FUJI ELECTRIC

Vector-Controlled AC Variable-Speed Drive

FRENIC5000VG3/VG3N

Instruction Manual

STANDARD Series FRENIC5000VG3

200V Series, 3.7 to 90kW
400V Series, 3.7 to 200kW

LOW NOISE Series FRENIC5000VG3N

200V Series, 0.75 to 22kW
400V Series, 5.5 to 45kW

Fuji Electric Co.,Ltd.

INR-HF 50168a-E

Preface

It is necessary to use properly as instructed in this manual to make the inverter FRENIC5000VG3 or FRENIC5000VG3N fulfill the performance as expected. Wrong handling causes malfunction, short service life, and faults. You should first read this manual before you use it. When you ship a machine or a control board that contains this inverter, make sure to send this manual to the actual user's hand.

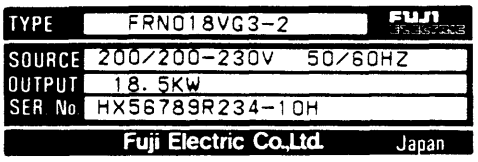
> CAUTION: Check the contents of the parameters FNO.51 to 8F mentioned in 7-2, and adjust the settings if necessary, before driving the motor. Make sure particularly that the number of poles and the specification of the pulse encoder agree with the motor nameplate.

CONTENTS

1. Checking the Received Inverter

Unpack the package and check the following:

① Check the nameplate on the front cover to make sure that it is as ordered.



← Inverter type
← Rated AC input voltage and frequency
← Rated output of standard driven motors
← Manufacturer's serial number

Fig. 1-1 Nameplate (example)

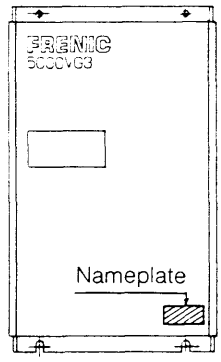


Fig. 1-2 Position of the nameplate

Inverter type code designation

FRN 018 VG3-2

- Supply voltage: 2→200V, 4→400V,
- Series name: Standard series→VG3, Low Noise series→VG3N
- Standard motor output: 018→18.5kW, 160→160kW (See 5. Standard Specifications)
- Product type: FRENIC5000

② Check for no defects such as damage or falling off of parts and dents on the enclosure. If you find any defect, contact the selling agent or the nearest Fuji sales office immediately.

2. Carrying and Storage

When you convey the received unit or store it temporarily, be careful of the following:

2-1 Caution in Carrying

① Be careful not to drop the unit while carrying.
② Carrying the unit by the terminal or the front cover may cause damage or dropping; therefore, be sure to hold the body.
③ Keep ambient temperature during carrying (incl. transport) between −25℃ and +65℃.

2-2 Storage

(1) Ambient temperature
Keep ambient temperature during storage between −25℃ and +65℃.

(2) Packing
Storage without packing is bad for prevention of rust, dust, and damage. Packing is necessary during storage.

(3) Place
Do not store the unit directly on a concrete floor, but on a platform or a shelf. Avoid places subject to direct sunlight.

(4) Humidity
Avoid storing the unit in a humid environment.

(5) Corrosive gases
Avoid storing the unit in an atmosphere that contains corrosive gases such as gaseous sulfide, ammonia, and chlorine.

2-3 Long Standstill After Installation

Some inverter boards are left unoperated for a long time after they are completed. Particularly when they are delivered during construction work, they are often subject to water and dust. In such a case, take a temporary protective measure till the operation starts.

2-4 Export Packing

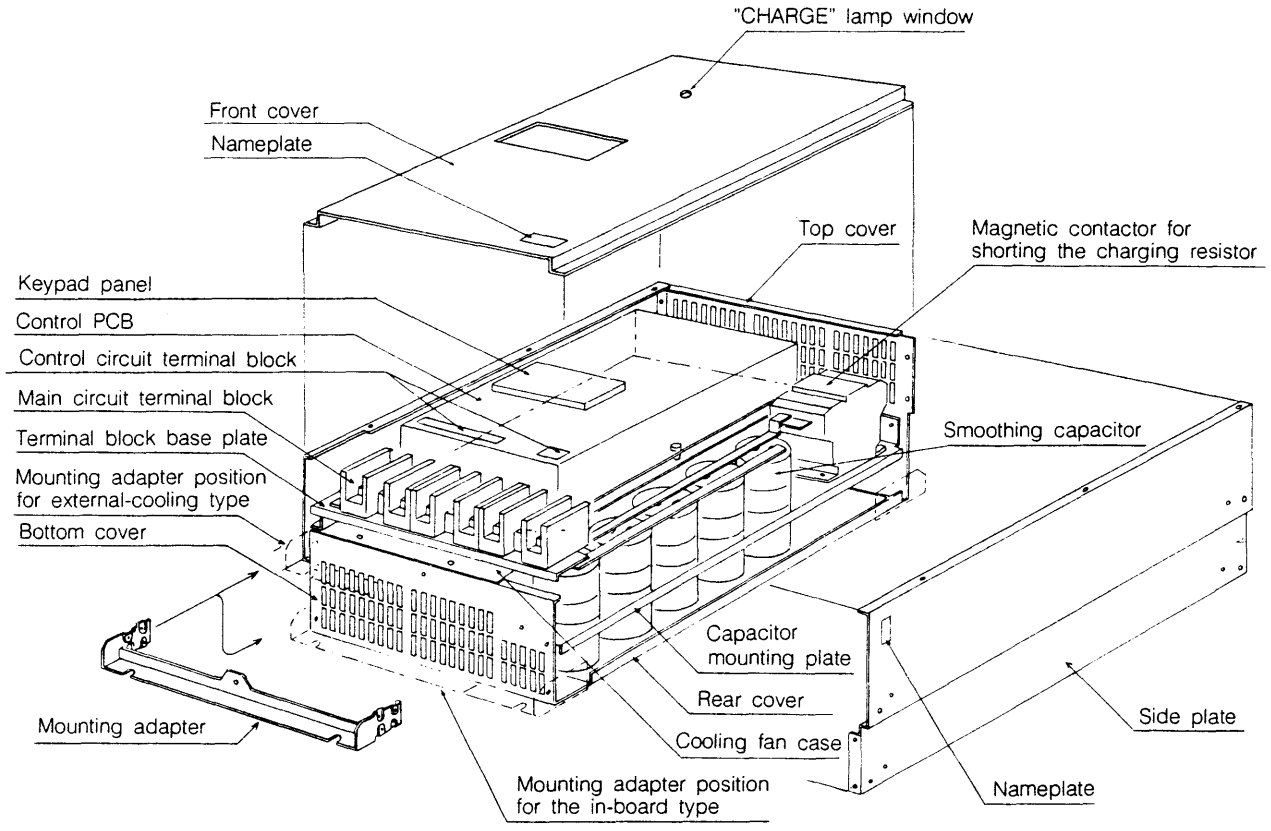
Export goods by ship are generally kept in harbor storages for a long time and sometimes cross the equator in a ship's hold; therefore, it is necessary to take measures against injury from salt and environmental conditions during transport.
For example, inverters passing through the tropics are subject to hot and humid environment, and to keep the unit from getting moldy and rusty, take measures such as export packing in accordance with JIS Z 1402 and putting a dehumidifying agent (silica gel) in the package.

3. Construction

(1) Inverters FRN055VG3-2 and below in 200V standard series, FRN110VG3-4 and below in 400V standard series and all types of low noise series.

There are two types different in cooling methods: in-board type and external-cooling type. Fig. 3-2 illustrates the in-board type, and Fig. 3-3, the external-cooling type that has the cooling fan outside the board. The external-cooling type discharges approx. 70% of the total loss of the inverter to outside the board, resulting in easy cooling inside the board and economical board design. However, in a dusty environment due to waste thread or the like, the unit requires a dustproofing measure, about which please make inquiries individually. Check periodically to see if air passage is not obstructed because the cooling fan and fins are located outside the board.

These two types have a common construction. It can meet both types by the change of mounting adapter positions as shown in Fig. 3-1. Note that the inverter is shipped as a in-board type. If you require a external-cooling type, please move the mounting adapters to the specified positions.



NOTE: Fix both upper and lower mounting adapters to positions for each type as illustrated.

Fig. 3-1 Construction of FRENIC5000VG3 series (1)

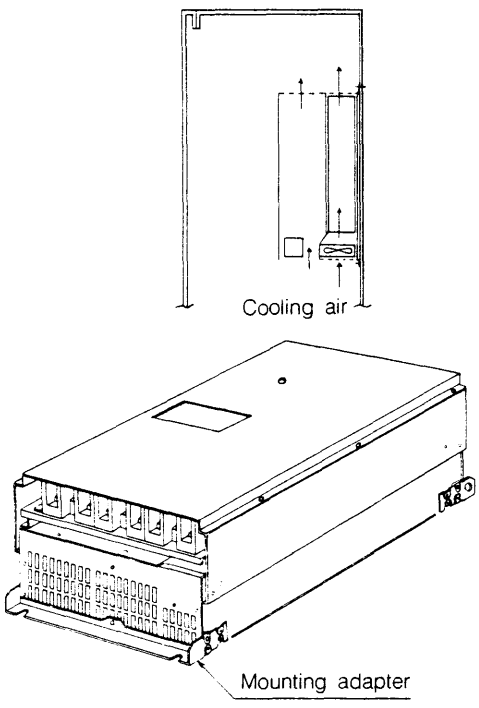


Fig. 3-2 In-board type

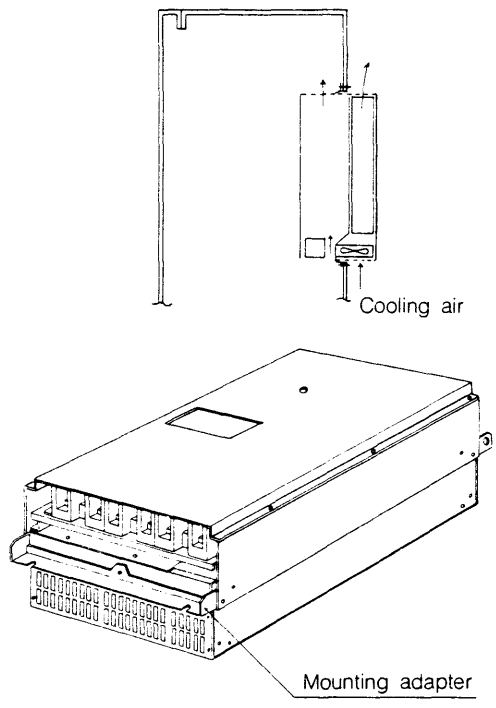


Fig. 3-3 External-cooling type

(2) Inverters FRN075VG3-2 and above in 200V standard series and FRN132VG3-4 and above in 400V standard series. The in-board and the external-cooling types have the same construction, which can meet both types without changing mounting adapters.

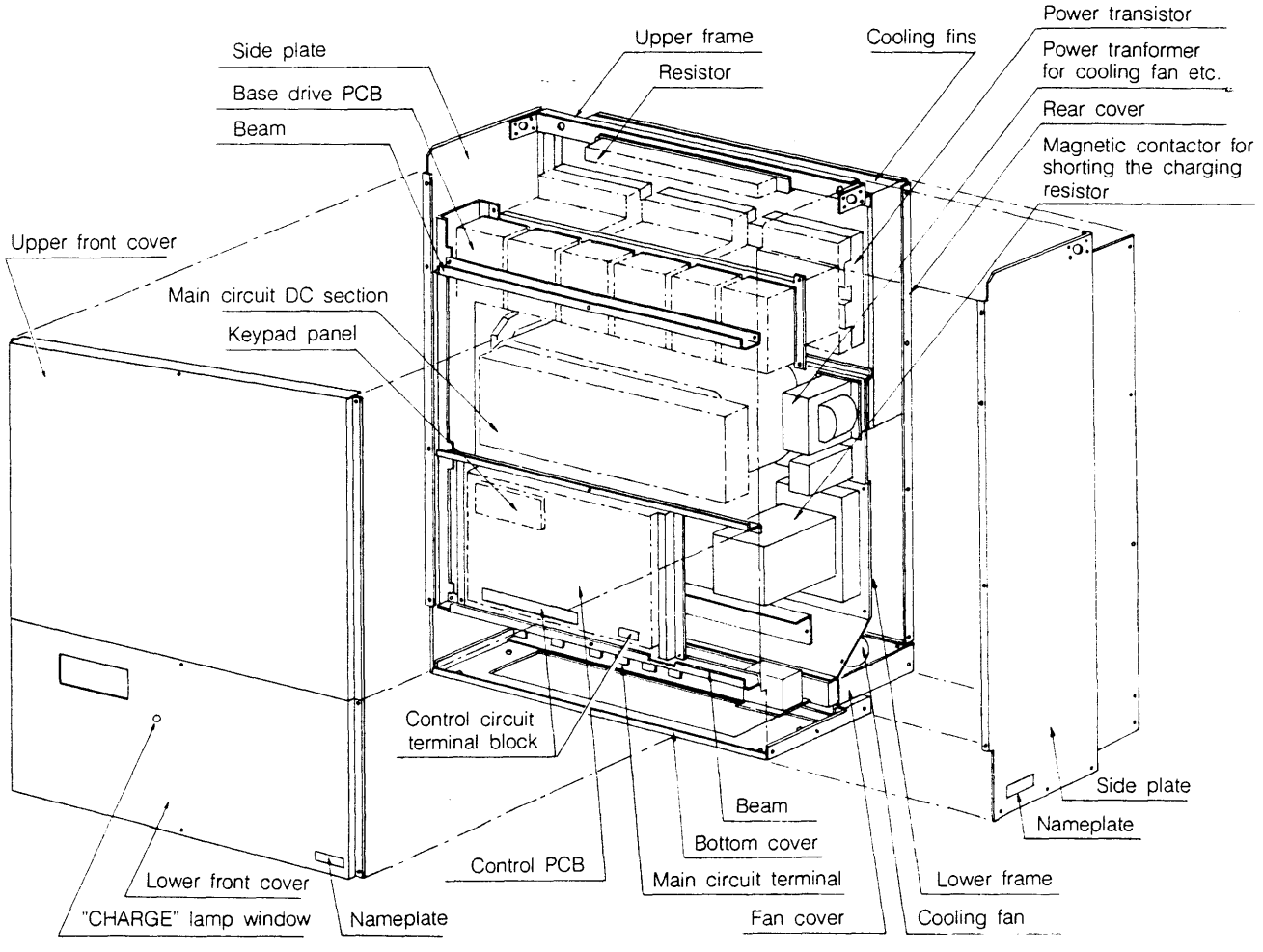


Fig. 3-4 Construction of FRENIC5000VG3 series (2)

4. Installation

4-1 Environment for Use

The inverters are used in various and wide-ranging environments. These environments have great influence on its performance and service life. The FRENIC5000VG3 series and VG3N series are designed to be used under the environmental conditions in Table 4-1 and places for use should satisfy them. Take sufficient measures against vibration particularly when you install it in machines, etc.

Table 4-1 Environmental conditions for use

Item	Specification	
Ambient temperature	−10～+50℃	Free of dew and ice due to a sudden change in temperature
Relative humidity	20～90% RH	
Altitude	Lower than 1000 m	
Atmosphere	Contains little dust. Free from corrosive gases, inflammable gases, oilmist, vapor, water drops, and direct sunlight. Contains little salt.	
Vibration	Less than 4.9m/s^2 (0.5G) (in accordance with JIS CO911)	

4-2 Direction and Space

(1) Direction of installation
Install the inverter with the characters FRENIC5000VG3 or FRENIC5000VG3N on the front face and perpendicular to the ground. It will be overheated if installed upside down or horizontally.

(2) Space
The inverter generates heat due to loss. To discharge this heat outside, some fans for forced air cooling are built in.
Provide sufficient space as shown in Fig. 4-1 to reduce obstacles to ventilation and effects on surroundings.

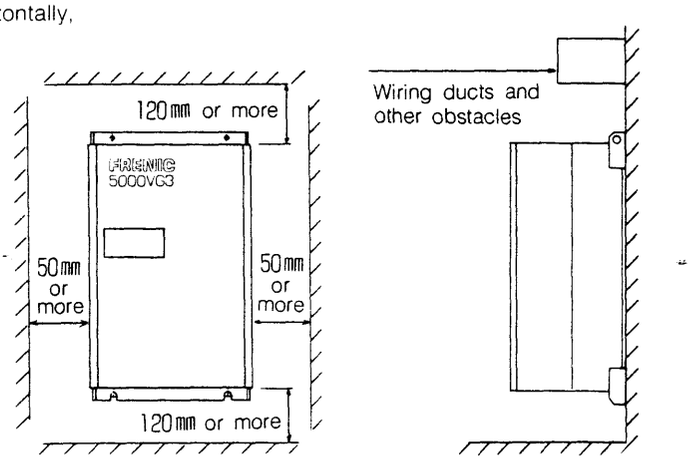
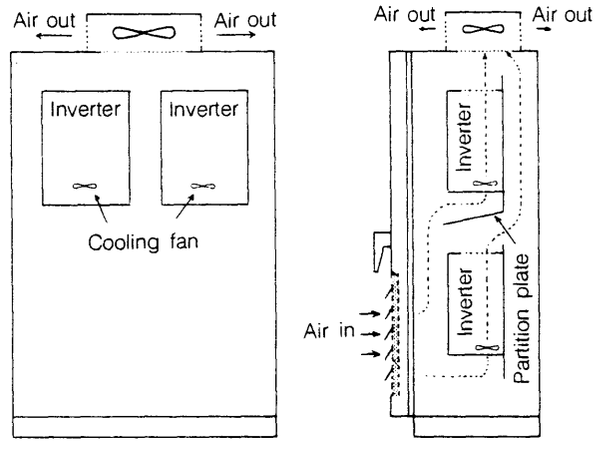


Fig. 4-1 Space around the inverter

4-3 Caution in Installation Inside a Board

① Temperature inside the board should not exceed 50℃.
② To avoid temperature rise in the board, do not install the inverter in a small sealed board nor install parts and heat sources close to it.
③ When installing a cooling (ventilation) fan to the board, make a design so that cooling air will pass through the heat generating part. Improper arrangement of the inverter and fan may cause temperature around the inverter not to be lowered to the specified value even though the fan has a required capacity.
④ When installing more than one inverter in a board, arrange them horizontally as shown in Fig. 4-2 (a). When vertical (above and below) arrangement is unavoidable, provide a partition plate between the inverters as shown in Fig. 4-2 (b) so that the heat from the lower inverter will not affect the upper one.



(a) Horizontal arrangement (b) Vertical arrangement

Fig. 4-2 Inverter arrangement in a board

5. Standard Specifications

(1) 200V series

Item			Specification															
Motor	Type		MVK 6096A	MVK 6097A	MVK 6107A	MVK 6115A	MVK 6133A	MVK 6135A	MVK 6165A	MVK 6167A	MVK 6185A	MVK 6187A	MVK 6205A	MVK 6206A	MVK 6207A	MVK 5254A	MVK 5256A	MVK 5284A
	Continuous rated output [kW]		0.75	1.5	2.2	3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90
	Base speed [r/min]		1500 NOTE: Make individual inquiries when you request other speeds than 1500r/min.															
	Maximum speed [r/min]		3600										3000			2400		1800
	Rated Current [A]		4	8	12.5	20	31	41	58	74	90	106	142	177	203	244	328	343
	Continuous rated torque [N-m] {kg-m}		4.77 {0.49}	9.55 {0.97}	14.0 {1.43}	23.5 {2.40}	35.0 {3.57}	47.7 {4.87}	70.0 {7.14}	95.5 {9.74}	117 {12.0}	140 {14.3}	191 {19.5}	235 {24.0}	286 {29.2}	350 {35.7}	477 {48.7}	572 {58.4}
	Rotor inertia [kg-m^2] (Rotor GD^2) {kgf-m^2}		0.009 {0.035}	0.009 {0.035}	0.009 {0.035}	0.016 {0.065}	0.030 {0.12}	0.038 {0.15}	0.085 {0.34}	0.12 {0.47}	0.22 {0.88}	0.27 {1.06}	0.34 {1.34}	0.41 {1.65}	0.47 {1.87}	1.0 {4.0}	1.4 {5.5}	1.9 {7.4}
	Noise	standard series	75dB(A) or less										80dB(A) or less			88dB(A) or less		
		low noise series	70dB(A) or less										—			—		
	Vibration		V10 or less													V15 or less		
	Cooling fan	Voltage	200V/50Hz, 200~230V/60Hz															
		Phase, Pole,	1φ, 4P 40/50W						3φ, 4P, 90/120W				3φ, 4P, 150/210W			3φ, 4P, 270/390W		
		Current [A]	0.29/0.27~0.31						0.49/0.44~0.48				0.75/0.77~0.8			1.9/2.0~2.0		
Inverter	Type	Standard Series	FRN 907 VG3-2	FRN 001 VG3-2	FRN 002 VG3-2	FRN 003 VG3-2	FRN 005 VG3-2	FRN 007 VG3-2	FRN 011 VG3-2	FRN 015 VG3-2	FRN 018 VG3-2	FRN 022 VG3-2	FRN 030 VG3-2	FRN 037 VG3-2	FRN 045 VG3-2	FRN 055 VG3-2	FRN 075 VG3-2	FRN 090 VG3-2
		Low Noise Series	FRN 907 VG3N-2	FRN 001 VG3N-2	FRN 002 VG3N-2	FRN 003 VG3N-2	FRN 005 VG3N-2	FRN 007 VG3N-2	FRN 011 VG3N-2	FRN 015 VG3N-2	FRN 018 VG3N-2	FRN 022 VG3N-2	—					
	Speed control range [r/min]		5~1500~3600										5~1500~3000			5~1500~2400		5~1500 ~1800
			Constant torque characteristics for less than 1500r/min, Constant output characteristics for more than 1500r/min.															
	Power Supply	Rated input AC voltage	3-phase, 3-wire system, 200V/50Hz, 200~230V/60Hz															
		Allowable fluctuation	Voltage: +10~−15%, voltage unbalance rate:3% or less **(Note 1)**, frequency: ±5% NOTE: Output may be reduced with voltage below 200V.															
		Required supply capacity [kVA]	1.2	2.5	4	6	9	12	17	22	28	34	45	55	67	84	104	120
	Power loss [kW] **(NOTE 3)**	Standard Series	0.16	0.20	0.25	0.35	0.40	0.50	0.70	0.95	1.1	1.2	1.5	1.7	2.1	2.9	3.5	3.7
		Low Noise Series	0.17	0.21	0.26	0.36	0.50	0.67	0.92	1.2	1.45	1.65	—					

(Note 1) When the supply voltage unbalance rate exceeds 3%, use an AC reactor for supply coordination or a DC reactor. Note that the DC reactor is applicable to standard series 22kW and above.

$$\text{Supply voltage unbalance rate [\%]} = \frac{\text{Max. voltage [V]} - \text{Min. voltage [V]}}{\text{Mean voltage of 3 phases [V]}} \times 100$$

(Note 2) The inverters for motors of 55kW and above are equipped with a DC reactor (supplied separately) as standard.

(Note 3) The total power loss of an inverter. The external-cooling type discharges approx. 70% of the total loss to outside.

(2) 400V series

Item			Specification																
Motor	Type		MVK 6115A	MVK 6133A	MVK 6135A	MVK 6165A	MVK 6167A	MVK 6185A	MVK 6187A	MVK 6205A	MVK 6206A	MVK 6207A	MVK 5254A	MVK 5256A	MVK 5284A	MVK 5286A	MVK 5310A	MVK 5314A	MVK 5316A
	Continuous rated output [kW]		3.7	5.5	7.5	11	15	18.5	22	30	37	45	55	75	90	110	132	160	200
	Base speed [r/min]		1500 NOTE: Make individual inquiries when you request other speeds than 1500r/min.																
	Maximum speed [r/min]		3600							3000			2400		1800				
	Rated Current [A]		10	15.5	20.5	29	37	45	53	71	89	102	122	164	189	228	290	334	390
	Continuous rated torque [N-m] {kg-m}		23.5 {2.40}	35.0 {3.57}	47.7 {4.87}	70.0 {7.14}	95.5 {9.74}	117 {12.0}	140 {14.3}	191 {19.5}	235 {24.0}	286 {29.2}	350 {35.7}	477 {48.7}	572 {58.4}	700 {71.4}	840 {85.7}	1018 {103.9}	1273 {129.9}
	Rotor inertia [kg-m^2] (Rotor GD^2) {kgf-m^2}		0.016 {0.065}	0.030 {0.12}	0.038 {0.15}	0.085 {0.34}	0.12 {0.47}	0.22 {0.88}	0.27 {1.06}	0.34 {1.34}	0.41 {1.65}	0.47 {1.87}	1.0 {4.0}	1.4 {5.5}	1.9 {7.4}	2.2 {8.7}	3.6 {14.5}	4.3 {17.0}	5.0 {20.0}
	Noise	standard series	75dB(A) or less							80dB(A) or less			88dB(A) or less				90dB(A) or less		
		low noise series	70dB(A) or less							75dB(A) or less			——				——		
	Vibration		V10 or less										V15 or less						
	Cooling fan	Voltage	200V/50Hz, 200~230V/60Hz NOTE: Supply voltage for the cooling fan is of the 200V class. When you use 400V supply, adjust voltage with a transformer.																
		Phase, Pole,	1φ, 4P 40/50W			3φ, 4P, 90/120W				3φ, 4P, 150/210W			3φ, 4P, 270/390W			3φ, 4P, 1/1.5kW			
		Current [A]	0.29/ 0.27~0.31			0.49/0.44~0.48				0.75/0.77~0.8			1.9/2.0~2.0			3.4/4.2~4.0			
Inverter	Type	Standard Series	FRN 003 VG3-4	FRN 005 VG3-4	FRN 007 VG3-4	FRN 011 VG3-4	FRN 015 VG3-4	FRN 018 VG3-4	FRN 022 VG3-4	FRN 030 VG3-4	FRN 037 VG3-4	FRN 045 VG3-4	FRN 055 VG3-4	FRN 075 VG3-4	FRN 090 VG3-4	FRN 110 VG3-4	FRN 132 VG3-4	FRN 160 VG3-4	FRN 200 VG3-4
		Low Noise Series	—	FRN 005 VG3N-4	FRN 007 VG3N-4	FRN 011 VG3N-4	FRN 015 VG3N-4	FRN 018 VG3N-4	FRN 022 VG3N-4	FRN 030 VG3N-4	FRN 037 VG3N-4	FRN 045 VG3N-4	——						
	Speed control range [r/min]		5~1500~3600							5~1500~3000			5~1500 ~2400		5~1500~1800				
			Constant torque characteristics for less than 1500r/min, Constant output characteristics for more than 1500r/min.																
	Power Supply	Rated input AC voltage	3-phase, 3-wire system, 400~420V/50Hz, 400~460V/60Hz																
		Allowable fluctuation	Voltage: +10~−15%, voltage unbalance rate:3% or less **(Note 1)**, frequency: ±5% NOTE: Output may be reduced with voltage below 400V.																
		Required supply capacity [kVA]	6	9	12	17	22	28	34	45	55	67	84	104	120	145	175	205	260
	Power loss [kW] **(NOTE 3)**	Standard Series	0.35	0.40	0.60	0.70	0.85	1.0	1.1	1.2	1.5	1.8	2.6	3.0	3.3	4.1	5.0	6.0	6.8
		Low Noise Series	—	0.50	0.60	0.80	1.1	1.25	1.35	1.4	1.7	2.0	——						

(Note 1) When the supply voltage unbalance rate exceeds 3%, use an AC reactor for supply coordination or a DC reactor. Note that the DC reactor is applicable to standard series 22kW and above.

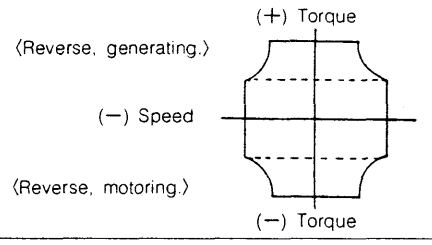
$$\text{Supply voltage unbalance rate [\%]} = \frac{\text{Max. voltage [V]} - \text{Min. voltage [V]}}{\text{Mean voltage of 3 phases [V]}} \times 100$$

(Note 2) The inverters for motors of 55kW and above are equipped with a DC reactor (supplied separately) as standard.

(Note 3) The total power loss of an inverter. The external-cooling type discharges approx. 70% of the total loss to outside.

5

(3) Common specifications

Item			Specification
Motor	Overload endurance		1 min at 150% of the continuous rated output (150%, 30s at output freq.≦1Hz)
	Insulation, pole		F class, 4P
	Terminal construction		Main terminal box: Main terminal lugs (3 for 110kW and below, 6 for 132-200kW, 3×2/phase), NTC thermistors (2 pcs). Aux. terminal box: Pulse encoder(PGP, PGM, PA, PB, SS), cooling fan (FU & FV or FU, FV & FW). **(Note 6)**
	Mounting method		Leg-mount bracket type (IMB3) NOTE: About other mounting methods, make individual inquiries.
	Protection and cooling system		Totally enclosed, fan cooling (JP44). Air flow: from anti-driving side to driving side.
	Installation place		Indoors, at altitudes less than 1000m
	Ambient temperature & humidity		−10~+40℃, 90% RH or less (free of dew condensation)
	Paint color		Munsell N5
	Standard accessories		Pulse encoder (1024P/R as standard), NTC thermistors, cooling fan
Inverter	Main-circuit system		Transistor type sine-wave PWM inverter
Control	Control system		Vector controlled, ASR control with ACR minor control (ACR: current control, ASR: speed control)
	Speed control accuracy	Analog setting	±0.2% of max. speed (25±10℃)
		Digital setting	±0.01% of max. speed (−10~+50℃)
	Speed setting resolution		0.005% of max. speed
	Speed control response		Response frequency 50 Hz (−3dB)
	Range of torque control		1 : 50
	Torque control accuracy		±5% (total accuracy)
	Speed-torque characteristics		 4-quadrant operation Max. torque: 150%, 1 min Stalled torque: 80%, cont. For speed ranges, see each separate specification.
	Acc/dec characteristics		Torque-limiting acceleration/deceleration, linear acc/dec (0.10-1200 s), curved (S-curve) acc/dec
	Braking method		Dynamic braking resistor method: 150%, duty cycle 5% ED, provided with separate brake resistor(s), and separate brake unit(s) in addition for 55kW and above.
	Protective functions		Overcurrent, main-circuit DC fuse blow, overvoltage, undervoltage **(Note 4)**, overspeed, inverter overload, inverter overheat, motor overheat, thermistor disconnection, memory error, current detection error, optional unit error, external alarm, CPU error, overload prediction, output short-circuiting, inverter ground-fault protection (option) **(Note 5)**
Input	Speed setting	Analog	0~+10 V DC or 0~±10V DC (main and aux. speed setting)
		Digital	16-bit binary or 4-digit BCD (with option OPC Ⅱ-VG3-DI), UP-DOWN setting, multistep speed setting
	Analog signals		Aux. speed settings (2 points), torque limit, torque setting, and magnetic flux setting; 2 points to be selected under certain restrictions.
	Contact signals		Forward/stop command, reverse/stop command, free-run command, pre-excitation, external alarm input, alarm reset.
			Multistep speed setting (5 speeds, max.), soft-start bypass, soft- start time selection (2 steps), torque limit, torque bias, ASR P/PI changeover, ASR PI constant selection (2 steps), droop control, UP-DOWN setting, and reverse-inhibiting command; 5 points to be selected under certain restrictions.
Output	Analog signal		Speed setting, detected speed, and torque setting; 1 point to be selected
	Contact signal		Overall alarm signal, 1 point from items right. / Speed arrival, speed agreement, optional speed detection, running (zero speed), optional torque, operating, motor overheat prediction, inverter overload prediction, accelerating, decelerating, intermediate voltage setup
	Open collector signal		3 points selected from items right under certain restrictions
Display	Signal for instruments		For speed and load meters, 0~+10V DC or 0~±10V DC
	Keypad panel display		Displays a function No. and data of the function list
	CHARGE lamp		Turned on by charging voltage to the smoothing capacitor in main-circuit DC voltage section.
Environment	Installation place		Indoors, at altitudes less than 1000m, not subject to direct sunlight, corrosive gases and dust.
	Ambient temperature and humidity		−10~+50℃, 20~90% RH (free of dew condensation) and humidity
	Vibration		4.9m/s^2 (0.5G) or less (in accordance with JIS C 0911)
	Temperature during transport and storage		−25~+65℃
	Mounting types		In-board type and external-cooling type
	Protection and cooling system		Protective housing (IP00: JEM 1030; IP20 optionally available for 55kW or below in 200V series and 110kW or below in 400V series.), fan cooling.
	Paint color		Munsell 5Y3/0.5, semigloss

(Note 4) Even if the power fails, operation will continue about 15ms at the rated load. In case of less load, operating time is longer. When the main-circuit DC voltage lowers to a undervoltage level, the inverter stops output immediately and holds trip condition. However, when the inverter control power fails, it is automatically reset.

(Note 5) The optional ground-fault protective unit only protects the inverter itself. For protection against human accidents, fire and damage of external devices, prepare leakage protective devices in addition.

(Note 6) Encoder terminals are (+V, 0V, PA, PB and SS) for motors of 55kW and above.

5

6. Terminals, Connection and Wiring

6-1 Terminals

(1) Basic circuit configuration and terminals

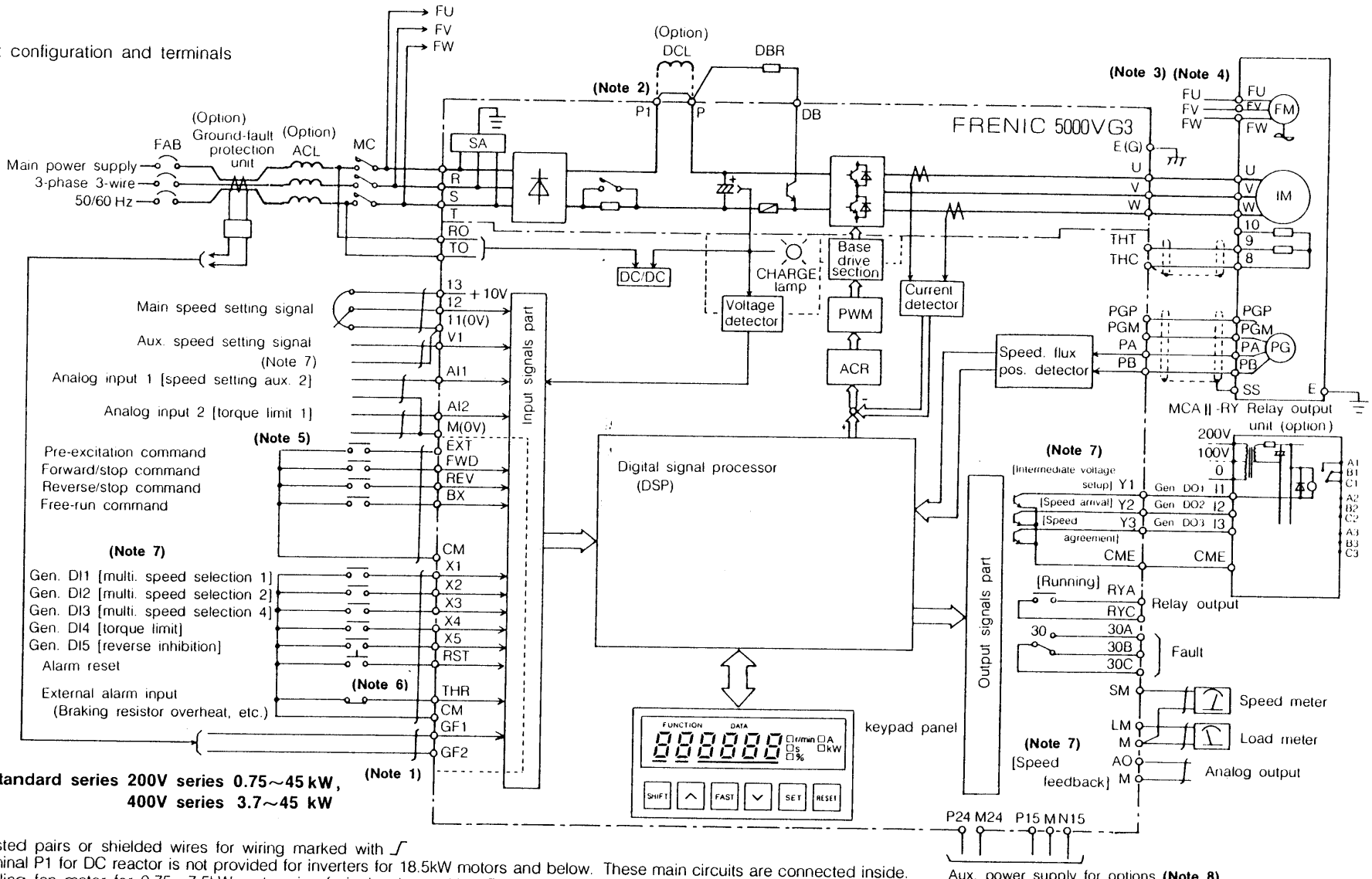


Fig. 6-1-1 Standard series 200V series 0.75~45 kW, 400V series 3.7~45 kW

(Note 1) Use twisted pairs or shielded wires for wiring marked with ⎍
(Note 2) The terminal P1 for DC reactor is not provided for inverters for 18.5kW motors and below. These main circuits are connected inside.
(Note 3) The cooling fan motor for 0.75~7.5kW motors is of single phase. Use FU and FV terminals.
(Note 4) Supply voltage for cooling fan motors for 400V series motors is 200V/200-230V, 50/60Hz. Make connections through transformers.
(Note 5) Be sure to use the pre-excitation command together with mechanical braking.
(Note 6) Short the control circuit terminals "THR" and "CM" when you do not use external alarm input. (They are connected with a short bar at shipment.) For the brake resistor overheat, see 6-2 2) (4).
(Note 7) The mark [ ] shows standard setting at shipment.
(Note 8) (P24, M24) and (P15, M, N15) are isolated inside the inverter. Do not connect M24 and M.

