FUJI Inverters FVR-K7S-2EX

0.2-4.0KW (1/3-5.5HP)

Instruction Manual

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Fuji Electric Co., Ltd.

Keypad panel

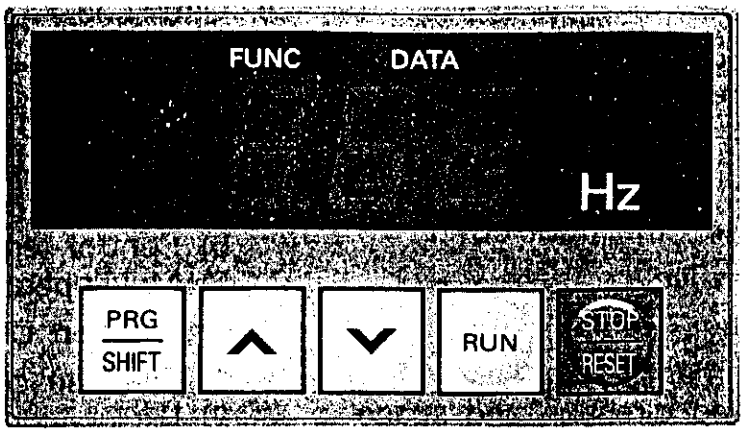
(1) Names And Functions

Function indication

- Function code is indicated by the 1st and 2nd digit (programming mode)
- Setting frequency, output frequency, alarm messages are indicated (operating mode)

Data indication

- Data code is indicated by the lower 2nd and 3rd digit (programming mode)
- Setting frequency, output frequency, alarm messages are indicated (operating mode)



Program key (Shift key)

- Programming
- Select & set function

Stop key (Reset key)

- Stopping
- Reset trip mode

Up/Down keys

- Individual data value setting (programming mode)
- Frequency setting (operating mode)

Run key

- Running

(2) Setting The Function And Data Codes

		STOP MODE		RUN MODE	
		Key operation	LED indication	Key operation	LED indication
Operating mode	Frequency setting	Set output frequency by using [∧][∨] key.	Setting frequency is blinking. 	Set output frequency by using [∧][∨] key.	Output frequency is indicated. 
Programming code	Function code selection	Select programming mode by pressing [PRG/SHIFT] key. (Access every function code)	1st and/or 2nd digit → Blinking 2nd and/or 3rd digit → Indication 	Select programming mode by pressing [PRG/SHIFT] key. (Access only limited function code. Please refer to chapter 9)	1st and/or 2nd digit → Blinking fast 2nd and/or 3rd digit → Indication 
	Data value setting	Set data value using [∧][∨] key then press [PRG/SHIFT] key. Data will enter into non-volatile memory and automatically shift to next function code. Setting frequency indicates following [F].	1st and/or 2nd digit → Blinking 2nd and/or 3rd digit → Indication 	Set data value using [∧][∨] key then press [PRG/SHIFT] key. Data will enter into non-volatile memory and automatically shift to next function code. Output frequency indicates following [6].	1st and/or 2nd digit → Blinking fast 2nd and/or 3rd digit → Indication 

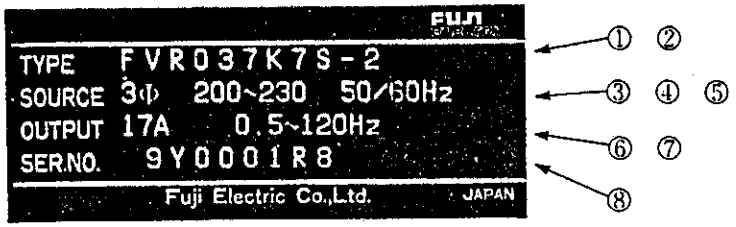
1. Introduction

Before installing or operating the inverter, please read this manual carefully to ensure maximum performance.

2. Visual Inspection Of The Inverter Upon Receipt

Upon receipt of the inverter, carefully inspect that it is as specified when ordering, referring to the name plate on the front cover.

NAME PLATE DESCRIPTION



① Applicable motor
002 → 0.2kw (1/3HP)
004 → 0.4kw (1/2HP)
008 → 0.8kw (1HP)
015 → 1.5kw (2HP)
022 → 2.2kw (3HP)
040 → 4.0kW(5.5HP)

② Input power supply
2EX→200V 3φSeries

③ Phase
3ø → 3 phase

④ Allowable variation;200~230V

⑤ Input frequency; 50/60Hz

⑥ Rated output current
1.5A → 002 (0.2kw, 1/3HP)
3.0A → 004 (0.4kw, 1/2HP)
5.0A → 008 (0.8kw, 1HP)
8.0A → 015 (1.5kw, 2HP)
11.0A → 022 (2.2kw, 3HP)
17.0A → 040(4.0kW, 5.5HP)

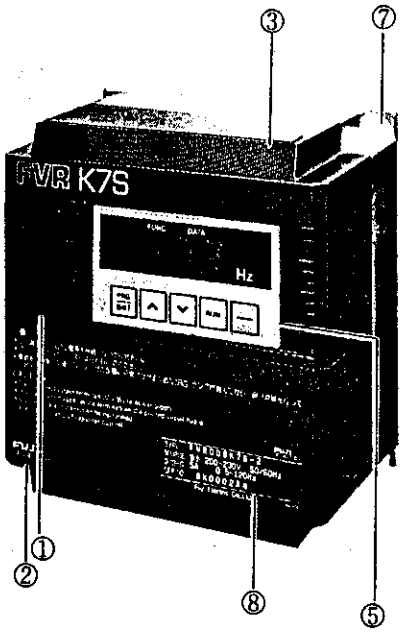
⑦ Output frequency; 0.5 ~ 120Hz

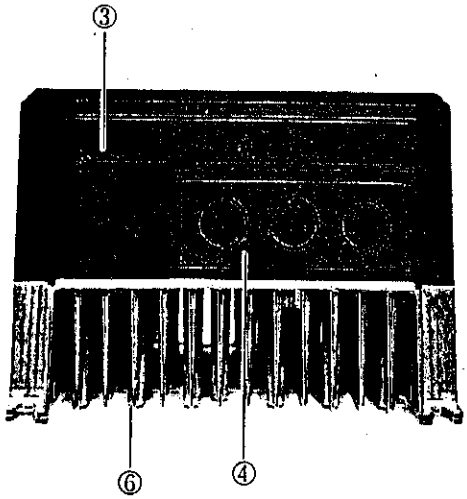
⑧ Serial number

3. Construction

(1) Names

FVR-K7S series have IP40 construction, but removable cable inlet plate allows easy wiring.

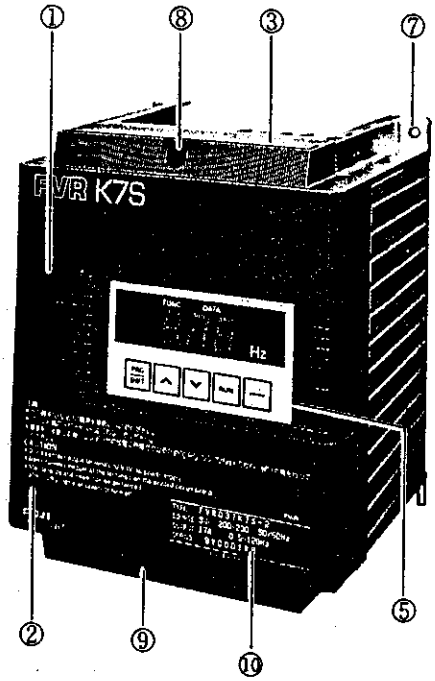


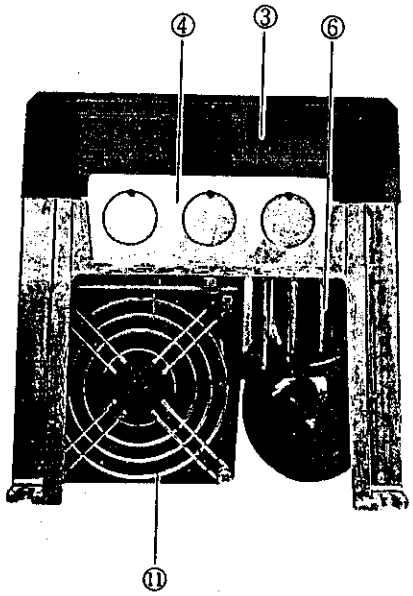


① Inverter cover
② Terminal cover
③ Ventilation hole blind plate
④ Cable inlet plate
⑤ Keypad panel
⑥ Heat sink
⑦ Mounting hole
⑧ Name plate

Rubber bushing
(provided loose)

FVR002~008K7S-2EX





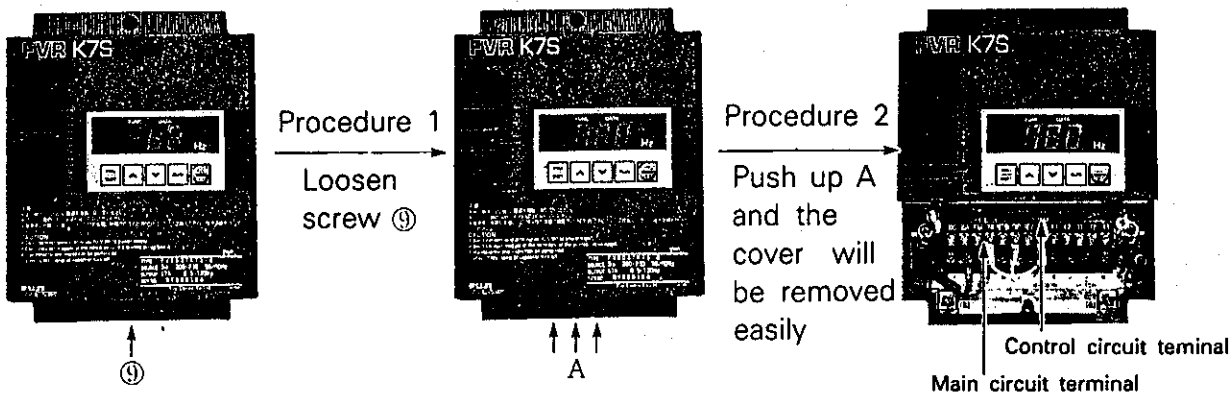
① Inverter cover
② Terminal cover
③ Ventilation hole blind plate
④ Cable inlet plate
⑤ Keypad panel
⑥ Heat sink
⑦ Mounting hole
⑧ Screw for inverter cover
⑨ Screw for terminal cover
⑩ Name plate
⑪ Cooling fan

Rubber bushing
(provided loose)

FVR015~040K7S-2EX

(2) Removing The Front Cover

Remove terminal cover as follows.



NOTE) FVR002–008K7S do not have screw ⑨.

4. Application Notice

① Do not apply input voltage which exceeds the allowable specification as it may result in damage to the inverter.
② Do not apply input power supply to the output main circuit terminals (U, V, W). It will damage the inverter. Power supply should be connected to the input main circuit terminals (L1, L2, L3)
③ Do not apply input power supply to the Dynamic Braking Resistor terminals ((+), DB), and please use suitable specification resistor. If, by any chance,(+)and DB are shorted, the inverter will be damaged.
④ Do not apply AC 200V to the control terminals except 30A and 30C.
⑤ Do not start and stop the inverter using incoming circuit magnetic contactor. Please use FWD or REV control terminal.
⑥ Do not start and stop the motor using output circuit magnetic contactor.
⑦ Do not install power factor correcting capacitors to the output circuit inverter circuit.
⑧ Do not perform dielectric megger tests on control terminals.
⑨ Automatic (external) reset of inverter fault is not recommended. Please check the inverter first according to the fault diagnosis and remove the cause of alarm. After that try to restart the inverter.
⑩ Please install earth (grounding) cable to the inverter GND(PE) terminal.
⑪ Please install an AC reactor to the incoming inverter circuit, in the event the power supply transformer capacity is greater than 500 KVA.
⑫ Please shut off incoming power supply immediately in case the thermal sensor of DB Resistor is activated.
⑬ Do not connect a phase capacitor to the output terminal of the inverter.
⑭ Do not perform dielectric megger test on control terminals or between power circuit terminals.

