e m o t r o n ®

DEDICATED DRIVE

DFE
FREQUENCY INVERTER

INSTRUCTION MANUAL

Contents

F O R E W O R D

To fully employ all functions of the inverter, and to ensure the safety of users, please read through this operating manual in detail. Should you have any further query, please feel free to contact your local distributor or sales person of Emotron.

SAFETY

The Inverter is a power electronic device, for safety reason, please take special care for paragraphs with "WARNING" or "CAUTION" symbol. They are important safety precautions to be aware of while transporting, installation, operating or examining the inverter. Please following these precautions to ensure your safety.

WARNING! Personnel injury may be resulted by improper operation.

CAUTION! The inverter or mechanical system may be damaged by improper operation.

WARNING!

- **Do not touch the PCB or components on the PCB right after turning off the power before the charging indicator went off.**
- **Do not attempt to wire circuitry while power is on. Do not attempt to examine the components and signals on the PCB while the inverter operating.**
- **Do not attempt to disassemble or modify internal circuitry, wiring, or components of the inverter.**
- **The grounding terminal of the inverter must be grounded properly according to local safety standards.**

CAUTION!

- **Do not attempt to proceed dielectric strength test to internal components of the inverter. There are sensitive semiconductordevices vulnerable to high voltage in the inverter.**
- **Do not connect the output terminals: T1(U), T2(V), and T3(W) to AC power outlet.**
- **The CMOS IC on the primary PCB of the inverter is vulnerable to static electrical charges. Do not contact the primary PCB of the inverter.**

Examination before installation

Each inverter has been fully tested and examined before shipment. Please carry out following examination procedures after unpacking your inverter.

- Check to see the model number of the inverter. It should be the one that you ordered.

- Check to see if there is any damage during the transportation. Do not connect the inverter to the power supply if there is any sign of damage.

Report to regional sale representative if you find any abnormal condition as mentioned above.

1 .   S A F E T Y   A N D   P R E C A U T I O N S

1.1   Safety instructions

1.1.1 Before applying power

⚠ CAUTION! Choose the appropriate power source with correct voltage setting as the input voltage specification of the inverter.

⚠ WARNING! Special care must be taken while wiring the primary circuitry panel. The L1 and L2 terminal must be connected to input power source and must not be mistakenly connected to T1, T2 or T3 terminal. This may damage the inverter when the power is turned on.

⚠ CAUTION!

- Do not attempt to transport the inverter by the front cover. Securely hold the inverter by the heat-sink mounting chassis to prevent the inverter from falling that may cause personnel injury or damage the inverter.
- Install the inverter onto firm metal base. Do not install the inverter onto or nearby any flammable material.
- Additional cooling fan should be installed if several inverter are installed into one control panel to lower the temperature inside below 40°C to avoid.
- Turn off power supply before proceeding removal or installation of operating panel. Carry out installation procedure according to instructions given to avoid poor contact situation resulting operating panel malfunction or no displaying information.
- Suitable for use on a circuit capable of delivering not more than 5000 A RMS, 240V maximum.
- Not equipped with over speed Protection or equivalent.
- Only intended for use in a macro environment pollution degree 2 or equivalent.

1.1.2 The power is turned ON

⚠ WARNING! Do not attempt to install or remove the connections of the inverter when the power supply is turned on. The inverter may be damaged due to the surge peak caused by the insertion or removal.

1.1.3 Operation

WARNING! Do not switch ON or OFF the motor during operation. Otherwise, the inverter can be damaged due to surge currents.

WARNING!

- Do not remove the front cover of the inverter when the power is ON to avoid personnel injury caused by electrical shock.
- When the automatic restart function is enabled, the motor machinery will be restarted automatically after fully stop from operation. Do not get close to the machinery to avoid personnel injury.

CAUTION!

- Do not touch the heat-sink.
- The inverter can be easily operated from low speed to high speed range. Please reconfirm the operating range of motor and machinery.
- Do not check the signals on the PCB of the inverter when it is in operation.

CAUTION! Do not proceed with disassembling or checking before ensuring that the power is off and the Power LED is off.

1.1.4 Checking and maintenance

CAUTION! Inverter environment should be within temp: -10°C - +40°C, humidity under 95% RH without condensing.

CAUTION! After the removal of shield sticker, the environment temperature should be within -10°C - +50°C and humidity under 95% RH without condensing. Besides, the inverter should be free from water dripping or metal dust.

2. INSTALLATION

2.1 Installation

Please carefully choose the installation site to meet the following requirements:

- Mount the unit vertically.