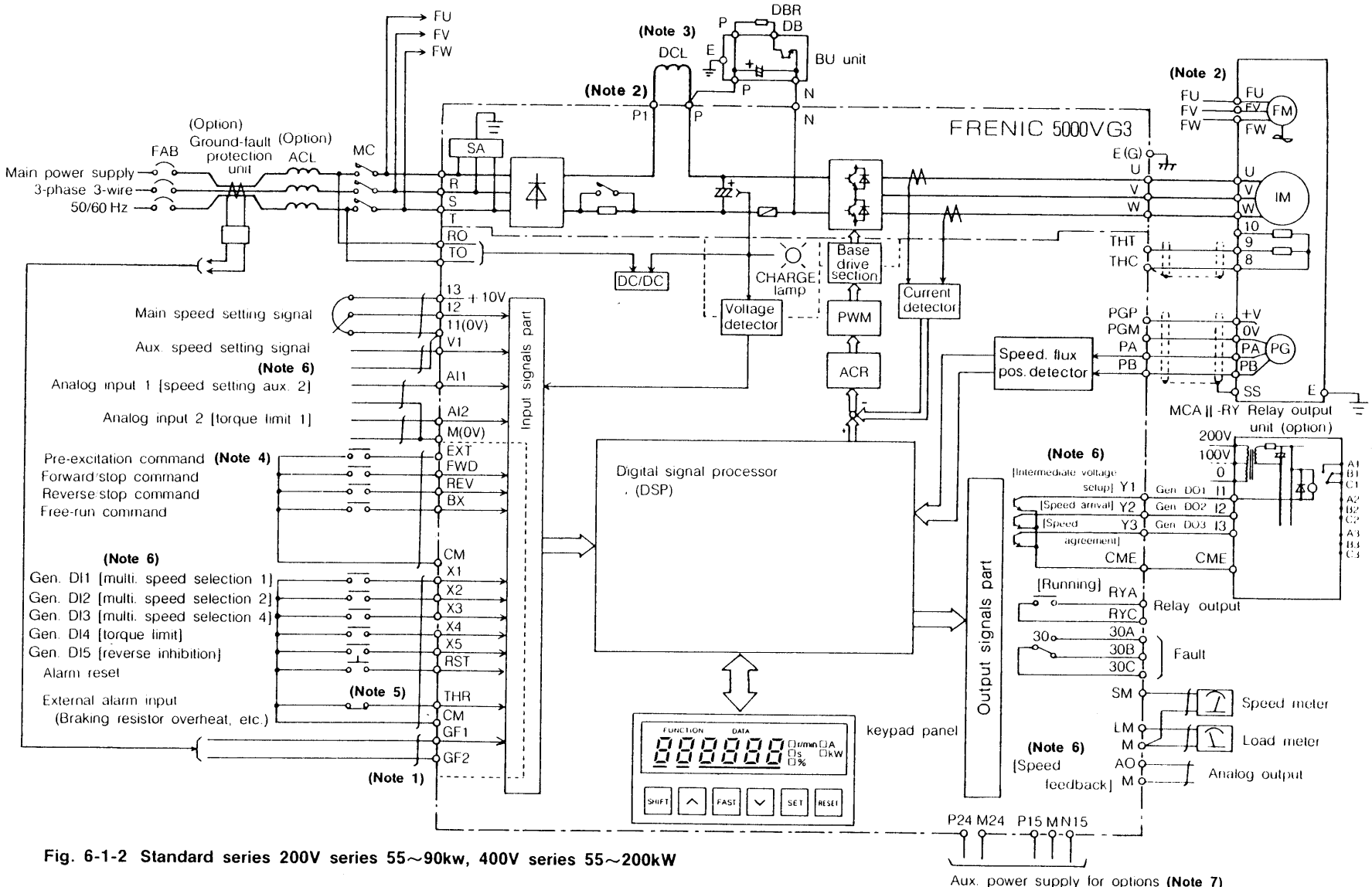


Fig. 6-1-2 Standard series 200V series 55~90kw, 400V series 55~200kW

(Note 1) Use twisted pairs or shielded wires for wiring marked with ∫.
(Note 2) Supply voltage for cooling fan motors for 400V series motors is 200V/200-230V, 50/60Hz. Make connections through transformers.
(Note 3) The DC reactor (DCL) is provided as standard for motors of 55kW and above.
(Note 4) Be sure to use the pre-excitation command together with mechanical braking.
(Note 5) Short the control circuit terminals "THR" and "CM" when you do not use external alarm input. (They are connected with a short bar at shipment.) For the braking unit and braking resistor overheat, see 6-2 2) (4).
(Note 6) The mark [ ] shows standard setting at shipment.
(Note 7) (P24, M24) and (P15, M, N15) are isolated inside the inverter. Do not connect M24 and M.

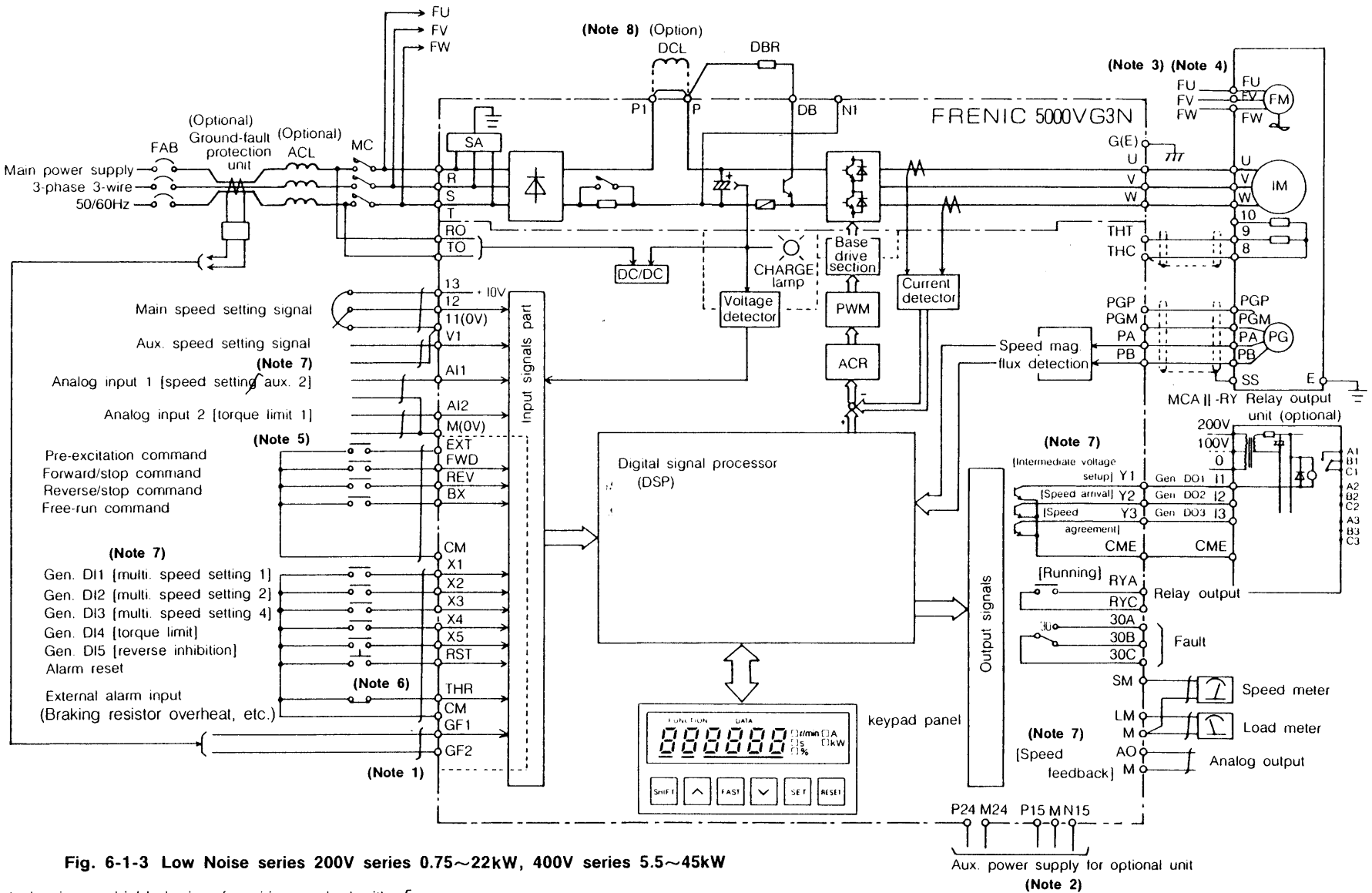


Fig. 6-1-3 Low Noise series 200V series 0.75~22kW, 400V series 5.5~45kW

(Note 1) Use twisted pairs or shielded wires for wiring marked with ∫ .
(Note 2) (P24, M24) and (P15, M, N15) are isolated inside the inverter. Do not connect M24 and M.
(Note 3) The cooling fan motor for 0.75~7.5kW motors is of single phase. Use FU and FV terminals.
(Note 4) Supply voltage for cooling fan motors for 400V series motors is 200V/200-230V, 50/60Hz. Make connections through transformers.
(Note 5) Be sure to use the pre-excitation command together with mechanical braking.
(Note 6) Short the control circuit terminals "THR" and "CM" when you do not use external alarm input. (They are connected with a short bar at shipment.) For the brake resistor overheat, see 6-2 2) (4).
(Note 7) The mark [ ] shows standard setting at shipment.
(Note 8) Terminal "P1" is equipped only in 30~45kW unit.

(2) Functions of the terminals

① Main-circuit terminals

Symbol	Terminal name	Description of functions
R, S, T	Main-circuit input	Connected to 3-phase power supply. 200V series: 200/200-230V, 50/60Hz 400-V series: 400-420/400-460V, 50/60Hz
U, V, W	Inverter output	Connected to an exclusive-use motor.
P, DB	Braking resistor	Connected to a braking resistor. (3.7~45kW)
P, N	Braking unit	Connected to a braking resistor through a braking unit. (55kW and above)
P, P1	DC reactor	Connected to a DC reactor for power factor improvement. Available for 22kW and above.
E (G)	Grounding	For grounding of the inverter chassis. (Be sure to provide grounding to prevent an electric shock and to reduce radio noise.)
P, N1	Backup capacitor	Connected to power backup circuit (Note 1) to backup of power failure (for Low Noise Series).

(Note 1) Contact Fuji about power backup circuit.

② Control circuit terminals

Category		Symbol	Terminal name	Description of functions		
Control power supply	Input	RO, TO	Aux. control power input	Connected to single-phase AC power supply to back up control power supply. 200V series: 200/200~230V, 50/60Hz 400V series: 400~420/400~460V, 50/60Hz		
	Output	P24, M24	Option power supply (24V)	P24: +24±4V DC, M24: 0V, 200mA incl. built-in optional PCB. **(Note 5)**		
		P15, N15, M	Option power supply (15V)	P15: +15±0.8V DC, N15: -15±0.8V DC, M: 0V, 150mA each incl. built-in optional PCB.		
Input	Speed setting/control signals	11	Speed setting common terminal	Common (base potential) terminal for speed setting signals (terminals 12, 13, V1), connected to terminal M inside.		
		13	Speed setting power supply	+10V DC, used for power supply to the setting unit (1kΩ variable resistor).		
		12	Main speed setting voltage input	0~±10V DC, input resistance 10kΩ, max. speed at ±10V	Speed is set by the sum of 12 and V1 signals. Max. speed is clamped at speed correspondingto ±10V. (See Fig. 7-1-2)	
		V1	Aux. speed setting voltage input	0~±10V DC, input resistance 10kΩ, max. speed at ±10V		
		M	Analog input common terminal	Common (base potential) terminal for analog input signals (terminals AI1, AI2).		
		AI1, AI2 **(Note 3)**	General-purpose analog input	0 ~±10V DC, input resistance 10kΩ, used for torque limit input, etc. By function setting (FNO. 76, 77), two of signals mentioned in 5. (3) can be input. **(Note 4)**		
	Contacts **(Note 1)**	CM	Contact input common terminal	Common terminal for contact input signals		
		FWD **(Note 2)**	Forward/stop command	FWD-CM, ON: Forward, OFF: Stop	Stop is input when both FWD and REV are ON or OFF. When V1 is input, however, operation is continued by the V1 signal.	
		REV **(Note 2)**	Reverse/stop command	REV-CM, ON: Reverse, OFF: Stop		
		BX	Free-run command	BX-CM, ON: Inverter output is stopped at once without alarm signal output. Since it has no self-hold function, the inverter will restart when BX-CM is turned off with FWD or REV on.		
		RST	Alarm reset	When the cause of a fault is removed in an alarm stop and RST-CM is turned on, the operating protective function (hold of status at an inverter trip) is released.		
		THR	External alarm input	The alarm is stopped with THR-CM off. This signal has a self-hold function inside. Used for braking resistor overheat protection, etc.		
		EXT	Pre-excitation command	Used for pre-excitation (magnetic flux component current supply) to a motor. Use mechanical braking together when using this terminal.		
		X1, X2, X3, X4, X5 **(Note 3)**	General-purpose digital input	By function setting (FNO. 72, 73), five of contact signals mentioned in 5. (3) can be input.		
	Motor temperature/speed detection	THT, THC	Thermistor connection	Used exclusively for connection to thermistors for motor temperature detection.		
		PGP, PGM	Pulse encoder power supply	Used exclusively for connection to the Pulse encoder (PG) for motor speed detection.	PGP: +15V, PGM: 0V	
		PA, PB	pulse encoder phase signal		PA: A-phase signal, PB: B-phase signal.	
	Protection	GF1, GF2	Ground-fault protection input	Used exclusively for ground-fault detecting unit for inverter protection (option)		
Output	Analog signals	M	Analog output common terminal	Common (base potential) terminal for gen. analog output, speed meter, load meter (terminals AO, SM, LM)		
		AO **(Note 3)**	General-purpose analog output	By function setting (FNO.78), speed settings, torque setting, etc. can be selected. Used mainly for control.		0~±10V DC, Resolution: 12 bits, Load impedance: 3kΩ or more
		LM	Load meter	Used for a torque current meter or torque meter.	2 voltmeters with input resistance 10kΩ can be connected.	0~+10V DC or 0~±10V DC Resolution: 8 bits, Load impedance: 5kΩ or more
		SM	Speed meter	Used for a speed meter.		
	Contacts	30A, 30B, 30C	Overall alarm output	Outputs a signal when an inverter protective function operates to stop output. (1 changeover contact, 30A-30C turns on at abnormality.)		Contact capacity: 250V, 0.3A, AC ($\cos\phi = 0.3$)
		RYA, RYC	General purpose digital (relay contact) output	By function setting (FNO. 75),one of contact signals mentioned in 5. (3) can be output.		
	Open collector	CME	Open collector output common terminal	Common terminal for open collector		Open collector output. output: DC 50mA, max. 27V, max. (V_L=1.5V at I_L=10mA V_L=1.8V at I_L=50mA)
		Y1, Y2, Y3 **(Note 3)**	General purpose digital (open collector) output	By function setting (FNO. 74), three of signals mentioned in 5. (3) can be output.		

6

(Note 1) For contact input, use Fuji Electric control relay HH54PW or its equivalent, or open collector output. The current is about 3mA, 24V DC.

(Note 2) Motor rotating direction (See 7.1 control block biagram)

① Speed setting voltage signals 0 ~+10V. (terminal "12" input voltage)
Forward/stop command "FWD" ON: Forward rotation,
Reverse/stop command "REV" ON: Reverse rotation.

② Speed setting voltage signals 0~±10V. (terminal "12" input voltage)
Forward/stop command "FWD" ON, ⊕ polarity: Forward rotation,
⊖ polarity: Reverse rotation,
Reverse/stop command "REV" ON: ⊕ polarity: Reverse rotation,
⊖ polarity: Forward rotation.

③ When parameters FNO. 14~18 are 0~100% in multistep speed setting, the motor operates as the voltage signal ② is in ⊕ polarity and
0~−100%, the motor operates as the voltage signal ② is in ⊖ polarity.

④ In the interlocking operation of more than one motor, it will be enabled by FNO.5B modification to reverse a specified motor if it is required for some reason such as reduction gear using a forward command.

(Note 3) Standard setting at shipment is as follows:

AI1: Aux. speed setting signal 2	X2: Multistep speed selection 2	RY: Running signal
AI2: Torque limit value 1	X3: Multistep speed selection 4	Y1: Intermediate voltage setup
AO: Detected speed	X4: Torque limit command	Y2: Speed arrival
X1: Multistep speed selection 1	X5: Reverse inhibition	Y3: Speed agreement

(NOTE 4) FNO. means Function No. See 7. Functions.

(NOTE 5) (P24, M24) and (P15, M, N15) are isolated inside the inverter. Do not connect M24 and M.

6

(3) Terminal arrangement and screw sizes

① Control circuit terminal arrangement

TB5

SM	LM	M	V1	12	13	AI1	AI2	PA	PGP	FWD	REV	CM	X1	X2	X3	X4	X5	Y2	CME	RYA	30C	GF1
A0	M	P15	M	N15	11	M	THT	THC	PB	PGM	P24	M24	BX	RST	CM	THR	EXT	Y1	Y3	RYC	30B	30A	GF2

TB4 (Note)

R0		T0

② List of terminals and screw sizes
(Standard Series)

Voltage	Motor [kW]	Inverter type	Fig.No.in ③	Screw size					
				Main circuit terminals				Control circuit terminals	
				R,S,T	U,V,W	DB,P1,P	E(G)	TB4	TB5
200V series	0.75	FRN907VG3-2	B	M5	M5	M5	M5	M4	M3
	1.5	FRN001VG3-2							
	2.2	FRN002VG3-2							
	3.7	FRN003VG3-2							
	5.5	FRN005VG3-2							
	7.5	FRN007VG3-2							
	11	FRN011VG3-2	C	M6	M6	M6	M6		
	15	FRN015VG3-2		M8	M8	M8	M6		
	18.5	FRN018VG3-2	E	M8	M8	M8	M6		
	22	FRN022VG3-2	F	M8	M8	M8	M6		
	30	FRN030VG3-2	G	M8	M8	M8	M8		
	37	FRN037VG3-2	H	M10	M10	M10	M8		
	45	FRN045VG3-2							
	55	FRN055VG3-2	K	M10	M10	φ11	M8		
	75	FRN075VG3-2	M	φ13	φ13	φ13	M10		
	90	FRN090VG3-2							
400V series	3.7	FRN003VG3-4	A	M4	M4	M4	M4	M4	M3
	5.5	FRN005VG3-4							
	7.5	FRN007VG3-4	B	M5	M5	M5	M5		
	11	FRN011VG3-4							
	15	FRN015VG3-4	C	M6	M6	M6	M6		
	18.5	FRN018VG3-4							
	22	FRN022VG3-4	D	M6	M6	M6	M6		
	30	FRN030VG3-4	F	M8	M8	M8	M8		
	37	FRN037VG3-4	G	M8	M8	M8	M8		
	45	FRN045VG3-4							
	55	FRN055VG3-4	J	M10	M10	M10	M8		
	75	FRN075VG3-4							
	90	FRN090VG3-4							
	110	FRN110VG3-4	L	M10	M10	φ11	M8		
	132	FRN132VG3-4	M	φ13	φ13	φ13	M10		
	160	FRN160VG3-4	N	φ13	φ13	φ13	M10		
	200	FRN200VG3-4							

(Note) TB4 for 200V series FRN055VG3-2 and above and for 400V series FRN055VG3-4 and above:

RO		TO		●

·Exclusive terminal (not for users)

(Low Noise Series)

Voltage	Motor [kW]	Inverter type	Fig.No.in ③	Screw size					
				Main circuit terminals				Control circuit terminals	
				R,S,T	U,V,W	DB,N1,P,P1	E(G)	TB4	TB5
200V series	0.75	FRN907VG3N-2	O	M5	M5	M5	M5	M4	M3
	1.5	FRN001VG3N-2							
	2.2	FRN002VG3N-2							
	3.7	FRN003VG3N-2							
	5.5	FRN005VG3N-2							
	7.5	FRN007VG3N-2							
	11	FRN011VG3N-2	P	M6	M6	M6	M6		
	15	FRN015VG3N-2	Q	M8	M8	M8	M6		
	18.5	FRN018VG3N-2		M8	M8	M8	M6		
	22	FRN022VG3N-2		M8	M8	M8	M6		
400V series	5.5	FRN005VG3N-4	O	M5	M5	M5	M5	M4	M3
	7.5	FRN007VG3N-4							
	11	FRN011VG3N-4							
	15	FRN015VG3N-4	P	M6	M6	M6	M6		
	18.5	FRN018VG3N-4							
	22	FRN022VG3N-4	R	M6	M6	M6	M6		
	30	FRN030VG3N-4	S	M8	M8	M8	M8		
	37	FRN037VG3N-4							
	45	FRN045VG3N-4							

③ Terminal arrangement

Fig. A 400V : 3.7,5.5kW

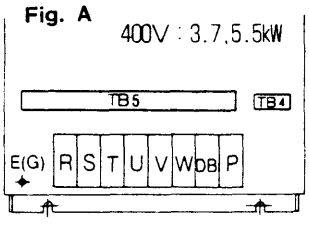


Fig. B 200V : 0.75~7.5kW
400V : 7.5,11kW

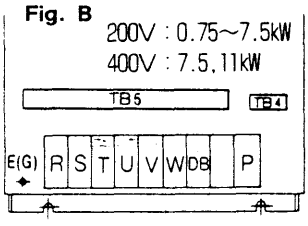


Fig. C 200V : 11,15kW
400V : 15,18.5kW

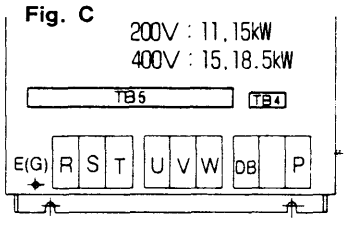


Fig. D 400V : 22kW

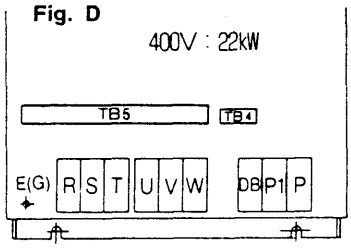


Fig. E 200V : 18.5kW

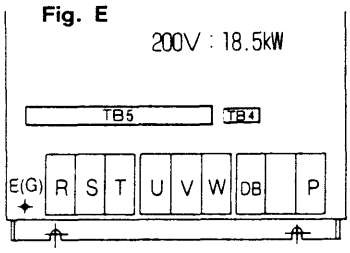


Fig. F 200V : 22kW
400V : 30kW

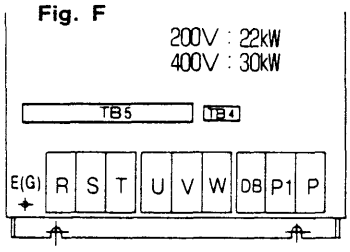


Fig. G 200V : 30kW
400V : 37,45kW

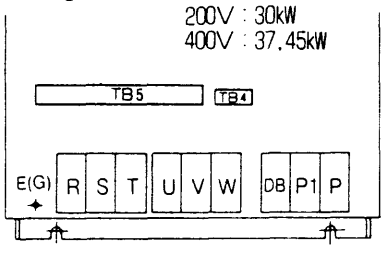


Fig. H 200V : 37,45kW

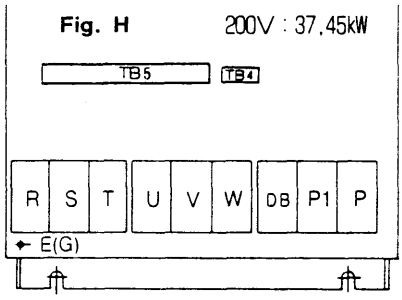


Fig. J 400V : 55~90kW

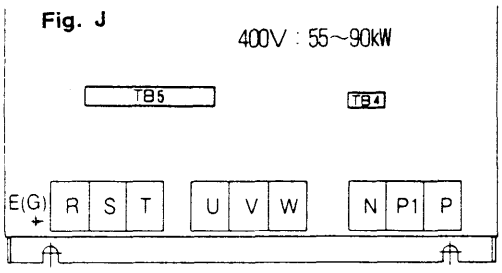


Fig. K 200V : 55kW

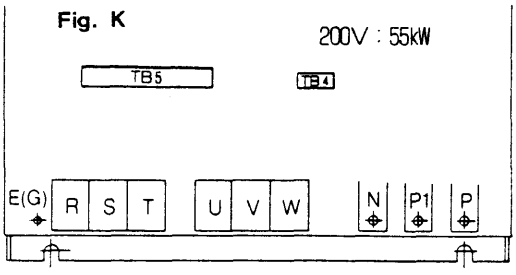


Fig. L

400V : 110kW

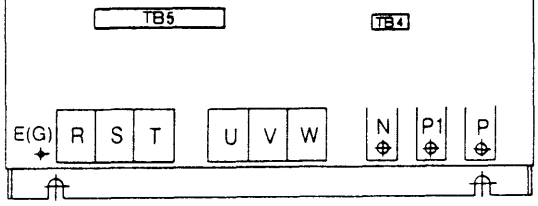


Fig. M

200V : 75, 90kW
400V : 132kW

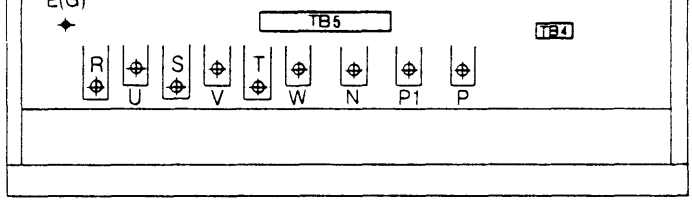


Fig. N

400V : 160, 200kW

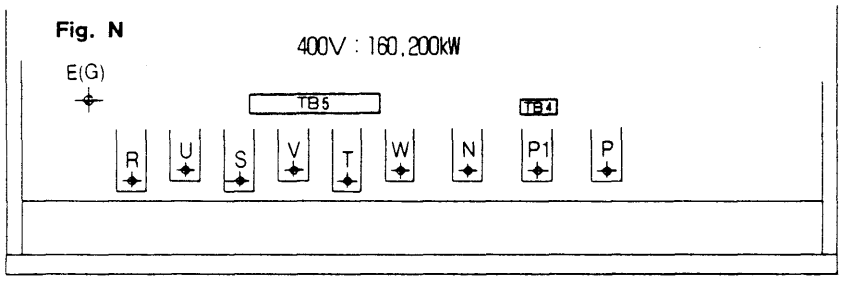


Fig. O

Low Noise Series
200V : 0.75~7.5kW
400V : 5.5~11kW

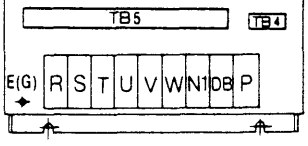


Fig. P

Low Noise Series
200V : : 11kW
400V : 15, 18.5kW

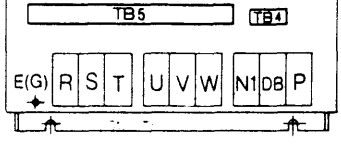


Fig. Q

Low Noise Series
200V : 15~22kW

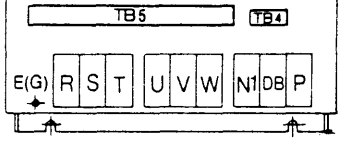


Fig. R

Low Noise Series
400V : 22kW

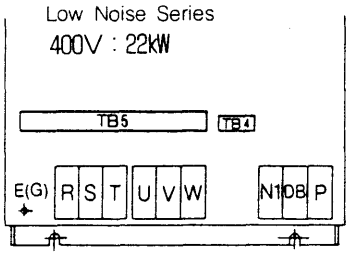
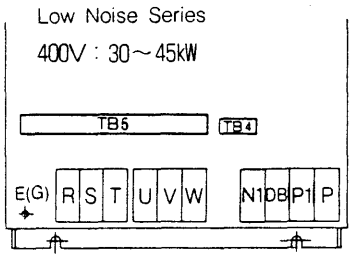


Fig. S

Low Noise Series
400V : 30~45kW



6

6-2 Connection and Wiring

Keep the cautions mentioned below. Be sure to check for correct connection when you finish wiring. Note that wrong wiring causes not only malfunction but also damage of the inverter.

1) Terminal arrangement and connection at shipment.

When you remove the front cover, you will see the main-circuit terminals and control circuit terminals arranged at the lower part of the inverter. At shipment, the external alarm input terminals THR and CM are connected with a short bar, and in standard series inverters of 22-45kW and low noise series 30~45kW, P1 and P are connected with a short bar.

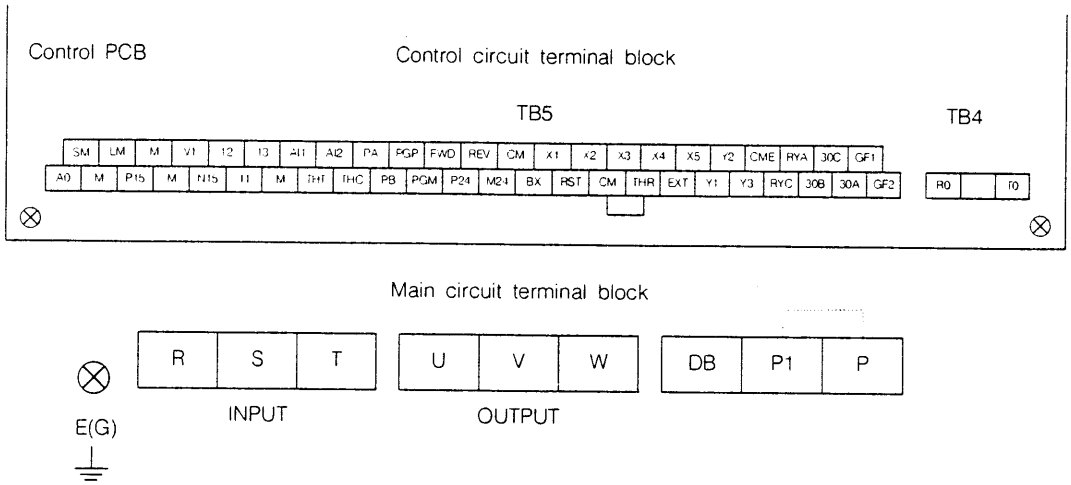


Fig. 6-2-1 Terminal arrangement and connection at shipment (an example of FRENIC022VG3-2)

2) Main circuit

(1) Connection to power supply

Be sure to connect a molded-case circuit breaker (FAB) between the main-circuit power supply and the terminals for main-power supply (R, S, and T). There is no need to check phase sequenc in this case. Connect a magnetic contactor (MC) to disconnect the inverter from the power supply when its protective function operates to prevent a fault or damage from spreading. Start and stop the inverter with contact input "FWD" or "REV" but not with magnetic-switch switching.

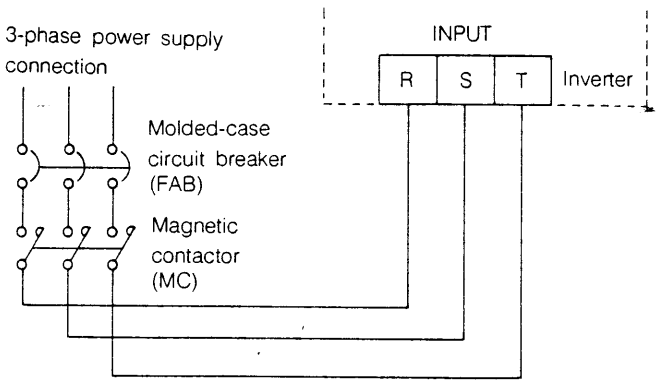


Fig. 6-2-2 Power supply

(2) Connection to the output terminals

① Be sure to turn off the power supply during connection to the inverter output terminals U, V, and W.

② Connect the terminals U, V, and W in the correspondent phase sequence as in Fig. 6-2-3. The motor rotates counterclockwise viewing from the driving side by a forward command. To get reverse rotation with a forward command, see 7-3 (4-7) FNO. 5B Definition of forward and reverse commands.

③ Do not connect power supply to the terminals U, V, and W. Application of external voltage will cause damage in the inverter.

④ Capacitors can not be connected. They will be overheated or damaged by high harmonics (Fig. 6-2-4).

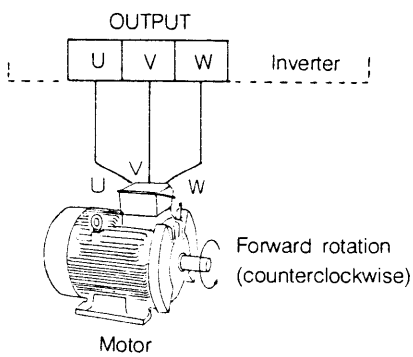


Fig. 6-2-3 Connection of a motor

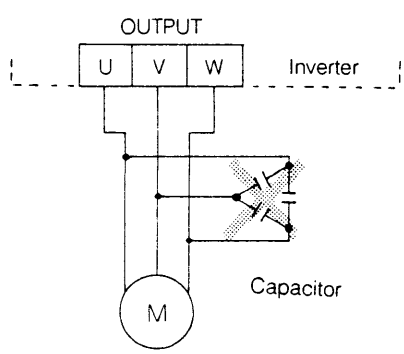


Fig. 6-2-4 Capacitor connection forbidden

(3) Connection of a DC reactor for power factor improvement.
To connect a DC reactor to standard series inverters of 22 ~45kW and low noise series 30~45kW, remove the short bar between terminals P1 and P connected at shipment and connect the reactor there. Do not fail to notice the short bar that is connected inside the inverter.

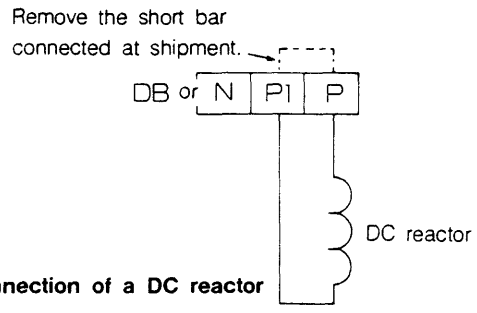


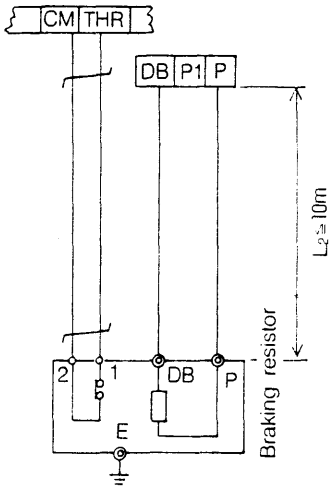
Fig. 6-2-5 Connection of a DC reactor

(4) Connection of braking unit(s) and braking resistor(s).

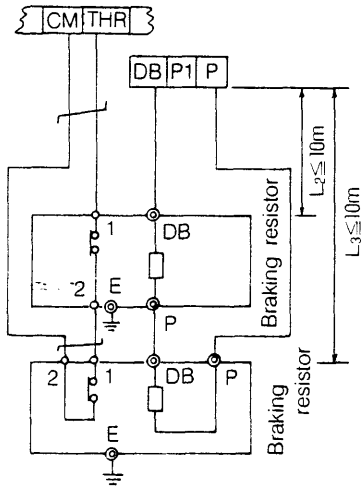
① Be sure to connect braking unit(s) in combination with braking resistor(s) for 55kW or above. THe number of braking units and braking resistors differs according to types as shown in Fig. 6-2-6. Make connections following 12 (4) Braking units and braking resistors, Specifications. Be sure to make the terminal symbols P and N of the braking unit correspond to those of the inverter.

② Remove the short bars between terminals CM and THR connected at shipment, and make a circuit from THR to CM through the thermal contacts both in braking units and in braking resistors in series. Connections for the thermal contact of braking units should be such that the terminal 1 is toward the inverter terminal THR and terminal 2, toward CM.

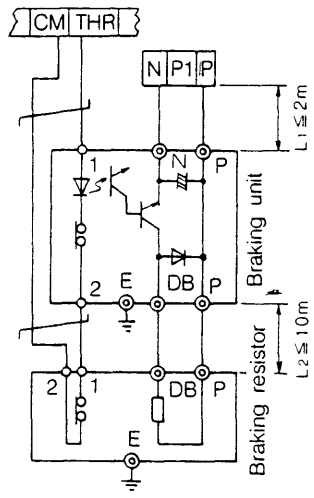
(a) 1 braking resistor (for 45kW or less)



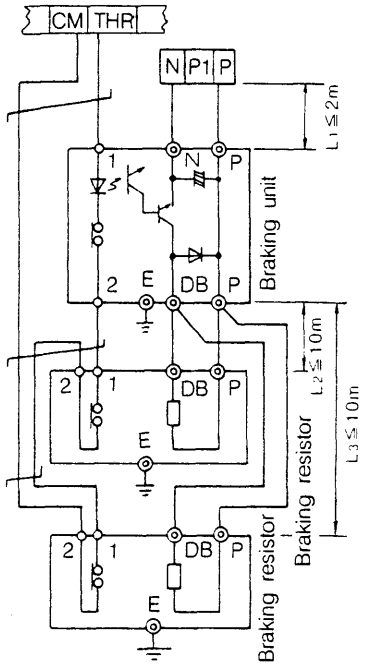
(b) 2 braking resistors (for 45kW or less) (used in series)



(c) 1 braking unit 1 braking resistor



(d) 1 braking unit 2 braking resistors (used in parallel)



(e) 2 braking units 2 braking resistors (used both in parallel)

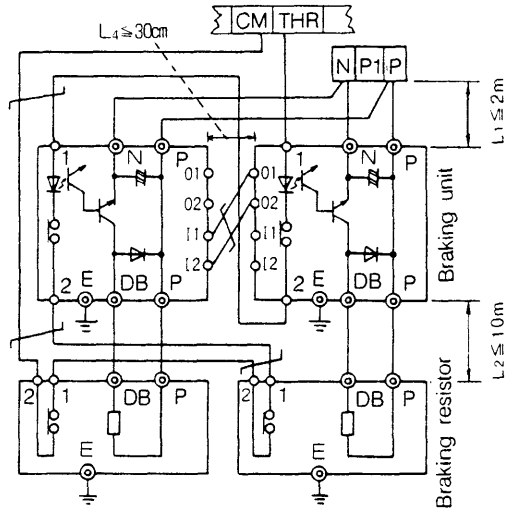


Fig. 6-2-6 Connection of braking units and braking resistors

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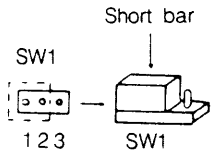
③ When you use two braking units, set the switch SW1 on its printed-circuit board as shown in Fig. 6-2-7. Setting at shipment is (b) in the figure.

(a) Braking unit with I1 and I2 connected



(b) Braking unit with O1 and O2 connected

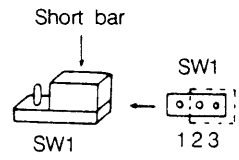


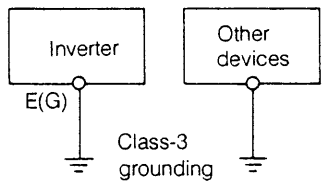
Fig. 6-2-7 Change of SW1

When you use one braking unit, short-circuit 2-3 of SW1 as in Fig. 6-2-7 (b). Take care of this matter when you reuse a braking unit that was used in two-unit combination.