5. Installation

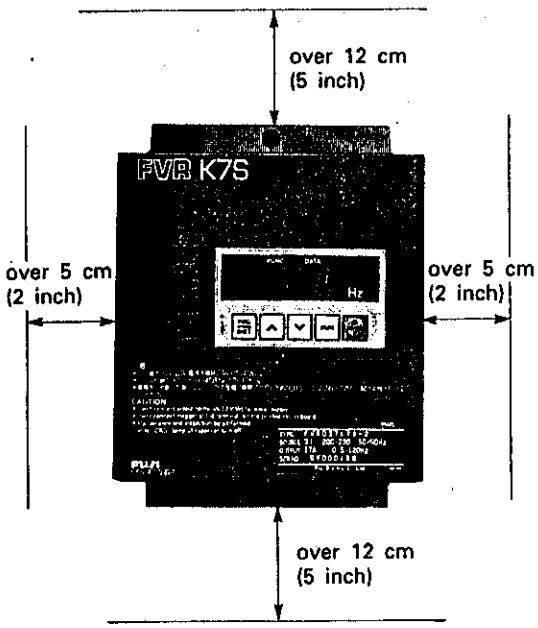
(1) Environment

Install the inverter to satisfy the following conditions.

① Ambient temperature; −10 ~ +50°C*1
② Relative humidity; 20 ~ 90% RH (non-condensing, non-freezing)
③ Altitude; not more than 1000 m
④ Vibration; not more than 0.6G
⑤ Avoid locations where the inverter in exposed to the direct sunlight, dust corrosive fumes, oil mist, or inflammable gases.

NOTE)
*1Please take off ventilating hole blind plate above +40°C.

(2) Mounting Direction And Space



① **Direction**
Install the inverter vertically so that "FVR-K7S" can be seen in front. Horizontal or other positional installation will cause overheat of the inverter.

② **Space**
The inverter will generate heat during operation. Allow sufficient space around the unit as shown in the picture on the left.

③ **Mounting plate**
Heat sink temperature will reach around +90°C during operation. Please use thermostable material for inverter mounting plate.

④ **Multi-mounting**
When 2 or more inverters are installed within an inverter switchboard, arrange them side by side, also keeping the spacing (shown on the left) between each inverter. Please refer to the technical data for panel design. (MEH341)

(3) Mounting Screws

① Use 5 mm mounting screw to install the inverter unit.
② Refer to chapter 12 of outline dimensions to find exact position of mounting holes.

(4) Cable Inlet

Use provided rubber bushings to ensure the protection of cable and exclusion of dust.

NOTICE

The durabity and reliability of the inverter will be affected by ambient temperature. Do not place the unit where ambient temperature is not proper. Observe the following temperature range.
With ventilation cover: −10 ~ +40°C
Without ventilation cover: −10 ~ +50°C

6. Wiring

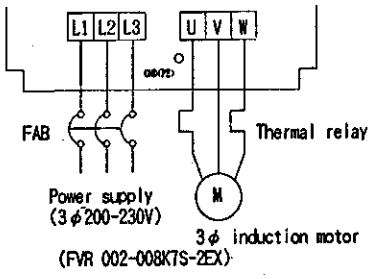
(1) Wiring The Main Circuit Terminal

① Power supply connections (L1, L2, L3)
Phase rotation does not matter for motor rotating direction.

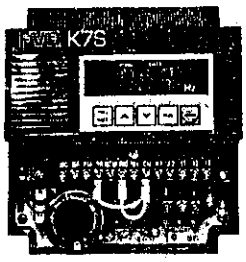
② Motor connections (U, V, W)
If motor rotation is reversed, inter-change any 2 motor connections at the U, V and W terminal.

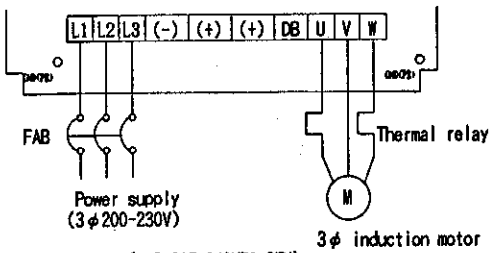
③ Ground terminal connections GND(PE)
Be sure to ground the inverter so as to prevent the malfunctions due to external noise.

NOTICE
Inverter may be damaged by wrong connections.

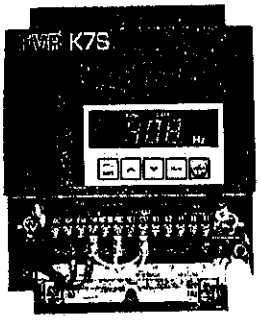


(FVR 002-008K7S-2EX)





(FVR 015-040K7S-2EX)

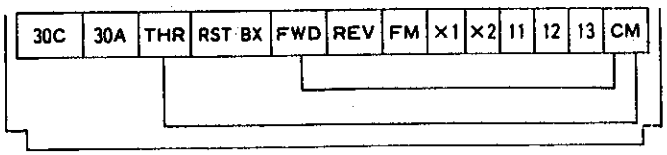


(2) Wiring The Control Terminal

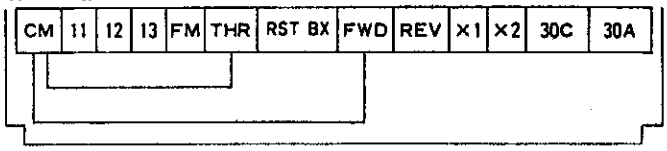
① Keypad panel operation (Factory shipment wiring)
It is unnecessary to modify the wiring after shipment from the FUJI factory.
* Function code 01, and data code 0 is set at the factory.

(RUN : Running STOP / RESET : Stopping ^ v : Frequency setting)

0.2~0.75kW

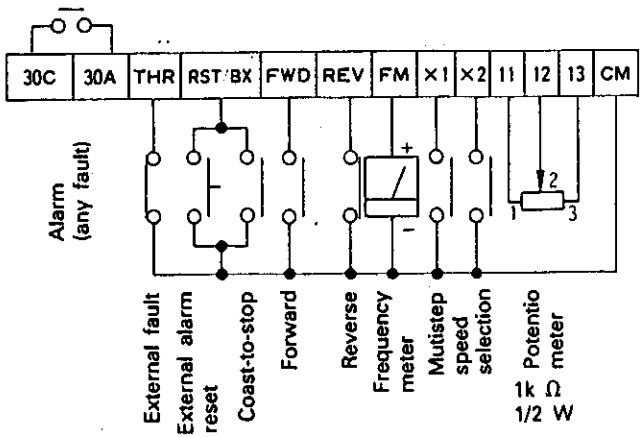


1.5~4.0kW

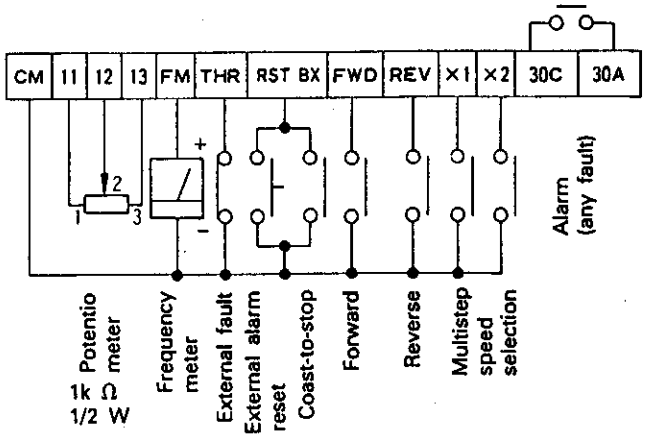


② Control terminal operation (External operation)

0.2~0.75kW



1.5~4.0kW



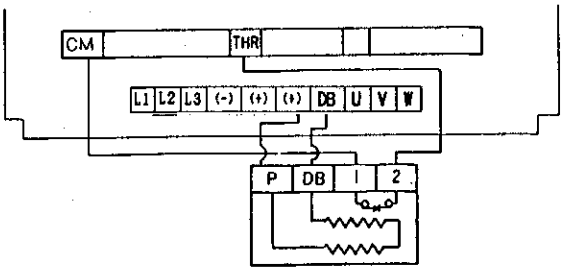
NOTICE

Function data set.	Frequency setting.	Run-Stop command
010	Touch panel	Touch panel
011	Terminals 12, 11 (Analog)	
012	Touch panel	Terminal FWD or REV
013	Touch panel 12, 11 (Analog)	

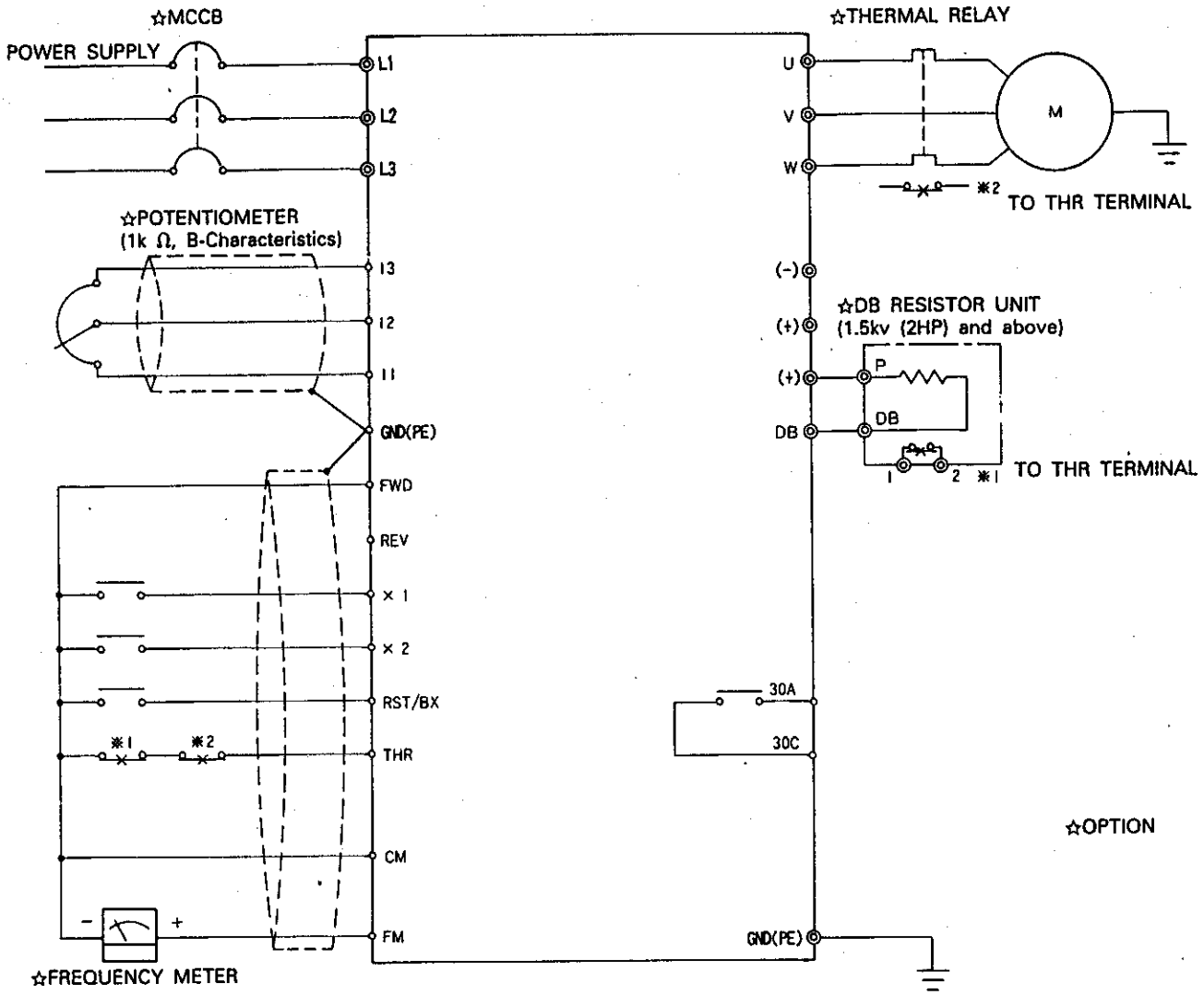
(3) Wiring The External DB Resistor Unit (Option)

When requiring frequent braking or a high torque braking, connect an external DB resistor unit as shown in the drawing on the right.
(FVR002K7S to FVR008K7S are not provided with DB terminals.)

