell main circuit undervoltage P-M	This status is output if the DC main circuit voltage is too low (receiving voltage ratio is approximately 80%) during inverter operation or if the DC main circuit voltage does not exceed the detection level even after the initial charge.	UV PM	
Cell main circuit undervoltage M-N	This status is output if the DC main circuit voltage is too low (receiving voltage ratio is approximately 80%) during inverter operation or if the DC main circuit voltage does not exceed the detection level even after the initial charge.	UV MN	
Cell main circuit voltage unbalance	This status is output if the difference between the positive (P) and negative (N) sides of DC voltage in a cell exceeds 14% of rated voltage for more than 5 seconds.	UNB	
Cell PWM optical signal error	This error is detected if the optical link for PWM signals becomes abnormal.	PWM	
Cell control power source drop	This status is detected if the control power source voltage in a cell drops or if the control power source in a cell becomes abnormal.	PWRL	
Cell coolant overheating	This status is detected if the cooling fin temperature in a cell becomes 95°C or higher.	OTF	
Cell local optical link error	This error is detected if an error occurs in the optical link that composes multiplex transmission.	LLINK	

Contributes to energy saving

FRENIC4600FM5e inverter operation promises substantial energy-saving and carbon dioxide reduction.

In air-conditioning or pumping facilities, fans or pumps typically run at a constant speed even when the load is light. Adjustable speed control according to the load (air or liquid flow) through inverter operation greatly reduces energy consumption and maintains the maximum possible motor efficiency even at low-speed operation.

Liquid flow and power characteristics



Example of application and energy-saving effect

The following example compares constant speed motor operation with valve (or damper) control, against inverter adjustable speed control operation, and shows the electric power saved.

●Example conditions for calculation

Motor output:
1,000kW, for annual operation time 4,000 hours
Operation pattern:
85% flow for 1/2 of overall time (2,000 hours)
60% flow for the remaining half (2,000 hours)

●Constant speed operation of motor (with valve control)

At 85% load of liquid flow (Q)
Required Power (P) = 91%×1,000kW = 910kW
At 60% load of liquid flow (Q)
Required Power (P) = 76%×1,000kW = 760kW
Annual power consumption
910kW×2,000h+760kW×2,000h = 3,340,000kWh

●Inverter operation (adjustable speed control operation with inverter)

At 85% load of liquid flow (Q)
Required Power (P) = 61%×1,000kW = 610kW
At 60% load of liquid flow (Q)
Required Power (P) = 22%×1,000kW = 220kW
Annual power consumption
610kW×2,000h+220kW×2,000h=1,660,000kWh

●Annual energy-saving

3,340,000−1,660,000 = 1,680,000kWh
(energy-saving = about 50%)
Carbon dioxide reduction = 635,040kg

Options

Field Web adapter (plusFSITE)

plusFSITE

This adapter enables users to carry out remote monitoring of inverters promptly and easily with their own personal computers without using a dedicated system.

Main features

- Web server function
  Inverters can be monitored from the browser of a personal computer. (Display screen can be changed if requested.)

Setting data list window

Real-time operation status window

Real-time trend graph window

- Mail sending function
  Actions can be reported periodically from inverters.
- Installation and wiring both easy
  - ·A small and lightweight structure mountable on the front of the inverter panel
  - ·Connectable with the loader connector of an inverter (RS-232C interface)
  - ·Connectable with personal computers through LAN cable (IEEE802.3 10BASE-T)
- Equipped with a 32-bit RISC chip/real-time OSμITRON
- Protocol converting function
  (Changeable from RS-232C to LAN)
- The corresponding drive unit is applicable to the FRENIC4600FM5e and other products of Fuji Electric.

LCD touch panel

The touch panel offers the following key loader functions:

- Start and stop of inverter
- Setting, change and display of control parameters
- Fault data display and fault resetting
- Data monitoring (LED display)

The contents of the above data are displayed on the LCD.

DDC loader

A loader using a notebook personal computer is available. The easy-to-use interactive type of loader offers the following functions.

- Start and stop of inverter
- Online setting, change, display and printing of control parameters
- Fault resetting
- Trace-back data
- Fault data display and printing
- Data monitoring

Analog output unit (AO unit)

Data can be output in analog mode during operation. Output data can be freely selectable among about 100 items by operating the touch panel.