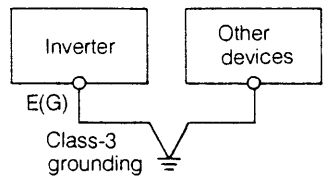
(5) Grounding connections

Be sure to provide grounding to prevent an electrical shock due to leakage and to reduce noise effect. Provide exclusive grounding for an inverter as far as possible. When it is not possible, common grounding may be used in which ground wires for the inverter and other devices are connected at a grounding point. Avoid using a ground wire common to the inverter and other devices. Use thick ground wire and make its route as short as possible.

(a) Exclusive grounding (good)



(b) Common grounding (tolerable)



(c) Grounding with a Common ground wire (unacceptable)

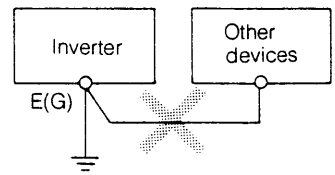


Fig. 6-2-8 Grounding connections

3) Control circuits

Make wiring following the explanations and figures below. For the description of terminal functions, see 6-1 Terminals.

(1) Wiring to control circuit terminals.

Use shielded wires or twisted vinyl wires for wiring to control circuit terminals and install them more than 100 mm apart from the main circuit. When crossing is unavoidable, make them cross at right angles as in Fig. 6-2-9. It is desirable that twisted shielded wires are used for a long wiring distance.

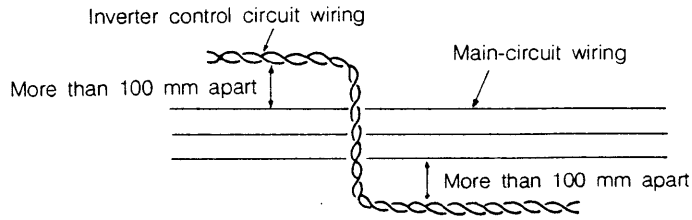


Fig. 6-2-9 Inverter control wiring

(2) Connection to aux. control power input terminals.

When a protective circuit actuates to open the supply- side magnetic contactor, the inverter loses control power supply and can not hold the fault indication and general alarm output signal. In case the hold of protective circuit operation is required, make connection to aux. control power input terminals RO and TO as in Fig. 6-2-10.

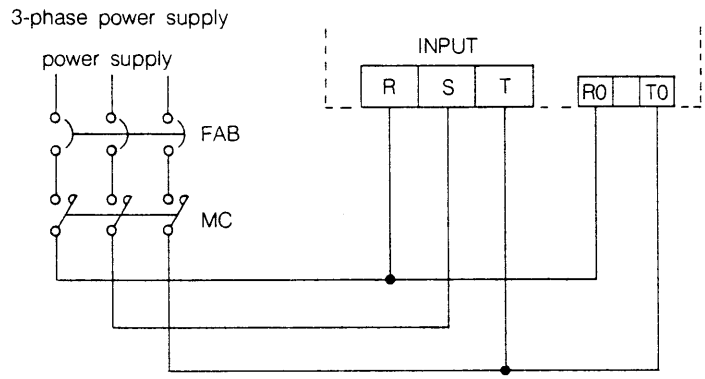


Fig. 6-2-10 Connection for control power supply

(3) Connection to terminals for load meter (LM) and speed meter (SM).

Two types of meters can be used for the load meter and speed meter: one-side move, 0 to +10V DC, and both-side move, 0 to±10V DC. According to a type you use, carry out both switch reconnection and keypad panel setting as mentioned below.

At most 2 sets of 10V, 1mA meters can be connected.

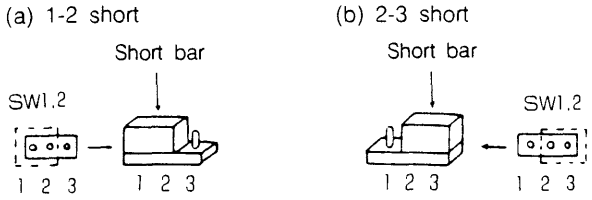


Fig. 6-2-12 Reconnection of SW1 and SW2

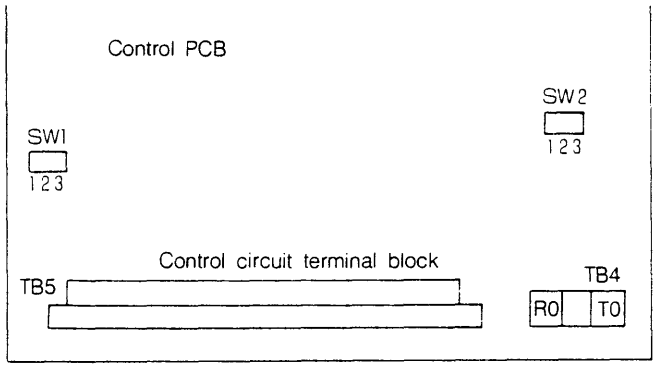
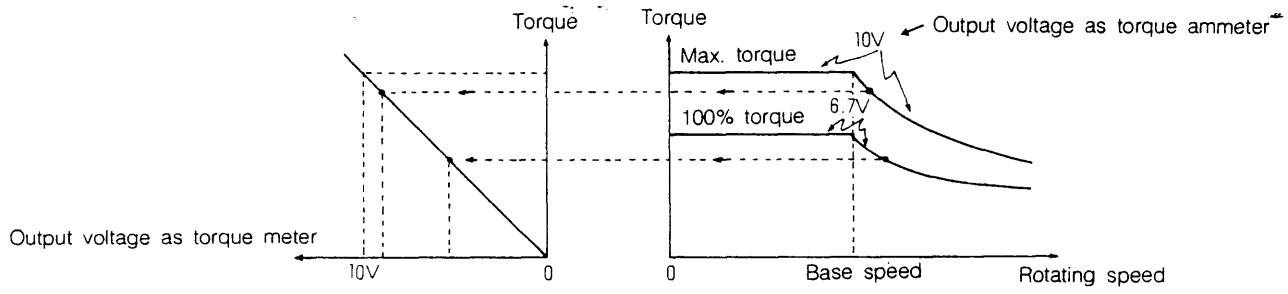


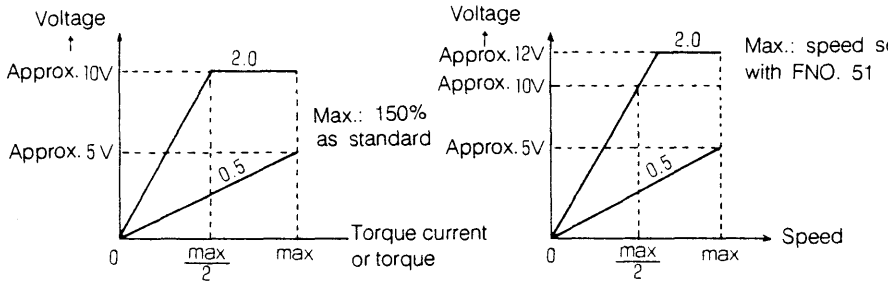
Fig. 6-2-12 Positions of switches SW1, SW2

Item	Output voltage	Connection		FNO. setting on keypad panel		At shipment
Load meter output LM	0~+10V	SW1	1-2 short	FNO.70	1 (torque ammeter) 3 (torque meter)	SW1: 2-3 short FNO.70: 0
	0~±10V		2-3 short		0 (torque ammeter) 2 (torque meter)	
Speed meter output SM	0~+10V	SW2	1-2 short	FNO.71	0	SW2: 1-2 short FNO.71: 0
	0~±10V		2-3 short		1	
Remarks		Note that of other combinations than above will cause abnormal voltage output.				

NOTE: The use of a load meter as torque ammeter or as torque meter:



Load meter output voltage can be adjusted with FNO. 38, and speed meter output voltage, with FNO. 39.



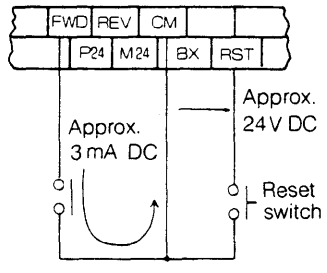


Fig.6-2-13 Voltage and current at contact input terminals

(4) Connection of an alarm reset switch.

To operate alarm reset from the other place than the inverter (for example, an inverter board), connect a self-reset switch to the RST terminal.

(5) Contacts connected to speed setting terminals. and contact input terminals
Use micro-signal contacts of high contact reliability because the current is very small.
For example, Fuji Electric control relay: HH54PW, or the like.
Voltage and current as shown in Fig.6-2-13 are impressed on the contact input circuit.

(6) Contact capacity for contact output.
AC 250V, 0.3A ($\cos\phi = 0.3$). In case of switching a large-capacity magnetic switch or the like, use a relay of large contact capacity as shown in Fig. 6-2-14.

(7) Connection of open collector output termnials.
When you want to use this output signal, you are recommended to use an optional relay output unit MCA II-RY.
If you do not use the MCA II-RY, electrical specification for the open collector should be DC 27V, max. and 50mA, max.
Be careful to protect it from damage due to surge voltage and not to mistake power supply polarity.

(8) Connection of a surge absorber.
Surge voltage (noise) due to the sudden change of current is generated by the switching of the excitation coil circuit of magnetic contactors, control relays, and solenoid valves. This surge voltage sometimes causes malfunction of inverter electronic circuits and other peripheral devices. To avoid such trouble, connect a surge absorber directly to both ends of a noise source coil. Wiring should be as short as possible, about 20cm at longest.

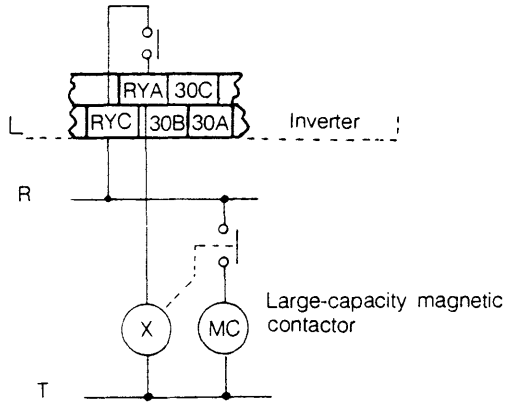


Fig. 6-2-14 Amplification of contact capacity

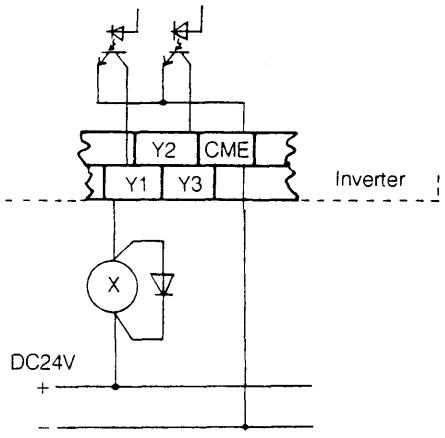


Fig. 6-2-15 Connection to open collector output terminals

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Table 6-2-1 Surge absorber application
(Circuit voltage: 250V or less)

Device		CR filter or diode
Magnetic contactors (main circuit)	AC	S2-A-O or its equivalent
	DC	Diode or S2-A-O
Auxiliary relays	AC	S1-B-O or its equivalent
	DC	Diode or S1-B-O
Solenoids, brakes, clutches	AC	S2-A-O
	DC	Diode or S2-A-O

CR filter capacity
S2-A-O C: 0.2μF
R: 500Ω
(Okaya Electric Industries make)
S1-B-O C: 0.1μF
R: 200Ω
(Okaya Electric Industries make)
Diode capacity (for operating coil curent 1A or less)
ERB44-06C 600V, 1A
(Surge 30A/10ms)
(Fuji Electric make)

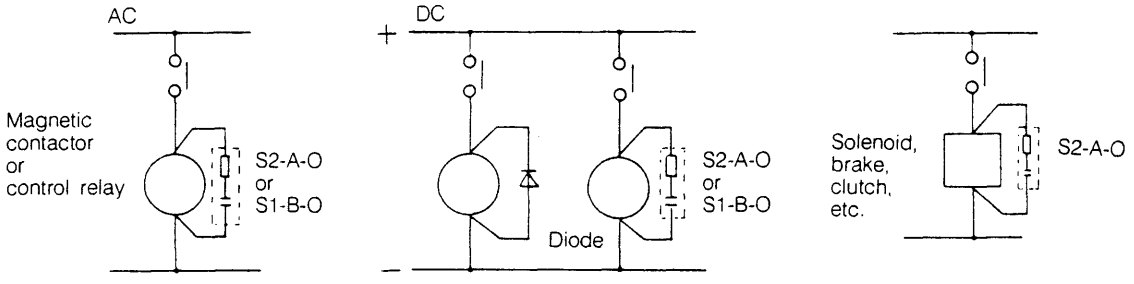
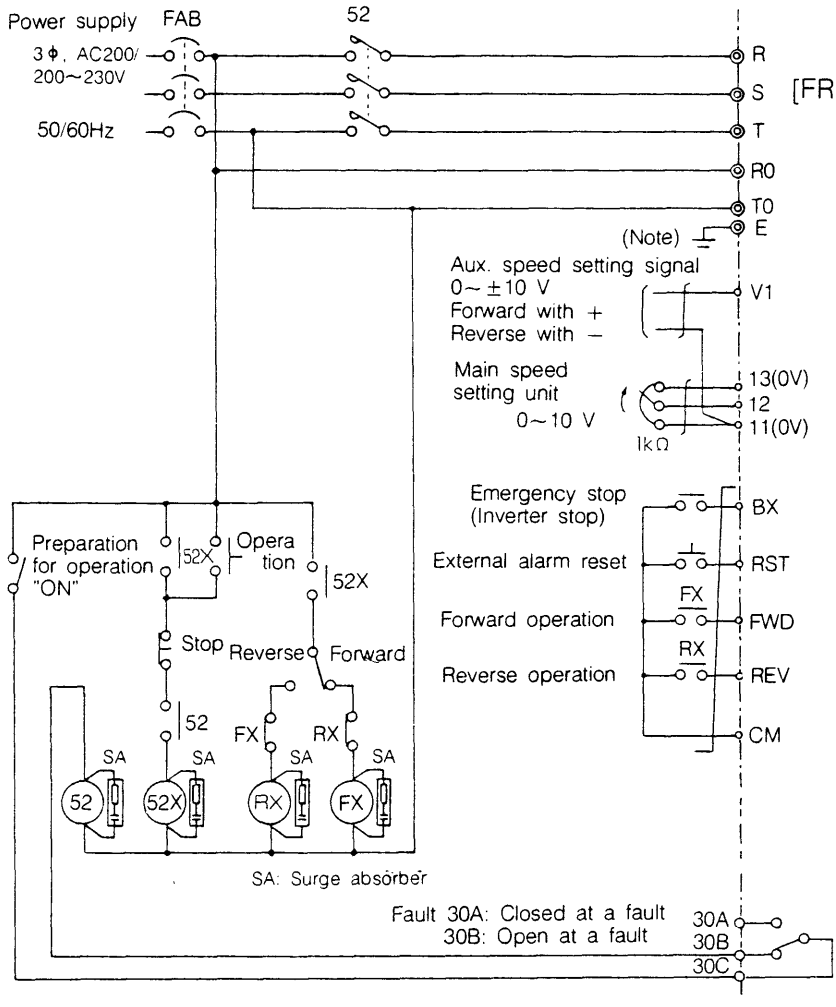


Fig. 6-2-16 Connection of surge Absorbers

(9) Example of an operational schematic diagram



(Note) When there is input at V1, operation will continue even if FWD or REV is turned off. To stop operation during V1 signaling, interrupt it by opening the contact.

(10) In case of auto-restart from instantanuous power failure, change the short bar of SW11 which is located on the control PCB under the keypad panel's right and upper part to 2-3 short from 1-2 short. At shipment, 1-2 short is set. Change this switch while power off (R, S, T; RO, TO) and the charge lamp is not lighted.
This switch's actions are described as follows.

- 1-2 short: When this inverter detects the state of under voltage, it displays "LU" on the keypad panel, and cuts off the inverter drive, so the motor stops as free-running. When re-powered, it does not re-start automatically. (In case of the power failure that the control power supply is lost, when re-powered, it re-starts automatically.)
- 2-3 short: It does not display "LU", but cuts off the inverter drive, so the motor stops free-running. When re-powered, it re-starts automatically.

7. Functions

7-1 Outline of Functions

Fig. 7-1-1 shows the whole control block diagram and Figs. 7-1-2 and 7-1-3 show the detailed control block diagrams of the speed setting section and the speed regulating section (ASR). Fig. 7-1-2 illustrates the soft start/stop mode and Fig. 7-1-3, the UP/DOWN setting mode. The general-purpose input/output signals show functions set at shipment (changeable using the keypad panel). When using the functions marked with , modify the defintions of general-purpose input/output signals and internal switches (FNO. 72~79). The soft start/stop mode or UP/DOWN setting mode can be set by FNO. 5E on the keypad panel. (Soft start/stop mode with FNO. 5E=0, UP/DOWN setting mode with FNO. 5E=1; standard setting at shipment is FNO. 5E=0.)

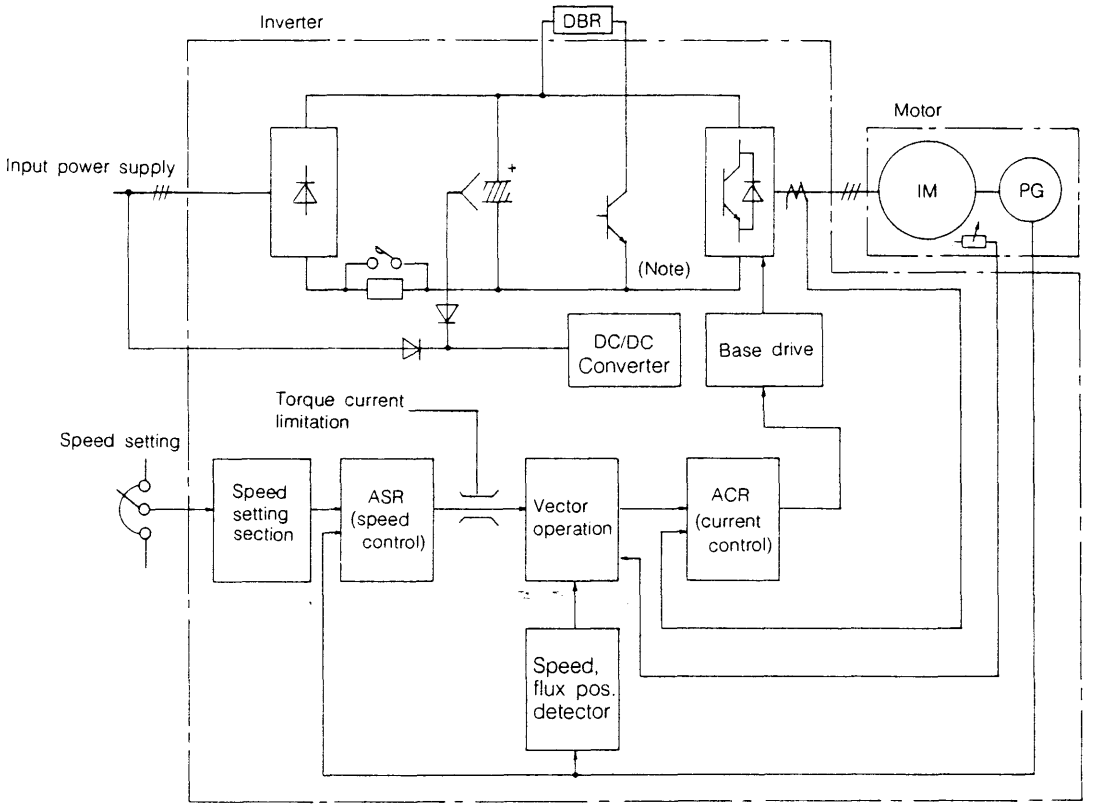


Fig. 7-1-1 Control block diagram for FRENIC5000VG3

(Note) The transistor for dynamic braking is not built in for 55kW and above (for both 200V and 400V series). It is supplied separately.

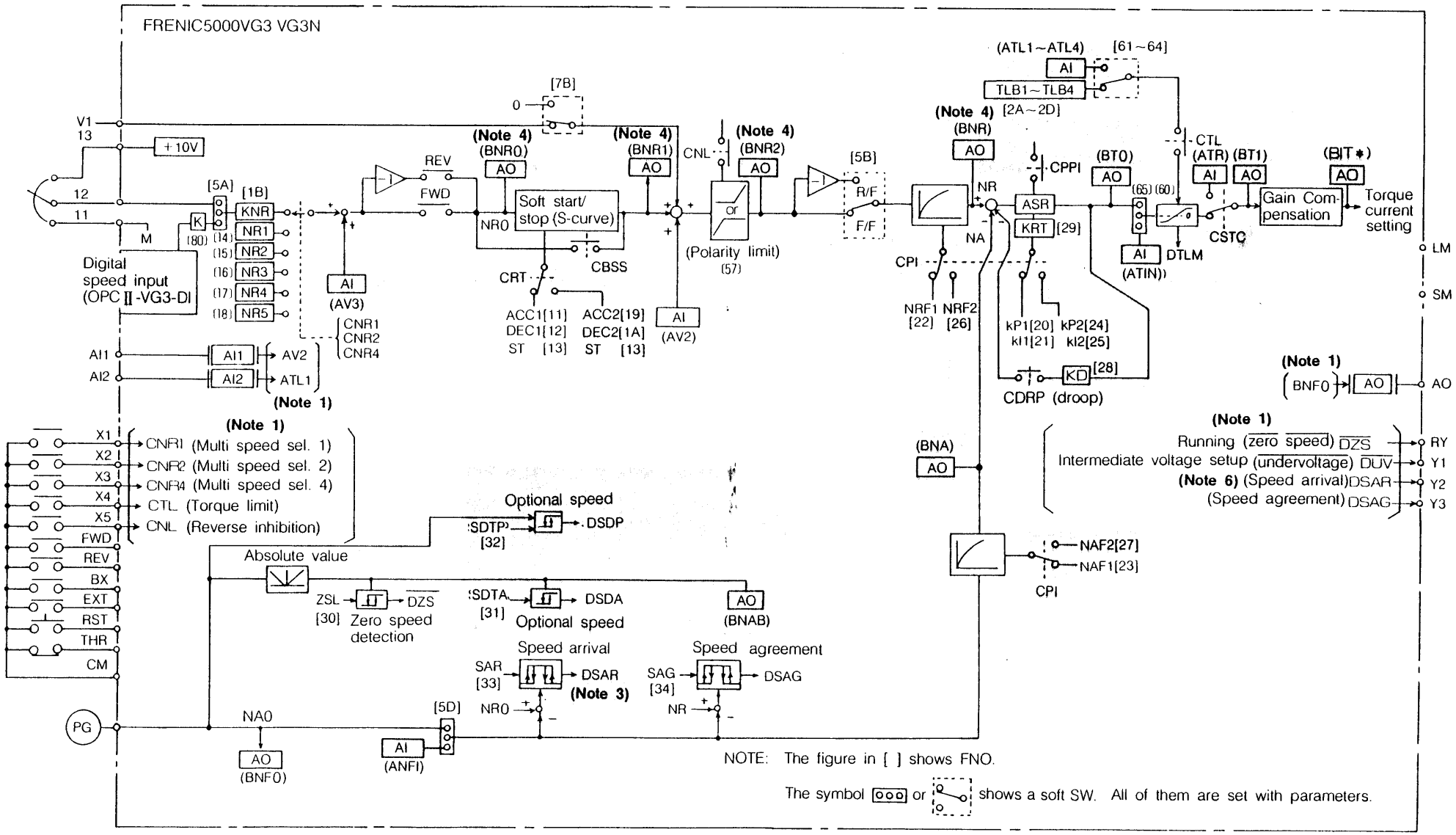


Fig. 7-1-2 Control block diagram of the speed setting and speed regulating sections (soft start/stop mode, FNO. 5E= 0)

(Note 1) The [ ] shows standard settings at shipment. They can be changed with FNO. 72~79.

(Note 2) Check FNO. 5A and 80 when using OPC II-VG3-DI.

(Note 3) Speed arrival DSAR is no output when aux. speed setting V1 or AV2 are used. Set FNO. 7B=0 and don't set AV2 with FNO. 76 and 77 when you want to use DSAR.

(Note 4) Analog output BNR0~2, BNR are done to zero-hold at inverter stop. (Inverter stop is caused by (operation command "OFF" and zero speed) or inverter fault)

(Note 5) When using the function marked with , modify the definitions of general-purpose input/output signals and internal switch (FNO. 72~79).

(Note 6) To use "DSAR", refer to 7, 3 (2-11).

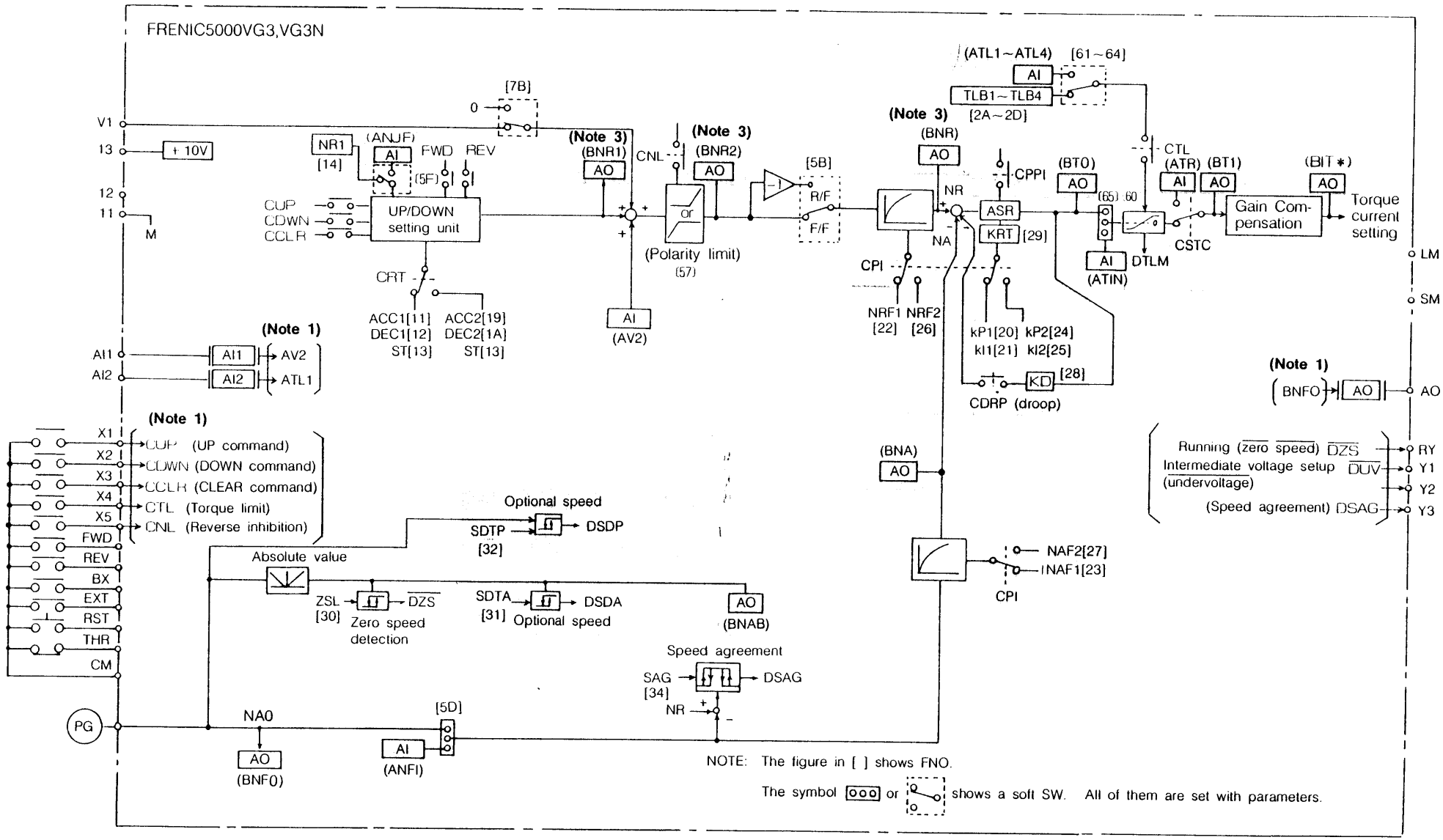


Fig. 7-1-3 Control block diagram of the speed setting and speed regulating section (UP/DOWN mode, FNO. 5E= 1)

(Note 1) The [ ] shows standard settings at shipment. They can be changed with FNO. 72~79.

(Note 2) Check FNO. 5F, 81 when using the UP/DOWN setting mode.

(Note 3) Analog output BNR0~2, BNR are done to zero-hold at inverter stop. (Inverter stop is caused by (operation command "OFF" and zero speed) or inverter fault)

(Note 4) When using the function marked with , modify the definitions of general-purpose input/output signals and internal switch (FNO. 72~79).

7-2 Lists of Parameters

Below shown are the lists of parameters set or displayed on the keypad panel. For the method of operating the keypad panel, see 8. Keypad Panel. Each data display and parameter setting has a 2-digit function No. (hereinafter referred to as FNO.). To modify a setting, call the FNO. and carry out data display and parameter setting. Table 7-2-1 shows the classification of parameters. Parameters FNO. 51 to 8F include those to set the number of motor poles and the definition of general-purpose input/output. Set them before motor start in trial operation.

Table 7-2-1 FRENIC5000VG3 Parameter classification

FNO.		Contents		Remarks	
0	1~F	Operation monitoring			
1	0~F	Basic parameters	Speed setting	10 : FNO. 11~3F set data protection	
2	0~F		ASR (speed regulator)		
3	0~F		Others		
4	0~F	Faults			
5	0~F	Operating mode selection (Definition)	Basics	50 : FNO. 51~8F set data protection	
6	0~F		Torque		
7	0~F		Input/output, etc.		Setting change not allowed during inverter operation.
8	0~F	Definition for optional units Analog adjustment			(except FNO. 82, 83, 86, 87)
9	0~F	Transmission and others			

Category	Ref.	Function			Setting, data display			Meaning of data	Setting at works	Entry	7-3 Item
		FNO.	Name	Abbr.	Range	Unit	Min. unit				
Operation monitoring (display only)		01	Detected motor speed	NA		r/min	1 r/min		—		
		02	Motor speed setting	NR		r/min	1 r/min		—		
		03	Detected load speed					Detected motor speed [01] ×load speed conversion factor [5C] **(Note 1)**	—		
		04	Torque current setting			%	1%	Cont. rating: 100%	—		
		05	Torque setting			%	1%	Cont. rating: 100%	—		
		06	Motor output			kW	0.1 (kW)	Calculated value	—		
		07	Inverter output current			A	**(Note 2)**	Fundamental effective value	—		
		08	Motor temperature		−30~150		1℃		—		
		09	Input signal (1) (SEG)						—		(1-1)
		0A	Input signal (2) (SEG)						—		(1-2)
		0B	Output signal (SEG)						—		(1-3)
		0C	Operation mode (SEG)						—		(1-4)
		0D	Soft switch (1) (SEG)						—		(1-5)
		0E	Soft switch (2) (SEG)						—		(1-6)
		0F	Magnetic flux		0~100	%	1%		—		

(Note 1) For example, when motor speed 1500r/min corresponds to load speed 120m/min, setting is FNO. 5C=0.08 (=120/1500). If FNO. 01=750 (r/min) is displayed, FNO. 03 display 60 (m/min). (No unit displayed.)

(Note 2) 0.1A for 3.7~45kW
1A for 55~200kW:

Category	Ref.	Function			Setting, data display			Meaning of data	Setting at works	Entry	7-3 Item
		FNO.	Name	Abbr.	Range	Unit	Min. unit				
Protection		10	Set data protection (Basic parameters 11~3F)		0, 1			0: Change inhibited 1: Data changeable **(Note 3)**	0		
Basic parameters (speed setting)		11	Soft start/stop acc. time 1	ACC1	0.10~1200	s	**(Note 1)**		5.00		(2-1)
		12	Soft start/stop dec. time 1	DEC1	0.10~1200	s	**(Note 1)**		5.00		
		13	Soft start/stop range of S-curve	ST	0~50	%	1%		0		
		14	Multistep speed setting 1	NR1	−100~100.0	%	0.01% **(Note 2)**	Max. speed setting: 100% (FNO. 51)	0.00		(2-2)
		15	Multistep speed setting 2	NR2	−100~100.0	%	0.01% **(Note 2)**	Max. speed setting: 100% (FNO. 51)	0.00		
		16	Multistep speed setting 3	NR3	−100~100.0	%	0.01% **(Note 2)**	Max. speed setting: 100% (FNO. 51)	0.00		
		17	Multistep speed setting 4	NR4	−100~100.0	%	0.01% **(Note 2)**	Max. speed setting: 100% (FNO. 51)	0.00		
		18	Multistep speed setting 5	NR5	−100~100.0	%	0.01% **(Note 2)**	Max. speed setting: 100% (FNO. 51)	0.00		
		19	Soft start/stop acc. time 2	ACC2	0.10~1200	s	**(Note 1)**		5.00		(2-3)
		1A	Soft start/stop dec. time 2	DEC2	0.10~1200	s	**(Note 1)**		5.00		
		1B	Speed setting input gain	KNR	0.01~2.00		0.01	1.00: Max. speed set at 10V input	1.00		
		1C									
		1D									
		1E									
		1F									

(Note 1) Min. unit 0.02s for 0.10~9.98s
Min. unit 0.1s for 10.0~99.9s
Min. unit 1s for 100~1200s

(Note 2) Displays as follows:
−100, −99.9, ..., −10.0, −9.9, ..., −0.1, 0.00, 0.01, ..., 99.9, 100.0

(Note 3) Protects various data set with the keypad panel against careless operation. SET FNO. 10= 0 when trial operation is finished.

NOTE: Details are described in the items marked with ( ) in Section 7.3.

Category:	Ref.	Function			Setting, data display			Meaning of data	Setting at works	Entry	7-3 Item
		FNO.	Name	Abbr.	Range	Unit	Min. unit				
· Basic parameters (ASR)		20	ASR P (1)	KP 1	0.1~1000		**(Note 1)**	Proportional gain	20.0		
		21	ASR I (1)	KI 1	0~5.000 (Note 3)	s	**(Note 2)**	Integral time	0.040		
		22	Speed setting filter time constant (1)	NRF 1	0~5.000	s	**(Note 2)**		0.040		
		23	Speed detection filter time constant (1)	NAF 1	0~5.000	s	**(Note 2)**		0.005		
		24	ASR P (2)	KP 2	0.1~1000		**(Note 1)**	Proportional gain	20.0		(2-4)
		25	ASR I (2)	KI 2	0~5.000 **(Note 3)**	s	**(Note 2)**	Integral time	0.040		
		26	Speed setting filter time constant (2)	NRF 2	0~5.000	s	**(Note 2)**		0.040		
		27	Speed detection filter time constant (2)	NAF 2	0~5.000	s	**(Note 2)**		0.005		
		28	Droop	KD	0~25.0	%	0.1%		0.0		(2-5)
		29	ASR P changeover ramp time constant	KRT	0.1~2.55	s	0.01 s		1.00		(2-6)
		2A	Torque limit 1/ torque bias setting 1	TLB 1	−250~250	%	1%	Cont. rating: 100%	150		(2-7)
		2B	Torque limit 2/ torque bias setting 2	TLB 2	−250~250	%	1%	Cont. rating: 100%	10		
		2C	Torque limit 3/ torque bias setting 3	TLB 3	−250~250	%	1%	Cont. rating: 100%	150		
		2D	Torque limit 4	TLB 4	0~250	%	1%	Cont. rating: 100%	150		
		2E	Magnetic flux setting level	LFAI	10~100	%	1%	Enabled by FNO. 66=1.	100		
		2F	Light load magnetic flux setting level	LFAL	10~100	%	1%		25		

(Note 1) Min. unit 0.1 for 0.1~2.0
Min. unit 2 for 2~100
Min. unit 5 for 100~1000

(Note 2) Min. unit 0.001s for 0.000~0.100s
Min. unit 0.010s for 0.100~1.000s
Min. unit 0.100s for 1.000~5.000s

(Note 3) When KI1 or KI2 =0.000, P-control operation is set.