*1. Remove the wire across CM-THR before operation.
*2. Shut off power supply in case of OH2 alarm comes out.



(4) Basic Wiring Diagram

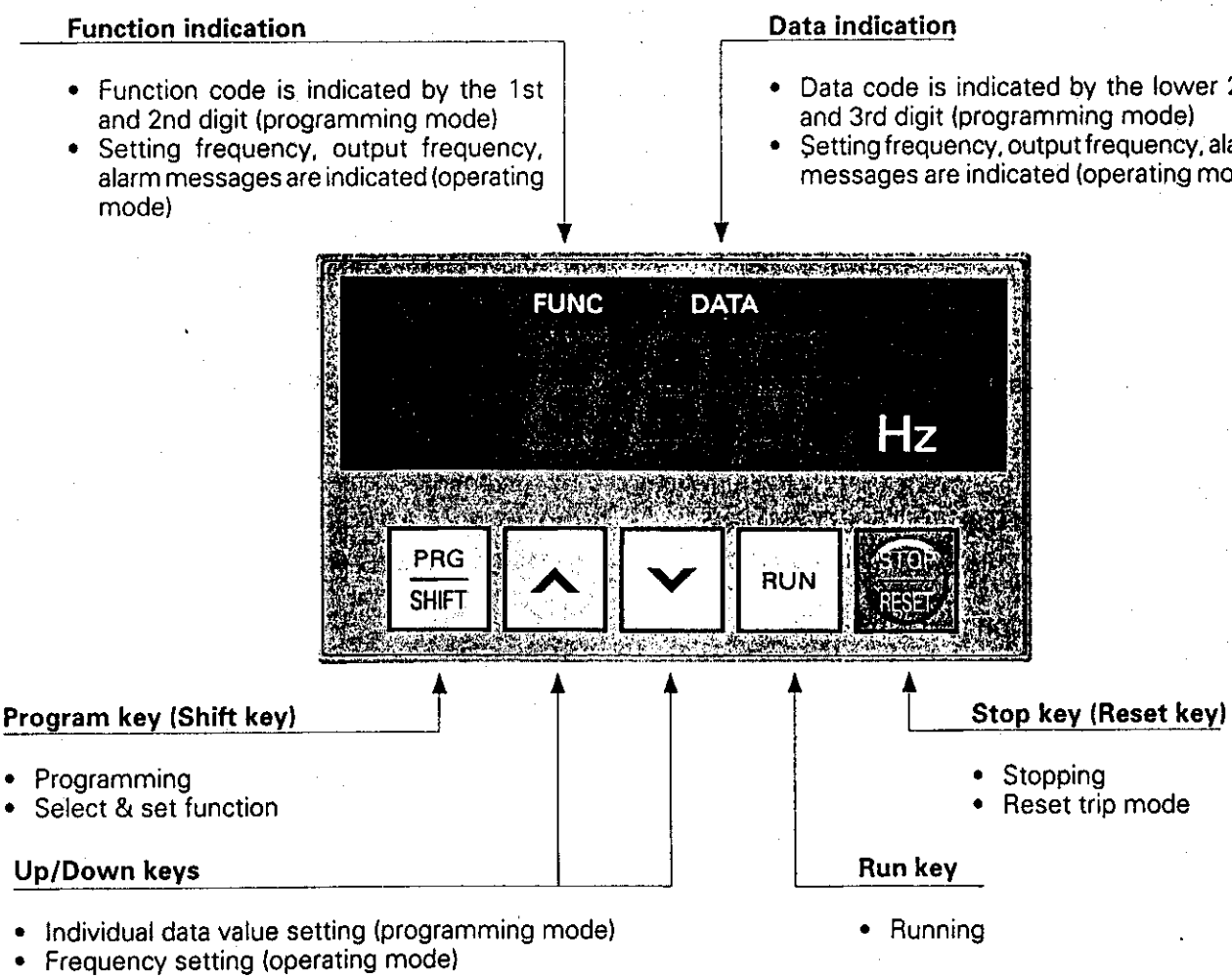


NOTICE

① Do not run wiring for power circuit and control circuit in the same wiring duct.
② We recommend to keep control circuit wiring away from power circuit wiring at least 100 mm.
③ Both circuit wiring should intersect right angles.
④ Use shielded wire for control circuit and connect one end of the shield to the grounding terminal of inverter GND(PE). The other end should be open circuit.
⑤ Maximum allowable control wiring length is 20 m.
⑥ Install surge supression to magnetic contactor or solenoid valve which are located near the inverter.

7. Keypad panel

(1) Names And Functions



(2) Setting The Function And Data Codes

		STOP MODE		RUN MODE	
		Key operation	LED indication	Key operation	LED indication
Operating mode	Frequency setting	Set output frequency by using [∧][∨] key.	Setting frequency is blinking. 46.5	Set output frequency by using [∧][∨] key.	Output frequency is indicated. 46.5
Programming code	Function code selection	Select programming mode by pressing [PRG SHIFT] key. (Access every function code)	1st and/or 2nd digit → Blinking 2nd and/or 3rd digit → Indication 04	Select programming mode by pressing [PRG SHIFT] key. (Access only limited function code. Please refer to chapter 9)	1st and/or 2nd digit → Blinking fast 2nd and/or 3rd digit → Indication 215
	Data value setting	Set data value using [∧][∨] key then press [PRG SHIFT] key. Data will enter into non-volatile memory and automatically shift to next function code. Setting frequency indicates following [F]	1st and/or 2nd digit → Blinking 2nd and/or 3rd digit → Indication 043	Set data value using [∧][∨] key then press [PRG SHIFT] key. Data will enter into non-volatile memory and automatically shift to next function code. Output frequency indicates following [6]	1st and/or 2nd digit → Blinking fast 2nd and/or 3rd digit → Indication 285

8. Operation

(1) Inspection Before Operation

When the installation and wiring has been completed, carry out the inspection regarding the following items before applying power supply.

① Check for miswiring.
② Check for wire or drilling chips.
③ Check screws for tightness.
④ Check that barbed wire of crimp terminal is not in contact with other terminals.

<Warning>

Do not perform dielectric megger test on control terminals or between power circuit terminals.

(2) Checking Point During Test Operation

Set reference frequency around 5 Hz to avoid dangerous conditions and check following items.

① Is motor rotation smooth?
② Is motor rotating direction correct?
③ Is there any abnormal vibration and/or noise on the rotating motor?
④ Is acceleration and/or deceleration smooth?

(3) Selection Of Operating Method

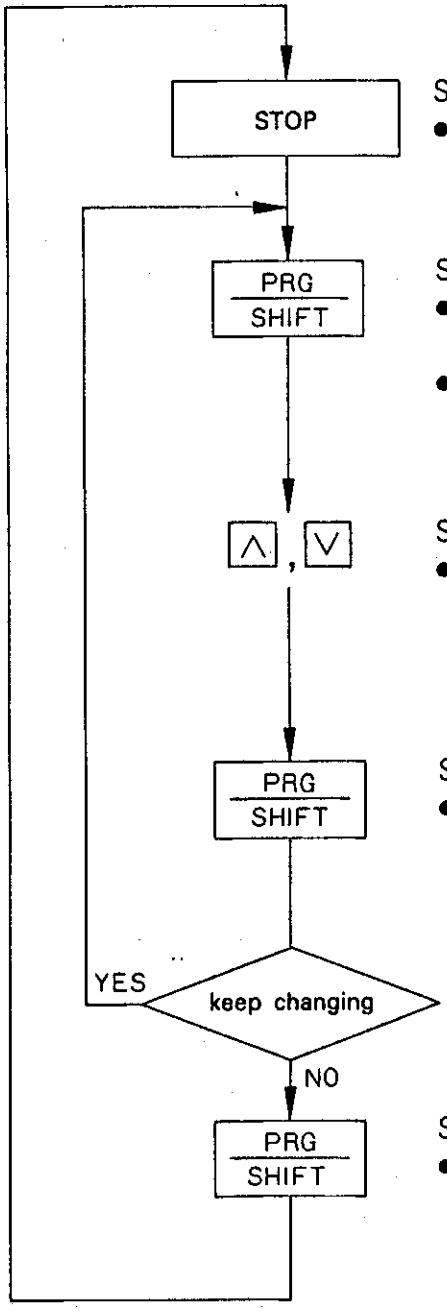
FVR-K7S series will provide 5 types of operating methods.

	Run • Stop	Frequency setting	Function code
1	RUN STOP/RESET	∧∨ key	0 1 0 (factory set)
2		potentiometer or analog signal	0 1 1
3	external signal (FWD, REV)	∧∨ key	0 1 2
4		potentiometer or analog signal	0 1 3
5	Multi-frequency setting (maximum 4 steps) • No. 1 frequency is set by 0 1 . • No. 2, No. 3, No. 4 frequencies are set by ? , 8 , 9 and selected by external signal combination of X1 and X2.		

(4) Data Setting

In order to get the best operating condition of inverter and motor, please check and change each function data to a suitable value. Provided as outlined below to change function code and data. Before operation, please check the setting data of basic function at least as 04, 11, 41, and 51.

① Data change during stop mode



Step 1
- FWD and REV both signals are off. (blinking set frequency) 50.0

Step 2
- When this key is pressed, function code proceed one step. (blinking first digit only) 01.0 .
- Stop to press when you reach desired function.

Step 3
- Change the data by pressing ∧,∨(up-down) key.

Step 4
- Press this key to enter data setting into memory and to proceed to next function.

Step 5
- When data changes are completed, keep pressing until return to step 1.

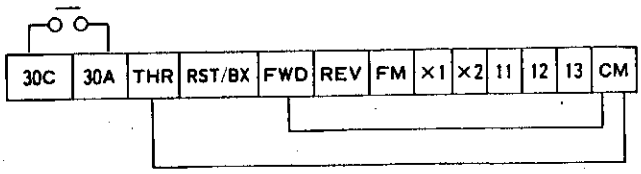
② Data change during operation

Same routine as described above, but with limited function access. (Please refer to chapter 9.)