Lifter

A special lifter for drawing out inverter cells

List of Options and Spare Parts

List of options

Description			Standard specifications
Rating	Rated short-time withstand current		See the list of code symbols in standard specifications.
	Auxiliary power source	Control power source	1 ϕ 200/220V
		Fan power source	3 ϕ 200/220V
		Power source for momentary power interrupt detection	The fan power source is used for momentary power interrupt detection. (The same system as the main circuit must be used.)
Structure, paint finish	Protective structure		IP20
	Front side specifications		Hooking cover (door only in control section)
	Rear side specifications		Hooking cover
	Door grip type		Flat type (key No. 200)
	Door stopper		Not provided
	Card folder in panel		Not provided
	Protective cover in charge section	Main circuit	Not provided
		Control circuit	Not provided
		Part	Not provided
	Ceiling fan redundancy		No redundancy
	Paint finish color		Munsell 5Y7/1 (semigloss)
	Environment	Processing for tropical and humid zones	Not provided
		Measures against corrosive gas	Not provided
		Processing for salt resistance	Not provided
	Channel base		No prior delivery (shipping with panel mounted)
	Cable storage		Lower part for both main circuit and control section
	Cable cover plate		Steel plate (In two parts)
	Dimensions of loading entry		No restrictions
	Cable support		Provided only on control circuit
Wiring	Wiring colors		Main circuit: Black; Control section: Yellow; Ground wire: Green
	Phase identification	Three-phase circuit	Phase 1: Red; Phase 2: White; Phase 3: Blue; Neutral phase: Black
		Single-phase circuit	Phase 1: Red; Neutral phase: Black; Phase 2: Blue
		DC circuit	Positive electrode (P): Red; Negative electrode (N): Blue
Transformer	Dial thermometer		Not provided
	Wheel		Not provided (provided as a standard component for 3.3 kV, 770 kVA (VT specifications) or lower)
	Tap		±5%
Control	Control frequency range		0.2～50/60Hz
	Inverter start-up		0 Hz start-up (start-up from stopped state)
	Momentary power interruption		Major fault
	Synchronizing and parallel off		Not provided
	Commercial switching		Not provided
	Transmission		Not provided
	Frequency (speed) command		Analog DC 4 to 20 mA
	Rotating direction		Normal rotation only
	Operation location switching		Not provided
	Number of spare terminals for control		10% (with terminal cover)
Accessories	Panel interior lighting		Not provided
	Outlet		Not provided
	Panel interior space heater		Not provided
	Motor cooling circuit		Not provided
	Motor winding temperature detection		Not provided
	Motor bearing temperature detection		Not provided
	Motor space heater circuit		Not provided
	Thermolabel		Not provided
	Display and operation unit		Small LCD (touch panel) with Japanese language display
	DIO extension card		Not provided
	Panel meter		Not provided
	AO external output		Not provided
	Panel surface push button		Not provided
	Collective indicator		Not provided
	Foundation bolt		Not provided
	Field web adapter		Not provided
Auxiliary component	Lifter		Not provided
	DDC loader		Not provided
	AO for testing		Not provided
Overseas standard	IEC supported		Not provided
	EC Directive (CE marking)		Not provided