Category:	Ref.	Function			Setting, data display			Meaning of data	Setting at works	Entry	7-3 Item
		FNO.	Name	Abbr.	Range	Unit	Min. unit				
Basic parameters (others)		30	Zero speed detection level	ZSL	0.2~10.0	%	0.1%	Max. motor speed: 100% (FNO. 51)	0.5		(2-8)
		31	Optional speed detection level (absolute value)	SDTA	1~100	%	1%	Max. motor speed: 100% (FNO. 51)	100		(2-9)
		32	Optional speed detection level (with polarity)	SDTP	−100~−1, 1~100	%	1%	Max. motor speed: 100% (FNO. 51)	100		(2-10)
		33	Speed arrival detection level	SAR	1.0~20.0	%	0.1%	Max. motor speed: 100% (FNO. 51)	3.0		(2-11)
		34	Speed agreement detection level	SAG	1.0~20.0	%	0.1%	Max. motor speed: 100% (FNO. 51)	3.0		(2-12)
		35	Torque detection level	TDT	1~250	%	1%	Cont. rating:100%	100		(2-13)
		36	Overload prediction level	LOL	25~100	%	5%		90		(2-14)
		37	Motor overheat prediction level	LOLM	75~150		5℃		140		(2-15)
		38	Load meter output calibration factor	KLM	0.50~2.00		0.01		1.00		
		39	Speed meter output calibration factor	KSM	0.50~2.00		0.01		1.00		
		3A	Motor stop count in simple position control	SPC	0~FFFF		1 pulse	Data in hexadecimal	8000		(2-16)
		3B	Selection of motor sound tone		0~20		1		0		(2-17)
		3C									
		3D									
		3E									
		3F									

7

Category	Ref.	Function FNO.	Name	Abbr.	Setting, data display Range	Unit	Min. unit	Meaning of data	Setting at works	Entry	7-3 Item
Faults (display only)		40	Contents of 1st fault					Code display of fault status	----		(3-1)
		41	Contents of 2nd fault					(Same as FNO. 40)	----		
		42	Present fault status					(HEX notation)	0000		(3-2)
		43	Speed setting at fault occurence		0~	%	1%	Max. motor speed: 100% (FNO. 51)	0		
		44	Detected speed at fault occurence		0~	%	1%	Max. motor speed: 100% (FNO. 51)	0		
		45	Torque current setting at fault occurs		0~	%	1%		0		
		46	Motor current (U-phase) at fault occurs		0~	%	1%	Overcurrent level: 100% (momentary value)	0		
		47	Motor current (W-phase) at fault occurs		0~	%	1%	Overcurrent level: 100% (momentary value)	0		
		48	Operation mode at fault occurence (SEG)					(Same as FNO. 0C)			(1-4)
		49	Operation mode at fault occurence (HEX)					(HEX notation of FNO. 48)	0000		(3-3)
		4A	Soft switches 1 at occurence (SEG)					(Same as FNO. 0D)			(1-5)
		4B	Soft switches 2 at occurence (SEG)					(Same as FNO. 0E)			(1-6)
		4C	Soft switches at occurence (HEX)					(HEX notation of FNO. 4A and 4B)	0000		(3-4)
		4D	Contents of the last fault (1st fault)					(Same as FNO. 40)	----		(3-1)
		4E	Contents of the last but one (1st fault)					(Same as FNO. 40)	----		
		4F	Contents of the last but two (1st fault)					(Same as FNO. 40)	----		

Category	Ref.	Function FNO.	Name	Abbr.	Setting, data display Range	Unit	Min. unit	Meaning of data	Setting at works	Entry	7-3 Item
Protection		50	Set data protection (Definitions 51~8F)		0, 1			0: Change inhibited 1: Data changeable **(Note 1)**	0		
Operation mode selection (Basics)	*	51	Max. motor speed		125~12000	r/min	1r/min	**(Note 2)**	1500.		(4-1)
	*	52	Motor base speed		125~6000	r/min	1r/min	**(Note 3)**	1500.		(4-2)
	*	53	Use of DC braking		0, 1		s	0: Not used, 1: Used	0		(4-3)
	*	54	Use of V limit function		0, 1			0: Not used, 1: Used	1		(4-13)
	*	55	DC braking time		0.0~10.0	s	0.1s		0.1		(4-3)
		56									
	*	57	Speed limiter (peak limiting)		**(Note 4)** −100~100	%	0.1%	Max. motor speed (FNO. 51): 100%	100		(4-4)
	*	58	Definition of operation mode (1)		0, 1			0: High-speed response mode 1: High-precision speed control mode	0		(4-5)
	*	59	Definition of operation mode (2)		0, 1			0: Usual operation 1: Operation stop when speed lowers below zero speed level.	0		(4-6)
	*	5A	Definition of speed setting mode (1)		0, 1, 2			0: Analog speed setting 1: Digital Speed setting (binary) } With OPC II-VG3-DI 2: digital speed setting (BCD) }	0		
	*	5B	Definition of forward and reverse commands		0, 1			0: Forward with FWD 1: Reverse with FWD	0		(4-7)
	*	5C	Load speed conversion factor		0.01~1.50		0.01	See Note for FNO. 03.	1.00		
	*	5D	Definition of speed detecting sections		0, 1, 2			0: Usual 1: External AI input 2: Pulse encoder and AI (ANFI) high-selector (for winder use) **(Note 5)**	0		
	*	5E	Definition of speed setting mode (2)		0, 1			0: Soft start/stop mode 1: U/D setting mode	0		
	*	5F	Slow speed setting for U/D units		0, 1			0: Parameter NR1 (FNO. 14) 1: External AI input **(Note 6)**	0		

7

*: Shows a parameter not to be changed during operation.

(Note 1) Protects various data set with the keypad panel from careless operation. Before starting the motor in trial operation, carry out parameter setting for operation modes (FNO. 51 to 8F) and press SET at FNO. 50=0.

(Note 2) (1) The maximum motor speed that can be set on the keypad panel is different according to the number of motor poles. When using a 4-pole motor, set it to 1500~3600r/min (or 3000, 2400, 1800r/min).

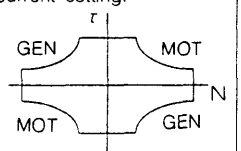
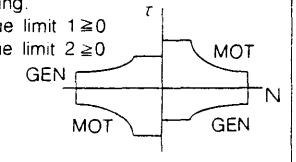
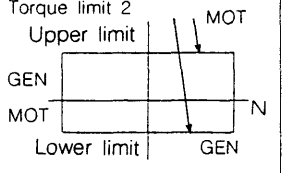
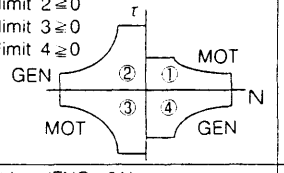
(2) The keypad panel displays 0.~9999. for 0~9999r/min and 1000~1200 for 10000~12000r/min.

(Note 3) When using a 4-pole standard motor, set the base speed to 1500r/min. Do not change it.

(Note 4) Displays as follows: −100→−99.9→−99.8→... 99.8→99.9→100

(Note 5) Make an inquiry when you want to set FNO. to 1 or 2.

(Note 6) When using the UP/DOWN setting mode without slow speed setting, make settings FNO. 5F=0 and FNO. 14=0.00.

Category	Ref.	Function FNO.	Function Name	Function Abbr.	Setting, data display Range	Setting, data display Unit	Setting, data display Min. unit	Meaning of data	Setting at works	Entry	7-3 Item
Operation mode selection (Torque)	*	60	Definition of torque limiting mode		0,1,2,3			0: Limits torque by absolute values of torque current setting. Torque limit 1≧0 τ: Torque N: Speed MOT: Motoring GEN: Generating  1: Limits MOT and GEN separately by torque current setting. MOT: Torque limit 1≧0 GEN: Torque limit 2≧0  2: Limits torque by upper and lower torque settings (ASR output). (with polarity) Upper limit : Torque limit 1 Lower limit : Torque limit 2  3: Limits torque in 4 quadrants by individual torque current setting. ① : Torque limit 1≧0 ② : Torque limit 2≧0 ③ : Torque limit 3≧0 ④ : Torque limit 4≧0 	0		
	*	61	Definition of torque limit 1/torque bias setting 1		0,1			0: Parameter setting (FNO. 2A) 1: AI	0		
	*	62	Definition of torque limit 2/torque bias setting 2		0,1			0: Parameter setting (FNO. 2B) 1: AI	0		
	*	63	Definition of torque limit 3/torque bias setting 3		0,1			0: Parameter setting (FNO. 2C) 1: AI (not to be used in standard types) **(Note 2)**	0		
	*	64	Definition of torque limit 4		0,1			0: Parameter setting (FNO. 2D) 1: AI (not to be used in standard types) **(Note 2)**	0		
	*	65	Use of external AI for torque command		0,1			0: Not used 1: Used (as a slave in mechanically tied control, etc.)	0		
	*	66	Definition of magnetic flux setting		0,1,2			0: Usual setting 1: Parameter setting (FNO. 2E) 2: AI **(Note 2)**	0		
		67									
		68									
		69									
		6A									
		6B									
		6C									
		6D									
		6E									
		6F									

7

*: Shows a parameter not to be changed during operation.

(Note 1) For details, see 7-3 2) Basic Parameters (2-7) FNO. 2A~2D. Set FNO. 60 to 0 generally, and to 1 when not using DB (generating mode).

(Note 2) SET FNO. 63, 64, and 66 to 0. (Do not change the settings.)

Category	Ref.	Function FNO.	Name	Abbr.	Setting, data display Range	Unit	Min. unit	Meaning of data	Setting at works	Entry	7-3 Item
Operation mode selection (Input/output, etc.)	*	70	Definition of LM terminals		0,1,2,3			0: Torque ammeter (with polarity) 1: Torque ammeter (absolute value) 2: Torque meter (with polarity) 3: Torque meter (absolute value) **(Note 1)**	0		
	*	71	Definition of SM terminals		0,1			0: Speed meter (absolute value) 1: Speed meter (with polarity) **(Note 1)**	0		
	*	72	Definition of DI (X1~X4, X6, X7)		0~15			**(Note 2)**	0		(4-8)
	*	73	Definition of DI (X5)		0~15				5		
	*	74	Definition of DO (Y1~Y5)		0~15			**(Note 2)**	0		(4-9)
	*	75	Definition of DO (RY)		0~15				1		
	*	76	Definition of AI (AI1)		0~15				0		(4-10)
	*	77	Definition of AI (AI2)		0~15				2		
	*	78	Definition of AO (AO)		0~15				0		(4-11)
	*	79	Definition of AO (AO2, AO3)		0~15			**(Note 3)**	0		
	*	7A	No. of motor poles, pulse encoder specification		1~20 (12, 16, 19, 20 skipped)			2P ①128P/R ②256P/R ③512P/R ④1024P/R 4P ⑤256P/R ⑥512P/R ⑦1024P/R ⑧2048P/R 6P ⑨384P/R ⑩768P/R ⑪1536P/R — 8P ⑬512P/R ⑭1024P/R ⑮2048P/R — 12P ⑰768P/R ⑱1536P/R — — Example: Data set to 7, 4P, 1024P/R. **(Note 4)**	7		
	*	7B	V1 enabled or not		0,1			0: Disabled, 1: Enabled	1		
	*	7C	Selection of motor current's		1~22				12		(4-12)
		7D	output								
		7E									
		7F									

*: Shows a parameter not to be changed during operation.

(Note 1) See 6-2 3) (3) Connection to terminals for load meter and speed meter.

(Note 2) X6, X7, Y4, and Y5 require option OPC Ⅱ-VG3-T2 or OPC Ⅱ-VG3-TL.

(Note 3) AO2 and AO3 require option OPC Ⅱ-VG3-AO.

(Note 4) The 1024P/R pulse encoder is used for 4-pole standard motor operation. SET FNO. 7A to 7. (Do not change it.) Check the motor nameplate before setting.

7

Category	Ref.	Function FNO.	Name	Abbr.	Setting, data display Range	Unit	Min. unit	Meaning of data	Setting at works	Entry	7-3 Item
Definitions for optional units	*	80	Conversion factor for speed setting BCD input		99~7999			Sets BCD data at max. speed setting. (Note 6)	1000		(5-1)
	*	81	Definition of initial data for UP/DOWN setting unit		0,1			0: Start from 0 1: Start from preceding operation data (OPC Ⅱ-VG3-T2 required.)	0		(5-2)
		82	Transmitted data writing disabled or not		0,1			0: Disabled from writing of FNO. 90~95 data 1: Enabled **(Note 3)**	1		
		83	Transmission ID code		00~FF			Displays in hexadecimal.	00		
		84									
Analog adjustment	*	85	AO adjustment		0,1,2 **(Note 5)**			0: Usual 1: Gain adjustment (Outputs data corresponding to +10V) LM, SM, AO2, AO3 2: Offset adjustment (Outputs data corresponding to 0V) AO2,AO3	0		
		86	AI1 filter		0~5.000	s	**(Note 1)**		0.010		
		87	AI2 filter		0~5.000	s	**(Note 1)**		0.010		
	*	88	12 offset adjustment					**(Note 2)**			6)
	*	89	12 gain adjustment			r/min					
	*	8A	V1 offset adjustment					**(Note 2)**			
	*	8B	V1 gain adjustment			r/min					
	*	8C	AI1 offset adjustment					**(Note 2)**			
	*	8D	AI1 gain adjustment			**(Note 4)**					
	*	8E	AI2 offset adjustment					**(Note 2)**			
	*	8F	AI2 gain adjustment			**(Note 4)**					

The mark * shows a parameter not to be changed during operation.

(Note 1) Min. unit 0.001s for 0.000~0.100s, Min. unit 0.010s for 0.100~1.000s, Min. unit 0.100s for 1.000~5.000s.

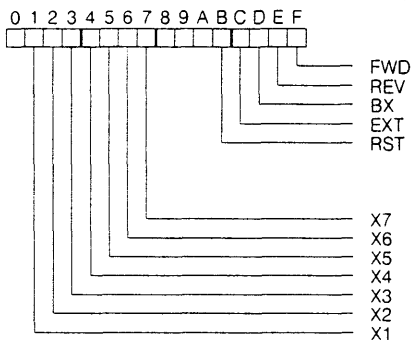
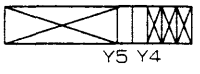
(Note 2) SAVE is enabled only when 0 is display. The range of offset adjustment is 0~±30mV.

(Note 3) For details of FNO. 82 and 83, see the manual of option OPC Ⅱ-VG3-T2 or OPC Ⅱ-VG3-TL.

(Note 4) The unit "r/min", "%", "no display" is determined by AI defintion in FNO. 76 and 77.

(Note 5) During AO adjustment, if an operation command (FWD, REV or EXT) is input, 0 will be set automatically.

(Note 6) The setting is required only when 2 (Digital speed setting BCD) is set in FNO. 5A Speed setting modes. Output is limitted when values over FNO. 80 are input.

Category	Ref.	Function FNO.	Name	Abbr.	Setting, data display Range	Unit	Min. unit	Meaning of data	Setting at works	Entry	7-3 Item
Transmission (only display for FNO. 90~96) (Note 1)		90						Displays written data from transmission. VG3 operates according to the or-operation of transmission data and VG3 contact input signals. RST from transmission is enabled only for transmission error.	0000		
		91	Transmission speed setting or NTO-mode selection		0,1			0: Speed setting for inverter 1: Speed setting for transmission	0		
		92	Transmission speed setting	NTO	0~±100%			**(Note 2)**	0000		
		93	Transmission speed setting bias	NBT	0~±100%			**(Note 2)**	0000		
		94	Selection of transmission torque setting or TTO-mode		0,1			0: Torque setting for inverter 1: Torque setting for transmission	0		
		95	Transmission torque setting	TTO	2000H/+100%			**(Note 2)**	0000		
		96	General-purpose DO 						0000		
		97	Trace data mode		0,1,2			1: Restart 2: Trace data transmitting 0: Data tracing stopped (Restart is possible only during 0.)	2		
		98									
		99									
Others		9A	Data SAVE check (display only)					**(Note 3)**	0		
		9B	ALL SAVE function		0,1			1: Saves all data. "SAVE" is displayed during SAVE operation. **(Note 4)**	0		
		9C									
		9D									
		9E									
		9F									

(Note 1) For details of FNO. 90~97, see the manual of option OPC II-VG3-T2 or OPC II-VG3-TL.

(Note 2) Displayed hexadecimally on the keypad panel.

(Note 3) Displays the number of unsaved data after data change. (It only includes data changed on the keypad panel, but does not include data written from transmission.) The FNO. of data unsaved is displayed by [∧] [∨] key operation in a parameter setting mode on the keypad panel.

(Note 4) See 8-4 Parameter Setting and Change.

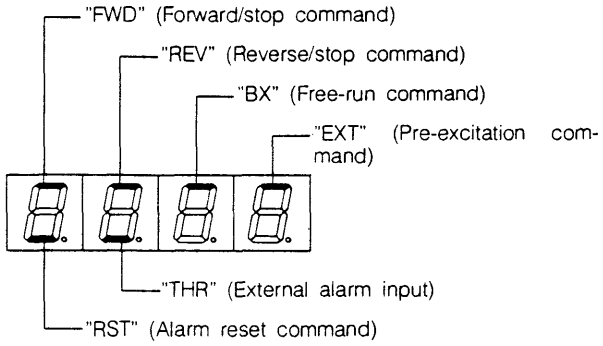
7

7-3 Detailed Descriptions of Parameters

1) Operation monitoring

(1-1) FNO.09 Input signal (1) display (SEG display)

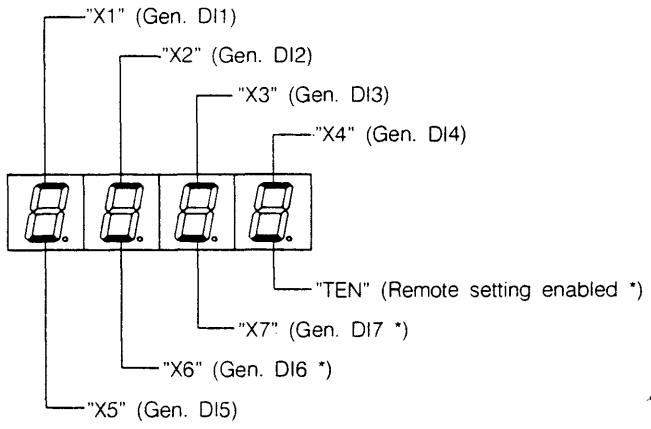
Displays the ON/OFF status of contact input signals on the 7-segment LED data display. Lit with contact ON, Turned off with contact OFF.



(1-2) FNO.0A Input signal (2) display (SEG display)

Displays the ON/OFF status of contact input signals on the 7-segment LED data display. Lit with contact ON, Turned off with contact OFF.

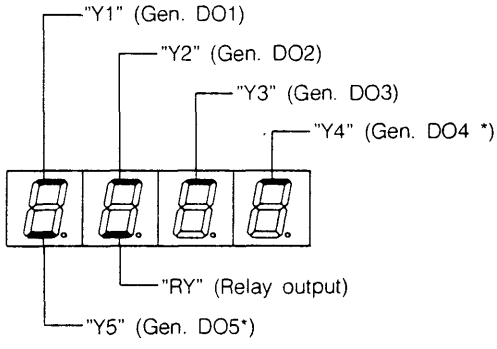
* X6, X7, and TEN are enabled when option OPC Ⅱ-VG3-T2 or OPC Ⅱ-VG3-TL is used.



(1-3) FNO.0B Output signal display (SEG display)

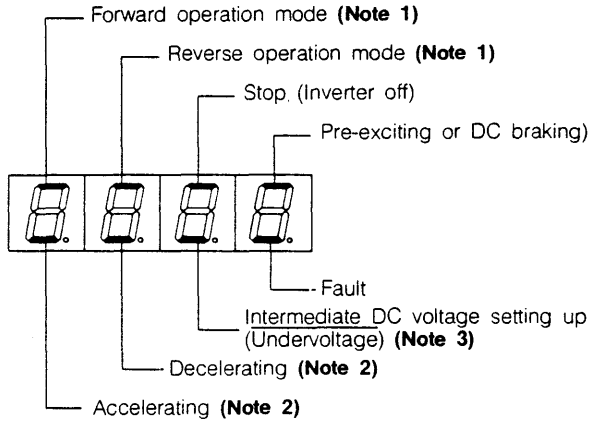
Displays the ON/OFF status of digital output signals on the 7-segment LED data display.
Lit with DO ON, Turned off with DO OFF.

* Y4 and Y5 are enabled when option OPC Ⅱ-VG3-T2 or OPC Ⅱ-VG3-TL is used.



(1-4) FNO.0C, 48 Operation mode display (SEG display)

Displays the present operation mode on the 7-segment LED data display.
A segment LED is lit in each operation mode as shown on the right.



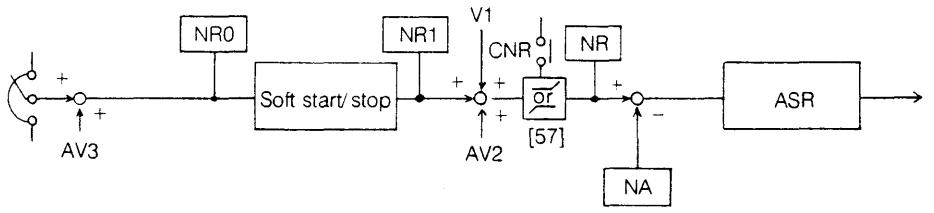
(Note 1) The forward or reverse operation mode is determined as below according to the combination of ON and OFF of contact input signals "FWD" and "REV".

Contact input "FWD"	Contact input "REV"	Operation mode —
ON	ON	
ON	OFF	"Forward operation mode" lit
OFF	ON	"Reverse operation mode" lit
OFF	OFF	—

Exceptions are that when contact input signal "BX" is ON, "Forward (reverse) operation mode" is turned off. When pre-exciting signal "EXT" is ON and when "FWD" or "REV" is ON, "Pre-excitation or DC braking" is turned off.

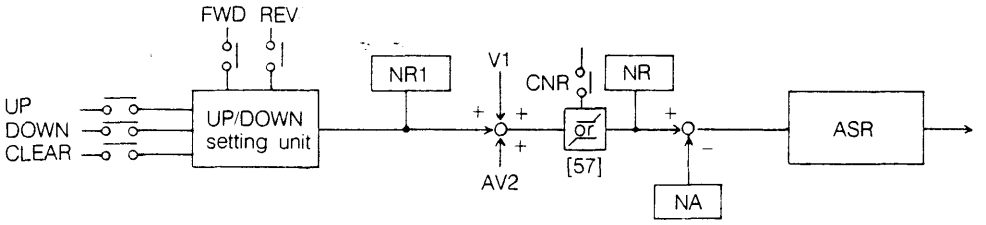
(Note 2) Output during acceleration and deceleration is as follows:

① Soft start/stop mode



Signals are output following the comparison of the speed setting NR0 of the soft start/stop input and actual speed NA. Acceleration or deceleration mode is turned off at speed arrival state which is determined by FNO. 33.
However, these signals are not output when aux. speed settings V1 and AV2 are used, speed setting limit is set to other than 100%, or reverse inhibiting command (CNR) is ON. To use signals during acceleration and deceleration, select FNO. 7B=0, FNO. 57=100, and not AV2 for FNO. 76 and 77.

② UP/DOWN setting mode

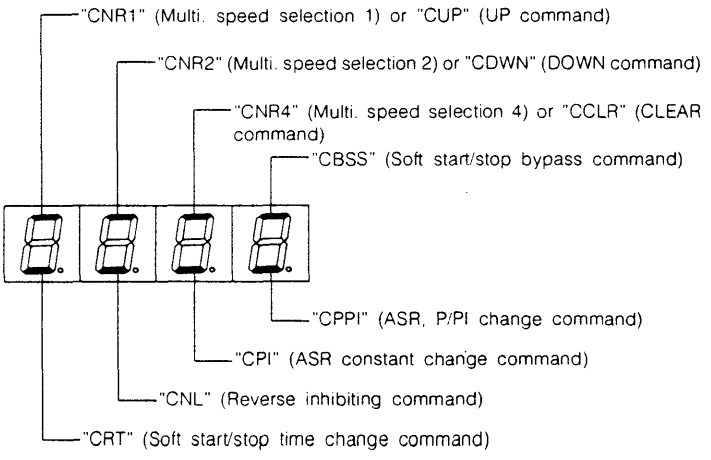


Signals for acceleration or deceleration are output following the increase or decrease of UP/DOWN setting unit output NR1.

(Note 3) The mark "—" of $\overline{\text{Undervoltage}}$ means "not" (not undervoltage).

(1-5) FNO.**0D, 4A** Soft switch (1) display (SEG display)

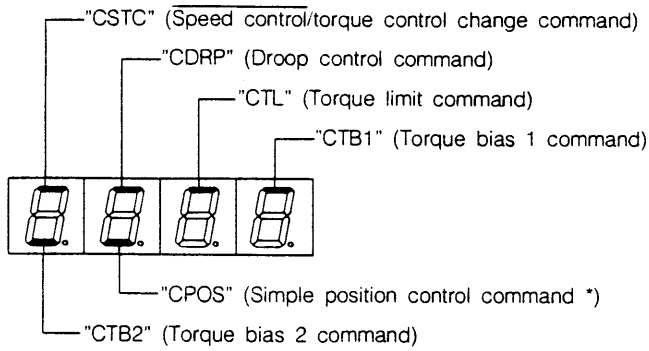
Displays the soft switch status set by general-purpose DI ON/OFF and DI definitions for FNO. 72 and 73 on the 7-segment LED data display.
Lit with switch ON,
Turned off with switch OFF.



7

(1-6) FNO.**0E, 4B** Soft switch (2) display (SEG display)

Displays the internal switch status set by general-purpose DI ON/OFF and DI definitions for FNO. 72 and 73 on the 7-segment LED data display.
Lit with switch ON,
Turned off with switch OFF.
*For simple position control command, see (2-16) FNO. 3A.

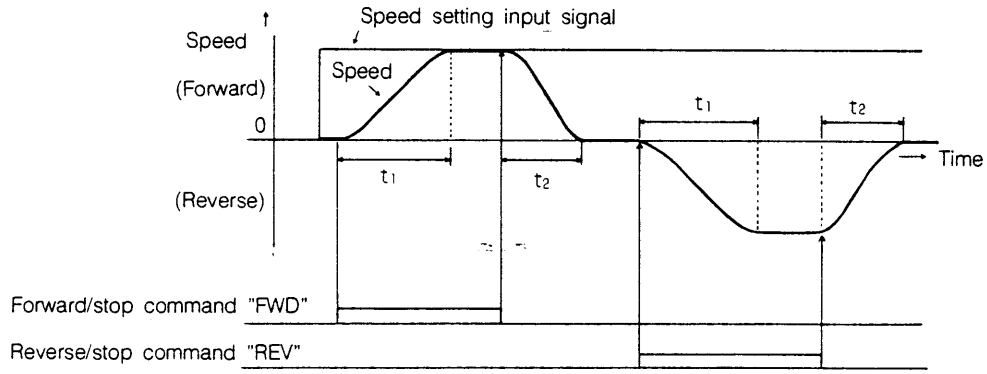


2) Basic parameters

(2-1)	Range of data	Data at shipment
FNO. **11** Soft start/stop acceleration time 1 (ACC1)	0.10~1200 s	5.00
FNO. **12** Soft start/stop deceleration time 1 (DEC1)	0.10~1200 s	5.00
FNO. **13** Soft start/stop S-curve range (ST)	0~50%	0

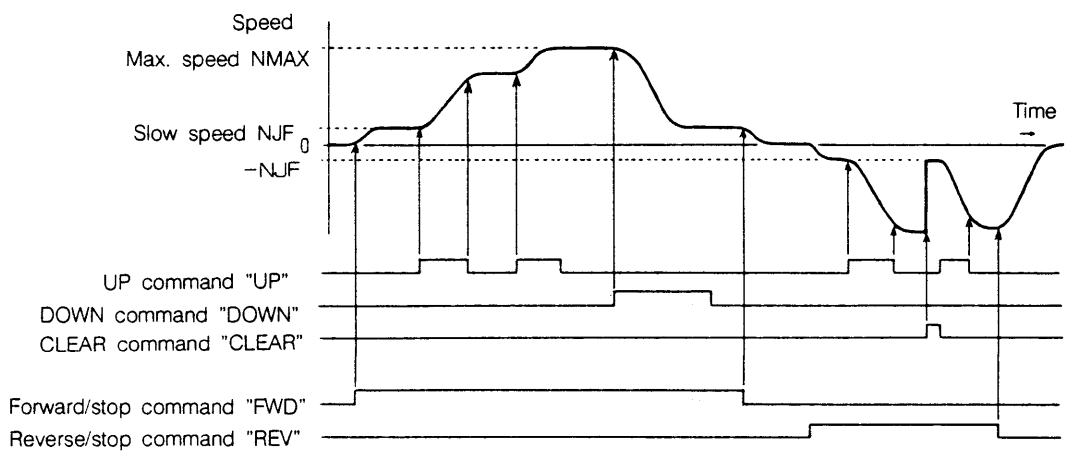
Sets acceleration time from 0 r/min to max. speed (FNO. 51) and deceleration time from max. speed to 0 r/min.

① Soft start/stop mode



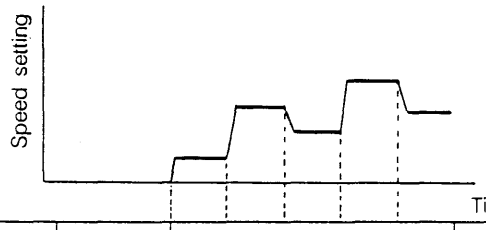
$$\left\{\begin{array}{l} t_1 = ACC1 \cdot (1+2\times\frac{ST}{100})[s] \cdots\cdots(1) \\ t_2 = DCE1 \cdot (1+2\times\frac{ST}{100})[s] \cdots\cdots(2) \end{array}\right\}$$ Time for 0~max. speed

② UP/DOWN setting mode
Calculation for acceleration and deceleration time is the same as (1) and (2) above.
Example of operation:



(2-2)	Range of data	Data at shipment
FNO. **14~18** Multistep speed setting 1~5 (NR1~NR5)	−100~100.0%	0.00

You can select 5-step of speed by general-purpose contact signals/soft switches. The inclination of speed change between stages are determined by acceleration and deceleration time setting.
The selection of multistep speed disables operation by external speed setting signals.
The relation between general-purpose contact signals and internal switches is defined by FNO. 72 and 73. See (4-8).
NOTE: ●: ON state, ○: OFF state.



Internal switch	External speed setting	Multistep speed					External speed setting
		1	2	3	4	5	
CNR1	○	●	○	●	○	●	○ : ●
CNR2	○	○	●	●	○	○	● : ●
CNR4	○	○	○	○	●	●	● : ●

(2-3)	Range of data	Data at shipment
FNO. **19** Soft start/stop acceleration time 2 (ACC2)	0.10~1200 s	5.00
FNO. **1A** Soft start/stop deceleration time 2 (DEC2)	0.10~1200 s	5.00
FNO. **13** Soft start/stop S-curve range (ST)	0~50%	0

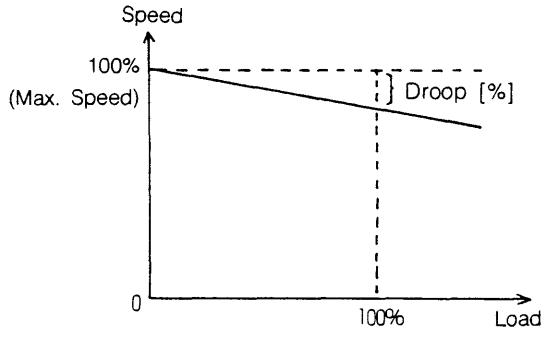
The first acceleration and deceleration times (FNO.11, 12, 13) and the second ones (FNO. 19, 1A, 13) can be changed with general-purpose contact signal/soft switch (CRT). The second ones are selected by the soft switch(CRT) turned on.
The relation between the general-purpose contact signal and soft switch is defined by FNO. 72 and 73. See (4-8).

(2-4)	Range of data	Data at shipment
FNO. **24** ASR P (2) (KP2)	0.1~1000	20.0
FNO. **25** ASR I (2) (KI2)	0~5.000 s	0.040
FNO. **26** Speed setting filter (2) (NRF2)	0~5.000 s	0.040
FNO. **27** Speed detection filter (2) (NAF2)	0~5.000 s	0.005

The first speed regulator parameters (FNO.20, 21, 22, 23) and the second ones (FNO. 24, 25, 26, 27) can be changed with general-purpose contact signal/soft switch (CPI). The second ones are selected by the soft switch(CPI) turned on.
The relation between the general-purpose contact signals and soft switch is defined by FNO. 72 and 73. See (4-8).

(2-5)	Range of data	Data at shipment
FNO. **28** Droop (KD)	0~25.0%	0.0

When speed control is performed together with other inverters, loads on drive units can be balanced by droop characteristics added to constant speed control (droop control). Droop is defined as given in the right figure. The ON-OFF of droop contact is done by the general-purpose contact signal/soft switch (CDRP). When soft switch CDRP is ON, droop control is ON. The relation between the general-purpose contact signals and soft switch is defined by FNO. 72 and 73.
See (4-8).



(2-6)	Range of data	Data at shipment
FNO. **29** ASR P Changeover ramp time constant (KRP)	0.1~2.55 s	1.00

To reduce a shock at the changeover of the speed regulator parameters (2-4), the parameters are changed in a ramp function manner between ASR P (1) and ASR P (2).

(2-7)	Range of data	Data at shipment
FNO. **2A** Torque limit 1/torque bias setting 1	−250~250% **(Note 1)**	150
FNO. **2B** Torque limit 2/torque bias setting 2	−250~250% **(Note 1)**	10
FNO. **2C** Torque limit 3/torque bias setting 3	−250~250% **(Note 1)**	150
FNO. **2D** Torque limit 4	0~250%	150
FNO. **60** Definition of torque limiting modes1	0~3	0
FNO. **61~64** Definition of torque limit 1~4	0, 1	0

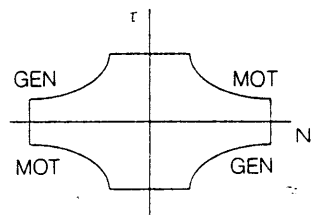
FNO. 2A~2C sets either a torque limit or a torque bias setting. A function can be selected by the definition of the soft switch (CTL or CTB1, 2). The relation between the soft switch and general-purpose contact input is defined by FNO. 72 and 73. See (4-8).

① Torque limiting function

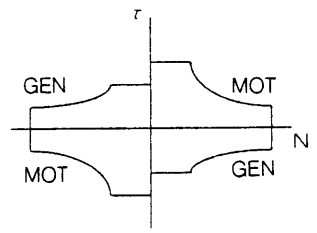
Use FNO. 60=0 for usual torque limiting. When using no braking resistor in an application that requires no DB (generatig mode), use FNO. 60=1, FNO. 62=0, FNO. 2B=3~10%, and soft switch CTL turned ON.

(i) FNO. 60 defines torque limiting modes.

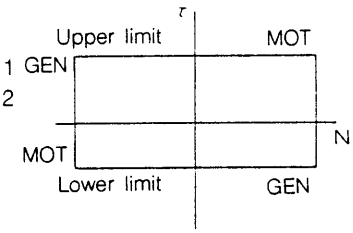
0: Limits torque by absolute values of torque current setting.
Torque limit 1≧0
τ : Torque
N: Speed
MOT: Motoring
GEN: Generating



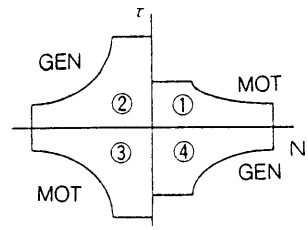
1: Limits MOT and GEN separately. by torque current setting.
MOT: Torque limit 1≧0
GEN: Torque limit 2≧0



2: Limits torque by upper and lower torque settings (ASR output).
(with polarity)
Upper limit: Torque limit 1
Lower limit: Torque limit 2



3: Limits torque in four quadrants by individual torque current setting.
① : Torque limit 1≧0
② : Torque limit 2≧0
③ : Torque limit 3≧0
④ : Torque limit 4≧0



(ii) FNO. 61 and 62 define whether torque limits 1 and 2 are set with parameters or analog input AI.
Setting with parameters: 0
Setting with analog input: 1
FNO. 63 and 64 should be set to 0 because these torque limits are set with parameters.

(iii) For setting with analog input, see (4-10) FNO. 76 and 77.

(iv) For setting with parameters FNO. 2A~2D, see the table below:

FNO. 60	0	1	2	3
FNO. 2A	0~150% **(Note 1)**	MOT 0~150% **(Note 1)**	Upper limit 0~±150% **(Note 1)**	1st quadrant 0~150%
FNO. 2B	Unused	GEN 0~150% **(Note 1)**	Lower limit 0~±150% **(Note 1)**	2nd quadrant 0~150% **(Note 1)**
FNO. 2C	Unused	Unused	Unused	3rd quadrant 0~150% **(Note 1)**
FNO. 2D	Unused	Unused	Unused	4th quadrant 0~150% **(Note 1)**

(Note 1) Though the range of data is −250 (0)~250%, standard setting should be within 0~150% or 0~±150%.

② Torque bias function

Fig. 7-1-4 shows a control block diagram with torque bias in use. As illustrated, the bias function is given to ASR output. It is used to improve response at start in hoisting application.

This function can be used in Fig. 7-1-2 Soft start/stop mode and Fig. 7-1-3 UP/DOWN setting mode. When using a function marked with , change the definitions of general-purpose I/O signals and soft switches (FNO. 72~79). The torque bias function is within the mark and requires change of soft switch definition. When you are using this function, you can not use torque limiter function (soft switch CTL).

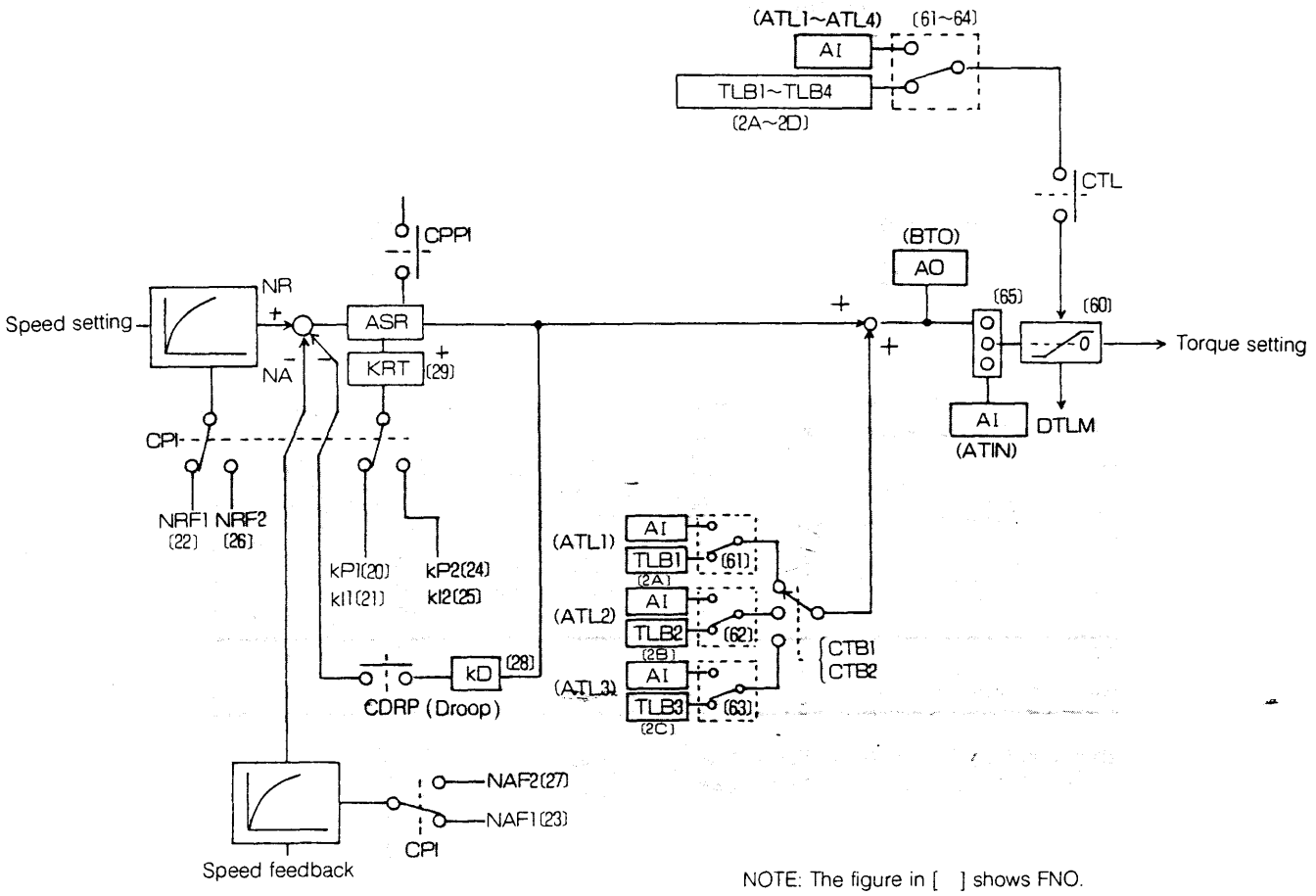


Fig. 7-1-4 Control block diagram for torque bias operation

(i) FNO. 72 and 73 define the connection of soft switch CTB1, CTB2 and general-purpose DI.