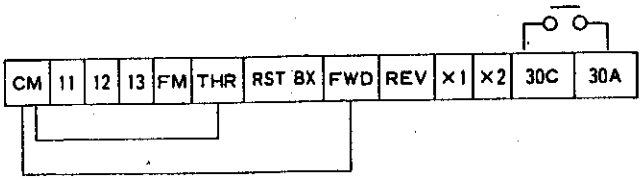
(5) Control Terminal Wiring

① Factory shipment wiring

0.2 - 0.75kw (1/3 - 1HP)



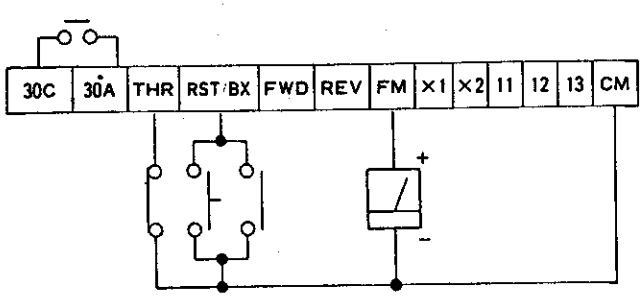
1.5~4.0kW(2-5.5HP)



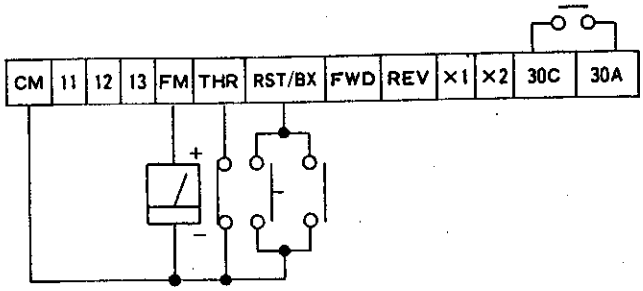
* This is basic wiring for function [0][0], [0][1] .

② Common wiring regardless of function code

0.2 - 0.75kw (1/3 - 1HP)



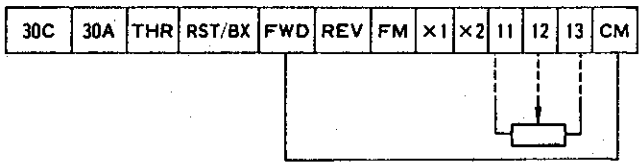
1.5~4.0kW(2-5.5HP)



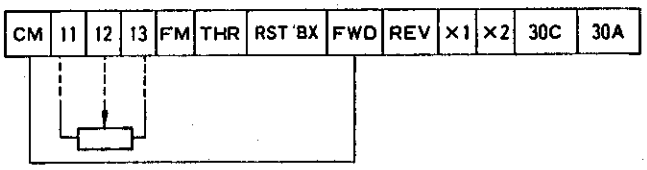
* 30A, 30C ....This normally open contact will close when any alarm comes out.
* FM .....Terminal for external analog frequency meter.
* THR .....Terminal for external thermal sensor. (Thermal overload relay for motor, heat sensor for DB resistor etc.) Please remove factory wiring and connect to normally close contact of the sensor.
* RST/BX .....During stoppling; alarm reset
  During deceleration operation; coast-to-stop
* CM .....0V (zero volt) termianl

③ Keypad panel operation (0 1 0 , 0 1 1)

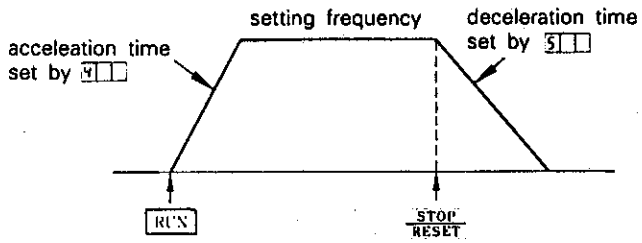
0.2 – 0.75kw (1/3 – 1HP)



1.5~4.0kW(2-5.5HP)

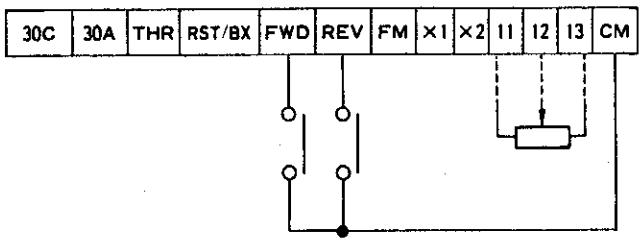


1) Particular wiring for this operation is FWD to CM. Do not remove this wiring.
2) In case of the function code setting is 0 1 1 , following 3 frequency setting methods are available.
   i) Connect potentiometer (1kΩ, 1/2W) to terminal 13, 12, 11.
   ii) Connect analog voltage signal (DC 0 to +10V) to terminal 12, 11.
   Terminal 12 is " + " polarity.
   iii) Connect analog current signal (DC 4 to 20mA) to terminal 12, 11.
   Terminal 12 is " + " polarity.
3) Operating pattern example:

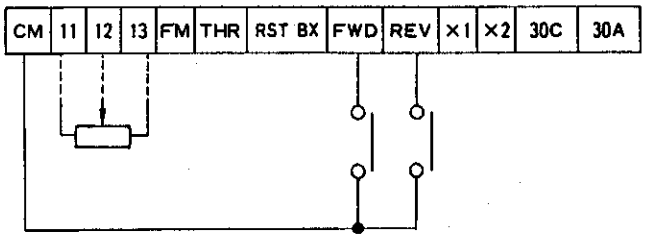


④ External signal operation (0 1 2 , 0 1 3)

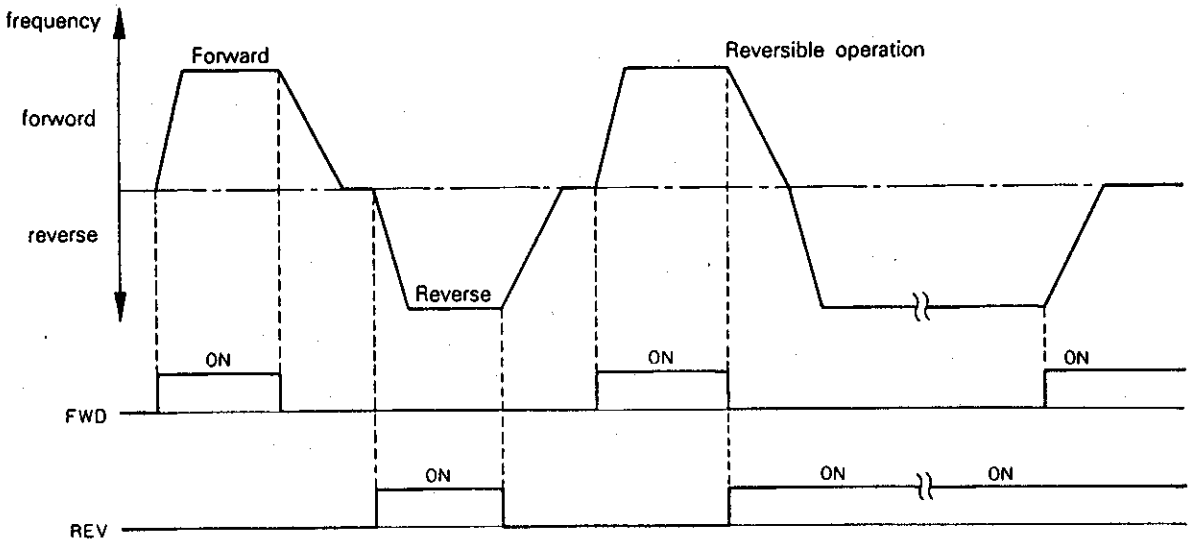
0.2 – 0.75kw (1/3 – 1HP)



1.5~4.0kW(2-5.5HP)



1) Take the wiring FWD to CM off.
2) In case of the function code setting 0 1 3 , 3 frequency setting methods are available. (same as 0 1 1)
3) Operating pattern example:



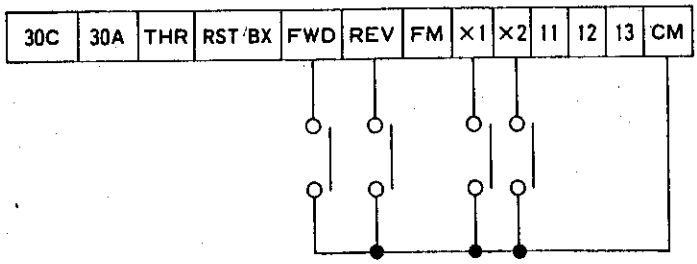
NOTE) When FWD and REV signals are applied at the same time the inverter will stop.

(6) Multi-operation (using X1, X2)

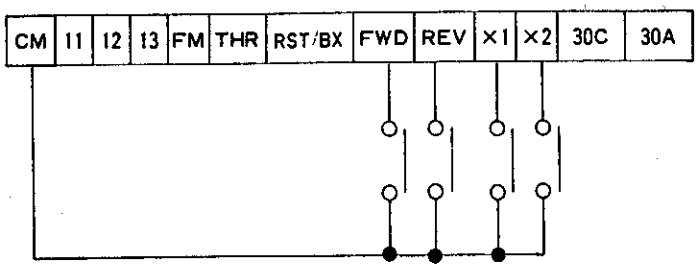
① Multi-frequency setting (maximum 4 steps)

1) Set operating method and No. 1 step frequency by using function code [0][1]. [refer to chapter 8. -(3)]
2) Set No. 2, No. 3 and No. 4 step frequency by using function codes [?][ ], [8][ ] and [9][ ].
3) Terminal arrangement.

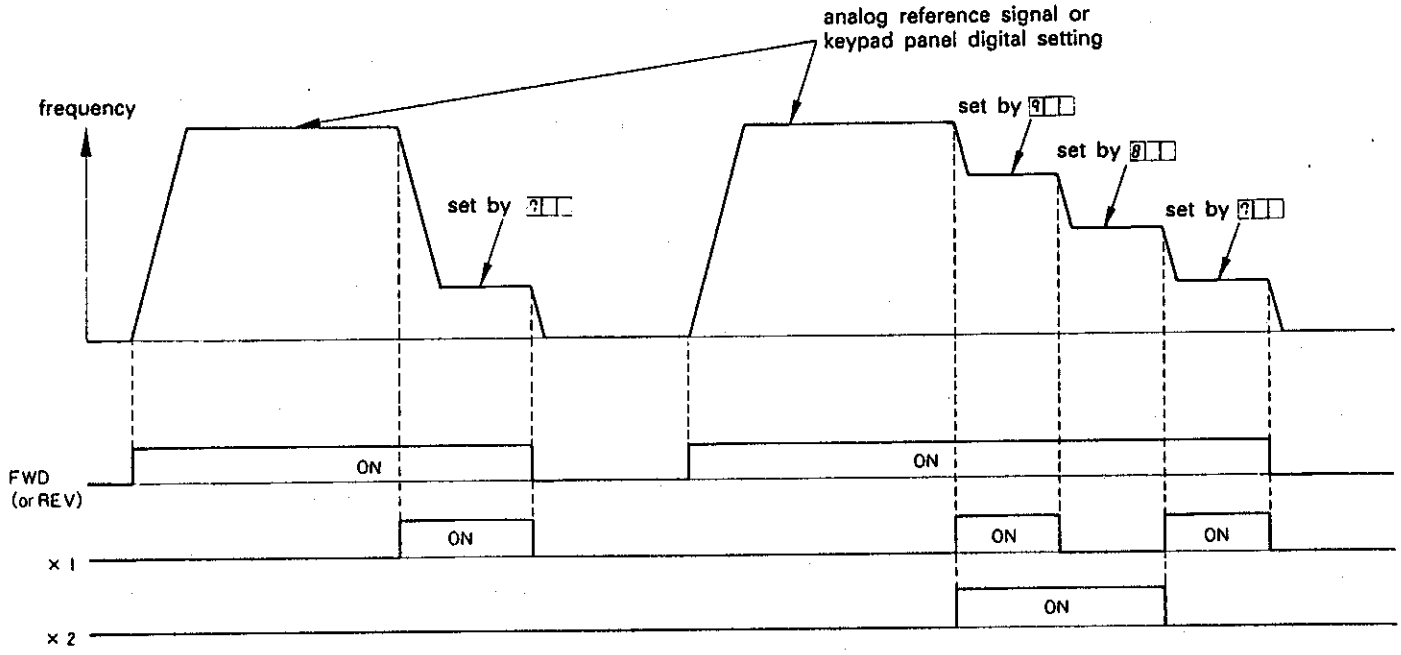
0.2 – 0.75kw (1/3 – 1HP)