	Specified by customer
	☐( )kA 1sec
	☐( ) ϕ AC( )V ( )Hz
	☐( ) ϕ AC( )V ( )Hz
	☐( ) ϕ AC( )V ( )Hz
	☐IP( ) IP21, 22, 30, 31, 32, 40, 41, 42 are supported.
	☐( )
	☐( )
	☐( )
	☐Provided
	☐Provided
	☐Provided
	☐Provided
	☐Provided
	☐Provided
	☐Front( ), Inside( )
	☐Provided
	☐Provided
	☐Provided
	☐Prior delivery (double base)
	☐Main circuit: Input( ), Output( ), Control( )
	☐( )
	☐Restricted(W= mm, H= mm, D= mm)
	☐Main circuit：( ), Control( )
	☐( )
	☐Phase 1：( ), Phase 2：( ), Phase 3：( ), Neutral phase：( )
	☐Phase 1：( ), Neutral phase：( ), Phase 2：( )
	☐Positive electrode(P)：( ), Negative electrode(N)：( )
	☐Provided (2 warning points (major and minor) are included in INV.)
	☐Provided
	☐( )
	☐0.2～( )Hz
	☐Lead-in start-up, ☐Speed search start-up
	☐Restart
	☐Duration 300 ms (Control power source: Commercial power)
	☐Duration 300 ms (Control power source: UPS)
	☐Synchronizing, ☐Parallel off
	☐Direct, ☐Reactor, ☐( )
	☐PROFIBUS-DP, ☐Modbus, ☐T-LINK
	☐Analog(～), ☐Panel surface adjusting knob, ☐Outside adjusting knob
	☐Transmission, ☐Others( )
	☐Normal and reverse rotation provided (☐Normal and reverse rotation DI command or ☐Analog signal −100 to +100%)
	☐Local and remote switching
	☐( )
	☐Provided, AC ( ) V, (☐Fuse or ☐MCB)
	☐Provided, AC ( ) V, (☐Fuse or ☐MCB)
	☐Provided, AC ( ) V, (☐Fuse or ☐MCB)
	☐Provided, AC( )V ( )kW
	☐Pt100Ω×( )pcs, ☐NTC×( )pcs, ☐Fault contact X ( ) pcs
	☐Pt100Ω×( )pcs, ☐Fault contact X ( ) pcs
	☐Provided, AC( )V ( )kW
	☐Provided,( )
	☐Touch panel (English)
	☐Large LCD (10.4 in.) (☐Japanese or ☐Chinese)
	☐Provided Di:DC24V 3mA 4 points, Do:DC24V Max50mA 8 points
	☐80 mm square class 2.5, ☐110 mm square class 1.5 *
	☐( )in total, ( )in total, ( )in total, ( )in total *
	☐( )points (☐4-20mA OR ☐0-10V)*
	☐PB(run), ☐PBL(run)
	☐PB(stop), ☐PBL(stop)
	☐PB(fault reset), ☐PBL(fault reset)
	☐PB(emergency stop)
	☐PB( ), ☐PBL( )
	☐( )window
	☐Provided( )
	☐Provided
	☐Provided
	☐PC, software, cable, ☐Software, cable
	☐Provided
	☐Provided
	☐Provided

*Provided with AO output as a set

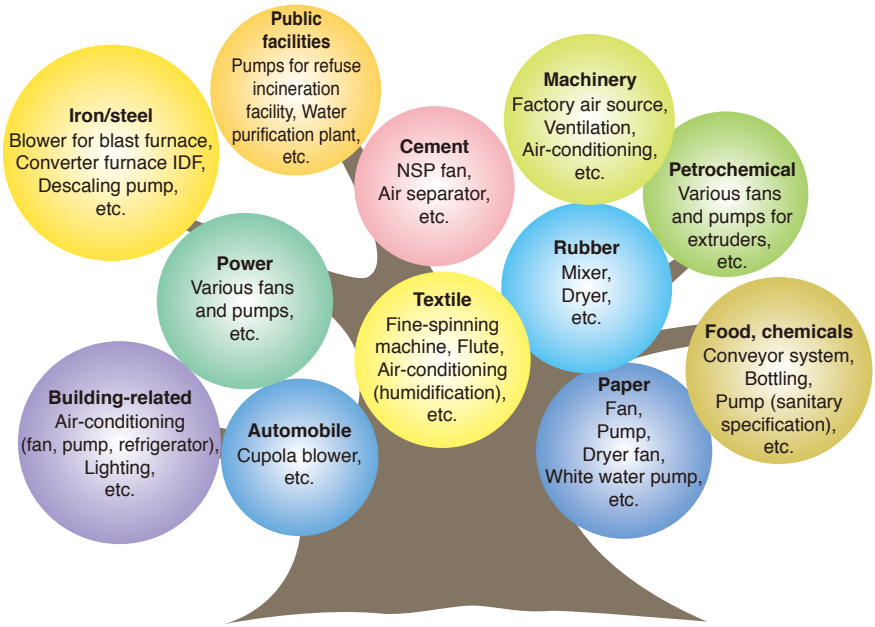
Spare parts

Description	Recommended number of spare parts	Specified
Inverter cell	2 units	
Control stack	1 unit	
Cooling fan	100%	
Air filter	100%	
Touch panel	1 unit	
Relay unit	1 unit	
Relay power source unit	1 unit	