(ii) FNO. 61 and 62 define whether torque bias 1 and 2 are set with parameters or analog input AI.
Setting with parameters: 0
Setting with analog input: 1
FNO. 63 should be set to 0 because this is normally set with a parameter.

(iii) For setting with analog input, see (4-10)FNO. 76 and 77.

(iv) The relation between the soft switch and torque bias is as follows:

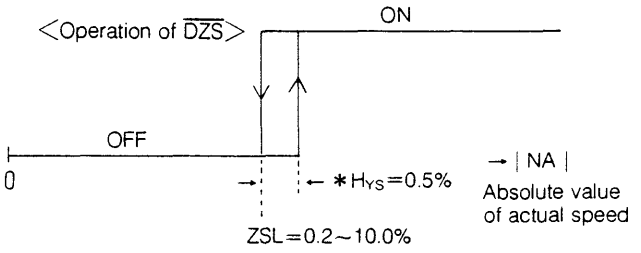
Soft switch	Without torque bias	TLB1 (FNO.2A) or AI (ATL1)	TLB2 (FNO.2B) or AI (ATL2)	TLB3 (FNO.2C)
CTB1	○	●	○	●
CTB2	○	○	●	●

NOTE: ● : ON state, ○ : OFF state

FNO. 30~37 set a comparator level to output the status of the inverter and motor by general-purpose DO. FNO. 74 and 75 select general-purpose DO to output the internal digital signal D＊＊＊resulted from comparison.

(2-8)	Range of data	Data at shipment
FNO. **30** Zero speed detection level (ZSL)	0.2~10.0%	0.5

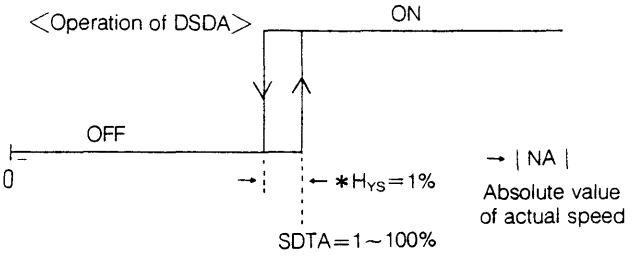
Sets zero speed level ZSL in % taking the max. motor speed of FNO. 51 as 100%.
This zero speed status $\overline{DZS}$ (OFF signal in zero speed state, ON signal in running state) can be output from general-purpose DO. See (4-9) FNO. 74 and 75.



＊H_{YS} : Hysteresis width

(2-9)	Range of data	Data at shipment
FNO. **31** Optional speed detection level (absolute) (SDTA)	1~100%	100

Sets optional speed detection level (absolute) SDTA in % taking the max. motor speed of FNO. 51 as 100%.
This speed status DSDA (ON signal when speed exceeds FNO. 31 setting level) can be output from general-purpose DO. See (4-9) FNO. 74 and 75.

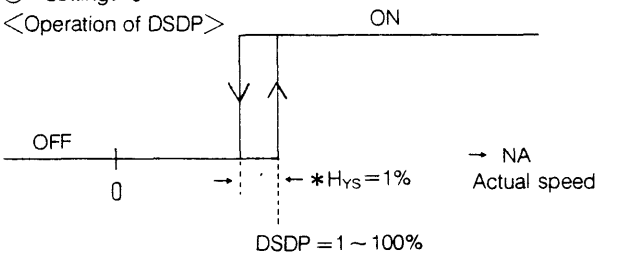


＊H_{YS} : Hysteresis width

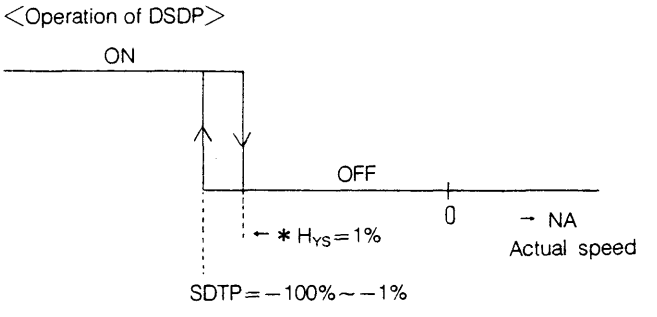
(2-10)	Range of data	Data at shipment
FNO. **32** Optional speed detection level (with polarity) (SDTP)	−100~−1, 1~100%	100

Sets optional speed detection level (with polarity) SDTA in % taking the max. motor speed of FNO. 51 as 100%. This speed status DSDP (ON signal when speed exceeds FNO. 32 setting level) can be output from general-purpose DO. See (4-9) FNO. 74 and 75.
The + side of the actual speed means forward operation, and the − side, reverse operation (when FNO. 5B = 0). When FNO. 5B = 1, the + side means reverse, and the − side, forward.

① Setting > 0



② Setting < 0



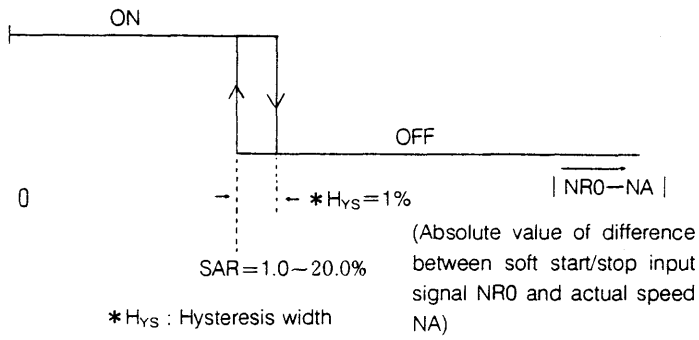
＊H_{YS} : Hysteresis width

(2-11)	Range of data	Data at shipment
FNO. **33** Speed arrival detection level (SAR)	1.0~20.0%	3.0

When speed setting is given in soft start/ stop mode, sets a detection level SAR for actual speed NA arriving at soft start/ stop input signal NR0.
The 100% of this setting level corresponds to the max. motor speed FNO. 51.

This signal is not output in UP/DOWN mode. Also, this signal is not output when aux. speed setting V1 and AV2 is used. When using this signal DSAR, set FNO. 7B=0, and do not select AV2 with FNO. 76 and 77.
This speed arrival status DSDP (ON signal by speed arrival) can be output from general-purpose DO. See (4-9) FNO. 74 and 75.

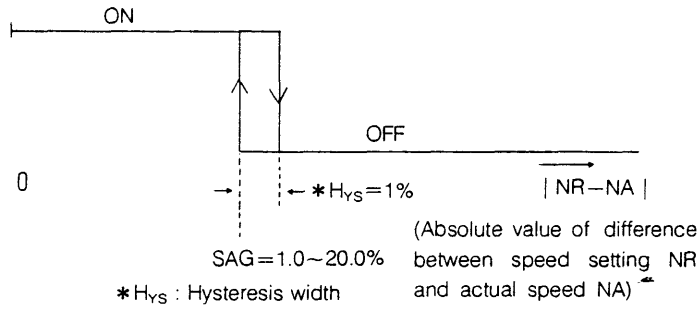
<Operation of DSAR>



(2-12)	Range of data	Data at shipment
FNO. **34** Speed agreement detection level (SAG)	1.0~20.0%	3.0

Sets an agreement level for speed setting NR and actual speed NA.
The 100% of this setting level corresponds to the max. motor speed FNO. 51.
This speed agreement status DSAG (ON signal by speed agreement) can be output from general-purpose DO. See (4-9) FNO. 74 and 75.

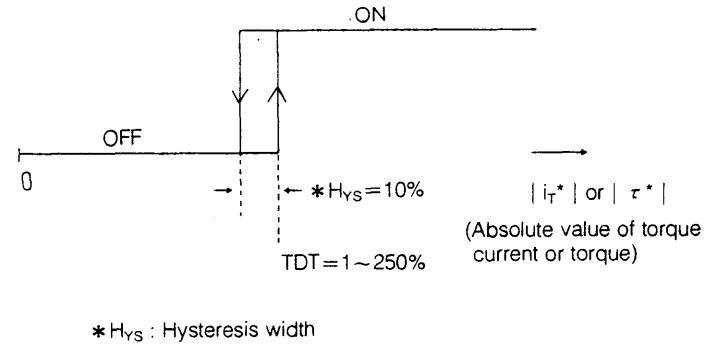
<Operation of DSAG>



(2-13)	Range of data	Data at shipment
FNO. **35** Torque detection level (TDT)	1~250%	100

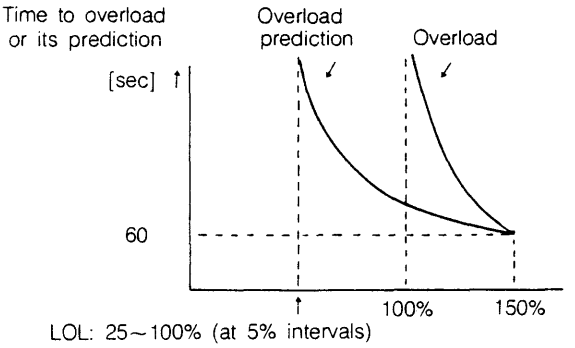
Sets such a torque level that turns signal DTDT on when torque current or torque exceeds the level.
The 100% of this torque detection level corresponds to the rated continuous torque current or torque.
To output the signal DTDT from general- purpose DO, see (4-9) FNO. 74 and 75. Torqu current setting or torque setting can be selected by FNO. 70 Definition of LM terminals: 0 or 1 for torque current setting and 2 or 3 for torque setting.

<Operation of DTDT>



(2-14)	Range of data	Data at shipment
FNO. **36** Overload prediction level (LOL)	25～100%	90

Sets a level of overload prediction for the inverter and motor. To output this overload prediction DOL (ON by overload prediction status) from general-purpose DO, SEE (4-9) FNO. 74 and 75.

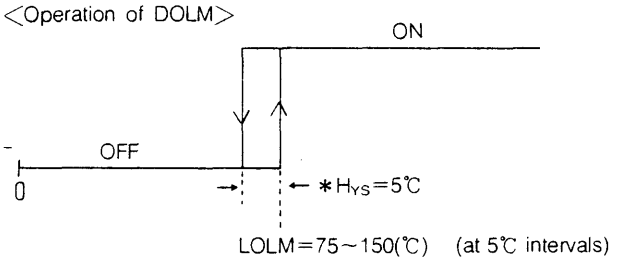


LOL: 25～100% (at 5% intervals)

(2-15)	Range of data	Data at shipment
FNO. **37** Motor overheat prediction level (LOLM)	75～150℃	140

Used for outputting prediction on motor winding temperature through DO.
To output this prediction DOLM (ON above the set temperature) from general-purpose DO, see (4-9) FNO. 74 and 75.

<Operation of DOLM>

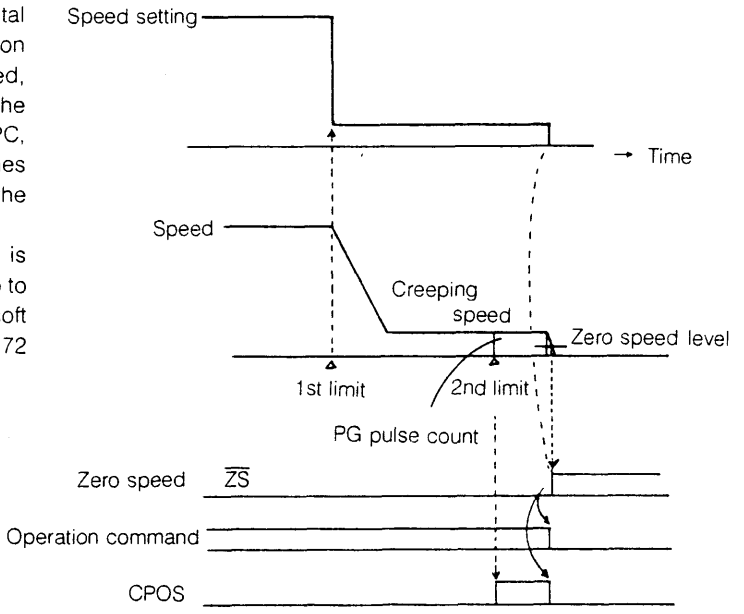


*H_{YS} : Hysteresis width

(2-16)	Range of data	Data at shipment
FNO. **3A** Simple position control motor stop count (SPC)	0～FFFF	8000

7

This function is used for simple position control in horizontal trucks and other applications. For example, as illustrated on the right, when 2nd limit switch operartes at creeping speed, soft switch CPOS is turned on to start pulse counting by the PG (pulse encoder). When the count reaches the set SPC, the inverter starts to stop and the speed level becomes under zero speed level,DC braking is applied to stop the motor.
In case of standard motors, the number of pulses of PG is 1024 P/R and FFFF=65535 pulses. Setting is available up to 65535/1024=64 revolutions. For the relation between soft switch CPOS and general-purpose DI, see (4-8) FNO. 72 and 73.



(2-17)	Range of data	Data at shipment
FNO. **3B** Selection of motor sound tone	0～20	0

This parameter makes the motor magnetic sound tone vary. This parameter is effective in FRENIC5000VG3.

Setting value	0 ⟷ 20
Sound tone	High ⟷ Low

3) Fault display

The inverter has the following three functions to display and retrieve the contents of faults:

(1) Contents of faults: FNO. 40, 41, and 42,

(2) Operation status when 1st fault occurs: FNO. 43~4C,

(3) Contents of past faults (records): FNO. 4D, 4E, and 4F.

When a fault occurs, the inverter is automatically put in a fault display mode. To retrieve successive faults, operation status at fault occurrence, and fault records, operate the keypad keys, and the contents will be displayed in order.

NOTE: The codes of FNO. 4D~4F are displayed only concerning the 1st fault (first detected fault when more than one fault occurred). The codes are the same as FNO. 40 and 41.

(3-1) FNO. **40** Contents of 1st fault
FNO. **41** Contents of 2nd fault

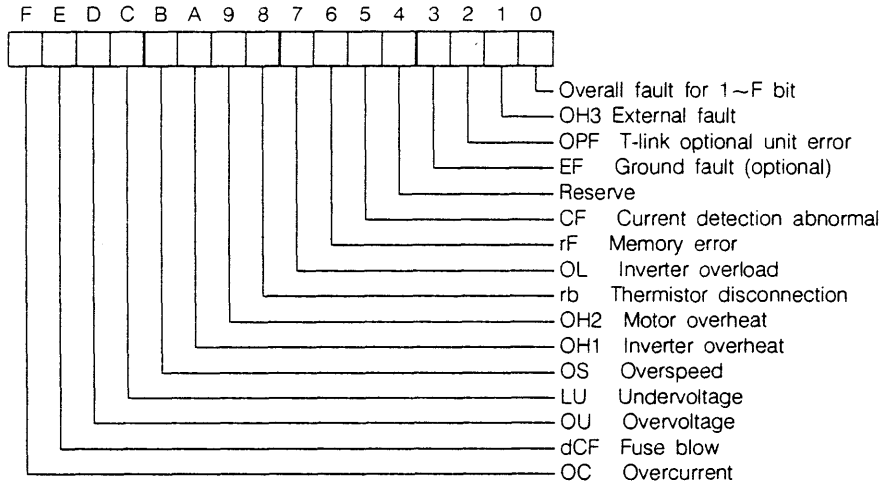
FNO. 40 displays 1st fault with a code of the right table. FNO. 41 displays 2nd fault that occurred successively before 1st fault was reset. The table of the codes and contents are shown on the right.

Display code				Contents
4th digit	3rd digit	2nd digit	1st digit	
0	C			Overcurrent
d	C	F		Fuse blow
0	U			Overvoltage
L	U			Undervoltage
0	S			Overspeed
0	H	1		Inverter overheat
0	H	2		Motor overheat
r	b			Thermistor disconnection
0	L			Inverter overload
r	F			Memory error
C	F			Current detection abnormal
E	F			Ground fault (optional)
0	P	F		T-link optional unit error
0	H	3		External fault

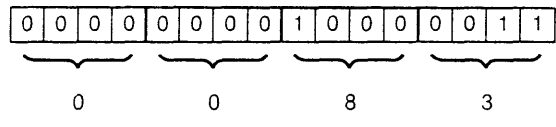
(3-2) FNO. **42** Status of faults

The present status of faults is displayed in hexadecimal notation.

Bit display	Decimal	Hexadecimal
0000	0	0
0001	1	1
0010	2	2
0011	3	3
0100	4	4
0101	5	5
0110	6	6
0111	7	7
1000	8	8
1001	9	9
1010	10	A
1011	11	B
1100	12	C
1101	13	D
1110	14	E
1111	15	F



Example: Inverter overload (OL) and external fault (OH3)



⇨ Display shows 0083.

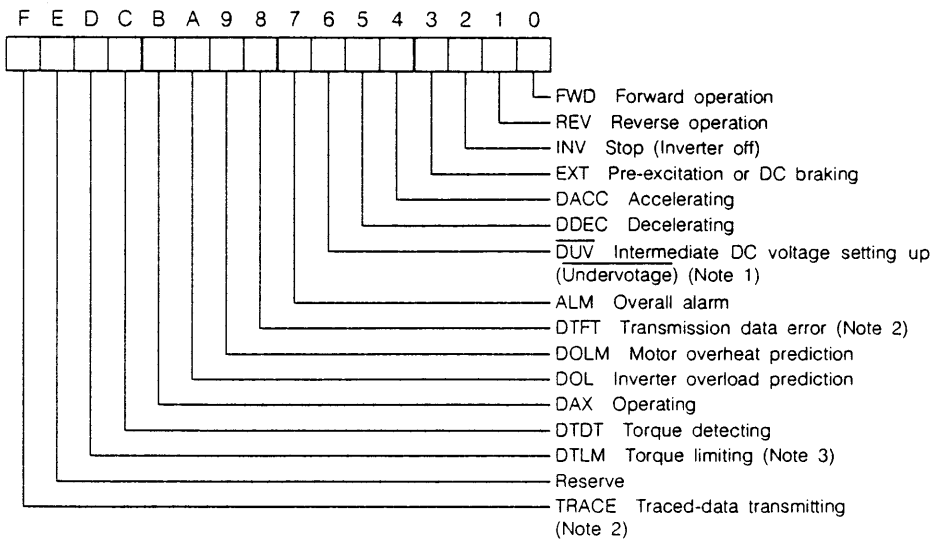
(3-3) FNO. **49** Operation mode at fault occurrence (HEX)

The operation mode when 1st fault occurred is displayed in hexadecimal notation. FNO. 48 gives SEG display for the contents of the bits 0~7 as FNO. 0C. does. refer to (1-4)

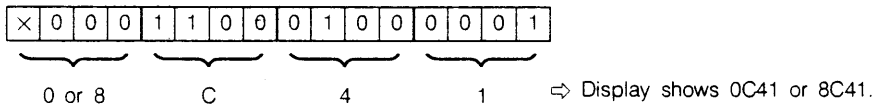
(Note 1) The line of Undervoltage for bit 6 means "not."

(Note 2) Transmission data error at bit 8 and traced-data transmitting at bit F concern option OPC Ⅱ -VG3-T2. When it is not used, bit 8 shows 0 and bit F shows 0 or 1.

(Note 3) "Torque limiting" is enabled only when switch CTL for torque limit is ON.



Example: Operating (DAX), overload prediction (DOL), intermediate DC voltage setting up (DUV) and forward operation (FWD).

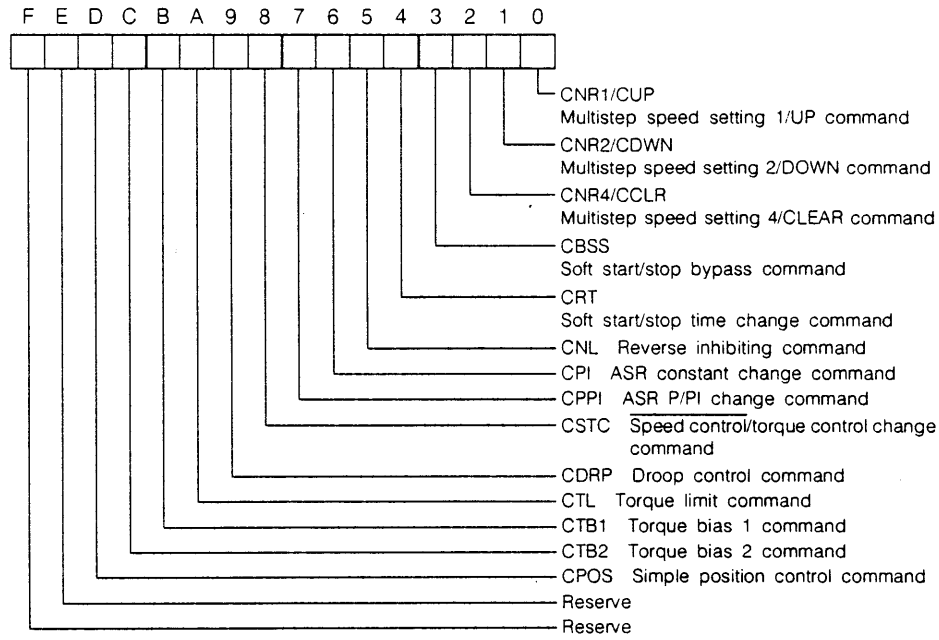


⇨ Display shows 0C41 or 8C41.

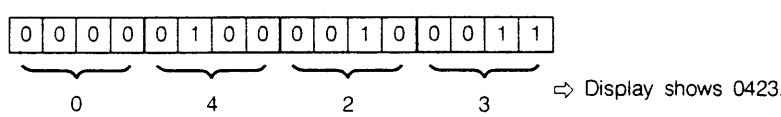
(3-4) FNO. **4C** Status of soft switches at fault occurrence (HEX)

The status of soft switches when 1st fault occurred is displayed in hexadecimal notation.

FNO. 4A and 4B give SEG display for the contents of the bits 0~7 and 8~F as FNO. 0D and 0E do respectively. refer to (1-5), (1-6)



Example: Multistep speed setting 1 (CNR1), multistep speed setting 2 (CNR2), reverse inhibiting command (CNL), and torque limit command (CTL) are ON.



⇨ Display shows 0423.

4) Operation mode selection (Parameters to be set before operation)

(4-1)	Range of data	Data at shipment
FNO. **51** Maximum motor speed	125~12000r/min	1500

The maximum motor speed that can be set with the keypad panel is different according to the number of motor poles. The range of data is shown in the table on the right. However, as shown in 5. Standard Specifications, setting should be within the range of 1500~3600 r/min (or 3000, 2400, 1800 r/min), the standard maximum speed for 4-pole motors, that is, standard motors.

Poles	Lower limit	Upper limit
2P	750r/min	12000r/min
4P	375r/min	6000r/min
6P	250r/min	4000r/min
8P	187r/min	3000r/min
12P	125r/min	2000r/min

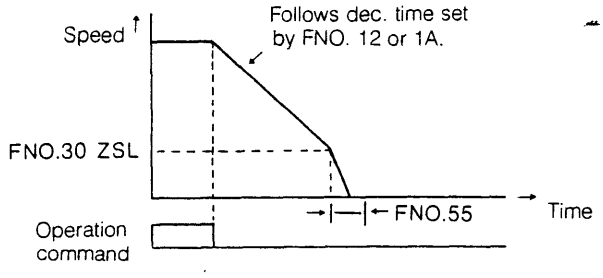
(4-2)	Range of data	Data at shipment
FNO. **52** Motor base speed	125~6000r/min	1500

The motor base speed that can be set with the keypad panel is different according to the number of motor poles. The range of data is shown in the table on the right. However, as shown in 5. Standard Specifications, base speed for 4-pole motors, that is, standard motors, is 1500 r/min. Do not change the data.

Poles	Lower limit	Upper limit
2P	750r/min	6000r/min
4P	375r/min	3000r/min
6P	250r/min	2000r/min
8P	187r/min	1500r/min
12P	125r/min	1000r/min

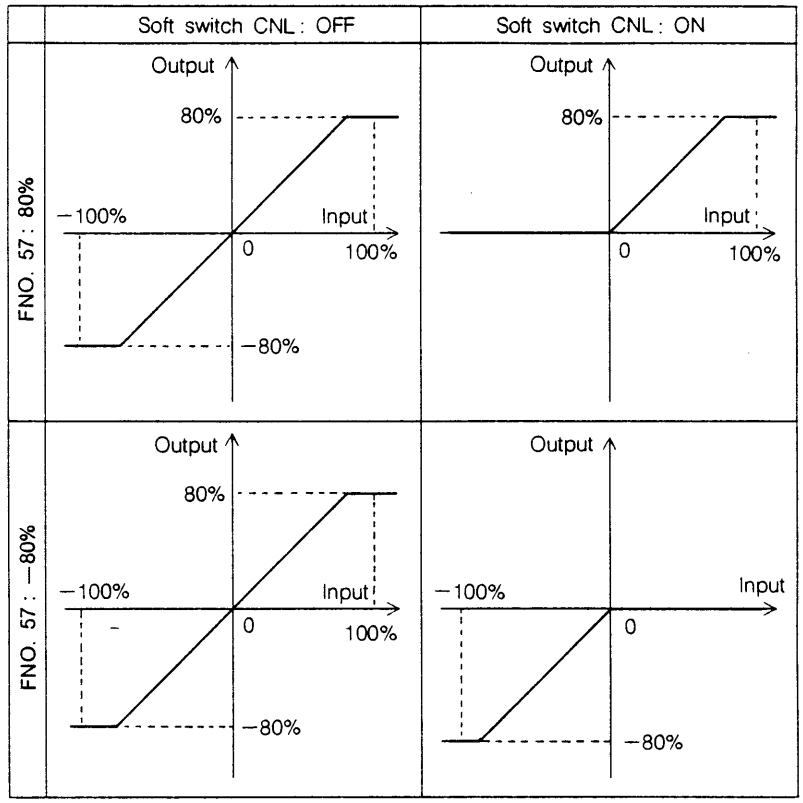
(4-3)	Range of data	Data at shipment
FNO. **53** Use of DC braking	0, 1	0
FNO. **55** DC braking time	0.0~10.0s	0.1

When 1 (uses DC braking) is set in FNO. 53, FNO. 55 is enabled. DC braking is applied on condition that operation commands FWD and REV are OFF, FNO. 53 is set to 1, and actual speed is below zero speed set by FNO. 30. After DC braking time set by FNO. 55 is over, inverter becomes free running.



(4-4)	Range of data	Data at shipment
FNO. **57** Speed limiter (peak limiting)	−100~100%	100

Applies peak limiting to speed setting. Speed setting is limited to one polarity as shown on the right when soft switch CNL for reverse inhibition is ON. The 100% means the maximum motor speed set by FNO. 51. For the definition of the general-purpose DI and soft switch, see (4-8) FNO. 72 and 73.



(4-5)	Range of data	Data at shipment
FNO. **58** Definition of operation mode (1)	0, 1	0

7

Defines the operation mode for the speed regulator.
Setting is 0 for high-speed response operation, and setting is 1 for high-accuracy static speed control operation.

(4-6)	Range of data	Data at shipment
FNO. **59** Definition of operation mode (2)	0, 1	0

Defines the operation mode in connection with operation commands FWD and REV.
With data 0, normal operation, the inverter continues operation even in a zero-speed state of the motor when either FWD or REV is ON. Set FNO. 59 to 1 in order to stop operation by turning down the speed setting volume at terminals 11, 12, and 13 when FWD or REV is kept ON. In this case, the inverter operates as if FWD or REV is turned off when speed (input to terminal 12) comes below a zero speed level though FWD or REV is ON.
This function is disabled by FNO. 5A set to 1 or 2 (digital input setting) and by multistep speed setting.

·(4-7)	Range of data	Data at shipment
FNO. **5B** Definition of forward and reverse commands	0, 1	0

The rotating direction of motors is normally forward by FWD and reverse by REV. FNO. 5B is used to rotate a specified motor in a reverse direction in interlocking operation. The direction of rotation is set as shown on the right.

	External voltage input	0~10V	0~−10V
	Multi. speed parameter FNO. 14~18	0~100%	0~−100%
FNO. 5B=0	FWD ON	Forward	Reverse
	REV ON	Reverse	Forward
FNO. 5B=1	FWD ON	Reverse	Forward
	REV ON	Forward	Reverse

(4-8)	Range of data	Data at shipment
FNO. **72** Definition of DI (X1~X4, X6, X7)	0~15	0
FNO. **73** Definition of DI (X5)	0~15	5

FNO. 72 and 73 determine the relation between general-purpose digital inputs and soft switches. X6 and X7 are enabled only when option OPC Ⅱ-VG3-T2 is used.

FNO. 72 sets a combination of DI X1~X4, X6, and X7 to a column #0~#12 horizontally ranged in the table below.

(At shipment, column #0 is set by FNO. 72=0: X1=CNR1/CUP, X2=CNR2/CDWN, X3=CNR4/CCLR, X4=CTL, X6=CRT, and X7=CPI)

FNO. 73 sets X5 to any of $0~$13 vertically ranged in the table below.

(At shipment, X5 is set to $5 CNL by FNO. 73=5.)

	No.	Signal	Abbr.	Setting of FNO. 72 (at shipment FNO. 72=0)															
				#0	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15	Remarks
Setting of FNO. 73 (X5) (at shipment FNO. 73=5)	$0	Multistep speed setting 1/ U/D setting unit UP command	CNR1/ CPU	X1	X1	X1	X1	X1	X1	X1	X1	X1			(X6)	(X6)				Selected by FNO. 5E
	$1	Multistep speed setting 2/ U/D setting unit DOWN command	CNR2/ CDWN	X2	X2	X2	X2	X2	X2	X2	X2									Selected by FNO. 5E
	$2	Multistep speed setting 4/ U/D setting unit CLEAR command	CNR4/ CCLR	X3				X3	X3											Selected by FNO. 5E
	$3	Soft start/stop bypass	CBSS			X3					X3	X2	X1	X1		X1				
	$4	Soft start/stop time change	CRT	(X6)	(X6)		X3	X4	X4	X3	X4	X3	X2	X2	X1	X2				
	$5	Reverse inhibiting command	CNL										(X7)	(X7)		(X7)				
	$6	ASR PI constant change	CPI	(X7)	(X7)	(X7)	(X7)	(X7)		(X7)			X3	X3	X3	X3				
	$7	ASR P/PI change	CPPI																	
	$8	Speed control/torque control change	CSTC																	**(Note 2)**
	$9	Droop command	CDRP			(X6)	(X6)	(X6)		(X6)	(X6)	(X6)	(X6)	(X6)	X2					
	$10	Torque limit	CTL	X4		X4	X4		(X6)	X4		X4	X4	X4	X4	X4				
	$11	Torque bias 1 command	CTB1		X3															
	$12	Torque bias 2 command	CTB2		X4															
	$13	Simple position control command	CPOS						(X7)		(X7)	(X7)			(X7)					
	$14																			
	$15																			

(Note 1) When X5 is defined the same as another DI, whichever is earlier turns the signal on.

(Note 2) When you want to use Speed control/torque control change CSTC, please make an inquiry to us.

(4-9)	Range of data	Data at shipment
FNO. **74** Definition of DO (Y1~Y3, Y4, Y5)	0~15	0
FNO. **75** Definition of DO (RY)	0~15	1

FNO. 74 and 75 determine the relation between general-purpose digital outputs and inverter internal signals. Y4 and Y5 are enabled only when option OPC Ⅱ-VG3-T2 is used.

FNO. 74 sets a combination of DO Y1~Y5 to a column #0~#11 horizontal ranged in the table below.

(At shipment, column #0 is set by FNO. 74=0 : Y1=$\overline{\text{DUV}}$, Y2=DSAR, Y3=DSAG, Y4=DTDT, and Y6=DOL.)

FNO. 75 sets RY to any of $0~$15 vertical ranged in the table below.

(At shipment, RY is set to $1 $\overline{\text{DZS}}$ by FNO. 75=1.)

No.		Signal	Abbr.	Setting of FNO. 74 (at shipment FNO. 74=0)																
				#0	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15	Remarks
Setting of FNO. 75 (RY) (at shipment FNO. 75=1)	$0	Intermediate voltage setup (Undervoltage)	$\overline{\text{DUV}}$	Y1	Y1	Y1	Y1	Y1	Y1	Y1	Y1	Y1								
	$1	Running ($\overline{\text{Zero speed}}$)	$\overline{\text{DZS}}$										Y1	Y1	Y1					
	$2	Speed arrival	DSAR	Y2	Y2	Y2	Y2	Y2		Y2	Y2	Y2	Y2	Y2						
	$3	Speed agreement	DSAG	Y3								Y3	Y3	Y3						
	$4	Optional speed (absolute value)	DSDA		Y3			(Y4)												
	$5	Optional speed (with polarity)	DSDP			Y3														
	$6	Torque limiting	DTLM				Y3													
	$7	Torque detecting	DTDT	(Y4)	(Y4)	(Y4)	(Y4)	Y3	(Y4)	(Y4)	(Y4)				Y2					
	$8	Operating	DAX												Y3					
	$9	Accelerating	DACC						Y2				(Y4)		(Y4)					
	$10	Decelerating	DDEC						Y3				(Y5)		(Y5)					
	$11	Overload prediction	DOL	(Y5)	(Y5)	(Y5)	(Y5)	(Y5)	(Y5)	Y3	(Y5)									
	$12	Motor overheat prediction	DOLM							(Y5)	Y3									
	$13	Transmission data Y4	DTY4									(Y4)		(Y4)						
	$14	Transmission data Y5	DTY5									(Y5)								
	$15	Transmission data error	DTFT											(Y5)						

7

(Note) When RY is defined the same as another DO, both of them output the same signal.

(4-10)	Range of data	Data at shipment
FNO. **76** Definition of AI (AI1)	0~15	0
FNO. **77** Definition of AI (AI2)	0~15	2

FNO. 76 and 77 determine the relation between general-purpose analog inputs and input points into the inverter.
FNO. 76 sets AI1 to a column #0~#8 horizontally ranged in the table below.
(At shipment, column #0 is set by FNO. 76=0 : AI1=AV2)
FNO. 77 sets AI2 to any of $0~$10 and $15 vertical ranged in the table below.
(At shipment, AI2 is set to $2 ATL1 by FNO. 77=2.)

No.		Signal	Abbr.	Setting of FNO. 76 (at shipment FNO. 76=0)															
				#0	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15	Remarks
Setting of FNO1 77 (AI2) (at shipment FNO. 77=2)	$0	Aux. speed setting 2	AV2	AI1																±max. speed/ ±10V
	$1	Aux. speed setting 3	AV3		AI1															〃
	$2	Torque limit 1/ torque bias setting 1	ATL1								AI1									±max. torque/ ±10V **(Note 3)**
	$3	Torque limit 2/ torque bias setting 2	ATL2									AI1								〃
	$4	Torque limit 3/ torque bias setting 3	ATL3																	〃
	$5	Torque limit 4	ATL4																	〃
	$6	Torque setting input	ATIN			AI1														〃
	$7	Torque setting	ATR				AI1													〃
	$8	Flux setting input (0~10 V)	AFAI					AI1												100% flux/+10V **(Note 4)**
	$9	Speed feedback input	ANFI						AI1											±max. speed/ ±10V **(Note 4)**
	$10	U/D setting unit (0~10V) slow speed setting	ANJF																	±max. speed 10%/+10V
	$11																			
	$12																			
	$13																			
	$14																			
	$15	Motor temp. input (0~10 V) **(Note 2)**	ATM							AI1										200℃/+10 V

(Note 1) AI1 and AI2 input −10V~0~+10V. When AI2 is defined the same as AI1, AI1 has priority over AI2.

(Note 2) Motor temperature is input normally by an NTC thermistor. However, when Pt100 or the like is built in a motor, it is possible to input it into the inverter using a converter 0~10V/0~200℃

(Note 3) Normally 150% corresponds to the maximum torque.

(Note 4) When you want to use flux setting input AFAI or speed feedback input ANFI, please make an inquiry to us.

7

(4-11)	Range of data	Data at shipment
FNO. **78** Definition of AO (AO)	0~15	0
FNO. **79** Definition of DO (AO2, AO3)	0~15	0

FNO. 78 and 79 determine the relation between general-purpose analog outputs and inverter internal data. AO2 and AO3 are enabled only when option OPC Ⅱ-VG3-AO is used.

FNO. 78 sets AO (Inverter main PCB terminal) to any of $0~$11 vertically ranged in the table below.
(At shipment, AO is set to $0 BNF0 by FNO. 78=0.)

FNO. 79 sets a combination of AO2 and AO3 to a column #0~#12 horizontally ranged in the table below.
(At shipment, column #0 is set by FNO. 79=0 : AO2 BNF0, AO3 BT0.)

Setting of FNO. 78 (AO) (at shipment FNO. 78=0)				Setting of FNO. 79 (at shipment FNO. 79=0)															
No.		Signal	Abbr.	#0	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15	Remarks
	$0	Speed feedback output 0	BNF0	(AO2)	(AO2)	(AO2)	(AO2)							(AO2)	(AO2)					
	$1	Speed setting 0	BNR0		(AO3)			(AO2)	(AO2)	(AO2)										
	$2	Speed setting 1	BNR1			(AO3)		(AO3)			(AO2)	(AO2)								
	$3	Speed setting 2	BNR2				(AO3)		(AO3)		(AO3)		(AO2)							
	$4	Torque setting output 0	BT0	(AO3)						(AO3)		(AO3)	(AO3)							
	$5	Torque setting output 1	BT1											(AO3)						
	$6	Torque current setting	BIT*												(AO3)					
	$7	Speed setting	BNR					–								(AO2)				
	$8	Speed feedback	BNA													(AO3)				
	$9	Speed feedback, absolute	BNAB																	
	$10	Torque setting output, absolute	BTAB																	
	$11	Torque current setting output, absolute	BITAB																	
	$12	Motor current	BIM																	
	$13																			
	$14																			
	$15																			

(Note) When an AO is defined the same as another, both of them output the same signal.

Analog output: $0~$3, $7, and $8: 0~±10V/±100%
$4 and $5: 0~±10V/0~±max. torque setting (±150% as standard)
$6: 0~±10V/0~±max. torque current setting (±150% as standard)
$9: 0~+10V/0~±100%
$10: 0~+10V/0~±max. torque setting (±150% as standard)
$11: 0~+10V/0~±max. torque current setting (±150% as standard)
$12: This depends on FNO. 7C (Refer to (4-12).)