1.5~4.0kW(2-5.5HP)

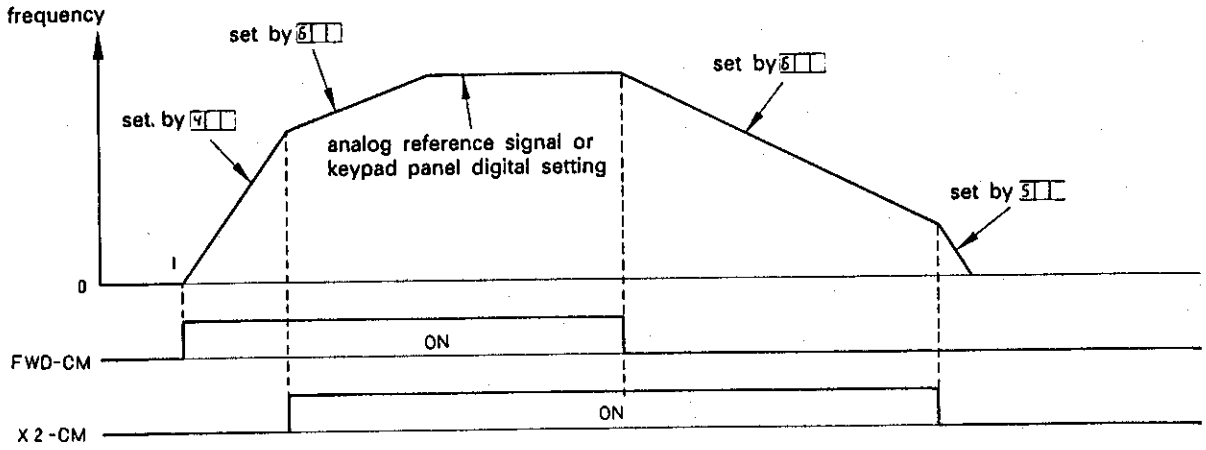


4) Operating pattern example:

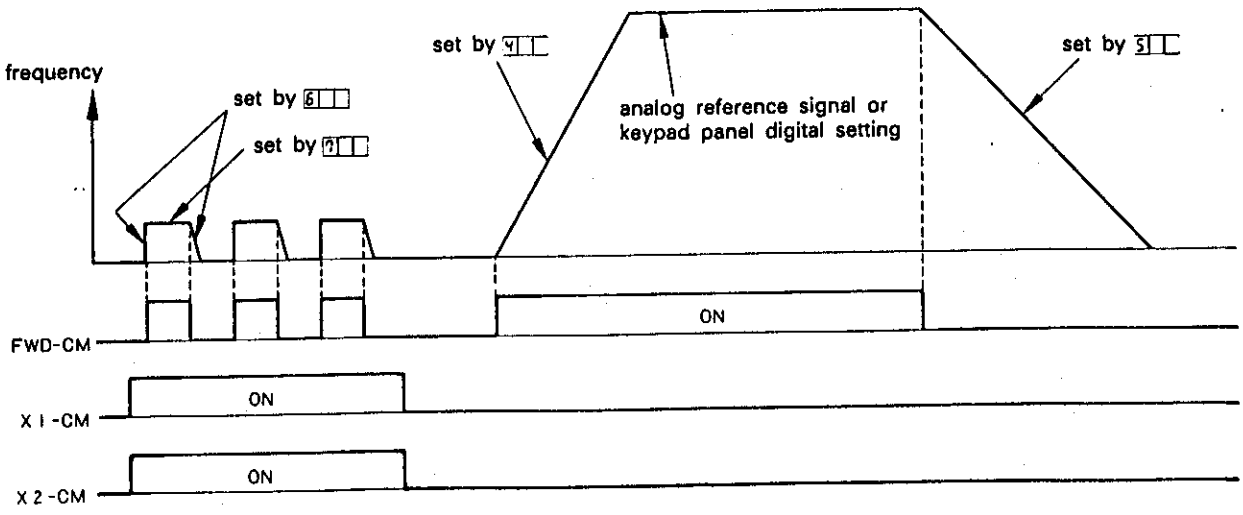


② No. 2 acceleration/deceleration setting (with 2 step multi-frequency setting)

1) Set No. 1 acc. time by using function code [4□□], and No. 1 dec. time by using function code [5□□].
2) Set No. 2 acc./dec. time by using function code [6□□].
   (Acc./dec. time are same setting)
3) Set function code [8□□], [9□□] as [800], [900], so you can use terminal X2 as the selecting signal for No. 2 acc./dec.
   The following figure is a operation pattern example:



4) Combination of X1, □□□(No. 2 step frequency setting) and X2, □□□(No. 2 acc./dec. time setting) is also available.



9. Description Of Function

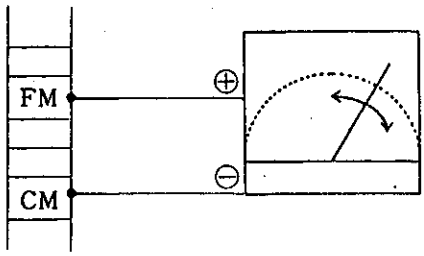
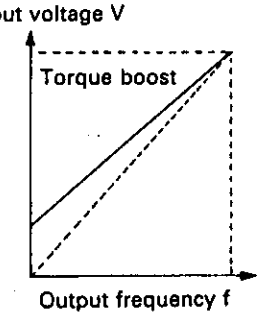
(1) Function Code List

FUNCTION CODE		DATA CODE ▲ ▼			
□■■	Function	■□□	Description	✻	Factory setting
00■	Manufacturer use function	000	—	—	000
01■	Operating method/ Frequency setting selection	010	Touch panel/keypad panel	X	010
		011	Touch panel/External analog signal		
		012	External signal/keypad panel		
		013	External signal/external analog signal		
02■	Auto-restart after instantaneous power failure	020	Inactive	X	020
		021	Active		
03■	Fault memory	030	Present + prior 3 event memory <turn by ▲▼ key>	O	...
04■	V/Hz characteristics	040 ~ 043	4 patterns are available	X	040
1■■	Maximum output voltage	100	Output voltage is according to input voltage	X	100
		115 ~ 123	150V ~ 230V (10V step)		
2■■	Frequency meter adjust	200 ~ 299	6.5V ~ 10.5V (FM terminal output voltage)	O	275
3■■	Torque boost	300 ~ 315	16 patterns are available	O	308
4■■	Acceleration time	400 ~ 431	0.2 ~ 300 sec. (32 patterns)	O	412
5■■	Deceleration time	500 ~ 531	0.2 ~ 300 sec. (32 patterns)	O	512
6■■	No. 2 acc/dec time	600 ~ 631	0.2 ~ 300 sec. (32 patterns)	O	612
7■■	Multi-frequency setting No. 1	700 ~ 760	Max. frequency 50/60 Hz; 1 Hz step output frequency = setting value Max. frequency 100/120 Hz; 2 Hz step output frequency = setting value X 2	X	700
8■■	Multi-frequency setting No. 2	800 ~ 860			800
9■■	Multi-frequency setting No. 3	900 ~ 960			900
A■■	DC injection brake	A00 ~ A10	10 patterns are available (00 : inactive)	X	A00
b■■	DC injection brake starting frequency	b00 ~ b60	Actual frequency setting (Hz) (00 : 0.5 Hz)	X	b00
C■■	DC injection brake time	C00 ~ C10	Actual time setting (sec) (00 : 100 ms)	X	C00
d■■	Upper limiter	d00 ~ d99	Percentage of maximum frequency 00 : Inactive	X	d00
E■■	Lower limiter	E00 ~ E99			E00
F■■	Bias	F00 ~ F99			F00

✻ Data changing during operation : (O ; possible, X ; impossible)

(2) Explanation Of Function

<table>
<tr><th>Function code</th><th>Description</th><th>Factory setting</th></tr>
<tr><td>00
Manufacturer use function</td><td>000</td><td>000</td></tr>
<tr><td>01
Operating method/ frequency setting selection</td><td>
<table>
<tr><th>Data</th><th>Run/Stop</th><th>Frequency setting</th></tr>
<tr><td>010</td><td>RUN STOP/RESET key</td><td>∧ ∨ key</td></tr>
<tr><td>011</td><td>RUN STOP/RESET key</td><td>Potentiometer or analog signal</td></tr>
<tr><td>012</td><td>Terminal FWD, REV</td><td>∧ ∨ key</td></tr>
<tr><td>013</td><td>Terminal FWD, REV</td><td>Potentiometer or analog signal</td></tr>
</table>
</td><td>010</td></tr>
<tr><td>02
Auto-restart after instantaneous power failure</td><td>020 ..... Inactive : If power supply reapplies during LU indicating fault alarm signal (30) comes out and the inverter will coast-to-stop.
021 ..... Active : If power supply reapplies during LU indicating the inverter automatically recovers prior operating condition very smoothly.
1 In the case where function code 010 or 011 is selected, this function will not activate.
2 This function will only activate when power supply reapplies during LU indication.</td><td>020</td></tr>
<tr><td>030
Fault memory</td><td>End ↓↑ Indicate present fault and prior 3 event
— — — ↓↑ Prior fault No. 3
0U ↓↑ Prior fault No. 2
0C2 ↓↑ Prior fault No. 1
0C3 ↓↑ Present fault
030 ↓↑ If there was no fault, — mark will be indicated.</td><td>— — —</td></tr>
</table>

Function code	Description	Factory setting
0 4 V/Hz Characteristics	The following 4 patterns are selectable 040: V, 50Hz 041: V, 60Hz 042: V, 50Hz 100Hz 043: V, 60Hz 120Hz	0 4 0
1 Maximum output voltage	1 0 0 ····· Output voltage is according to input voltage. 1 1 5 ····· 150 V set ↓ 1 2 3 ····· 230 V set } 2nd and 3rd digit show maximum output voltage in 10V steps.* *Output voltage is limited by input voltage.	1 0 0
2 Frequency meter adjustment	The maximum voltage adjustment for analog frequency meter. 2 0 0 ····· Approx. 6.5 V ↓ 2 9 9 ····· Approx. 10.5 V } Divided into 100 segments 	2 7 5
3 Torque boost	The setting of torque boost can be made according to the load and the characteristics of the motor within the range as follows. 3 0 0 ····· minimum ↑ 3 0 8 ····· standard ↓ 3 1 5 ····· maximum } 16 patterns 	3 0 8