- Ambiant temperature: –10°C – +40°C
  without shield sticker : –10°C – +50°C.

- Avoid placing close to any heating equipment.

- Avoid water dripping or humid environment.

- Avoid direct sunlight.

- Avoid oil or salty corrosive gas.

- Avoid contacting corrosive liquid or gas.

- Prevent dusts, flocks, or metal scraps from entering the inverter.

- Keep away from radioactive matter or flammable material.

- Avoid electric magnetic interference (soldering or power machinery).

- Avoid vibration, if vibration can not be avoided, anti–vibration measures should be installed to reduce vibration.

- If the inverter is installed in a control cabinet, please tear off the shield sticker. An additional cooling fan should be installed to lower the ambiant temperature below 50°C.
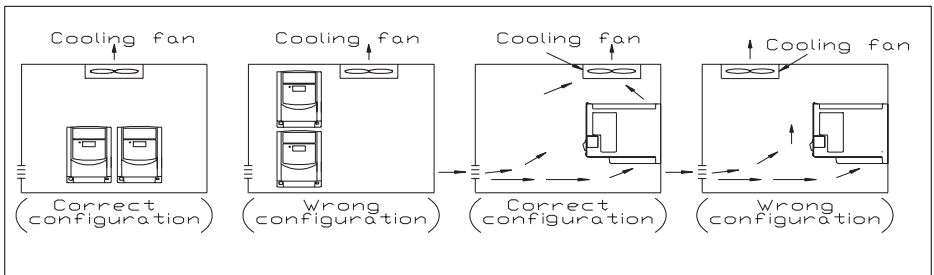
Fig. 1

- Installation of the inverter must place the front side of inverter facing front and the top of inverter towards up direction for better heat dissipation.

- Installation rooming must be compliant to following requirement.
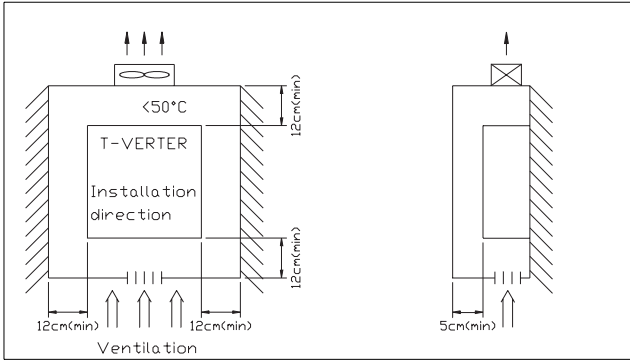
Fig. 2

NOTE! Please take away the shield sticker on top of the inverter!

2.2 Type number

Example: DFE23-04

230 VAC single phase 0.75 kW standard inverter.

DFE	23	01			
Series	Power voltage	Rated current	Motor power	Power supply	EMC filter
	23:230V	01:1.4 A 02:2.3 A 04:4.2 A 08:7.5 A 10:10.5 A	0.18 kW 0.37 kW 0.75 kW 1.5 kW 2.2 kW	Single Phase	Built in

Fig. 3

2.3   DFE inverter specification

Model No: DFE**		23-01	23-02	23-04	23-08	23-10
Rated	Motor power (kW)	0.2	0.4	0.8	1.5	2.2
	Current continuous (A)	1.4	2.3	4.2	7.5	10.5
	Current max (A)	2.1	3.4	6.3	11.2	15.8
	Capacity (kVA)	0.5	0.9	1.6	2.9	4
	Weight (Kg	0.8	0.8	0.8	1.7	1.8
Input Voltage Max.		Single phase 200-240V (+10%-15%), 50/60Hz (+/-5%)				
Output Voltage Max.		Three phase 200-240V +10%-15% (Input Voltage Max)				
Input Signal Type		PNP type (SOURCE) input				
Control Method		Sinusoidal wave PWM control				
Freq. Control	Frequency Range	0-200 Hz				
	Resolution Setting	Digital:0.1Hz(0-99.9Hz); 1Hz(100-200Hz) Analog:0.06Hz/60Hz				
	Keyboard Setting	Directly setup by +/- buttons.				
	External Signal Setting	0-10V, 4-20mA , 0-20mA				
	Other functions	Frequency upper and lower limit				
General Control	Acc.-/Decelerate time	0.1- 999 Sec				
	V/F Curve	6 curves				
	Torque boost	Torque boost level adjustable (manual torque boost)				
	Multi-Function input	2 point, to be used as multispeed 1(Sp1)/Jog/External emergency stop/External bb/Reset				
	Multi-Function output	1A Relay terminal, to be setup as Fault/Running/Frequency. agreed function				
	Braking Torque	About 20%, additional breaking resistance not allowed				
	Other functions	Decelerate or free run stop, Auto reset, DC braking frequency/Voltage/Time can be setup by constants.				
Indication function		3 x 7 segments indicates: frequency/inverter parameter/ fault record/program version.				
Operating temperature		-10 - +40°C (+50°C without protective sticker)				
Humidity		0-95% RH non-condensing				
Vibration		Under 1 G (9.8 m/s^2)				
EMC specification		Class A (Filter built in)				
Protection level		IP20				
UL		UL508C				
Protection function	Overload protection	150% for 1min.				
	Overvoltage	DC voltage > 410V				
	Under voltage	DC voltage < 200V				
	Momentary powerloss	0 - 2 sec : inverter can be restart by speed search				
	Stall Prevention	Accelerate / Decelerate / Constant speed				
Protection function	Output termi. shortcircuit	Electronic circuitry protection				
	Grounding fault	Electronic circuitry protection				
	Other function	Heat sink protection, Current limit. Fan activ only in Run mode.				
Dimensions WxHxD		72mm x 132mm x 118mm				
Installation		Screw or DIN rail (Option)				