(4-12)	Range of data	Data at shipment
FNO. **7C** Selection of motor current's output	1~22	12

Set this parameter when you need to use "AO" terminal as actual motor current's output.
This parameter defines the scale of output voltage/motor current.
Motor current value means rms, and output accuracy is ±10%.

Setting value	Scale	Setting value	Scale
1	$10^{A}/10^{V}$	12	$100^{A}/10^{V}$
2	$15^{A}/10^{V}$	13	$150^{A}/10^{V}$
3	$20^{A}/10^{V}$	14	$200^{A}/10^{V}$
4	$25^{A}/10^{V}$	15	$250^{A}/10^{V}$
5	$30^{A}/10^{V}$	16	$300^{A}/10^{V}$
6	$40^{A}/10^{V}$	17	$400^{A}/10^{V}$
7	$45^{A}/10^{V}$	18	$450^{A}/10^{V}$
8	$50^{A}/10^{V}$	19	$500^{A}/10^{V}$
9	$60^{A}/10^{V}$	20	$600^{A}/10^{V}$
10	$75^{A}/10^{V}$	21	$750^{A}/10^{V}$
11	$90^{A}/10^{V}$	22	$900^{A}/10^{V}$

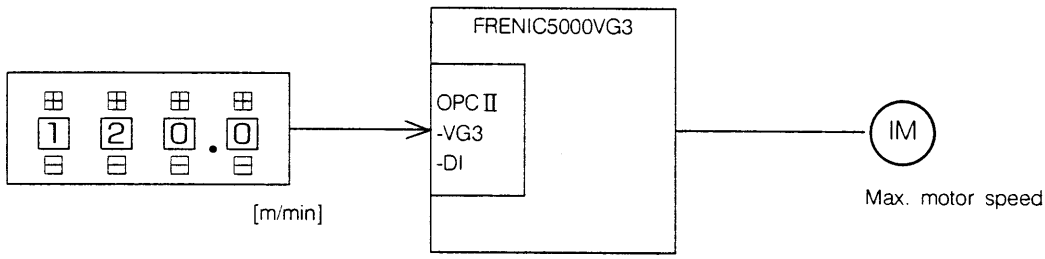
(4-13)	Range of data	Data at shipment
FNO. **54** Use of V limit function	0, 1	1

V limit function is the function that when Inverter intermediate voltage increase over the level, VG3/VG3N depress the generation power in order to depress the increasing of intermediate voltage.
0: No use of V limit function
1: use of V limit function

5) Definitions for options

(5-1)	Range of data	Data at shipment
FNO. **80** Conversion factor for speed setting BCD input	99~7999	1000

Using option OPC Ⅱ-VG3-DI, this function sets a BCD data at the maximum speed when speed setting is made by BCD input (when FNO. 5A is set to 2).
Example. When BCD data is 120.0 (m/min) at the maximum motor speed, setting is FNO. 80=1200.
When data over than 1200 is input, output is limited.



(5-2)	Range of data	Data at shipment
FNO. **81** Definition of UP/DOWN initial setting	0, 1	0

In case of speed setting with the UP/DOWN setting unit shown in Fig. 7-1-3, this function defines the initial setting to be 0 or the preceding operation data. The latter definition is used for restarting from the preceding set point when the inverter control power supply is recovered from stoppage due to power failure etc. Note that option OPC Ⅱ-VG3-T2 is required in this case.

6) Analog input adjustment

FNO.	Input terminal	Contents
FNO.88	12	Offset adjustment data
FNO.89	12	Gain adjustment data
FNO.8A	V1	Offset adjustment data
FNO.8B	V1	Gain adjustment data
FNO.8C	AI1	Offset adjustment data
FNO.8D	AI1	Gain adjustment data
FNO.8E	AI2	Offset adjustment data
FNO.8F	AI2	Gain adjustment data

① FNO. 88, 8A, 8C, 8E: Offset adjustment. Input 0V into each analog input terminal and operate [∧] or [∨] to have display data 0; then, press [SET]. (When operation of [∧] or [∨] does not give 0, check the input voltage and try again.)
Adjustment is normally unnecessary because it is carried out before shipment.
Adjustable range: 0～±30mV.

② FNO. 89, 8B: 12, V1 gain adjustment. Input as high speed setting as possible (～10V) into terminal 12 or V1. Operate [∧] or [∨] to have display data agreed with the input setting speed (r/min); then, press [SET].
Adjustable range:±10V±0.5V/max. speed setting

③ FNO. 8D, 8F: AI1, AI2 gain adjustment.
The display unit varies as shown in the table on the right according to the AI defintion OF FNO. 76 and 77. Carry out adjustment the same as ②. Note that in $15 motor temperature input, adjustment should be done with 5V input 100℃ display because 10V input causes motor trouble due to overheat.

No.	Signal	Abbr.	Data	Unit
$0	Aux. speed setting 2	AV2	0～max. speed	r/min
$1	Aux. speed setting 3	AV3	〃	r/min
$2	Torque limit 1/ torque bias setting 1	ATL1	0～±max. torque *	%
$3	Torque limit 2/ torque bias setting 2	ATL2	〃	%
$4	Torque limit 3/ torque bias setting 3	ATL3	〃	%
$5	Torque limit 4	ATL4	〃	%
$6	Torque setting input	ATIN	〃	%
$7	Torque setting	ATR	〃	%
$8	Flux setting input (0～10V)	AFAI	0～100	%
$9	Speed feedback input	ANFI	0～max. speed	r/min
$10	U/D unit (0～10V) slow speed setting	ANJF	0～max. speed×10%	r/min
$11				
$12				
$13				
$14				
$15	Motor temp. input (0～10V)	ATM	0～200	—

(Note) The maximum torque is normally 150%.

8. Keypad Panel

8-1 Functions and Construction

The setting and display device is named keypad panel, and data display and parameter setting and modification are all carried out with the keypad panel. The inverter is operated by parameters set with the keypad panel and external operation/control commands. Fig. 8-1-1 illustrates the operation.

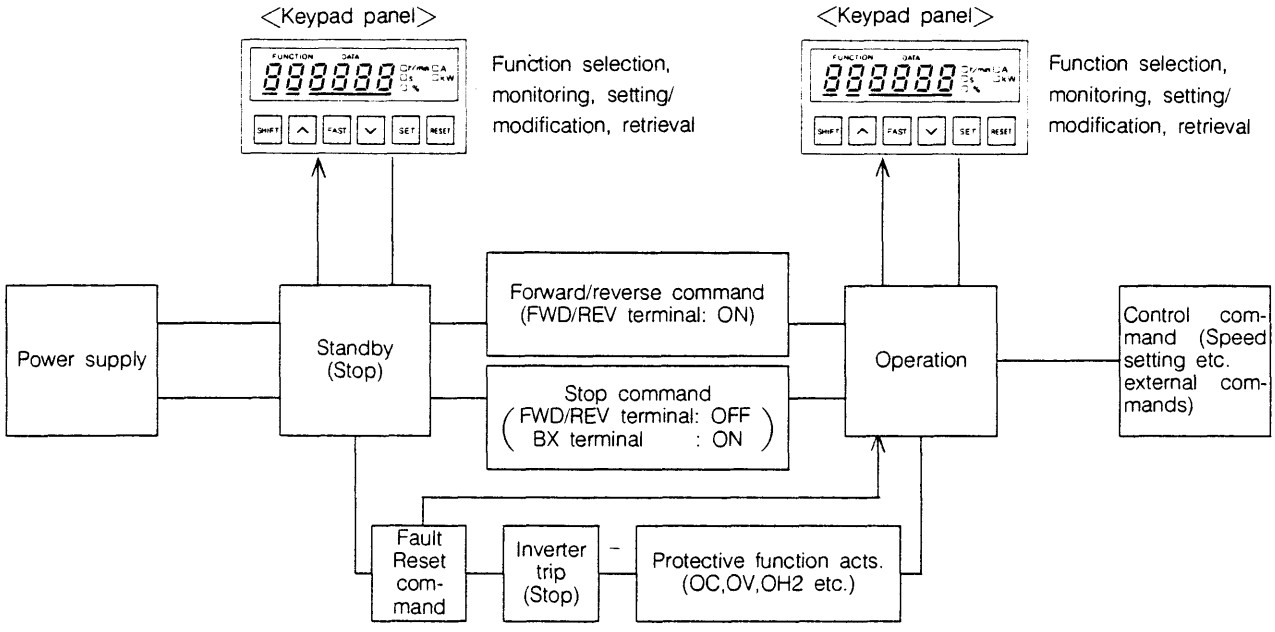


Fig. 8-1-1 Basic operation of FRENIC5000VG3 series

Table 8-1-1 shows the list of parameters, Table 8-1-2, functions of the keypad panel, and Table 8-1-3, display characters.

Table 8-1-1 List of parameters

FNO.		Contents		Remarks
0	1~F	Operation monitoring		
1	0~F	Basic parameters	Speed setting	10: FNO. 11~3F set data protection
2	0~F		ASR (speed regulator)	
3	0~F		Others	
4	0~F	Faults		
5	0~F	Operating mode selection	Basics	50: FNO. 51~8F set data protection
6	0~F		Torque	
7	0~F		Input/output, etc.	Setting change not allowed during inverter operation.
8	0~F	Definition for optional units Analog adjustment		(except FNO. 82, 83, 86, 87)
9	0~F	Transmission and others		

Table 8-1-2 Functions of the keypad panel

Function		FNO.	Contents
Operation monitoring		01~0F	Monitors inverter operating conditions.
Parameter setting	Basic parameters	11~3A	Sets parameters to be adjusted during operation such as P and I parameters for ASR system.
	Operating mode selection	51~7B	Definition items to be set before operation such as max. speed, AI/O and DI/O definitions.
	Definition for options	80~83	Defintions for using options to be set before operation.
	Analog adjustment	85~8F	Adjustments (offset and gain) for analog I/O to be set before operation.
Transmission data display		90~97	Displays transmission data when option OPC Ⅱ-VG3-T2 or OPC Ⅱ-VG3-TL is used.
Set data protection		10, 50	Protects set data against careless operation.
All save function		9A, 9B	Stores the whole set parameters in nonvolatile memory.
Fault display/retrieval		40~4F	Displays and retrieves contents and operation status at fault occurrence.
Reset		Reset key	Fault reset or reset to an operation monitoring mode after setting is over.

Table 8-1-3 Display characters

Figure	Display	Figure	Display	English letter	Display	English letter	Display	English letter	Display
0	0	5	5	A	A	F	F	U	U
1	1	6	6	B	b	H	H	V	U
2	2	7	7	C	C	L	L	S	5
3	3	8	8	D	d	O	0	P	P
4	4	9	9	E	E	R	r		

The same character is displayed on the keypad panel each for 0 and O, U and V, and 5 and S.

Fig. 8-1-2 shows the outline of the keypad panel.

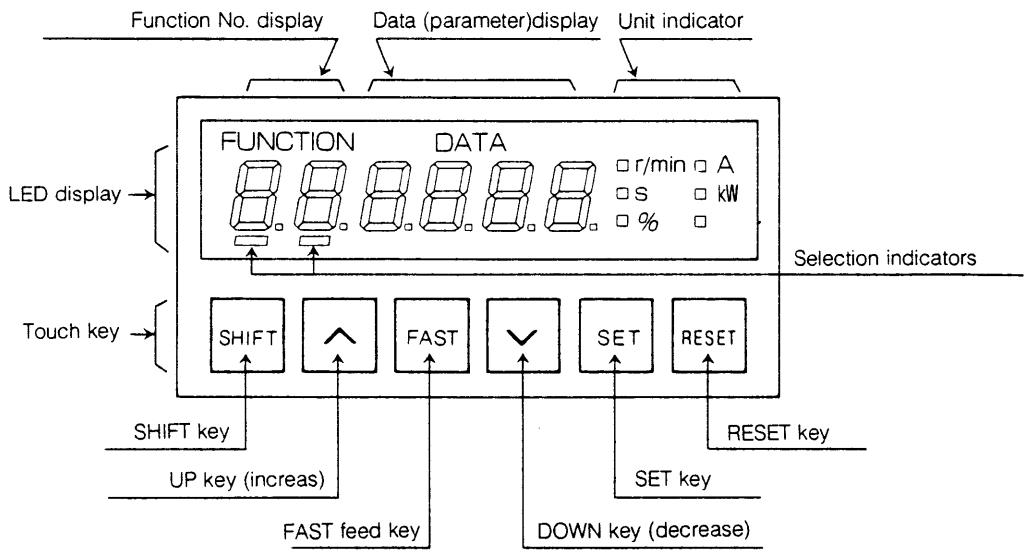


Fig. 8-1-2 Outline of the keypad panel

FUNCTION : Displays a selected function with a 2-digit number.
Selection indicator : Indicates the selected position for a digit to set a function. In a parameter setting mode, both are turned off.
DATA : Displays operation data, setting data for parameters, and fault status.
Unit indicator : Turns on an LED on the left side of a unit corresponding to the contents of display data.

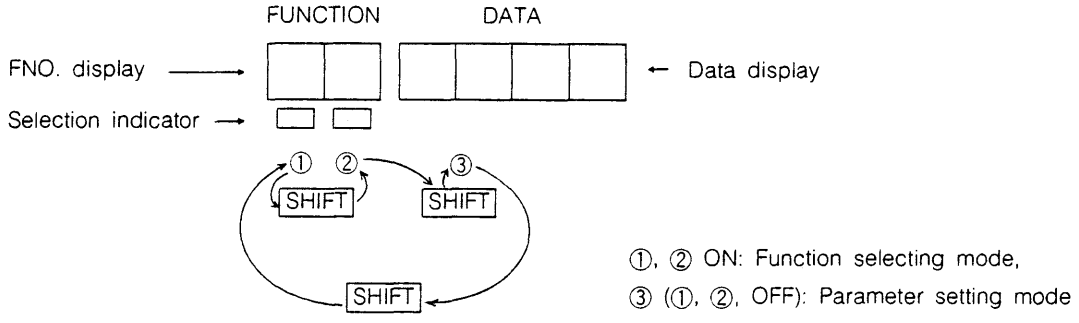
Functions of touch keys

SHIFT

Selects a mode from function selecting and parameter setting modes. Each mode is shifted by pressing [SHIFT] key in such an order as shown below:

① : Selection indicator, the tens digit → ② : Selection indicator, the units digit → ③ : DATA (parameter) → ① → ② → ③ → ...

However, when FNO. 01～0F and 40～4F are set or when data is protected (described later), order is → ① → ② → ① → ...



[∧] / [∨]

Used for changing numeral data in each mode selected with [SHIFT].

[∧] : Increases numeral data, [∨] : Decreases numeral data.

During parameter setting, data increase or decrease stops within the upper and lower limits of each parameter setting range.

FAST

Feeds numeral data fast during parameter setting.

You can start fast feed numeral data by pressing [FAST] together with [∧] or [∨] depressed, and can change the fast feed to the original feed by releasing [FAST] only.

Fast feed is not started by pressing [FAST] only.

SET

Used for storing data into nonvolatile memory during parameter setting. Stored data is not erased even when the power supply is turned off.

Data not stored by a press of [SET] after modification is erased when the power supply is turned off and data stored previously by a press of [SET] is valid.

When [SET] is pressed, [S][A][U][E] is displayed to show the data being written to nonvolatile memory. [S][A][U][E] is displayed about one second, followed by set data display.

RESET

① Display reset in a parameter setting mode:
Display returns to the FNO. for preceding operation monitoring display (FNO. 01～0F).

② Fault reset in a fault monitoring mode:
A press of [RESET] after fault recovery cancels the operating protective function and displays the FNO. selected before the fault occurred.

8-2 Protection of Set Data

There are two kinds of parameters: basic parameters and operation mode selection (definition) parameters, and both set data can be protected (inhibited from change).

FNO. 10: Protects the set data of basic parameters (11~3A).

FNO. 50: Protects the set data of operation mode selection parameters(51~8F).

(Data 0: change inhibited, data 1: change allowed.)

At shipment, both are initially set to 0 (data change inhibited), and parameters can not be changed.

① Cancellation of set data protection (Change allowed)

Set FNO. to 10 (or 50) with [SHIFT] and [∧] / [∨] and press [SHIFT] twice to display a parameter setting mode. Press [∧] to set data to 1.

After that, parameter change for each FNO. is allowed.

② Set data protection (Change inhibited)

Put the display in a parameter setting mode in the same way as in ①.

Press [∨] to set data to 0.

After that, parameter change for each FNO. is inhibited.

8-3 Displaying Data

To monitor the contents of functions, follow the operating steps below:

① Press [SHIFT] and see that selection indicator ① is lit to select the tens digit of FNo.

② Press [∧] or [∨] to set a code for the tens digit of a required FNO. At this time, a code for the units digit of FNO. will be set to 0.

③ Press [SHIFT] once; selection indicator ① is turned off and ② is lit. The units digit of FNO. is ready.

④ Press [∧] or [∨] to set a code for the units digit of a required FNO.

⑤ The function data is displayed on the data display, and its unit, on the unit indicator.

The unit indicator at the right bottom is lit for units other than those printed such as r/min, A, s, etc. These displays will continue till another function is set.

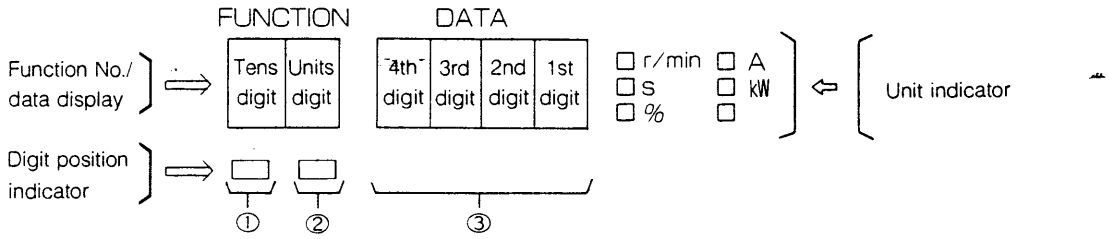


Fig. 8-3-1 LED display

8

8-4 Parameter Setting and Change

(1) Steps

①~④ Select a required function in the same way as 8-3 ①~④.

⑤ Press [SHIFT] and turn off selection indicators ① and ② in Fig. 8-3-1 to shift to a parameter setting mode. Note that during inverter operation, a parameter setting mode can not be displayed in connection with parameters that are disabled from setting during operation.

NOTE: "During inverter operation" means "inverter is not active."

⑥ Use [∧], [∨] and [FAST] to set a required data. After data is changed, it flickers.

⑦ To store set data into nonvolatile memory (to hold it after the power fails), press [SET].

The data stops flickering and is stored.

⑧ To change data after [SET] is pressed, repeat steps from ⑥.

NOTE: When a fault occurs, all of the parameters can not be set.

(2) Setting of more than one parameter.

① Carry out the first setting following (1) ①~⑦.

② Press [SHIFT] once and see that selection indicator ① (the tens digit of FNO.) is lit.

③ Display FNO. for the next parameter using [∧], [∨], and [SHIFT].

④ Carry out parameter setting in the same way.

(3) To store more than one parameter into nonvolatile memory at a time (ALL SAVE function)

① Call FNO. and set data in the same way as (1) ①~⑥.

② Do not press [SET] but display the next FNO. and set data using [SHIFT], [∧], and [∨].

③ Repeat operations ① and ② to finish setting all the parameters required; then, call FNO. 9B.

④ Since the contents of FNO. 9B is 0, press [∧] to display 1.
The dIsplay changes from 1 to [SAVE] to indicate data being written for about 3 s, while all the changed data are stored.

⑤ After data is written, the data of FNO. 9A (Data SAVE check) is automatically reset to 0.

(4) Example of parameter setting.
Setting change of max. speed to 2400 r/min starting from the display of output current monitoring.

Operation	Display	Description
Stop Op. Stop operation FWD/REV -CM : OFF	FUNCTION DATA 07 28.9 □ r/min ■ A □ S □ kW □ % □	Function No. and data of inverter output current is displayed. (Ex.: Output current 28.9 A) To change max. speed setting requires an operation stop of the inverter.
Press [SHIFT] once.	FUNCTION DATA 07 0.0 □ r/min ■ A □ S □ kW □ % □	The lighted selection indicator is shifted to the tens digit. Output current displays 0 for no inverter output.
Press [∧] times.	FUNCTION DATA 50 1 □ r/min □ A □ S □ kW □ % ■	Selects FNO. 50 to check for data protection for parameters. When the tens digit is set, the units digit displays o at the same time and data display indicates a code for data protection. Right bottom unit indicator is lit ecause of no unit. (Ex.: Data can be changed.)
Press [SHIFT] once.	FUNCTION DATA 50 1 □ r/min □ A □ S □ kW □ % ■	The lighted FNO. digit position indicator is shifted to the units digit.
Press [∧] once	FUNCTION DATA 51 3600 ■ r/min □ A □ S □ kW □ % □	The units digit of FNO. is set to 1 and DATA displays the present max. speed. (Ex.: Max. speed 3600 r/min)
Press [SHIFT] once	FUNCTION DATA 51 3600 ■ r/min □ A □ S □ kW □ % □	Selection indicators are turned off and the display is put in a parameter setting mode.
Set data with [∨] and [FAST]. In case of wrong setting, set again with [∧], [∨] and [FAST].	FUNCTION DATA 51 2400 ■ r/min □ A □ S □ kW □ % □	Carry out setting operation till 2400 r/min is displayed. The data flickers.
Press [SET].	FUNCTION DATA 51 2400 ■ r/min □ A □ S □ kW □ % □	Set data 2400 r/min is stored into nonvolatile memory displaying [SAVE]. After that, 2400 r/min is displayed again. Selection indicator light moves to the units digit.
Press [RESET].	FUNCTION DATA 07 00 □ r/min ■ A □ S □ kW □ % □	Resets the function of operation monitoring mode before setting. Since the inverter output is stopped, DATA is 0.

8

8-5 Fault Monitoring

(1) At fault occurrence.

① When a fault occurs, the present display mode is automatically changed to a fault display mode (FNO. 40) and the code of a fault that occurs first (1st fault) is shown on DATA display.
The units digit ② of the selection indicator is lit (see Fig. 8-3-1).

② To see if another fault is combined, call FNO. 41 with [∧]. FNO. 41 displays the code of a fault that occurs second (2nd fault).

NOTE: When there is no 2nd fault, DATA display shows [-][-][-][-].
The 2nd fault is not stored as a record (as it is cleared); it is recommended to record it to facilitate future operation and maintenance.

③ Press [∧] again to call FNO. 42. FNO. 42 displays the present fault status in hexadecimal notation.

④ To inspect the operation status at 1st fault occurrence, press [∧] to move to FNO. 43. and so on. FNO. 42~4C store the following data:

FNO. 43: Speed setting	FNO. 48: Operation mode (SEG display)
FNO. 44: Detected speed	FNO. 49: Operation mode (HEX notation)
FNO. 45: Torque current setting	FNO. 4A: Internal soft switch 1 (SEG display)
FNO. 46: Motor current (U phase)	FNO. 4B: Internal soft switch 2 (SEG display)
FNO. 47: Motor current (W phase)	FNO. 4C: Internal soft switch (HEX notation)

⑤ To inspect the last fault record, call FNO. 4D, which stores 1st fault at the preceding fault occurrence.
FNO. 4E stores the last but one 1st fault and FNO. 4F stores the last but two 1st fault.
The abovementioned 1st fault record is renewed by a press of [RESET] after the fault is removed.

⑥ Fault check is over; repair the fault and press [RESET].
Protective functions operated by fault occurrence will be canceled, the display will show the FNO. before the fault occurred, and the inverter will be ready for operation.
(In case all the causes of faults are not removed, protective functions will not be canceled even when you press the [RESET].)

(2) Retrieval of fault data when there is no fault (during normal operation).

① Press [SHIFT] to turn on selection indicator ① (for tens digit) and set tens digit to 4 using [∧] and [∨].

② Automatically 0 is displayed on units digit and FNO. 40 the contents of 1st fault is displayed.
Since there is no fault at present, [-][-][-][-] is displayed.
FNO. 41 the contents of 2nd fault also dispalys the same because there is no fault. FNO. 42 displays [0][0][0][0] in this case.

③ FNO. 43~4C displays operation status at the last fault occurrence.

④ FNO. 4D~4F store the contents of 1st fault for immediately previous 3 faults.
FNO. 4D displays a fault code for the last 1st fault, FNO. 4E, for the last but one 1st fault, and FNO. 4F, the last but two 1st fault.

8

9. Operation

9-1 Preparation for Operation

Before trial operation, be sure to check the following items:

① Input AC power supply agrees with the rating.
200V series: 3-phase 3-wire, 200/200~230V, 50/60Hz
400V series: 3-phase 3-wire, 400~420/400~460V, 50/60Hz
② The main circuit input/output are connected correctly. (Input power supply to R, S, T. To the motor from U, V, W.)
③ Cables for the main and control circuits are free from ground fault, contact with other terminals, and a short circuit.
④ The pulse encoder is connected correctly.
⑤ Foreign matter such as metal or cable scraps is not left or stuck in the panel.
⑥ Screws, connectors, terminals and other parts are not loose.
⑦ External sequential circuits operate properly.

(Note) Motors above 55kW encoder terminal's are (+V, 0V, PA, PB, SS).

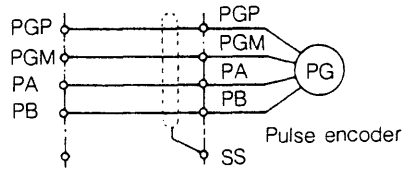


Fig. 9-1 Connection of Pulse encoder

9-2 Trial Operation

For safety's sake, separate the motor from the machine at the coupling or belt so that the motor can be operated independently. When operating the motor coupled with the machine, take full care to avoid danger.

① Turn off all of the control switches.

② **Check and re-setting of operation mode selection FNO. 51~8F.**
Before trial operation, check FNO. 51~8F, and if change is necessary, carry out re-setting following Sections 7 and 8. In particular, make sure that FNO. 7A, number of motor poles and pulse encoder specification, agrees with the motor nameplate.

Operation mode selection	FNO.51~5F	Basics
	FNO.60~66	Torque
	FNO.70~7C	Input/output
	FNO.80~83	Definition for options
	FNO.85~8F	Analog adjustment

③ Set the speed setting unit to the lowest speed.
④ Close the molded-case circuit breaker (FAB) to energize the control and sequential circuits, and leave them for some time to see that abnormalities (generation of heat, emitting smoke, a unusual smell, and others) are not found in them.
Also make sure that the CHARGE lamp on the front panel is lit.
⑤ Give a forward or reverse command. Turn the speed setting knob clockwise a little to see that the motor starts rotation. In this state, check for correct rotational direction. The rotational direction of the motor under a forward command is counterclockwise viewing from the shaft extension. To reverse the rotational direction, set the operation signal to a reverse command or change FNO. 5B setting when the operation signal can not be changed because of interlocking operation. Note that even if motor phase sequence is reversed, the motor rotation will not be reversed but will start hunting at a low speed.

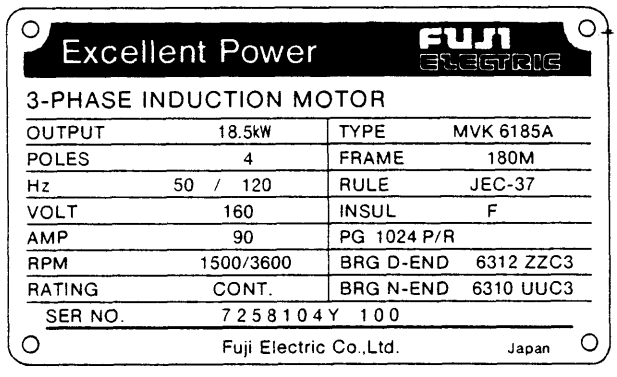


Fig. 9-2 Nameplate of Moter (example)

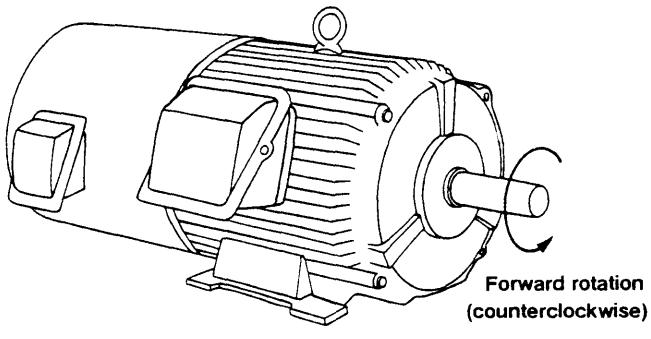


Fig. 9-3 Direction of rotation

⑥ It must be noted that if a forward command and a reverse command are given at the same time, the motor will be stopped by dynamic braking.

⑦ Next, raise the speed setting gradually and make sure that the motor reaches the maximum speed.
The maximum motor speed is set to 1500r/min at shipment.
To change the maximum motor speed, stop the inverter once and carry out re-setting of FNO. 51.

⑧ When you finish the above check, stop the inverter once. Set the speed setting to somewhat high speed and make sure that acceleration/deceleration is performed smoothly.
After you finish the above trial operation, start operation with the load connected.
If re-setting is necessary after the trial operation, follow the procedures in 8. Keypad Panel.

9-3 Operation

Follow the steps for operation below. As for items described in trial operation but not included below, adopt necessary items in consideration of circumstances.

① Turn on the power (FAB).

② Make sure that the CHARGE lamp on the front panel is lit.

③ When data change is necessary, follow the steps in 7. Functions and 8. Keypad Panel.

④ Input a forward or reverse command, and the motor will operate at a set speed.

⑤ When during operation, you want to display set data or to change data that can be re-set during operation, follow the steps in 7. Functions and 8. Keypad Panel.

⑥ Operate the motor with the load connected at about 1500r/min. Raise ASR P gain of FNO. 20 or 24 gradually till the motor starts hunting. Setting should be about 80% of this P gain.

⑦ Turn off forward/stop or reverse/stop command input, and the motor will decelerate and stop.
Unless it is operated immediately again, turn off the power when it stops for safety's sake.

10. Maintenance and Inspection

The inverter is composed of many parts and it can not bring its performance into full play unless those parts operate properly. Proper maintenace and inspection is necessary in order to prevent inverter trouble from occurring and to continue its reliable operation for a long time. For the inspection method, see Table 10-1 List of inspections.

10-1 Precautions in Maintenance and Inspection

① Turn off the power without fail.

② It takes time for the smoothing capacitor to discharge after the power is turned off. To avoid danger, do not start work before the power is off and the CHARGE lamp is turned off.

③ Pull out connectors by the housing, not by the cable. Be careful not to insert them into wrong positions.

10-2 Daily Inspection

① Carry out inspection without removing the covers to see if there is no abnormality such as unusual noise, smell, and damage following the items of Table 10-1 Inspection list.

② When you find an abnormality, investigate its place and extent immediately.

③ Check the contents of the abnormality. Even if operation can be continued, record them as reference data for future periodical inspection.

10-3 Periodical Inspection

Remove the outside covers, carry out visual check and other inspections following the items of Table 10-1 Inspection list.
Be sure to keep "10-1 Precautions in Maintenance and Inspection."

Table 10-1 Inspection list

Section	Item		Check points	Frequency			Inspection method	Acceptance criteria
				Daily	Periodically			
					Every 1 year	Every 2 year		
General	Environment		Ambient temp., humidity, dust, harmful gases, oil mist, etc.	○			See 4. Installation.	To satisfy 4-1 Table 4-1.
	Whole equipment		Abnormal vibration and noise.	○			Seeing and hearing.	To be all in good order.
	Supply voltage		Main-circuit voltage, control circuit voltage.	○			Voltage measurement between main power input terminals R, S, T.	200V series: 200V/50Hz, 200~230V/ 60Hz 400V series: 400~420V/50Hz, 400~460V/ 60Hz
Main circuit	General		(1) Megger check between main-circuit terminals and grounding terminal. (2) Loose tightening. (3) Trace of overheat. (4) Cleaning.		○ ○ ○	○	(1) See 10-6 Insulation test. (2) Add tightening. (3) Visual inspection. (4) Remove dust with a vacuum cleaner.	(2), (3) No defect.
	Conductor, cable.		(1) Deformation of conductors. (2) Damage and deterioration (crack, discoloration) of cable covering.		○ ○		(1), (2) Visual inspection.	(1), (2) No defect.
	Transformer, reactor.		Unusual smell and humming.	○			Seeing, hearing, and smelling.	No defect.
	Terminal block		Damage		○		Visual inspection.	No defect.
	Smoothing capacitor		(1) Liquid leak. (2) Safety valve projecting or swelling (3) Capacitance measurement	○ ○	 ○		(1), (2) Visual inspection. (3) Use an capacitance measuring instrument.	(1), (2) No defect. (3) Not less than 85% of rated capacitance.
	Relay, contactors.		(1) Chattering during operation. (2) Wear of contacts		○ ○		(1) Hearing. (2) Visual inspection.	(1), (2) No defect.
	Resistor		(1) Crack of insulation (2) Breaking of wire		○ ○		(1) Visual inspection. (2) Open connection at one side and check with tester.	(1) No defect. (2) Error shall be within ±10% of indicated resistance.
Control circuits Protection circuits	Operation check		(1) Balance check of phase output voltages in independent inverter operation. (2) Abnormality of protection and display circuits when sequential/protective operation test is applied.		○ ○		(1) Measure voltages between inverter output terminals U, V, W. (2) Simulate by shorting contact input terminals and common for inverter control.	(1) Voltage difference between terminals shall not exceed 2% of output voltage. (2) No error in external sequential operation.
	Parts	General	(1) Unusual smell, discoloration. (2) Serious rust.		○		(1), (2) Visual inspection.	(1), (2) No deffect.
		Capacitor	Liquid leak, deformation.	○			Visual inspection.	No defect.
Cooling system	Cooling fan		(1) Abnormal vibration and noise (2) Loose connection	○	 ○		(1) Seeing and hearing. Turn off power and turn the fan by hand. (2) Add tightening.	(1) Smooth rotation and no abnormal noise. (2) No defect
Display	Display		(1) Bulbs burnt out. (2) Cleaning.	○	 ○		(1) Check panel lamp lighting with the lamp test switch on the panel. (2) Clean with a cloth.	(1) All shall be lit.
	Meters		Indications.	○			Record panel meter indications.	To satisfy control limits and specified values.

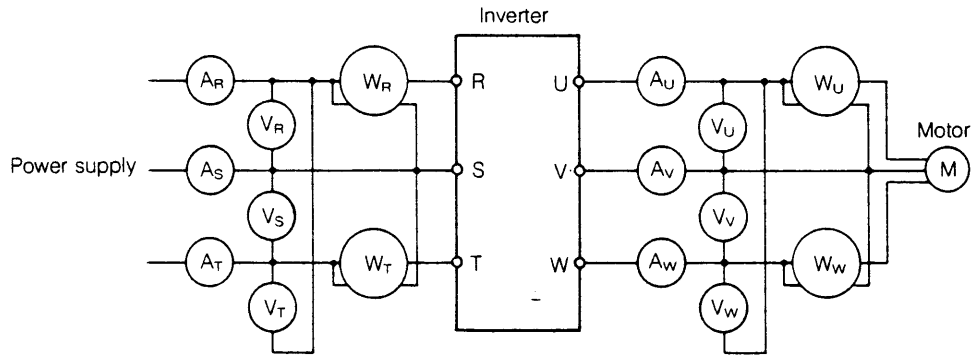
10-4 Periodical Replacement of Parts

Though the service life of an inverter depends on its working environment and time, the life expectancy of electrilytic capacitors is about 5 years, and that of cooling fans , about 3 years when they are operated continuously within allowable limits. Replacement before trouble is recommended.

10-5 Measuring Main-Circuit Electric Quantities

It is necessary to select suitable types of measuring instruments because the voltage and current of inverter input/output circuits include high harmonics. Follow Fig. 10-5-1 when you use instruments for commercial frequency, If power factor is measured with a power factor meter, it will include considerable error because of high-harminic current and output frequency fluctuation. When power factor is required, measure voltage, current, and power, and calculate the following formula:

$$\text{Power factor } (\%) = \frac{\text{Power (W)}}{\sqrt{3} \times \text{voltage (V)} \times \text{current (A)}} \times 100$$



Item	Input (power supply) side			Output (motor) side		
	Voltage waveform / Current waveform			Voltage waveform / Current waveform		
Instrument name	Ammeter $A_{R,S,T}$	Voltmeter $V_{R,S,T}$	Wattmeter $W_{R,S,T}$	Ammeter $A_{U,V,W}$	Voltmeter $V_{U,V,W}$	Wattmeter $W_{U,V,W}$
Type	Moving-iron type	Rectifier or moving-iron type	Dynamometer type	Moving-iron type	Rectifier type	Dynamometer type
notation						

Fig. 10-5-1 Measurement and instruments for main circuits

10

10-6 Insulation Check

Avoid the insulation test as far as possible because it was carried out before shipment. In case you can not avoid the test, **follow the instructions below. It must be noted that a mistake may cause inverter damage.**

(1) Main circuits

Use a 500V DC megger to apply insulation resistance tests.

① Remove the external connections from all the inverter terminals (including control circuit terminals) and clean those parts. Connect all the main circuit terminals with a common wire as shown in Fig. 10-6-1.

② Apply megger test only between main-circuit common wire and grounding terminal E(G).

③ In 400V series, the inverter is normal when the megger indicates more than 5MΩ.
In 200V series, the megger indicates 1~2MΩ.
The reason is that a surge absorber is provided to protect the inverter against surge that may enter with input power, and when a 500V DC megger is used, a leakage current flows in it because of its voltage characteristic. When a 250V DC megger is used, it indicates more than 5MΩ.

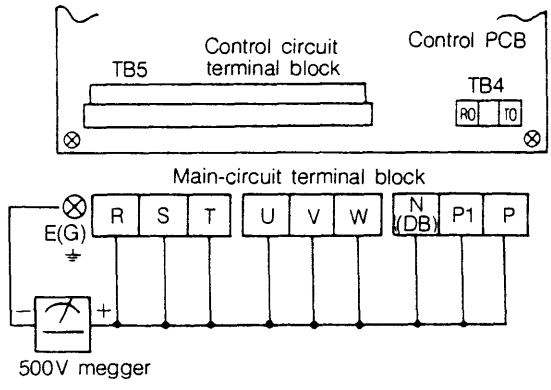


Fig. 10-6-1 Megger test connection

(2) Control circuits

Remove the external connections from control circuit terminals and carry out noncontinuity-to- ground test. Use an analog tester. Never use a megger or the like.