Function code	Description	Factory setting
4 ▢ ▢ Acceleration time 5 ▢ ▢ Deceleration time 6 ▢ ▢ No. 2 Acc/Dec time	The following table shows the acceleration time from zero to maximum frequency and/or deceleration time from maximum frequency to zero in seconds. No. 2 Acc./Dec. time is available when multi frequency setting is set as 800 900 and activate when X2-CM is closed.	4 1 2 5 1 2 6 1 2

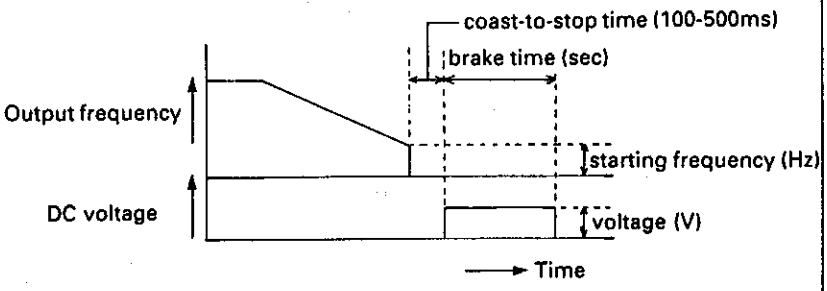
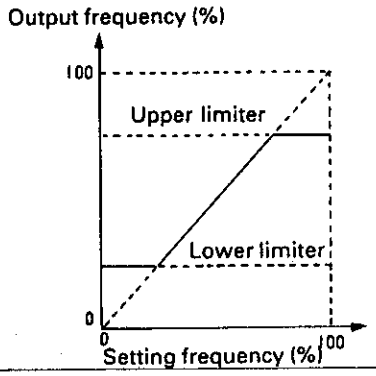
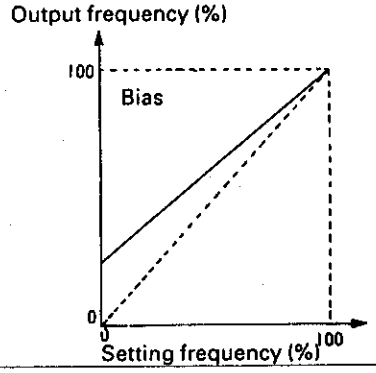
f max	■00	■01	■02	■03	■04	■05	■06	■07
50 Hz	0.17	0.33	0.50	0.67	0.83	1.3	1.7	2.1
60 Hz	0.20	0.40	0.60	0.80	1.00	1.5	2.0	2.5
100 Hz	0.33	0.67	1.00	1.33	1.67	2.5	3.3	4.2
120 Hz	0.40	0.80	1.20	1.60	2.00	3.0	4.0	5.0
f max	■08	■09	■10	■11	■12	■13	■14	■15
50 Hz	2.5	2.9	3.3	3.8	4.2	5.0	5.8	6.7
60 Hz	3.0	3.5	4.0	4.5	5.0	6.0	7.0	8.0
100 Hz	5.0	5.8	6.7	7.5	8.3	10	12	13
120 Hz	6.0	7.0	8.0	9.0	10	12	14	16
f max	■16	■17	■18	■19	■20	■21	■22	■23
50 Hz	7.5	6.3	13	17	25	33	42	50
60 Hz	9.0	10	15	20	30	40	50	60
100 Hz	15	17	25	33	50	67	83	100
120 Hz	18	20	30	40	60	80	100	120
f max	■24	■25	■26	■27	■28	■29	■30	■31
50 Hz	58	67	75	83	125	167	208	250
60 Hz	70	80	90	100	150	200	250	300
100 Hz	117	133	150	167	250	333	417	500
120 Hz	140	160	180	200	300	400	500	600

7 ▢ ▢ Multi frequency setting No. 1
8 ▢ ▢ Multi frequency setting No. 2
9 ▢ ▢ Multi frequency setting No. 3

The setting can be made by selecting the V/f characteristics within the range as follows.

V/Hz characteristics	040	041	042	043
00 / 50 / 60	0 ↓ 50 Hz	0 ↓ 60 Hz	0 ↓ 100 Hz	0 ↓ 120 Hz
Setting unit	1 Hz		2 Hz	

Factory setting: 7 0 0 / 8 0 0 / 9 0 0

Function code	Description	Factory setting
A □ □ DC injection brake voltage	A 0 0 ..... inactive A 0 1 ..... minimum ↓ } 10 patterns A 1 0 ..... maximum	A 0 0
b □ □ DC injection brake starting frequency	b 0 0 ..... start at 0.5 Hz. b 0 1 ..... 1 Hz ↓ } set by 1 Hz. step b 6 0 ..... 60Hz	b 0 0
C □ □ DC injection brake time	C 0 0 ..... 100 ms C 0 1 ..... 1 sec ↓ } set by 1 sec. step C 1 0 ..... 10 sec	C 0 0
		
d □ □ Upper limiter E □ □ Lower limiter F □ □ Bias	0 0 ..... inactive 0 1 ..... 1 ↓ } Set by 1% step of maximum frequency according to the V/Hz characteristics 9 9 99	d 0 0 E 0 0 F 0 0
		
		

10. Maintenance And Inspection

(1) Checking Point

Checking point	Inspection item	Inspection subject	Remedy
Environment	Power supply	• Input voltage (170 ~253V)	Inspect the trouble and remove cause.
	Ambient temperature	• -10 ~ +50°C	
	Ambient humidity	• 90% RH or less without condensation	
	Vibration	• 0.6 G or less	
Others	Noise	• Check the bearing noise of cooling fan.	Replace
	Smell	• Check scorching smell.	Replace
	Dust	• Check for deposit of dust on cooling fan, heat sink, and control P.C.B.	Cleaning
	Connector	Check loosening.	Tightening
	Screw	Check loosening.	Tightening

(2) Periodic Parts Replacement

The life an inverter varies depending on the environment of installation and operating time. The life expectancy of the DC bus capacitors and the cooling fan are 5 years and 3 years respectively, when continuously operated within an allowable temperature range. It is recommendable for them to be replaced before trouble is experienced.

<CAUTION>

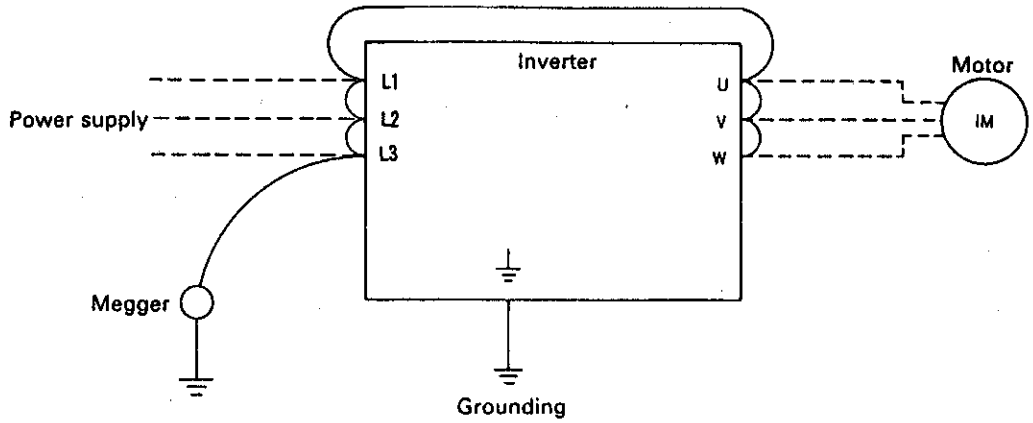
When carrying out an inspection, be sure to remove the power supply and wait until the CRG lamp goes out.

(3) Megger Test

① When carrying out a megger test of external circuit be sure to take off all inverter terminal wiring. In case of inverter megger test, only perform it on main power circuit according to the following figure.

② Do not perform megger test on control circuit.

③ Please use circuit tester (use high impedance range) for checking the wire connection. Do not use megger or buzzer.



11. Failure Diagnosis

(1) Protective Functions

Alarm message	Indication	Description	Protective action
Overcurrent Output short line to line	OC1	Overcurrent or output short line to line during acceleration.	• Shut off the inverter output. • Alarm signal (30) is activated. • The inverter will hold alarm condition and signal until reset signal is applied to the inverter.
	OC2	Overcurrent or output short line to line during deceleration.	
	OC3	Overcurrent or output short line to line during steady state running.	
Overvoltage	OU	DC bus voltage reaches the overvoltage protection level.	
Inverter heat sink overheating	OH1	Overheating of the inverter heat sink due to overload, cooling fan malfunction or abnormal ambient temperature.	
External alarm function	OH2	THR-CM terminal open due to external fault.	
CPU error	Err	CPU malfunction due to noise	
Low voltage	LU	Under voltage of power supply	• Shut off the inverter output.
Instantaneous power failure			• Within 15 msec power failure the inverter operate continuously.

(2) Failure Diagnosis And Correction

Indication	Check point		Remedy
OC1	① Power supply	(within allowable variation)	• Adjust the supply voltage to suitable value.
	② Output circuit	(short line to line)	• Check the wiring and motor winding.
	③ Torque boost	(too high boost value)	• Adjust to suitable value.
	④ Acceleration time	(too short line selling)	• Adjust to suitable value.
	⑤ Other than ① ~ ④		• Use larger size inverter.
OC2	① Power supply	(within allowable variation)	• Adjust the supply voltage to suitable value.
	② Output circuit	(short line to line)	• Check wire and motor winding insulation.
	③ Deceleration time	(too short time setting)	• Adjust to suitable value.
	④ Other than ① ~ ③		• Use larger size inverter. • Adopt external DB resistor.
OC3	① Power supply	(within allowable variation)	• Adjust the supply voltage to suitable value.
	② Output circuit	(short line to line)	• Check wire and motor winding insulation.
	③ Abrupt change on the load		• Eliminate load fluctuation.
	④ Other than ① ~ ③		• Use larger size inverter. • Check noise pick up.
OU	① Power supply	(within allowable variation)	• Adjust the supply voltage to sultable value.
	② Deceleration time	(too short time setting)	• Adjust to suitable value.
	③ Other than ① ~ ②		• Adopt external DB resistor.
OH1	① Ambient temperature	(within allowable variation)	• Put the inverter appropriate environment.
	② Cooling fan	(malfunction)	• Replace.
	③ Load condition	(too heavy load)	• Reduce the load or use larger size inverter.
OH2	① Motor protection circuit	(Thermal overload relay)	• Check the wiring and correct it.
	② Brake resistor protection	(Thermal switch)	
	③ Wiring	(THR-CM)	
LU	① Power supply	(within allowable variation)	• Adjust the supply voltage to suitable value
	② Lack of phase		• Check the wiring and correct it.
	③ Magnetic contactor or MCCB		• Make it sure to turn on these equipment.
	④ Other than ① ~ ③		• Check power supply capacity.
Err	① Noise generating device near inverter		• Check noise pick up.