2.4   Fuses/Wiring

External wiring should be carried out in accordance with following require-
ment. Check and measure that the wiring is correct after the wiring is complete.
(Do not megger the cables).

Model No: DFE	Recommended fuse (A)	Max. fuse (A)
23-01	10	20
23-02	10	20
23-04	10	20
23-08	16	32
23-10	20	32

Use cables according to the local standards.

**NOTE! Take all necesary measures to fullfil the EMC directives. See also Chapter 2.6
page 9 EMC connection.**

If the inverter is used to drive more than one motor, the total current must be
less or the same than the current of the inverter. Additional thermal relays must
be installed for every single motor. Use the Fn_18 at 1.0 times of the rated value
specified on the motor nameplate at 50 Hz, 1.1 times of the rated value specified
on the motor nameplate at 60 Hz.

Do not install power factor capacitors, LC or RC components between the
inverter and the motor.

The signal cable connector is suited for cables with a maximum diameter of
0.75 mm^2.

2.5   Recommendation for brake resistor

The choice of the resistor depends on the application switch–on duration and
duty–cycle.

DFE 23-08	minimum value 100 Ω
DFE 23-10	minimum value 70 Ω

2.6 EMC connection and earthing

A) It is very important to use a screened motor cable. The following instructions must be carried out to fulfill the demands acc. to the EMC standards.

• Use a metal mounting plate and place the frequency inverter on it.

• Use a screened motor cable with 4 wires (U,V,W,& Earth), don't use the shielding as safety earth (shield is high frequency earth)

• Use a metal unpainted clamp to connect the shielding to the mounting plate, so there is a good 360° contact between the shielding and the mounting plate (remove paint if necessary)

• Don't solder to the shielding (no pig tail connections).

• When using the optional Class B EMC filter for 1st environment, make sure to mount it as described in Chapter 2.2 page 6. Keep the wiring between frequency inverter and EMC filter as short as possible (< 30 cm).

• Use only motors with the same or less power rating than the inverter.

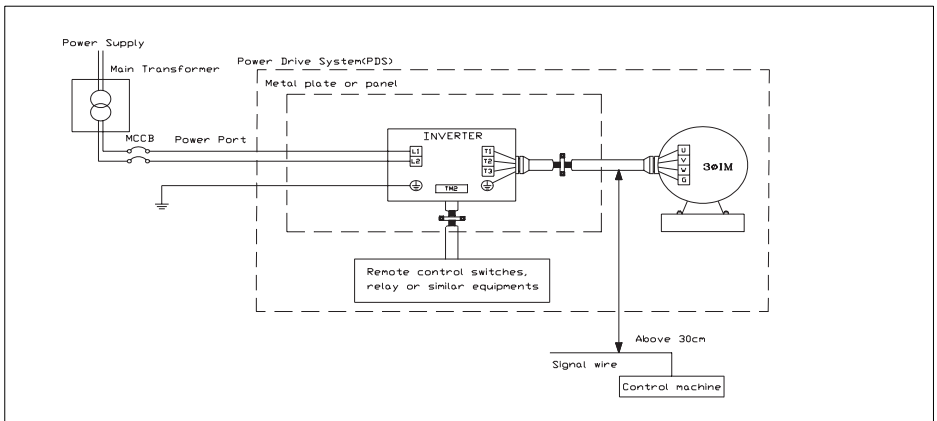### Class A Installation, 2nd environment according to EN61800-3