(3) Precautions in external-circuit tests

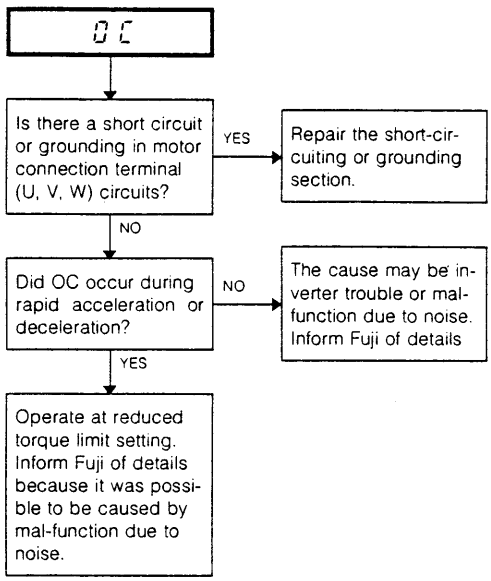
When you apply dielectric test or megger test to external main circuits and sequential control circuits, detach connections at all the terminals so that test voltage can not be impressed on the inverter.

11. Troubleshooting

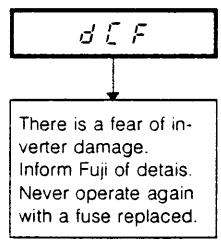
When a fault causes, inverter function failure or an extraordinary phenomenon is presented, refer to the diagnoses below to clear up the cause and to take steps. If your trouble is not included below, the inverter is damaged, its parts are broken, or you are in another difficulty, please communicate the matter to the agent you bought it or your nearest Fuji sales office.

11-1 Diagnoses and Steps at Fault Display

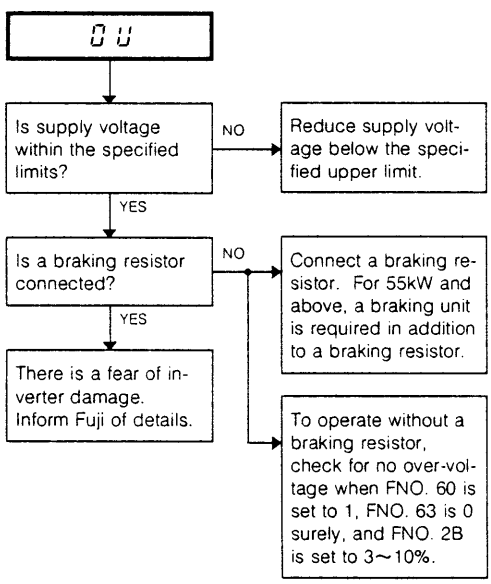
(1) Overcurrent



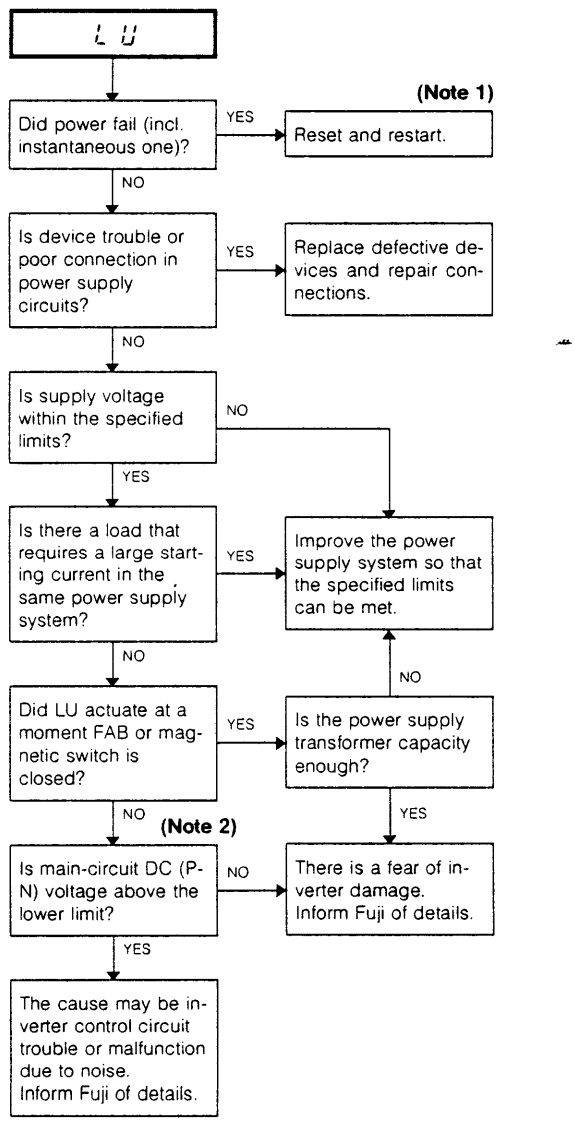
(2) Fuse blow



(3) Overvoltage



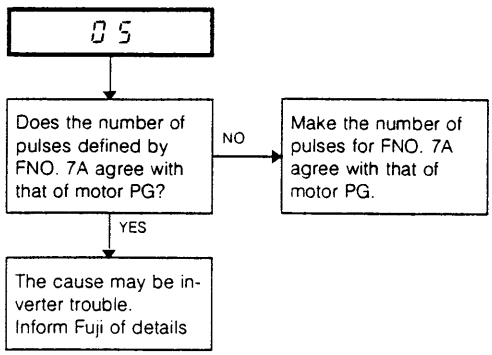
(4) Undervoltage



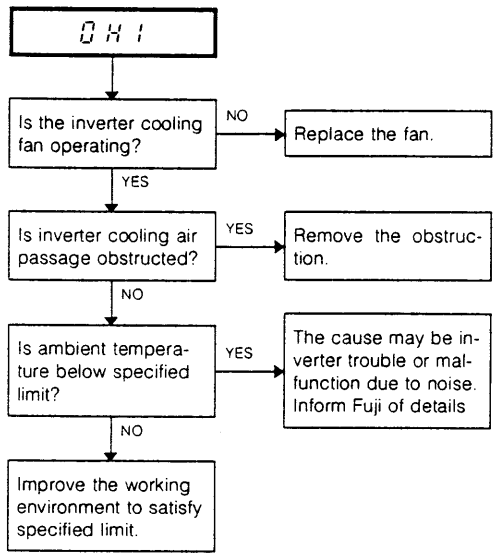
(Note 1) When the smoothing capacitor discharges and inverter control power fails at power failure, the alarm is automatically reset. If you need the continuation of operation when power is restored after instantaneous failure, please specify it when ordering. Our standard product gives an undervoltage alarm at instantaneous power failure, but at your request, the restart function can be added.

(Note 2) Inverters of 55kW and above have P, N terminals, but inverters of 45kW and below do not have P, N terminals.

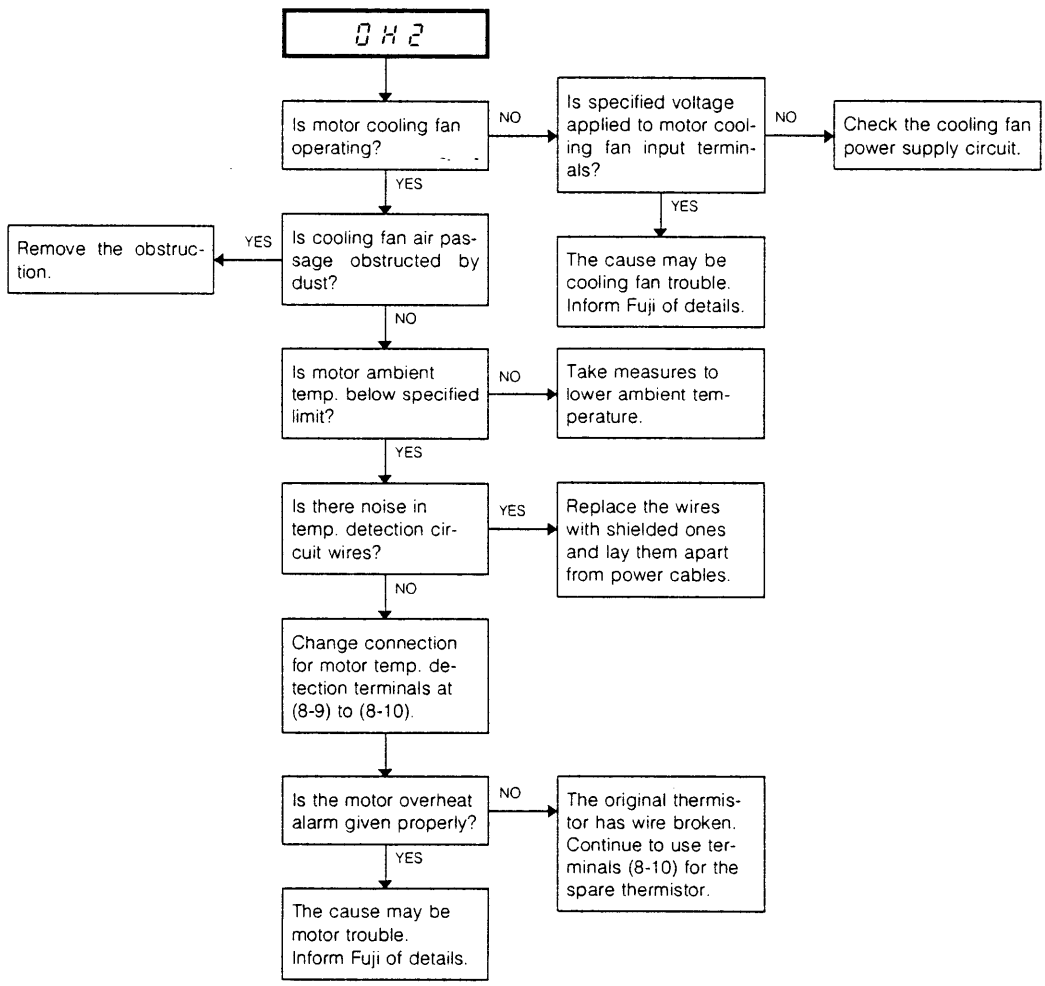
(5) Overspeed



(6) Inverter overheat

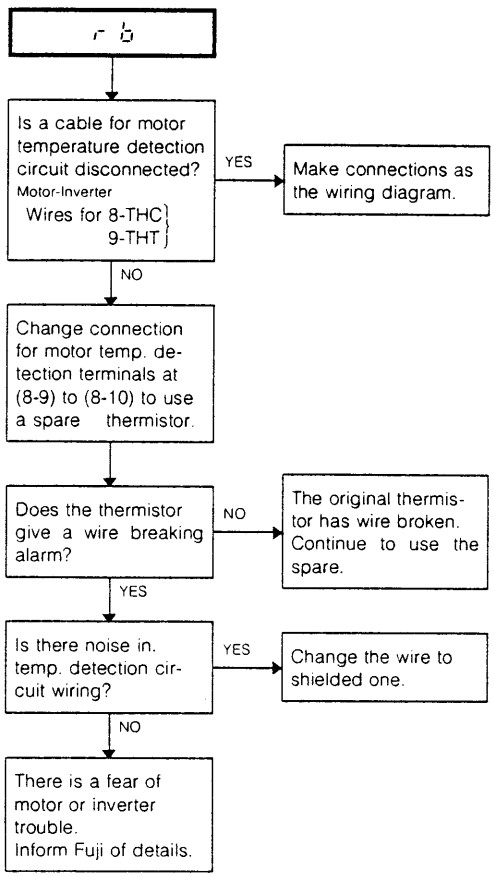


(7) Motor overheat

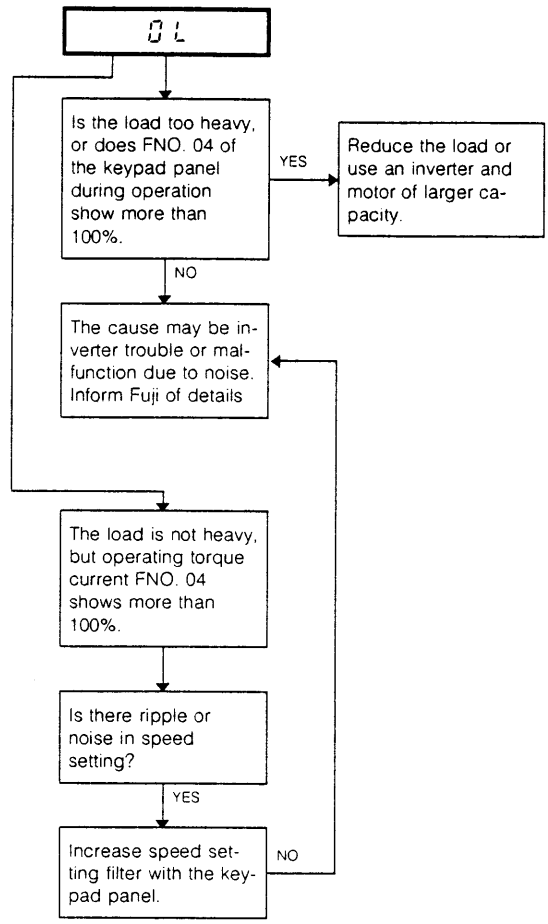


11

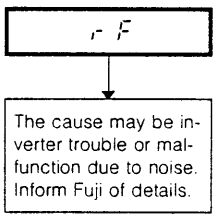
(8) Thermistor disconnection



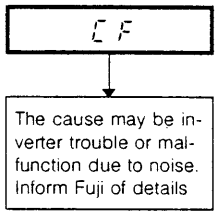
(9) Inverter overload



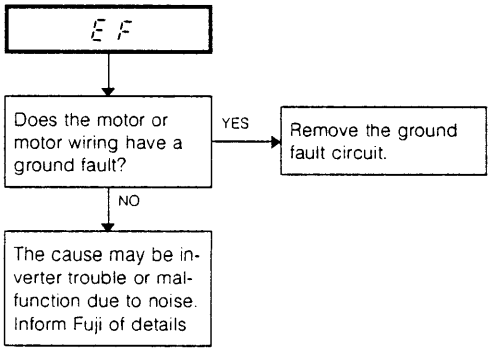
(10) Memory error



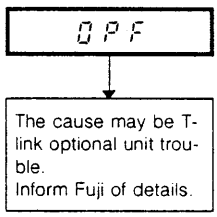
(11) Current detection abnormal



(12) Ground fault

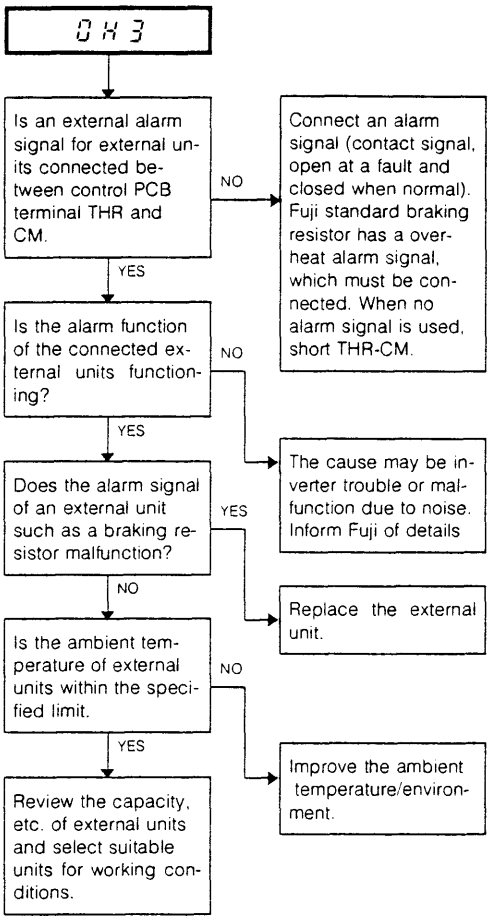


(13) T-link option error



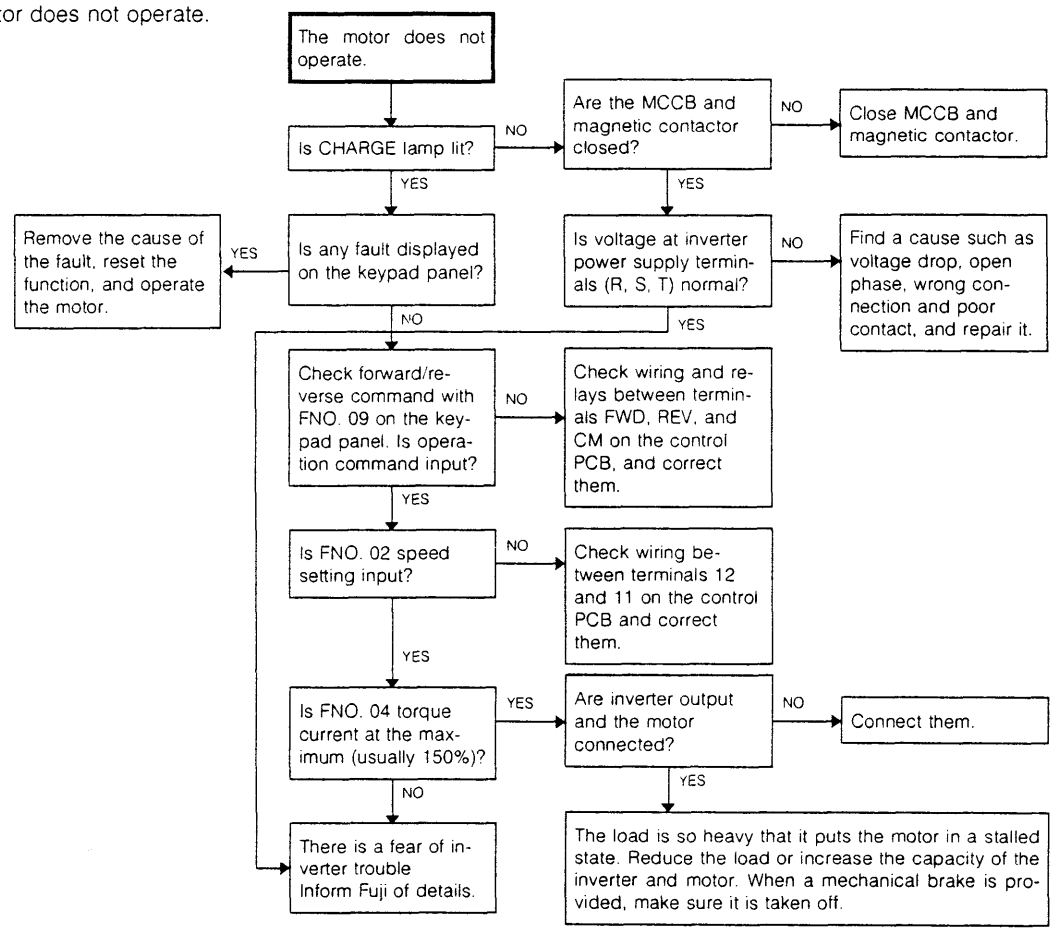
11

(14) External fault



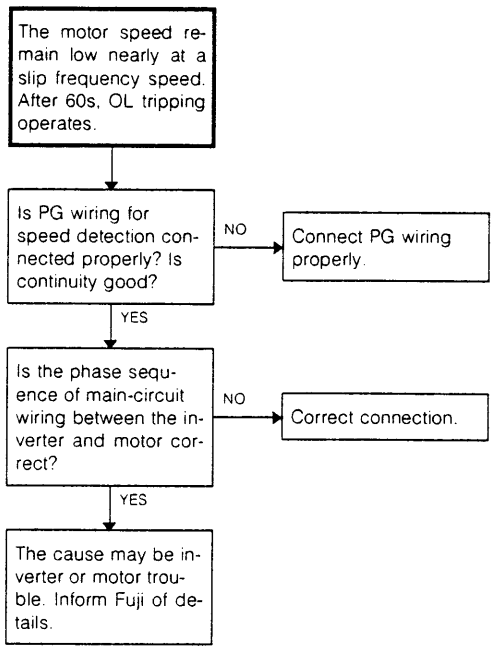
11-2 Diagnoses and steps for abnormalities

(1) The motor does not operate.

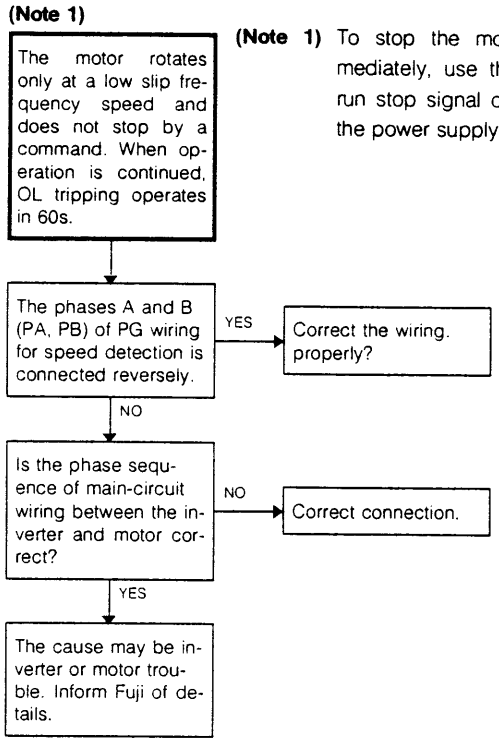


(2) The motor operates only at a low speed.

①

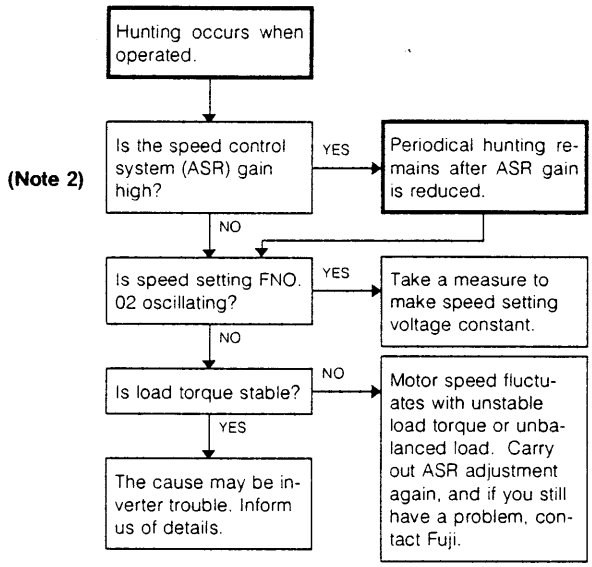


②



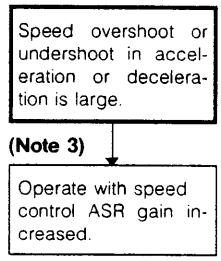
(Note 1) To stop the motor immediately, use the free-run stop signal or break the power supply.

(3) The motor shows hunting.



(Note 2) Carry out ASR adjustment with FNO. 20 and 21 on the keypad panel. Reduce FNO. 20 and increase FNO. 21 to obtain a stable state.

(4) Motor speed is unstable during acceleration and deceleration.



(Note 3) ① ASR gain can be adjusted with FNO. 20, 21 on the keypad panel. When FNO. 20 is set larger, overshoot becomes smaller. When FNO. 21 is set smaller, overshoot stabilizing time becomes shorter.

② When the GD^2 of the load is 20～30 times as large as that of the motor, hunting sometimes occurs as FNO. 20 is increased. In this case, increase FNO. 23 (speed detection filter time constant) and FNO. 21; then increase FNO. 20.

12. Options

(1) Control options

The OPC Ⅱ series is options of a PCB type to be built in the inverter. The MCA Ⅱ series is options of a separate type covered by a case.

Bus-coupled interface

Name	DI interface	AO interface	T-link interface	T-link exclusive interface
Type	OPC Ⅱ-VG3-DI	OPC Ⅱ-VG3-AO	OPC Ⅱ-VG3-T2	OPC Ⅱ-VG3-TL
Function and use	Converts 16-bit binary signals or 4-digit BCD signals into speed setting signals. (1) 16-bit binary signals 20,000/max. forward speed, Reverse is expressed by twos complement. (2) BCD signals −7999～+7999.	Outputs analog signals of inverter internal data (actual speed, speed setting, torque setting) to outside. 0～±10V DC, 2 channels.	Connects Fuji programmable controller MICREX-F with T link. RS232C interface for loader is also available. Using T link and RS232C, writing and setting of speed and parameters are made possible. The option stores back data for fault trace.	Connects Fuji programmable controller MICREX-F with T link. This is the option that eliminates RS232C function from OPC Ⅱ-VG3-T2.

NOTE: 1. At most 2 units of bus-coupled options can be mounted on an inverter. (Either one of OPC Ⅱ-VG3-T2 or OPC Ⅱ-VG3-TL is usable.)
2. To use bus-coupled options, exclusive-use cable CB-VG3-1 (for 1 option) or CB-VG3-2 (for 2 options) is required.

Analog signal interface

Name	Adder-subtracter	I/V, V/I converter	Comparator
Type	OPC Ⅱ-VG3-AD MCA Ⅱ-VG3-AD	OPC Ⅱ-VG3-IV MCA Ⅱ-VG3-IV	OPC Ⅱ-VG3-CP MCA Ⅱ-VG3-CP
Function and use	• Addition and subtraction of 2 inputs (2 circuits) • Output limiting (1 circuit) • I/O: 0～±10V DC.	Applies to the use of instrument signals as speed setting signals. • Conversion of 0～+10V DC and 4～20mA DC • I/V conversion: 1 circuit V/I conversion: 1 circuit • Input-output not isolated.	Used for level detection of speed and torque • Comparator 2 circuits (contact output) • Input: 0～±10V DC • Output: Contact signal (1c),contact capacity 250V AC, 0.3A, cos ϕ =0.3.

Name	Isolation converter	Dancer controller	F/V converter
Type	OPC Ⅱ-VG3-IA MCA Ⅱ-VG3-IA	MCA Ⅱ-PU	MCA Ⅱ-FV
Function and use	Used to isolate analog input signals when wiring distance between the inverter and other devices or the speed setting is long. • I/O: 0～±10V DC.	A PID controller for dancer control. • Input signals Synchronous oscillator: 90～121V AC, 180～253V AC, or DC voltage signal 0～±10V DC. • Output signal: 0～±10V DC	When detecting line speed with a pulse encoder, converts frequency signals into voltage signals. • Input signal Frequency: 5～40 kHz Signal mode: Voltage pulse input 12～15V or complementary line driver 5～15V • Output signal: 0～+10V DC 0～±10V DC.

NOTE: Only a unit of analog signal interface OPC Ⅱ series can be mounted on an inverter.

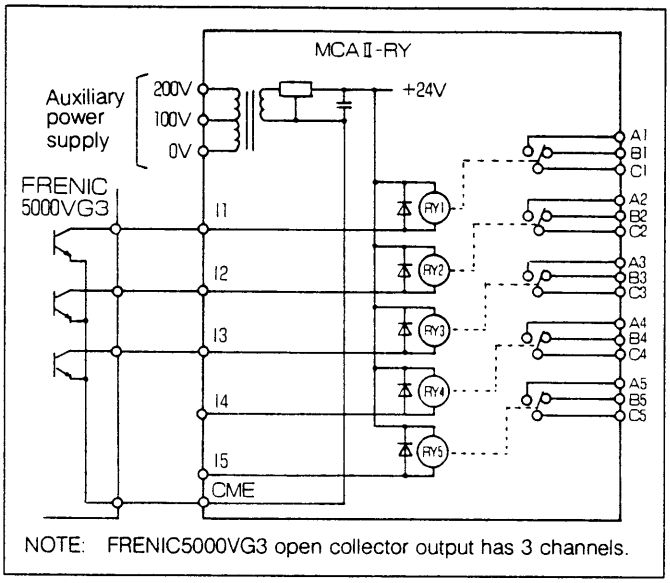
(2) Relay output unit MCA Ⅱ-RY

This unit is used to convert open-collector signals from the inverter into contact signals.

Specification

Item	Specification
Input	5-channel, relay control signal (24V DC, 20mA)
Output	5-channel contacts (250V AC, 0.3A, cos ϕ =0.3)
Aux. power supply	110V ±20%, 220V±20% 50/60Hz
Ambient temperature	−10～+50℃
Coating color	Munsell 5Y3/0.5, semigloss

Connection



NOTE: FRENIC5000VG3 open collector output has 3 channels.

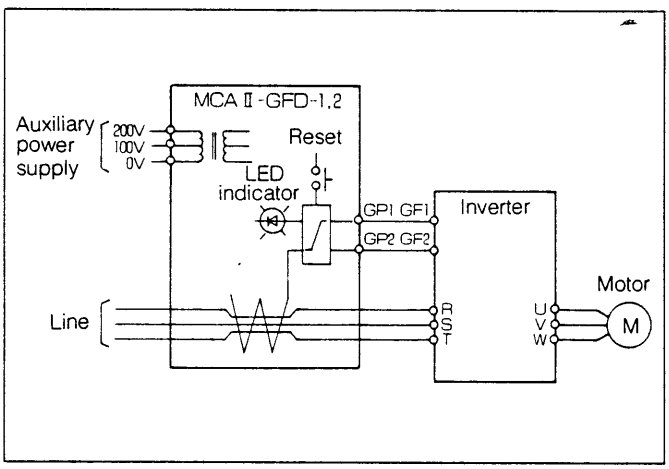
(3) Ground-fault detection unit MCA Ⅱ-GFD-1, MCA Ⅱ-GFD-2

Connect this unit on the line side of the inverter. It detects the ground fault of the inverter,output wiring, and the motor to actuate the inverter protective function. Since the ground-fault detection unit protects the inverter only, an earth leakage breaker or a ground detector relay must be connected to provide protection against personal injury and disaster.

Specification

Item	Soecification
Application	Use MCA Ⅱ-GFD-2 if 3-phase power supply cables can not go through the cable hole. Example of 600V PVC cable 〈200V〉 〈400V〉 MCA Ⅱ-GFD-1: 3.7～55kW 3.7～110kW MCA Ⅱ-GFD-2: 75～90kW 132～200kW
Rated sensitive current	10 A
Output and indication	Open-collector output (directly connected to the inverter), LED indicator.
Aux. power supply	110V±20%, 220V±20%, 50/60Hz
Ambient temp	−10～+50℃
Coating color	Munsell 5Y3/0.5, semigloss

Connection



12

(4) Braking units and resistors

Specifications

200V series		5% ED							10% ED						
Motor [kW]	Inverter type	Braking unit		Braking resistor				Con. Fig. 6-2-6	Braking unit		Braking resistor				Con. Fig. 6-2-6
		Type	Qty.	Type	Qty.	Cap. [kW]	Resist. [Ω]		Type	Qty.	Type	Qty.	Cap. [kW]	Resist. [Ω]	
0.75	FRN907VG3-2,FRN907VG3N-2	Built in the inverter	—	DBH003-2A	1	0.6	30		Built in the inverter	—	Make an inquiry as to an individual case.				—
1.5	FRN001VG3-2,FRN001VG3N-2														
2.2	FRN002VG3-2,FRN002VG3N-2														
3.7	FRN003VG3-2,FRN003VG3N-2			DB003V-21A	1	1.2	24				DB003V-22A	1	1.8	24	
5.5	FRN005VG3-2,FRN005VG3N-2			DB005V-21A	1	1.2	16				DB005V-22A	1	2.4	16	
7.5	FRN007VG3-2,FRN007VG3N-2			DB007V-21A	1	1.8	12				DB007V-22A	1	3.6	12	
11	FRN011VG3-2,FRN011VG3N-2			DB011V-21A	1	2.4	8	(a)			DB011V-22A	1	4.8	8	(a)
15	FRN015VG3-2,FRN015VG3N-2			DB015V-21A	1	3.6	6				DB015V-22A	1	7.2	6	
18.5	FRN018VG3-2,FRN018VG3N-2			DB018V-21A	1	3.6	4.5				DB018V-22A	1	7.2	4.5	
22	FRN022VG3-2,FRN022VG3N-2			DB022V-21A	1	4.8	4				DB022V-22A	1	9.6	4	
30	FRN030VG3-2			DB030V-21A	1	6.0	2.5				DB030V-22A	2 *	6X2	1.25X2	
37	FRN037VG3-2			DB037V-21A	1	7.2	2.25				DB037V-22A	2 *	7.2X2	1.125X2	(b)
45	FRN045VG3-2			DB045V-21A	1	9.6	2				DB045V-22A	2 *	9.6X2	1X2	
55	FRN055VG3-2	BU075-2A	1	DBH037-2A	2	4.8X2	3/2	(d)	Make an inquiry as to an individual case.						—
75	FRN075VG3-2	BU055-2A	2	DBH045-2A	2	6X2	2.5/2	(e)							
90	FRN090VG3-2	BU055-2A	2	DBH055-2A	2	7.2X2	2/2								

400V series		5% ED							10% ED						
Motor [kW]	Inverter type	Braking unit		Braking resistor				Con. Fig. 6-2-6	Braking unit		Braking resistor				Con. Fig. 6-2-6
		Type	Qty.	Type	Qty.	Cap. [kW]	Resist. [Ω]		Type	Qty.	Type	Qty.	Cap. [kW]	Resist. [Ω]	
3.7	FRN003VG3-4	Built in the inverter	—	DB003V-41A	1	0.8	96		Built in the inverter	—	DB003V-42A	1	1.8	96	
5.5	FRN005VG3-4,FRN005VG3N-4			DB005V-41A	1	1.2	64				DB005V-42A	1	2.4	64	
7.5	FRN007VG3-4,FRN007VG3N-4			DB007V-41A	1	1.8	48				DB007V-42A	1	3.6	48	
11	FRN011VG3-4,FRN011VG3N-4			DB011V-41A	1	2.4	32				DB011V-42A	1	4.8	32	(a)
15	FRN015VG3-4,FRN015VG3N-4			DB015V-41A	1	3.6	24				DB015V-42A	1	7.2	24	
18.5	FRN018VG3-4,FRN018VG3N-4			DB018V-41A	1	3.6	18	(a)			DB018V-42A	1	7.2	18	
22	FRN022VG3-4,FRN022VG3N-4			DB022V-41A	1	4.8	16				DB022V-42A	1	9.6	16	
30	FRN030VG3-4,FRN030VG3N-4			DB030V-41A	1	6.0	10				DB030V-42A	2 *	6X2	5X2	
37	FRN037VG3-4,FRN037VG3N-4			DB037V-41A	1	7.2	9				DB037V-42A	2 *	7.2X2	4.5X2	(b)
45	FRN045VG3-4,FRN045VG3N-4			DB045V-41A	1	9.6	8				DB045V-42A	2 *	9.6X2	4X2	
55	FRN055VG3-4	BU110-4A	1	DBH037-4A	2	4.8X2	12/2		Make an inquiry as to an individual case.						—
75	FRN075VG3-4	BU110-4A	1	DBH045-4A	2	6X2	10/2	(d)							
90	FRN090VG3-4	BU110-4A	1	DBH055-4A	2	7.2X2	7.5/2								
110	FRN110VG3-4	BU132-4A	1	Make an inquiry as to an individual case.				—							
132	FRN132VG3-4	BU110-4A	2												
160	FRN160VG3-4	BU110-4A	2												
200	FRN200VG3-4	BU132-4A	2												

Common specifications

Braking torque, %	150
Braking duty, %ED	5 (allowable duration: 5s) or 10 (allowable duration: 10s)
Protective function	When the braking unit or resistor overheats, the braking unit transistors are shut down and the inverter protective function is actuated.
Ambient temperature	−10~+50℃
Coating color	Braking unit: Munsell 5Y3/0.5, semigloss, Braking resistor: Munsell N1.2, semigloss.

* The types DB030V-22A~DB045V-22A and DB030V-42A~DB045V-42A are for the quantity of two.

(5) AC reactor for power supply coordination

Voltage	Motor, [kW]	Reactor type
200V series	0.75	ACR2-2.2
	1.5	
	2.2	
	3.7	ACR2-5.5
	5.5	
	7.5	ACR2-7.5
	11	ACR2-15
	15	
	18.5	ACR2-18.5
	22	ACR-22
	30	ACR2-37
	37	
	45	ACR2-55
	55	
	75	ACR2-75
	90	ACR2-90
400V series	3.7	ACR4-5.5
	5.5	
	7.5	ACR4-7.5
	11	ACR4-22
	15	
	18.5	
	22	
	30	ACR4-37
	37	
	45	ACR4-55
	55	
	75	ACR4-75
	90	ACR4-110
	110	
	132	ACR4-132
	160	ACR4-220
	200	

(6) Power-factor-correcting DC reactor

Voltage	Motor, [kW]	Reactor type
200V series	22	DCR2-22
	30	DCR2-30
	37	DCR2-37
	45	DCR2-45
	55	DCR2-55
	75	DCR2-75
	90	DCR2-90
400V series	22	DCR4-22
	30	DCR4-30
	37	DCR4-37
	45	DCR4-45
	55	DCR4-55
	75	DCR4-75
	90	DCR4-90
	110	DCR4-110
	132	DCR4-132
	160	DCR4-160
	200	DCR4-200

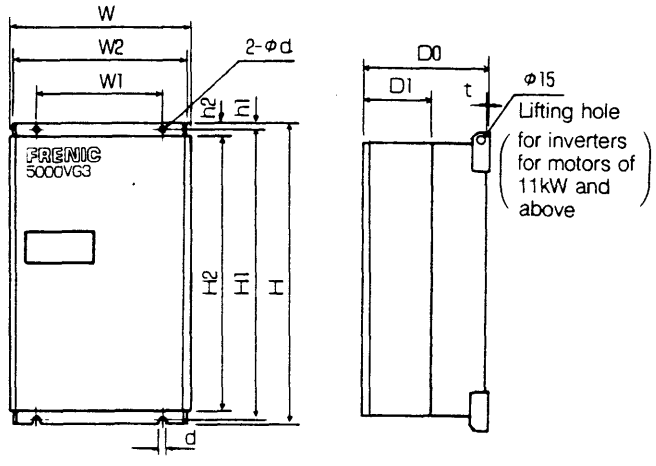
NOTE: Inverters of 55kW and above include a DC reactor as a standard component to be installed separately.

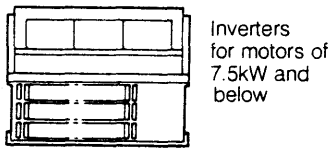
(7) Zero-phase reactor for radio noise suppression
200V series: 3.7~7.5kW: ACL-10A X 1pc.
11~90kW: ACL-10A X 4pcs.
400V series: 3.7~18.5kW: ACL-10A X 1pc.
22~200kW: ACL-10A X 4pcs.