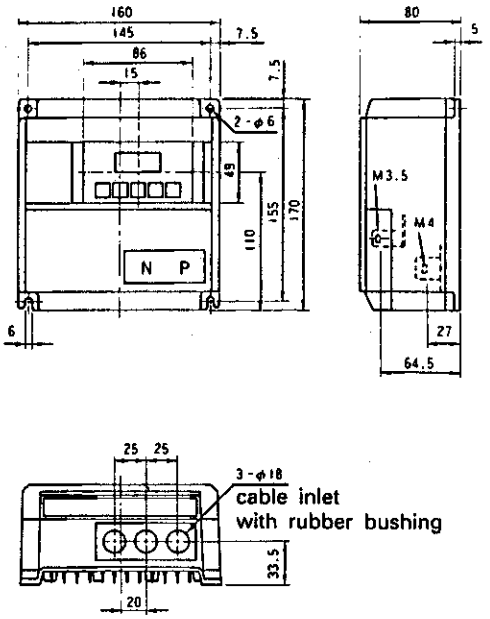
12. Appendix

(1) Standard Specification

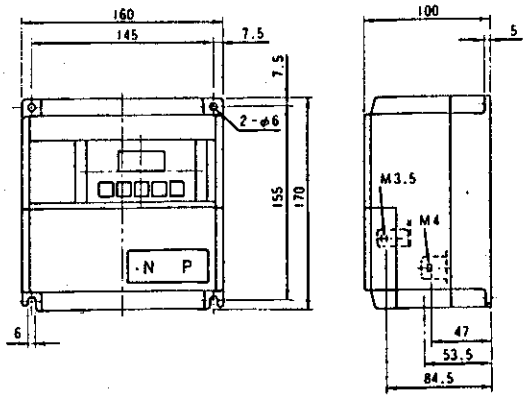
Inverter part number		FVR002K7S-2EX	FVR004K7S-2EX	FVR008K7S-2EX	FVR015K7S-2EX	FVR022K7S-2EX	FVR040K7S-2EX
Application motor output (kW)		0.2 (1/3HP)	0.4 (1/2HP)	0.8 (1.0HP)	1.5 (2.0HP)	2.2 (3.0HP)	4.0(5.5HP)
Output ratings	Output capacity [KVA]	0.57	1.10	1.90	3.00	4.20	6.50
	Output voltage (Max.) [V]	3-phase, 3 wire, 200 ~ 230V (limited by input voltage)					
	Output frequency [Hz]	50 Hz, 60 Hz, 100 Hz, 120 Hz					
	Output current [A]	1.5	3.0	5.0	8.0	11	17
	Overload capacity	150%, 1 min. (Inverse time characteristics)					
Input ratings	Power supply [V]	3-phase, 3-wire, 200 ~ 230V, 50/60 Hz					
	Allowable variation	Voltage; 170 ~ 253V, Frequency; ±5%, Voltage unbalance phase to phase; ±3%					
Protective enclosure & cooling		NEMA 1 (self cooled)			NEMA 1 (forced air cooled)		
Weight [kg]		1.3 (2.9 lbs)	1.6 (3.5 lbs)	2.1 (4.6 lbs)	3.3 (7.3 lbs)	3.4 (7.5 lbs)	3.5 (7.7 lbs)

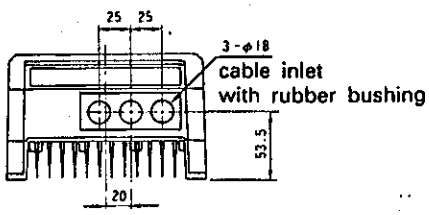
Control	Control system		Sinusoidal PWM control
	Output frequency range		0.5 Hz ~ 120 Hz
	Output frequency resolution		0.1 Hz
	Frequency setting resolution		Digital setting; 0.1 Hz at up to 99.9 Hz Analog setting; 0.02 Hz at 60 Hz
	Frequency stability		Digital setting; ±0.01% at -10~+50 ℃ Analog setting; ±0.20% at 25°C ±10°C
	Volt/Hz characteristic		4 patterns
	Torque boost		16 patterns
	Acceleration/Deceleration time		0.2 ~ 300 sec (at 60 Hz) independent adjustable
	Breaking torque	Regenerative	Regenerate to DC bus capacitor (external DB resistor is available only over 1.5 kw)
		DC injection	Time; 0.1 ~ 10 sec Voltage; 0 ~ 10% Starting frequency; 0.5 ~ 60 Hz
Protection			Stall prevention, Overcurrent, Overvoltage, Undervoltage, instantaneous power failure, Inverter heat sink overheating, External alarm
Operation	Frequency setting signal		Voltage input; DC 0 ~ 10V or Current input; DC 4 ~ 20 mA are selectable by using SW 6.
	Input signal		Forward command, Reverse command, Multi-frequency setting, coast-to-stop command, External alarm signal, Alarm rest signal
	Output signal		Fault; 30A, 30C N.O. contact, AC250 V, 0.3 A, CosØ = 0.3
Indication	Output frequency monitor		DC 0 ~ 10V analog (max. voltage adjustment; 6.5 ~ 10.5V)
	Touch panel 7-segment LED display	Running	Setting frequency, Output frequency
		Setting	Function code and setting data
		Fault	OC1, OC2, OC3, LU, OU, OH1, OH2, Err
	Charging lamp (CRG)		DC bus voltage level
Condition	Installation location		Indoor not more than 1000 m above sea level. Do not install in a dusty location or expose to corrosive gases or direct sunlight.
	Ambient temperature		-10°C ~ +50°C (Remove air ventilation hole cover plate more than +40°C.)
	Ambient humidity		20 ~ 90% RH (without condensation)
	Storage temperature		-20°C ~ +65°C
Option			• DB resistor unit • Radio interference suppressing reactor • AC line reactor • Frequency setting potentiometer • Frequency meter • Surge absorber

(2) Outline Dimensions (mm)

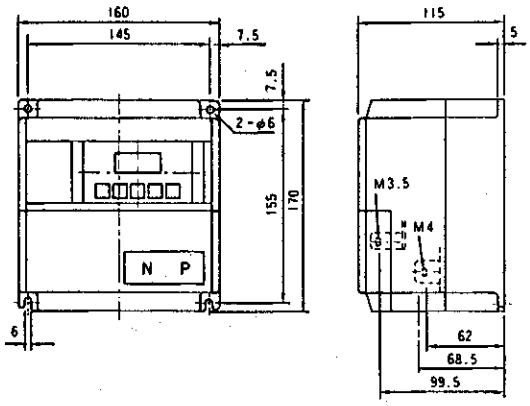


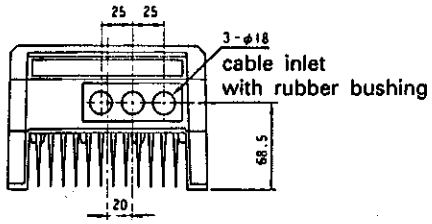
FVR002K7S-2EX



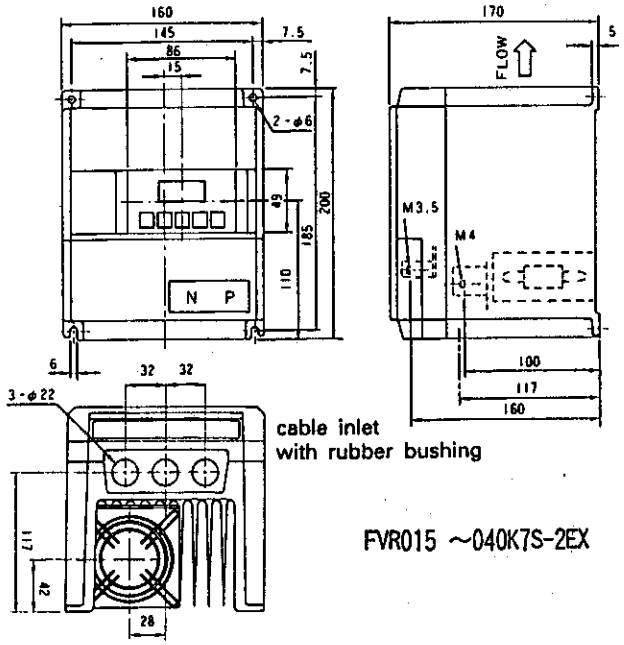


FVR004K7S-2EX



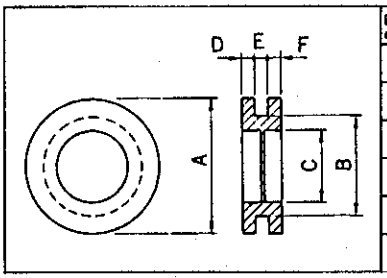


FVR008K7S-2EX



FVR015 ~040K7S-2EX

■ Rubber bushing dimensions



Bonom hole diameter	18mm	22mm
A (mm)	φ22	φ30
B (mm)	φ18	φ22
C (mm)	φ15	φ16
D (mm)	3	3
E (mm)	1	3
F (mm)	3	3

■ Terminal arrangement

For 0.2～0.75 kW

30C	30A	THR	RST/BX	FWD	REV	FM	×1	×2	11	12	13	CM
			L1	L2	L3		U		V		W	

GND(PE)

For 1.5～4.0 kW

CM	11	12	13	FM	THR	RST/BX	FWD	REV	×1	×2	30C	30A
L1	L2	L3	(-)	(+)	(+)	DB	U		V		W	

GND(PE) GND(PE)

(3) Terminal Designation

Symbol		Terminal name	Description
Main circuit	L1, L2, L3	Power input terminal	Commercial power supply AC 200 ~ 230V
	U, V, W	Inverter output terminal	3-phase induction motor
	(+), DB	External DB resister terminal	External DB resistor is connected between(+)and DB (FVR015 ~ 040)
	GND(PE)	Grounding terminal	Ground this terminal
	(+), (-)	DC intermediate voltage	DC high voltage is outputed. Do not use.
Control circuit (input)	13	Frequency setting power supply terminal	DC +10V
	12	Frequency setting signal input terminal	DC 0 ~ +10V SW 6 I [·▭·] V or DC 4 ~ 20 mA SW 6 I [▭·▭] V
	11	Frequency setting common terminal	Common terminal for voltage and current signal terminal. Do not ground, since this terminal is not isolated from CM.
	X1, X2	Multistep frequency operating command	4 kinds of frequency settings are available.

X1 - CM	OFF	ON	OFF	ON
X2 - CM	OFF	OFF	ON	ON
Selected Frequency	Touch Panel/ terminal 12	Multi frequency setting 1 7■■	Multi frequency setting 1 8■■	Multi frequency setting 1 9■■

No. 2 Acc./Dec. selecting (available when set as [000] [900])

X1 - CM	OFF	ON	OFF	ON
X2 - CM	OFF	OFF	ON	ON
Selected Frequency	Touch Panel/ terminal 12	Multi frequency setting 1 7■■	Touch Panel/ terminal 12	Multi frequency setting 1 7■■
Acc./Dec.	Acc. 4■■ Dec. 5■■	Acc. 4■■ Dec. 5■■	No. 2 Acc./Dec. 6■■	No. 2 Acc./Dec. 6■■

Control circuit (input)	FWD REV	Forward operation command Reverse operation command	FWD - CM ON ; forward run OFF ; decelerate and stop REV - CM ON ; reverse run OFF ; decelerate and stop When both signal apply to the terminal the inverter will decelerate and stop.
	CM	Control circuit common terminal	Common terminal for control input/output signal. Do not ground, since this terminal is not isolated from 11.
	THR	External thermal overload relay, external DB resistor thermostat terminal	The inverter will coast-to-stop, when THR - CM is open.
	RST/BX	External reset signal and/or coast-to-stop command	① During stop due to fault ; Alarm reset ② During Acc., steady state running to stop ; Inactive ③ During Dec. ; Coast-to-stop
Control circuit (output)	30A, 30C	Fault signal terminal	N.O. contact 250 V, 0.3 A, Cos Ø = 0.3, activate when fault
	FM	Analog frequency meter terminal	DC 0~+10 V/O~Top frequency Adjustable maximum voltage +6.5~+10.5 V Input impedance 1 kΩ meter can connect to the terminal (maximum two).