Fig. 4

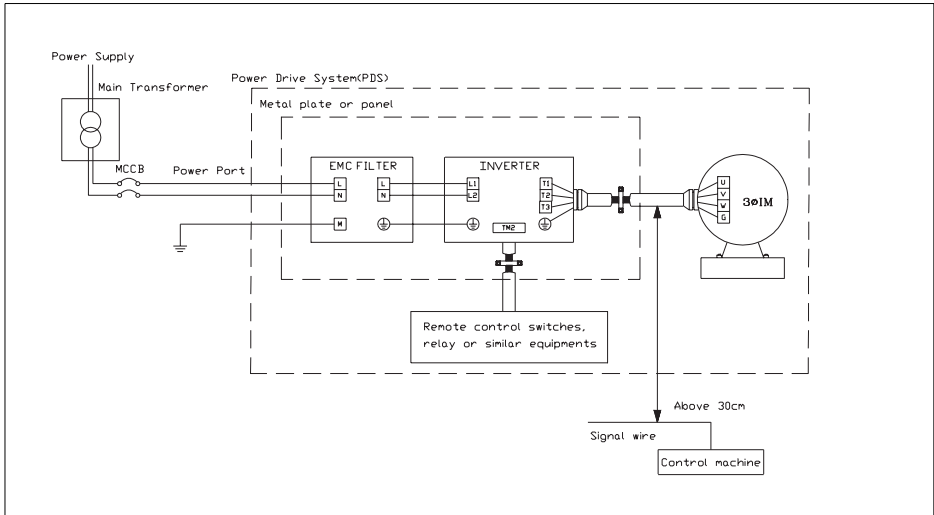## Class B Installation (Optional), 1st environment acc. to EN61800-3

Fig. 5

- When the distance between the inverter and motor is longer than 100m, cables should be carefully chosen to reduce the cable resistance below 3% and the voltage drop (V) = $\sqrt{3}$ x Cable resistance (Ω/km) x cable length (m) x current x 10-3.

B) Control cables must be separated and away from the power cables and other high voltage or large current power lines to avoid noise interference.

- To reduce the noise interference and avoid bad operation, shielded twisted pair cable must be used to wire the control circuitry. Please refer to the following diagram. Connect the shielding with a metal cable clamp to the mounting plate in order to get a good 360° connection (remove paint if necessary).

- Connect the shielding to the high frequency reference on both ends of the control cable.

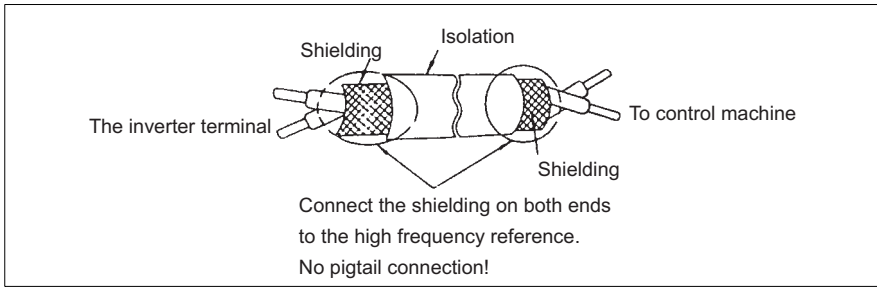**NOTE! Wiring distance must be under 50 m.**

Isolation

Shielding

The inverter terminal

To control machine

Shielding

Connect the shielding on both ends
to the high frequency reference.
No pigtail connection!

Fig. 6

C) The grounding terminal of the inverter must be correctly grounded in compliance with 200V class type three grounding.

- Grounding wire should be wired in accordance to electrical equipment (AWG) with the length of the grounding wire as short as possible.
- The grounding wire of the inverter must not be grounded together with other large current loading (such as soldering machine or large power motor). They should be grounded separately.
- Grounding circuitry must not be formed when grounding several inverters together.