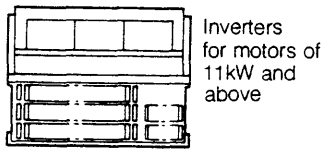
13. Dimensions

13.1 Inverters

Fig. A: In-board type







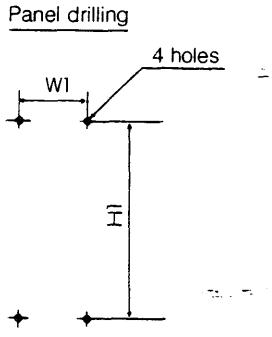
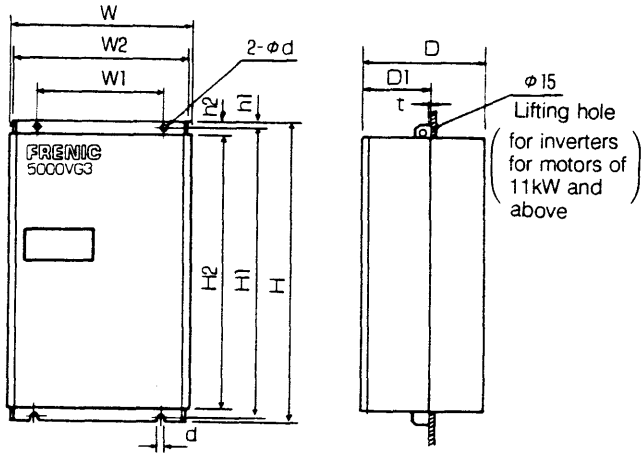
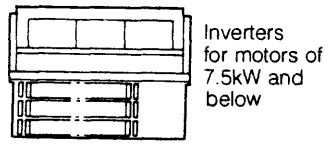
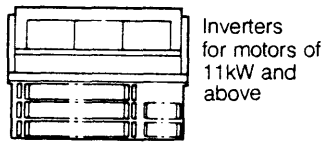
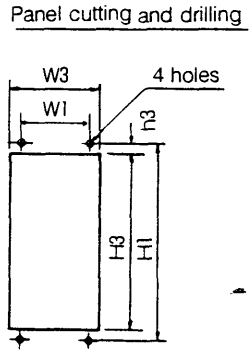


Fig. B: External-cooling type



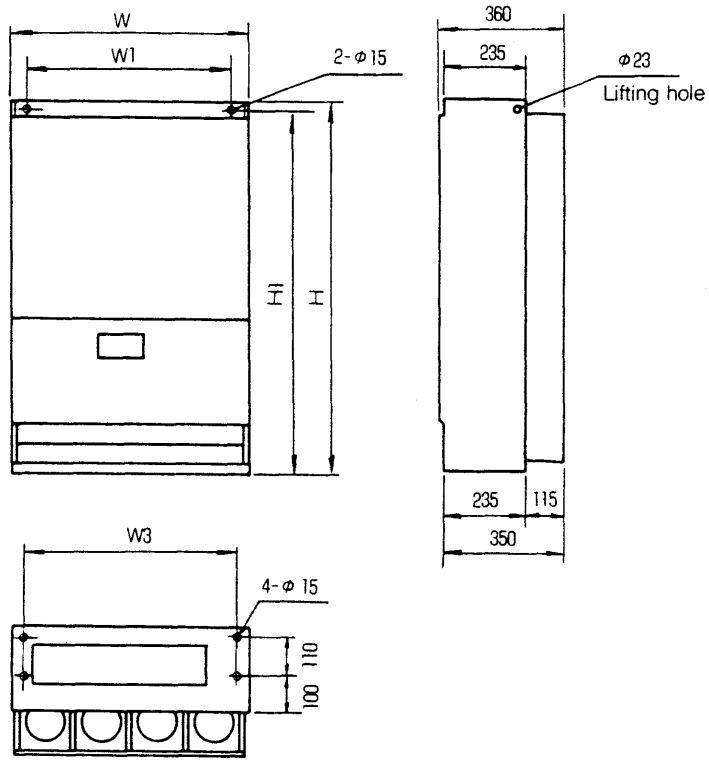


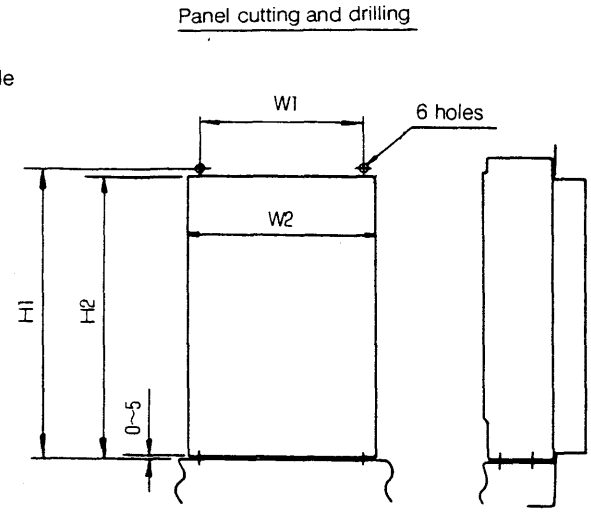




NOTE: In-board type inverters can be converted into external-cooling type ones by removing and reattaching the mounting adapters to the designated position.

Fig. C: In-board/external-cooling type





(Standard Series)
200V series

Motor [kW]	Inverter type	Fig.	Dimensions[mm]																Approx mass [kg]
			W	W1	W2	W3	H	H1	H2	H3	h1	h2	h3	D	D0	D1	d	t	
0.75	FRN907VG3-2	A B	255	155	253	246	440	425	403	410	10	21	7.5	252	255	150	7	2	14
1.5	FRN001VG3-2																		
2.2	FRN002VG3-2																		
3.7	FRN003VG3-2																		
5.5	FRN005VG3-2																		16
7.5	FRN007VG3-2		280	180	278	271	480	465	443	450									20
11	FRN011VG3-2		320	220	318	311		460	434	442	12	25	9				10		24
15	FRN015VG3-4						520	500	474	482									27
18.5	FRN018VG3-2		340	240	338	331	550	530	504	512									30
22	FRN022VG3-2																		
30	FRN030VG3-2		375	275	373	366	615	596	570	578									40
37	FRN037VG3-2		390	290	387	381	800	775	740	750	15	30	12.5				12		53
45	FRN045VG3-2																		
55	FRN055VG3-2		540	440	537	530	750	720	685	695	18	35	12.5	267	270	150	15	3.2	70
75	FRN075VG3-2	C	850	750	830	780	880	855	845	—	—	—	—	—	—	—	—	—	130
90	FRN090VG3-2																		

400V series

Motor [kW]	Inverter type	Fig.	Dimensions[mm]																Approx mass [kg]
			W	W1	W2	W3	H	H1	H2	H3	h1	h2	h3	D	D0	D1	d	t	
3.7	FRN003VG3-4	A B	280	180	278	271	440	425	403	410	10	21	7.5	252	255	150	7	2	20
5.5	FRN005VG3-4																		
7.5	FRN007VG3-4						480	465	443	450									22
11	FRN011VG3-4		320	220	318	311					12	25	9				10		
15	FRN015VG3-4						520	500	474	482									27
18.5	FRN018VG3-4																		
22	FRN022VG3-4		340	240	338	331	550	530	504	512									30
30	FRN030VG3-4		375	275	373	366	615	596	570	578									35
37	FRN037VG3-4						675	656	630	638									43
45	FRN045VG3-4																		
55	FRN055VG3-4		530	430	527	520	880	850	815	825	18	35	12.5	322	325	185	15	3.2	85
75	FRN075VG3-4																		
90	FRN090VG3-4																		95
110	FRN110VG3-4						1050	1020	985	995				337	340	200			105
132	FRN132VG3-4	C	680	580	660	610		1025	1015	—	—	—	—	—	—	—	—	—	135
160	FRN160VG3-4		850	750	830	780													170
200	FRN200VG3-4																		

13

(Low noise series)
200V series

Motor [kW]	Inverter type	Fig.	Dimensions[mm]																Approx mass [kg]
			W	W1	W2	W3	H	H1	H2	H3	h1	h2	h3	D	D0	D1	d	t	
0.75	FRN907VG3N-2	A B	255	155	253	246	440	425	403	410	10	21	7.5	252	255	150	7	2	14
1.5	FRN001VG3N-2																		
2.2	FRN002VG3N-2																		
3.7	FRN003VG3N-2																		
5.5	FRN005VG3N-2																		16
7.5	FRN007VG3N-2		280	180	278	271	480	465	443	450									20
11	FRN011VG3N-2		320	220	318	311		460	434	442	12	25	9				10		24
15	FRN015VG3N-4						520	500	474	482									27
18.5	FRN018VG3N-2		340	240	338	331	550	530	504	512									30
22	FRN022VG3N-2		375	275	373	366	615	596	570	578									40

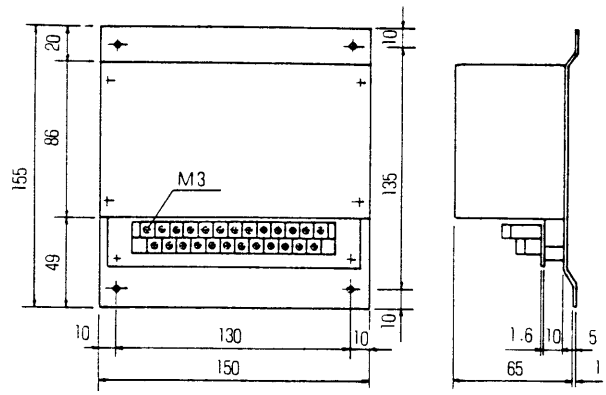
400V series

Motor [kW]	Inverter type	Fig.	Dimensions[mm]																Approx mass [kg]
			W	W1	W2	W3	H	H1	H2	H3	h1	h2	h3	D	D0	D1	d	t	
5.5	FRN005VG3N-4	A B	280	180	278	271	440	425	403	410	10	21	7.5	252	255	150	7	2	20
7.5	FRN007VG3N-4						480	465	443	450									22
11	FRN011VG3N-4		320	220	318	311	520	500	474	482	12	25	9				10		27
15	FRN015VG3N-4						560	540	514	522									28
18.5	FRN018VG3N-4																		
22	FRN022VG3N-4		375	275	373	366	615	596	570	578									35
30	FRN030VG3N-4																		
37	FRN037VG3N-4		530	430	527	520	830	800	765	775	18	35	12.5	280	280	160	15	3.2	—
45	FRN045VG3N-4																		

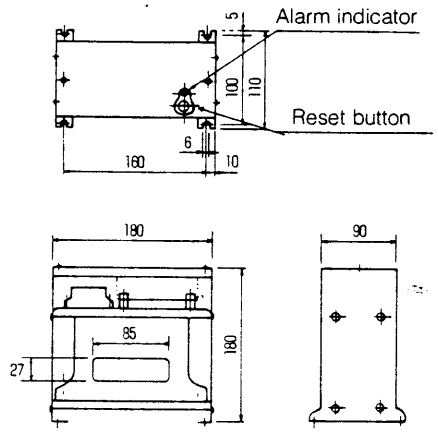
13

13-2 Options

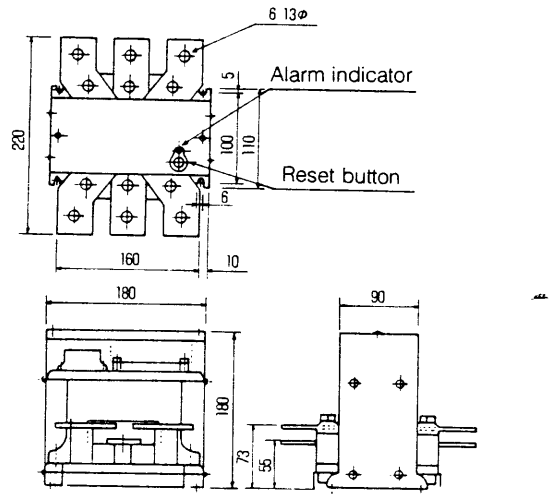
(1) Relay output unit MCA Ⅱ-RY
Mass: 1 kg



(2) Ground fault detection unit
MCA Ⅱ-GFD-1
Mass: 2 kg



MCA Ⅱ-GFD-2
Mass: 4 kg



(3) Braking unit

Voltage	Type	Fig.	Dimensions [mm]						Terminal arrangement and screw size			Mass
			W	W1	H	H1	H2	D	Fig.	P,N,DB	1,2,E,(I1,I2,O1,O2)	[kg]
200V series	BU055-2A	A	230	130	240	225	200	170	C	M6	M4	7
	BU075-2A		250	150	370	355	330	170	B	M8		11
400V series	BU110-4A	A	250	150	400	385	360	170	C	M6	M4	12
	BU132-4A								D	M8		

Fig. A

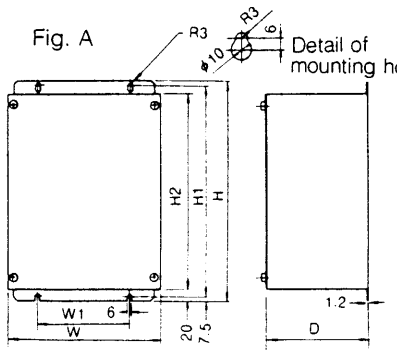


Fig. B

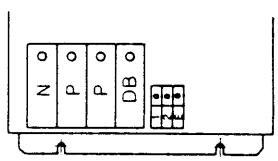


Fig. C

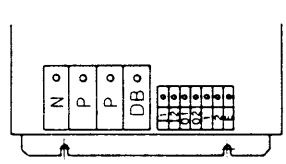
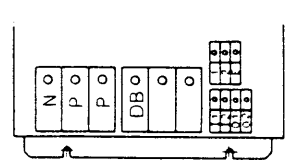
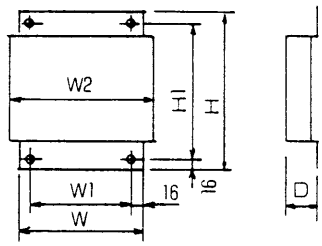


Fig. D



13

(4) Braking resistor

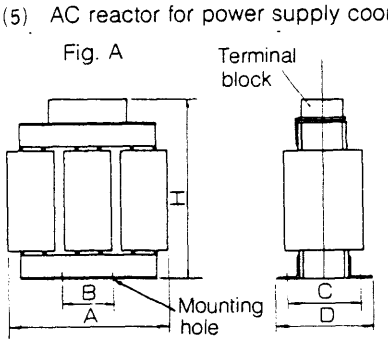


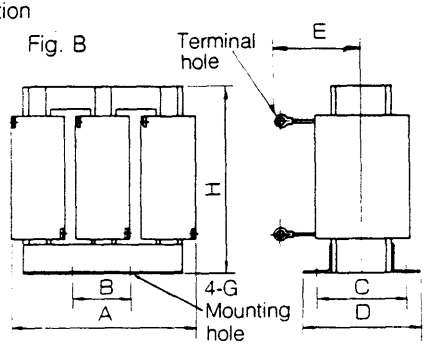
Category	Type	Case dimension [mm]						Mounting hole	No. of cases	Terminals		Approx mass [kg]
		W	W1	W2	H	H1	D			Main circuit	Temp. detect.	
200V series	DBH003-2A	330	298	330	242	210	140	φ8	1	M4	M4	4
	DB003V-21A	400	368	400	280	248						5
	DB005V-21A											
	DB007V-21A	400	368	400	480	448	140	φ10				7
	DB011V-21A											8
5% ED	DB015V-21A	400	368	400	660	628	140			M5		11
	DB018V-21A											
	DB022V-21A	400	368	400	660	628	240					15
	DB030V-21A									M6		20
	DB037V-21A	400	368	405	750	718	240					25
	DB045V-21A	400	368	405	750	718	340					30
	DBH037-2A	400	368	400	660	628	240		2	M5		30(15×2)
	DBH045-2A									M6		40(20×2)
	DBH055-2A	400	368	405	750	718	240					50(25×2)
200V series	DB003V-22A	400	368	400	480	448	140	φ10	1	M4	M4	7
	DB005V-22A											8
	DB007V-22A	400	368	400	660	628	140			M5		11
	DB011V-22A	400	368	400	660	628	240					15
10% ED	DB015V-22A	400	368	405	750	718	240			M6		25
	DB018V-22A											
	DB022V-22A	400	368	405	750	718	340					30
	DB030V-22A	400	368	400	660	628	240		2	M6		40(20×2)
	DB037V-22A	400	368	405	750	718	240		**(Note)**			50(25×2)
	DB045V-22A	400	368	405	750	718	340			M8		60(30×2)

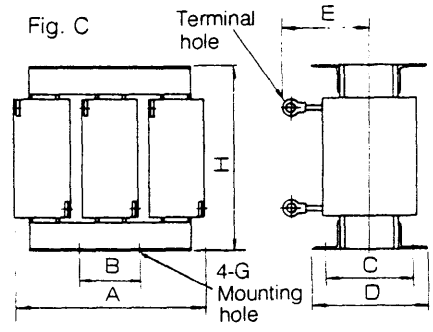
Category	Type	Case dimension [mm]						Mounting hole	No. of cases	Terminals		Approx. mass [kg]
		W	W1	W2	H	H1	D			Main circuit	Temp. detect.	
400V series	DB003V-41A	420	388	420	280	248	140	φ8	1	M4	M4	5
	DB005V-41A	420	388	420	480	448	140	φ10				7
	DB007V-41A											
	DB011V-41A											8
	DB015V-41A	420	388	420	660	628	140					11
	DB018V-41A											
5% ED	DB022V-41A	420	388	420	660	628	240					15
	DB030V-41A									M5		20
	DB037V-41A	420	388	425	750	718	240					25
	DB045V-41A	420	388	425	750	718	340					30
	DBH037-4A	420	388	420	660	628	240		2	M4		30(15×2)
	DBH045-4A									M5		40(20×2)
	DBH055-4A	420	388	425	750	718	240					50(25×2)
400V series	DB003V-42A	420	388	420	480	448	140	φ10	1	M4	M4	8
	DB005V-42A	420	388	420	660	628	140					11
	DB007V-42A											
	DB011V-22A	420	388	420	660	628	240					15
10% ED	DB015V-42A	420	388	425	750	718	240			M5		25
	DB018V-42A											
	DB022V-42A	420	388	425	750	718	340					30
	DB030V-42A	420	388	420	660	628	240		2			40(20×2)
	DB037V-42A	420	388	425	750	718	240		**(Note)**			50(25×2)
	DB045V-42A	420	388	425	750	718	340					60(30×2)

(Note) The types DB030V-22A~DB045V-22A and DB030V-42A~DB045V-42A are for the quantily of two.

(5) AC reactor for power supply coordination

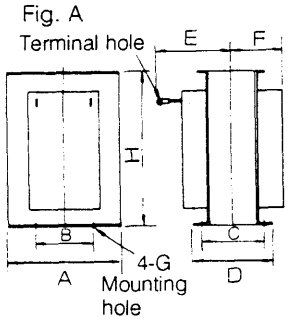


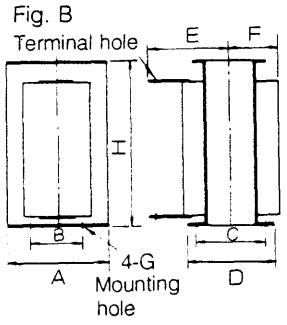


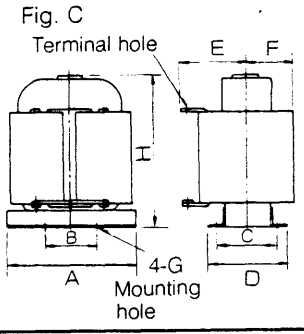


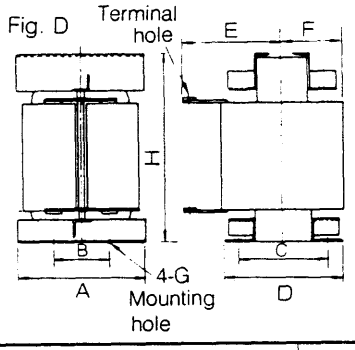
Voltage	Motor [kW]	Reactor type	Fig.	Dimension [mm] A	B	C	D	E	G	H	Terminal hole	Mass [kg]
200V series	0.75	ACR2-2.2	A	185	60	65	86	—	7X11	157	M5	4
	1.5											
	2.2											
	3.7	ACR2-5.5	A	185	60	80	100	—	7X10	157	M5	6
	5.5											
	7.5	ACR2-7.5	B	120	65	80	96	98	6X10	93	6.4	4
	11	ACR2-15	B	180	60	75	96	102	7X11	115	8.4	6
	15											
	18.5	ACR2-18.5	B	180	60	75	96	102	7X11	115	8.4	6.5
	22	ACR-22	B	180	60	75	96	102	7X11	170	8.4	8
	30	ACR2-37	B	190	60	90	120	170	7X11	190	8.4	11
	37											
	45	ACR2-55	C	190	60	90	120	200	7X10	190	13	12
	55											
	75	ACR2-75	C	250	100	90	120	200	9X14	250	13	25
	90	ACR2-90	C	285	190	120	158	190	12X20	210	13	26
400V series	3.7	ACR4-5.5	B	120	65	70	90	98	6X10	93	6.4	3
	5.5											
	7.5	ACR4-7.5	B	120	65	80	96	98	6X10	93	6.4	4
	11	ACR4-22	B	180	60	75	96	102	7X10	170	6.4	8
	15											
	18.5											
	22											
	30	ACR4-37	B	190	60	90	120	170	7X10	190	8.4	11
	37											
	45	ACR4-55	C	190	60	90	120	200	7X10	190	10.5	12
	55											
	75	ACR4-75	C	190	60	90	126	197	7X10	190	11	12
	90	ACR4-110	C	250	100	105	136	202	9.5X18	245	13	24
	110											
	132	ACR4-132	C	250	100	115	146	210	9.5X18	250	13	32
	160	ACR4-220	C	320	120	110	150	240	12X20	300	13	40
	200											

(6) Power-factor-correcting DC reactor





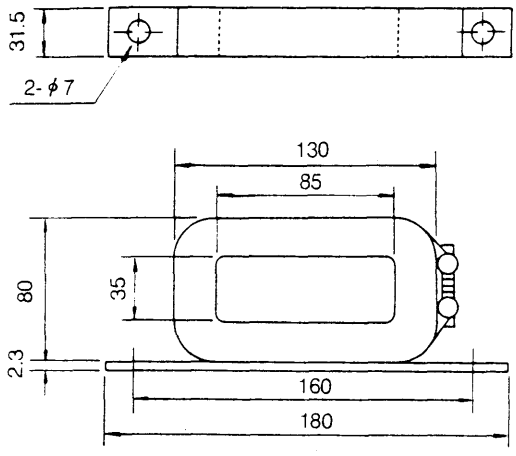
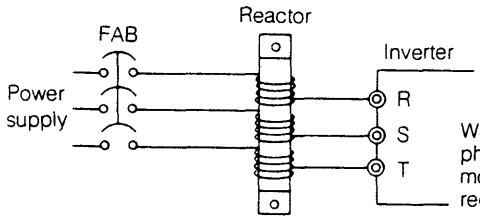
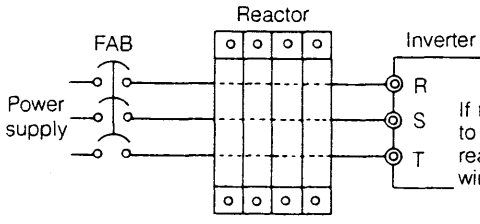




Voltage	Motor [kW]	Reactor type	Fig.	Dimension [mm] A	B	C	D	E	F	G	H	Terminal hole	Mass [kg]
200V series	22	DCR2-22	A	155	75	90	116	105	70	9×15	210	10.5	14
	30	DCR2-30	A	146	75	100	126	130	70	9×15	210	10.5	16
	37	DCR2-37	B	156	80	100	126	110	70	9×15	260	10	19
	45	DCR2-45	B	156	80	110	136	130	75	9×15	260	10	23
	55	DCR2-55	B	170	85	110	136	130	75	9×15	300	10	28
	75	DCR2-75	C	200	80	95	126	180	75	10×16	240	12	19
	90	DCR2-90	D	180	100	100	131	150	75	10×15	275	15	22
400V series	22	DCR4-22	A	155	112	105	126	150	70	7×11	130	6.4	12
	30	DCR4-30	A	150	75	85	111	155	70	9×15	210	8.4	14
	37	DCR4-37	A	146	75	100	126	155	70	9×15	210	8.4	17
	45	DCR4-45	A	146	75	115	141	180	75	9×15	210	10.5	21
	55	DCR4-55	A	146	75	130	156	190	85	9×15	210	10.5	25
	75	DCR4-75	D	200	70	120	151	160	80	10×16	250	10.5	25
	90	DCR4-90	D	220	70	140	171	165	85	10×16	280	13	32
	110	DCR4-110	D	220	70	150	181	170	95	10×16	290	13	36
	132	DCR4-132	D	190	80	146	177	180	90	11	360	13	40
	160	DCR4-160	D	220	90	140	171	200	90	12×20	350	12	45
	200	DCR4-200	D	230	100	140	181	180	110	12×20	310	15	50

13

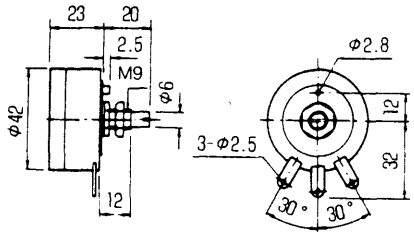
(7) Zero-phase reactor for radio noise suppression

Dimension [mm]	How to use
Type ACL-10A  Mass: 1.7kg	 Wind the wire of each phase four turns or more in the same direction.  If the wire is too thick to wind, stack four reactors and run the wires through them.

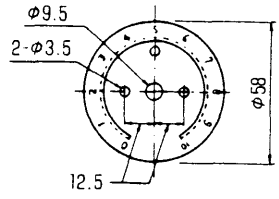
(8) Control circuit parts

(i) Speed setting unit

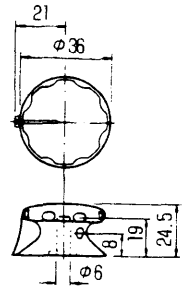
Type WAR3W-1kΩ
(B characteristic)



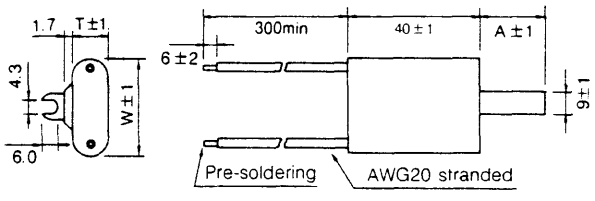
Scale plate Type 60P



Knob Type 40N



(ii) Surge absorber



Application	Type	Capacitance [μF]	Resistance [Ω]	Dimensions [mm]		
				W	T	A
Control relay timer	S1-B-O	0.1	200 (1/2W)	17.5	9.1	20.0
Magnetic contactor	S2-A-O	0.2	500 (1/2W)	27.5	10.4	30.0

For circuit voltage 250V or less (Okaya Electric Industries make)

14. Suitable Wiring Materials

Voltage	Motor [kW]	Inverter type	VG3/VG3N Power source (Inverter Input) side (R. S. T) Without AC reactor: MCCB (interrupting current) [kA]	Magnetic contactor	wire size [mm²]	With AC reactor: MCCB (interrupting current) [kA]	Magnetic contactor	wire size [mm²]	Inverter output side (U. V. W) wire size [mm²]	VG3 DC reactor (P1. P) wire size [mm²]	VG3 VG3N DB resistor (P. DB. N) wire size [mm²]
200V series	0.75	FRN907VG3-2, FRN907VG3N-2	EA53B/15 (5)	SC-05	3.5 (3.5)	EA53B/15	SC-05	3.5 (3.5)	3.5 (3.5)	—	3.5 (3.5)
	1.5	FRN001VG3-2, FRN001VG3N-2	EA53B/20 (5)								
	2.2	FRN002VG3-2, FRN002VG3N-2	EA53B/30 (5)	SC-5-1		EA53B/20					
	3.7	FRN003VG3-2, FRN003VG3N-2	EA53B/30 (5)	SC-2N	3.5×2 (5.5)	EA53B/30	SC-5-1	5.5 (5.5)	3.5 (3.5)		
	5.5	FRN005VG3-2, FRN005VG3N-2	EA53B/50 (5)	SC-2SN	14 (5.5)	EA53B/40	SC-1N		8 (3.5)		
	7.5	FRN007VG3-2, FRN007VG3N-2	EA63B/60 (5)	SC-3N	8×2 (14)	EA53B/50	SC-2N	8 (5.5)	14 (5.5)	—	
	11	FRN011VG3-2, FRN011VG3N-2	EA103B/75 (25)	SC-4N	14×2 (22)	EA63B/60	SC-3N	14 (14)	22 (14)		5.5 (3.5)
	15	FRN015VG3-2, FRN015VG3N-2	EA103B/100 (25)	SC-5N	38 (22)	EA103B/75		14×2 (22)	38 (14)		
	18.5	FRN018VG3-2, FRN018VG3N-2	EA203B/125 (25)	SC-6N	60 (38)	EA103B/100	SC-5N	38 (22)	38 (22)		
	22	FRN022VG3-2, FRN022VG3N-2	EA203B/150 (25)			EA203B/125	SC-6N	60 (38)	60 (22)	60 (22)	8 (5.5)
	30	FRN030VG3-2	EA203B/175 (25)	SC-8N	38×2 (60)	EA203B/150	SC-7N	38×2 (38)	38×2 (38)	38×2 (38)	
	37	FRN037VG3-2	EA203B/200 (25)	SC-10N	60×2 (60)	EA203B/175	SC-8N	38×2 (60)	60×2 (60)	38×2 (60)	14 (5.5)
	45	FRN045VG3-2	EA403A/250 (35)	SC-11N	60×2 (100)	EA203B/225	SC-10N	60×2 (60)	60×2 (60)	60×2 (60)	22 (8)
	55	FRN055VG3-2	EA403A/300 (35)		100×2 (100)	EA403A/250	SC-11N	100×2 (100)	100×2 (100)	100×2 (100)	22 (14)
	75	FRN075VG3-2				EA403A/300			100×2 (150)	150×2 (150)	38 (14)
	90	FRN090VG3-2	EA403A/350 (35)	SC-12N	150×2 (150)	EA403A/350	SC-12N	150×2 (150)	150×2 (150)	150×2 (200)	22×2 (14×2)
400V series	3.7	FRN003VG3-4	EA53B/20 (2.5)	SC-5-1	3.5 (3.5)	EA53B/15	SC-05	3.5 (3.5)	3.5 (3.5)	—	3.5 (3.5)
	5.5	FRN005VG3-4, FRN005VG3N-4	EA53B/30 (2.5)	SC-1N			SC-5-1				
	7.5	FRN007VG3-4, FRN007VG3N-4		SC-2N	5.5 (3.5)	EA53B/20	SC-1N				
	11	FRN011VG3-4, FRN011VG3N-4	EA53B/40 (2.5)	SC-2SN	8 (5.5)	EA53B/30	SC-2N	5.5 (3.5)	8 (3.5)		
	15	FRN015VG3-4, FRN015VG3N-4	EA53B/50 (2.5)		14 (5.5)	EA53B/40	SC-2SN	14 (5.5)	14 (5.5)		
	18.5	FRN018VG3-4, FRN018VG3N-4	EA63B/60 (2.5)	SC-3N	22 (14)	EA53B/50			14 (5.5)		
	22	FRN022VG3-4, FRN022VG3N-4	EA103B/75 (10)			EA63B/60	SC-3N	14 (14)	22 (8)	14 (14)	
	30	FRN030VG3-4, FRN030VG3N-4	EA103B/100 (10)	SC-5N	14×2 (22)	EA103B/75	SC-4N	14×2 (14)	38 (14)	14×2 (14)	
	37	FRN037VG3-4, FRN037VG3N-4	EA203B/125 (15)	SC-6N	60 (22)	EA103B/100	SC-5N	38 (22)	38 (22)	38 (22)	5.5 (3.5)
	45	FRN045VG3-4, FRN045VG3N-4	EA203B/150 (15)	SC-7N	60 (38)	EA203B/125	SC-6N	60 (22)	60 (22)	60 (22)	8 (3.5)
	55	FRN055VG3-4			38×2 (38)	EA203B/150	SC-7N	60 (38)	60 (38)	60 (38)	14 (5.5)
	75	FRN075VG3-4						38×2 (38)	38×2 (60)	38×2 (60)	
	90	FRN090VG3-4	EA203B/200 (15)	SC-8N	60×2 (60)	EA203B/175	SC-8N	38×2 (60)	60×2 (60)	60×2 (60)	22 (8)
	110	FRN110VG3-4	EA203B/225 (15)	SC-10N		EA203B/225	SC-10N	60×2 (60)	60×2 (100)	100×2 (100)	22 (14)
	132	FRN132VG3-4	EA403A/300 (22)	SC-11N	100×2 (100)	EA403A/250	SC-11N	100×2 (100)	100×2 (100)		38 (22)
	160	FRN160VG3-4	EA403A/400 (22)	SC-12N		EA403A/300	SC-12N		100×2 (150)	150×2 (150)	22×2 (8×2)
	200	FRN200VG3-4			150×2 (150)	EA403A/400		150×2 (150)	150×2 (200)	200×2 (200)	22×2 (14×2)

* The figure in ( ) shows an interrupting current.

(Note 1) When you use the S series of molded-case circuit breakers (FAB) and the EG or the SG series of earth leakage circuit breakers (ELCB), make the rated current equivalent.

(Note 2) Wire sizes are based on 600V PVC wires. The figures in ( ) show wire sizes of WL1 wires: Furukawa Electric 600V flame-retarded lead wires or FSLC: Furukawa Electric switchboard wiring wires BOARDREX.

(Note 3) When you select MCCB, examine the interrupting current.

(Note 4) Wire sizes for the braking (P, DB, N) circuit are based on the braking duty of 5% ED.

(Note 5) Use shielded control PVC-insulated PVC-sheathed cables (CVVS) of 2mm² or its equivalent for shielded wiring to the pulse encoder for speed detection, NTC thermistor, and analog meters (speed meter and load meter).
Use 1.25mm² wires for connection to the other control circuit terminals.

(Note 6) Use 3.5mm² wires for connection to RO and TO terminals.

(Note 7) Use wires of 2mm² or more for inverter unit grounding E (G).

Appendix

FRENIC 5000VG3/VG3N Parameter setting list

Customer : _____ **INV type : FRN VG3/VG3N-** _____

Order Sheet : _____ **Serial No. :** _____

Application : _____ **Test Date :** _____

FNO.	Name	Setting at works	Entry	FNO.	Name	Setting at works	Entry
10	Set data protection (Basic parameters 11~3F)	0		50	Set data protection (Definitions ~8F)	0	
11	Soft start/stop acc. time 1	5.00		51	Max. motor speed	1500.	
12	Soft start/stop dec. time 1	5.00		52	Motor base speed	1500.	
13	Soft start/stop range of S-curve	0		53	Use of DC braking	0	
14	Multistep speed setting 1	0.00		54	Use of V limit function	1	
15	Multistep speed setting 2	0.00		55	DC braking time	0.1	
16	Multistep speed setting 3	0.00		57	Speed limiter (peak limiting)	100	
17	Multistep speed setting 4	0.00		58	Definition of operation mode (1)	0	
18	Multistep speed setting 5	0.00		59	Definition of operation mode (2)	0	
19	Soft start/stop acc. time 2	5.00		5A	Definition of speed setting mode (1)	0	
1A	Soft start/stop dec. time 2	5.00		5B	Definition of forward and reverse commands	0	
1B	Speed setting input gain	1.00		5C	Load speed conversion factor	1.00	
20	ASR P (1)	20.0		5D	Definition of speed detecting sections	0	
21	ASR I (1)	0.040		5E	Definition of speed setting mode (2)	0	
22	Speed setting filter time constant (1)	0.040		5F	Slow speed setting for U/D unit	0	
23	Speed detection filter time constant (1)	0.005		60	Definition of torque limiting mode	0	
24	ASR P (2)	20.0		61	Definition of torque limit 1/torque bias setting 1	0	
25	ASR I (2)	0.040		62	Definition of torque limit 2/torque bias setting 2	0	
26	Speed setting filter time constant (2)	0.040		63	Definition of torque limit 3/torque bias setting 3	0	
27	Speed detection filter time constant (2)	0.005		64	Definition of torque limit 4	0	
28	Droop	0.0		65	Use of external AI for torque command	0	
29	ASR P changeover ramp time constant	1.00		66	Definition of magnetic flux setting	0	
2A	Torque limit 1/torque bias setting 1	150		70	Definition of LM terminals	0	
2B	Torque limit 2/torque bias setting 2	10		71	Definition of SM terminals	0	
2C	Torque limit 3/torque bias setting 3	150		72	Definition of DI (X1~X4, X6, X7)	0	
2D	Torque limit 4	150		73	Definition of DI (X5)	5	
2E	Magnetic flux setting level	100		74	Definition of DO (Y1~Y5)	0	
2F	Light load magnetic flux setting level	25		75	Definition of DO (RY)	1	
30	Zero speed detection level	0.5		76	Definition of AI (AI1)	0	
31	Optional speed detection level (absolute value)	100		77	Definition of AI (AI2)	2	
32	Optional speed detection level (with polarity)	100		78	Definition of AO (AO)	0	
33	Speed arrival detection level	3.0		79	Definition of AO (AO2, AO3)	0	
34	Speed agreement detection level	3.0		7A	No. of motor poles, pulse encoder specification	7	
35	Torque detection level	100		7B	V1 enabled or not	1	
36	Overload prediction level	90		7C	Selection of motor current's output	12	
37	Motor overheat prediction factor	140		80	Conversion factor for speed setting BCD input	1000	
38	Load meter output calibration factor	1.00		81	Definition of initial data for UP/DOWN setting unit	0	
39	Speed meter output calibration factor	1.00		82	Transmitted data writing disabled or not	1	
3A	Motor stop count in simple position control	8000		83	Transmission ID code	00	
3B	Selection of motor sound tone	0		86	AI1 filter	0.010	
				87	AI2 filter	0.010	
				97	Trace data mode	2	

Record of revisions

* Manual No. stated at the right bottom on the front cover.

Date of printing	*Manual No.	Contents of revision
July 1991	INR-HF50168-E	First printing
April 1994	INR-HF50168a-E	Revised a. SI unit, Supplement of VG3N series and 0.75~2.2kW VG3. Supplement of FNO. 3B, 54, 7C etc.

Fuji Electric Co., Ltd.

〒100 Shin Yurakucho Building
1-12-1 Yurakucho Chiyoda-ku Tokyo, Japan
Tel: 03-3211-7111

Issued by: Fuji Electric Co., Ltd. Kobe Factory.

〒651-22 1-1, Takatsukadai 4-chome, Nishi-ku,
Kobe-city, Japan
Tel: 078-991-2111