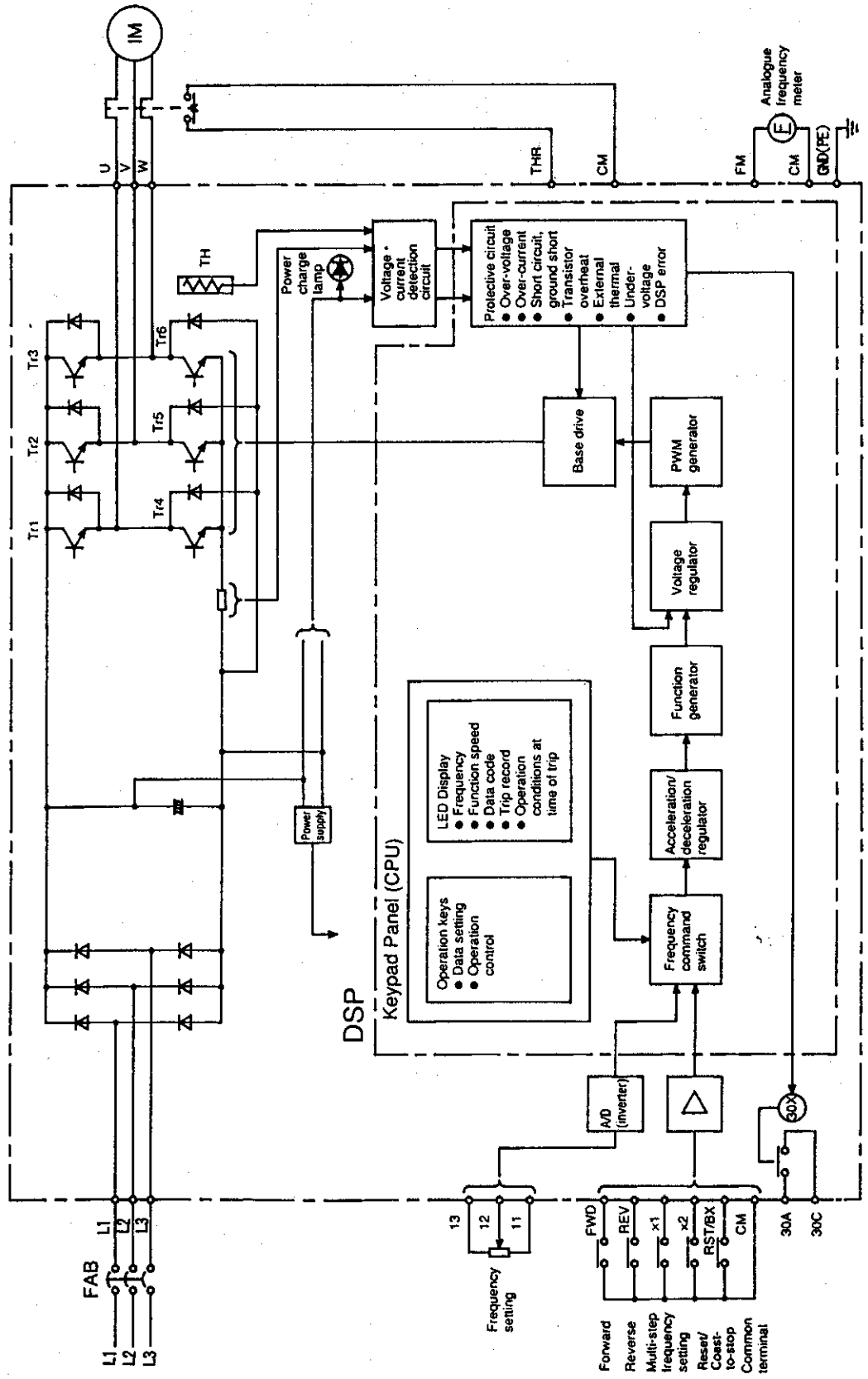
(4) Application Of Wiring And Equipment

Motor Output [kW]		0.2	0.4	0.75	1.5	2.2	4.0
Inverter Model		FVR002 K7S-2EX	FVR004 K7S-2EX	FVR008 K7S-2EX	FVR015 K7S-2EX	FVR022 K7S-2EX	FVR040 K7S-2EX
Inverter Capacity [KVA]		0.57	1.1	1.9	3.0	4.2	6.5
Applicable wire sizes [mm²]	Main circuit	1.25			2		3.5
	Control circuit	0.5					
FUJI Auto Braker		SA33B/15			SA33B/30		SA53B/40
Fuji Fault Breaker		SG33B/15			SG33B/30		SG53B/40
Fuse [A]		5		10	20		30
FUJI Magnetic Contractor		SC-05					SC-5-1
FUJI Thermal Relay		TR-ISN (0.95 ~ 1.45)	TR-ISN (1.7 ~ 2.6)	TR-ISN (2.8 ~ 4.2)	TR-ISN (5 ~ 8)	TR-ISN (7 ~ 11)	TR-ISN (13 ~ 20)
Spark killer		S2-A-0 (for magnetic contacter), S1-B-0 (for mini control relay and timer)					

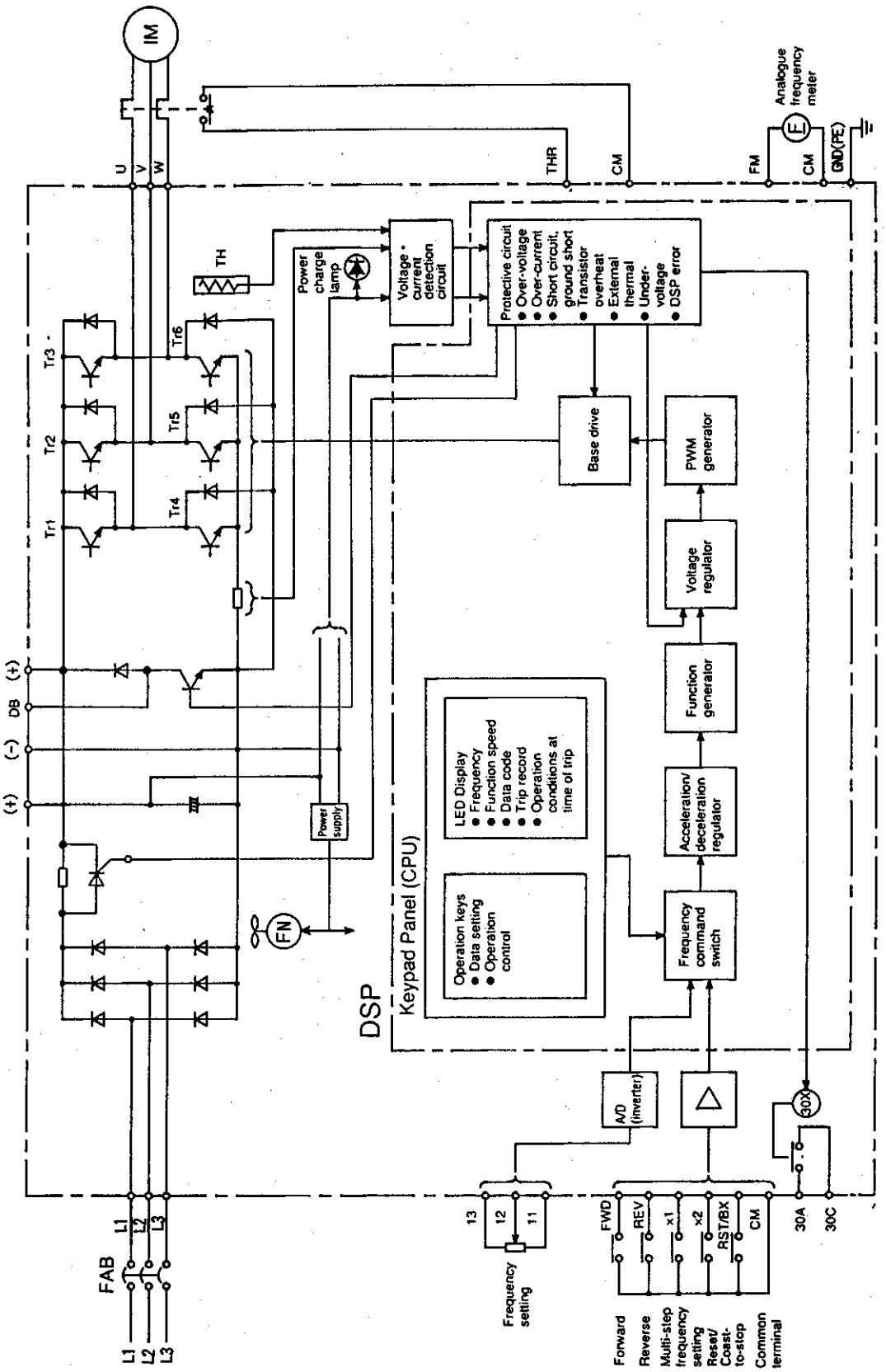
(Note 1) The above data is based on the commonly used FUJI motor

(5) Control Block Diagram

① FVR002 ~ 008 K7S-2EX



② FVR015 ~ 040 K7S-2EX



Function code list

FUNCTION CODE		DATA CODE ▲ ▼			
□■■	Function	■□□	Description	✱	Factory setting
00■	Manufacturer use function	000	—	—	000
01■	Operating method/ Frequency setting selection	010	Touch panel/keypad panel	X	010
		011	Touch panel/External analog signal		
		012	External signal/keypad panel		
		013	External signal/external analog signal		
02■	Auto-restart after instantaneous power failure	020	Inactive	X	020
		021	Active		
03■	Fault memory	030	Present + prior 3 event memory <turn by ▲▼ key>	○	...
04■	V/Hz characteristics	040 ~ 043	4 patterns area available	X	040
1■■	Maximum output voltage	100	Output voltage is according to input voltage	X	100
		115 ~ 123	150V ~ 230V (10V step)		
2■■	Frequency meter adjust	200 ~ 299	6.5V ~ 10.5V (FM terminal output voltage)	○	275
3■■	Torque boost	300 ~ 315	16 patterns are available	○	308
4■■	Acceleration time	400 ~ 431	0.2 ~ 300 sec. (32 patterns)	○	412
5■■	Deceleration time	500 ~ 531	0.2 ~ 300 sec. (32 patterns)	○	512
6■■	No. 2 acc/dec time	600 ~ 631	0.2 ~ 300 sec. (32 patterns)	○	612
7■■	Multi-frequency setting No. 1	700 ~ 760	Max. frequency 50/60 Hz; 1 Hz step output frequency = setting value Max. frequency 100/120 Hz; 2 Hz step output frequency = setting value X 2	X	700
8■■	Multi-frequency setting No. 2	800 ~ 860			800
9■■	Multi-frequency setting No. 3	900 ~ 960			900
A■■	DC injection brake	A00 ~ A10	10 patterns are available (00 : inactive)	X	A00
b■■	DC injection brake starting frequency	b00 ~ b60	Actual frequency setting (Hz) (00 : 0.5 Hz)	X	b00
C■■	DC injection brake time	C00 ~ C10	Actual time setting (sec) (00 : 100 ms)	X	C00
d■■	Upper limiter	d00 ~ d99	Percentage of maximum frequency 00 : Inactive	X	d00
E■■	Lower limiter	E00 ~ E99			E00
F■■	Bias	F00 ~ F99			F00

✱ Data changing during operation : (○ ; possible, X ; impossible)