[a] good   [b] good   [c] not good

Fig. 7

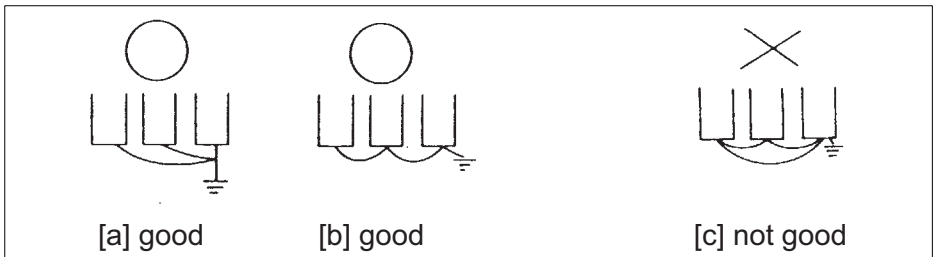**D)** Use appropriate cable with correct diameter for primary power circuitry and control circuitry in accordance with the local electricity regulations.
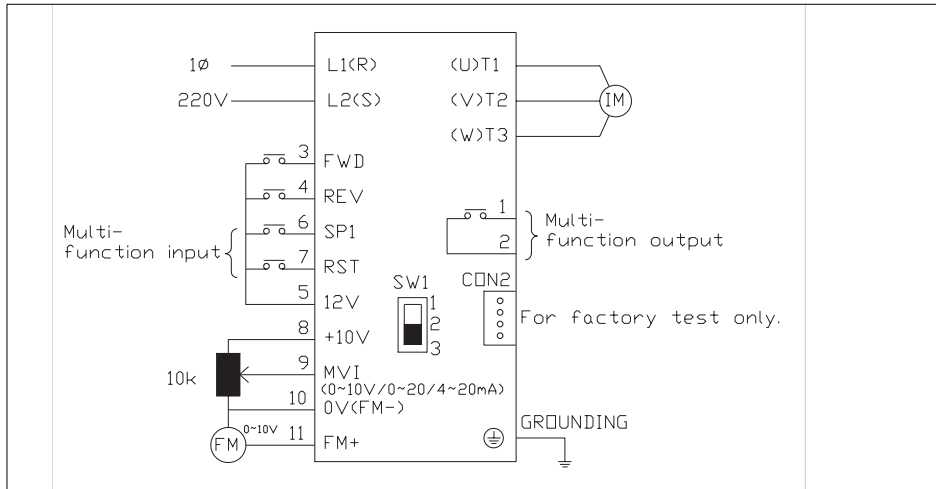
2.7 Wiring example

Fig. 8

Note! If the start input is connected using a jumper an error message is displayed and the inverter will not start. Change parameter Fn_28.
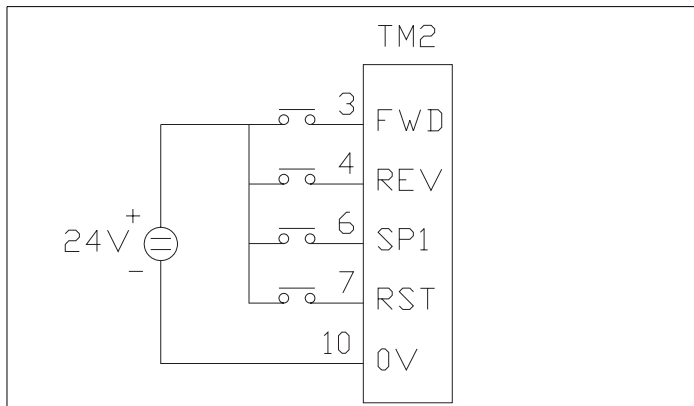
2.8 External 24V control supply

Fig. 9

2.9 Power terminals

Power terminal (TM1)

Terminal symbol	Function description
L1 (R)	Primary power source input
L2 (S)	
T1 (U)	Inverter output
T2 (V)	
T3 (W)	

- Wire voltage rating must be minimum of 300 V.
- Electric ratings of the terminals (TM1) as 300 V 15 A.

2.10 Control terminals

	Terminal symbol	Terminal function description
1	TRIP	Trip relay output
2	RELAY	Connection point rated capacity 250 VAC/1 A (30 VDC/1 A)
3	FWD	Start/stop and forward/reverse control (refer to Fn_03, page 22)
4	REV	
5	+12V	Common for terminals 3 / 4 / 6 / 7
6	SP1	Multifunction input terminals (refer to Fn_19, page 28)
7	RESET	
8	+10V	Supply for potentiometer (Pin 3)
9	Vin	Analog frequency signal input (Pin 2 of potentiometer or positive terminal of 0-10 V/4-20 mA/0-20 mA)
10	0V	Analog signal common point (Pin 1 of potentiometer or negative terminal of 0-10 V/4-20 mA/0-20 mA)
11	FM+	Analog frequency signal output terminal. Output terminal signal is 0 - 10 VDC/Fn6

- Cable voltage rating must be minimum of 300 V.
- Control wiring should not run in the same conduit as power cable.
- Single Input and Output Terminals (TM2) Ratings are ALL Class 2.