Wealth of functions to accommodate every need

Application	Series	Features	Output voltage [V]	Capacity range [kVA] (10 / 100 / 1000 / 10000)
For plant	FRENIC 4000VM5	Vector controlled inverter for plants • High-performance vector control system for quick response, high-accuracy and wide range speed control. • The DC-link system allows highly efficient plant operation.	400	5400
	FRENIC 4000FM5	V/f controlled inverter for plants • Frequency of fan, pump and group-driven motors can be controlled accurately. • The DC-link system allows highly efficient plant operation.	400	900
	FRENIC 4400VM5	Large-capacity vector controlled inverter • The capacity of FRENIC4000 series units has been increased due to 3-level control.	800	6000
	FRENIC 4400FM5	Large-capacity V/f controlled inverter • The capacity of FRENIC4000 series units has been increased due to 3-level control.	800	2000
	FRENIC 4700VM5	Medium-voltage large-capacity vector controlled inverter • The capacity of FRENIC4000 series units has been increased thanks to the series-connected device and 3-level control.	3440	7800
	FRENIC 4800VM5	Medium-voltage, water-cooling, large-capacity and vector controlled inverter • The capacity of FRENIC4000 series units has been increased due to 3-level control. • Downsizing achieved by adopting a water-cooling system	3100	24000
For general industry (medium-voltage)	FRENIC 4600FM5	Medium-voltage direct-output inverter • 3.3/6.6kV IGBT inverter • Variable speed operation of medium-voltage motors saves energy. • Circuit configuration and control are well designed for power supplies and motors.	3300 6600	3750 7500
	FRENIC 4600FM5e	Medium-voltage direct-output inverter (for fans and pumps) • Compact	3300 6600	5200 10500
	FRENIC 4600FM5d	• Variable speed operation of medium-voltage motors saves energy. • Circuit configuration and control are well designed for power supplies and motors.	6600	2300
For general industry (low-voltage)	FRENIC-VG	High-performance vector controlled inverter	200 400	90kW 800kW
	FRENIC-MEGA	High-performance V/f controlled inverter	200 400	90kW 630kW
	FRENIC-ECO	V/f controlled inverter for fans and pumps	200 400	110kW 560kW

Examples of applications



Selection of inverter capacity

When selecting inverter capacity, select an inverter whose rated current value is larger than the operating current of the motor to be driven.

●Selection example 1

For driving a 3.3kV, 60Hz, 300kW, 4-pole motor:
Rated current value of motor: 65A
Operating current value of motor: 65A
→Select an inverter capacity of 390kVA (68A).
(65 < 68A)

●Selection example 2

For driving a 3.3kV, 60Hz, 800kW, 4-pole motor:
Rated current value of motor: 173A
Operating current value of motor: 130A
→Select an inverter capacity of 770kVA (134A).
(130 < 134A)

FRENIC4600FM5e(6.6kV 10,500kVA(*))

Back to back installation
(front side)

(*): Max. capacity of this model

Ordering Information

When placing an order or making an inquiry, please state the following.

Application of inverter					**Remarks:**
Load machine specifications					
Name: ☐Pump, ☐Fan, ☐Blower, ☐Air compressor, ☐Other ( )					
Load torque characteristics: ☐Square-law speed, ☐Constant torque, ☐Constant output					
Moment of load inertia after conversion into motor shaft (J): kg・m²					
Overload: %					
Input specifications					
Rated voltage: V± %		Rated frequency: Hz± %			
Control power source: -phase, -wires, V, Hz					
Drive motor					
Motor specifications: ☐Squirrel-cage rotor, ☐ ( ), ☐Existing, ☐New installation					
Rating	Output: kW	No. of poles:	Voltage: kV		
	Frequency: Hz	Speed: r/min	Current: A		
Speed control					
Controllable range: r/min to r/min					
Rotational frequency setting method					
☐Analog signal: 4 to 20mA, 0 to 10V, ☐Up/down signal, ☐ ( )					
Commercial power source bypass circuit					
☐with, ☐without					
Ambient conditions					
Install location: Indoor	Humidity: %RH	Temperature: ˚C	Altitude: m		
Provision of air conditioning:		Limit on carrying-in:			

JAB CM021

ISO 14001 JACO EC97J1061

UKAS MANAGEMENT SYSTEMS 051

Kobe Factory, where this instrument is manufactured, is certified by ISO14001 Environmental management systems.

MEMO

Printed on recycled paper

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2011-12(L2011h/H2007)KO-D/CTP7Ok Printed in Japan