2.11   SW1 function description

SWITCH 1	External signal type
	0-20 mA analog signal (When Fn11 set to 1) 4-20 mA analog signal (When Fn11 set to 2)
	0-10 VDC analog signal (When Fn11 set to 1)

2.12 Dimensions
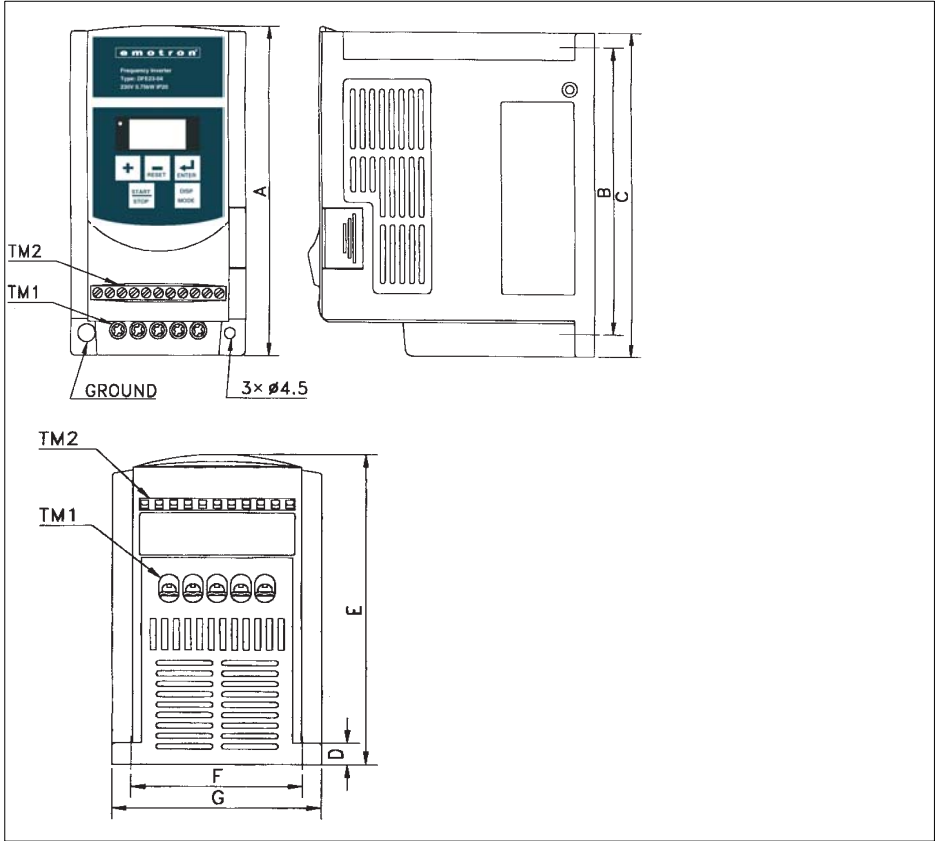
Fig. 10

MODEL	A, mm	B, mm	C, mm	D, mm	E, mm	F, mm	G, mm
DFE23-01/02/04	132	116	130	8.2	118	61	72
DFE23-08/10	143	128	140	8.2	172	108	118

2.13 Dimensions & Installation of class B Filter (E2F-2102/E2F-2202)
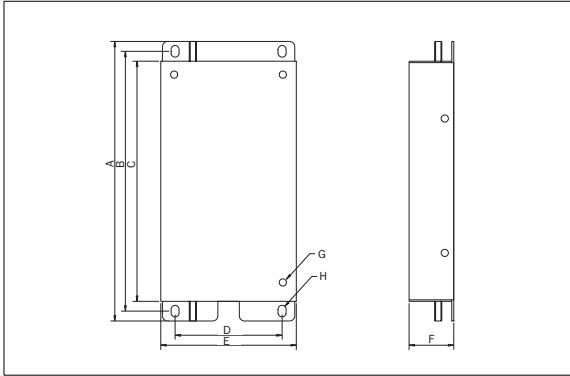
Fig. 11

MODEL	A, mm	B, mm	C, mm	D, mm	E, mm	F, mm	G, mm
DFE23-01/02/04	156	145	134	60	76	35	M4x14
DFE23-08/10	170	156	144	106	122	38	M4x14

Inverter with class B filter (E2F-2102) mounted.

Inverter with class B filter (E2F-2102) & Din rail (DINE2-201) mounted.
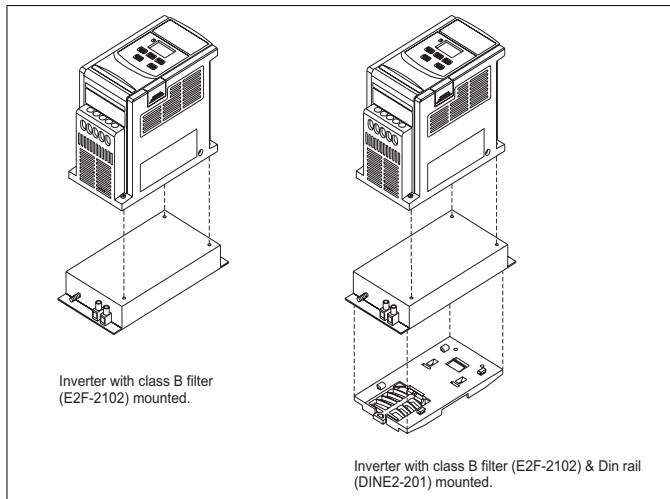
Fig. 12

2.14 Din rail option

Step 1-
Aim and insert the 4 retention ribs of DIN rail option at the 4 holes in rear panel of the inverter

Step 2-
Push the DIN rail option forward until the middle rib grips firmly with the rear panel

Inserting hole

STEP 2

STEP 1

Retention rib
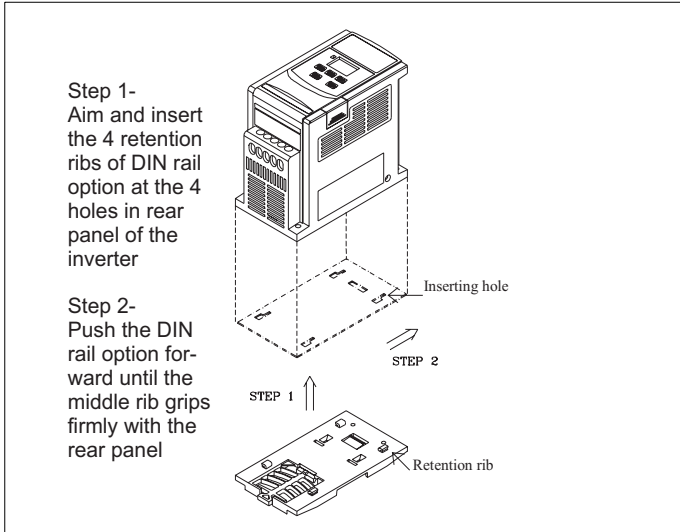
Fig. 13

DIN rail option and 35 mm width DIN rail must be used to install the inverter on the rail.

Mounting

Demounting

Mounting plate

Pull mounting plate

Screw driver

First place the groove on the back of module on the upper edge of of DIN rail and then push the module down to the lock position. Finally press the mounting plate upward into the module.

1 Pull the mounting plate downward.

2 Rotate the inverter module to demount it.

Fig. 14

Fig. 15

Mounting clamp must be used to secure the inverter.

3. FUNCTIONAL DESCRIPTION

3.1 Keypad indication and operating instructions

Fig. 16

⚠️ **CAUTION! Do not operate keypad by screwdriver or other sharpended tool to avoid damaging the keypad.**

3.2 Keypad operation flowchart

Fig. 17

3.3 List of Parameters

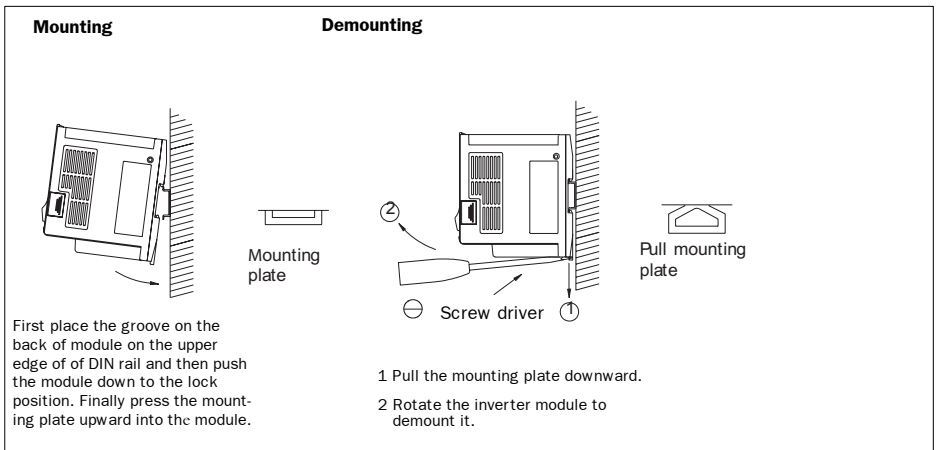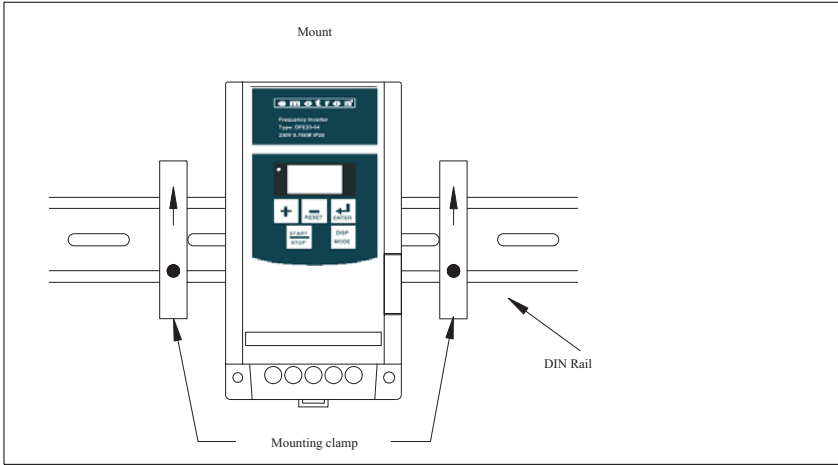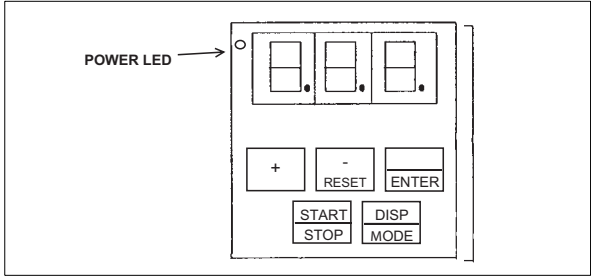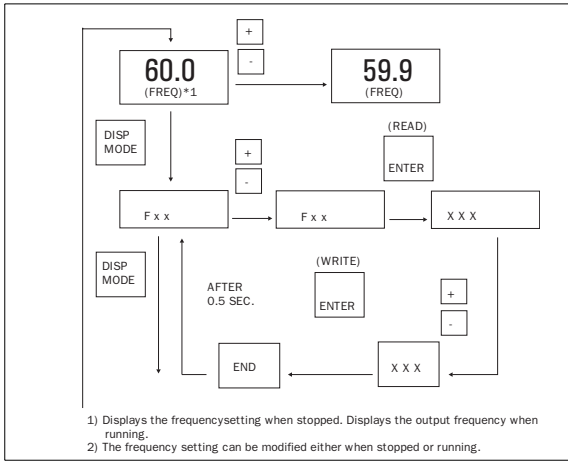| Function	FN	Function Description	Unit	Range	Factory setting	Note
	0	Factory Adjustment			0	
Accelerate/ Decelerate Time	1	Accelerate time	0.1s	0.1 - 999 s	5.0	*1*3
	2	Decelerate time	0.1s	0.1 - 999 s	5.0	*1*3
Operation mode	3	0: Forw/Stop, Rev/Stop 1: Run/Stop, Forw/Rev	1	0 - 1	0	
Motor rotation direction	4	0: Forward 1: Reverse	1	0 - 1	0	*1
V/F Pattern	5	V/F pattern setting	1	1 - 6	1/4	*2
Frequency upper /lower limit	6	Frequency upper limit	0.1Hz	1.0 - 200Hz	50/60Hz	*2*3
	7	Freq. lower limit	0.1Hz	0.0 - 2000Hz	0.0Hz	*3
SP1 frequency	8	SP1 frequency	0.1Hz	1.0 - 200Hz	10Hz	*3
JOG frequency	9	JOG frequency	0.1Hz	1.0 - 200Hz	6Hz	
Operation control	10	0: Keypad 1: External terminal	1	0 - 1	0	
Frequency Control	11	0: Keypad 1: Ext. terminal (0-10V/ 0-20mA) 2: External terminal (4-20mA)	1	0 - 2	0	
Carrier freq. control	12	Carrier Frequency setting	1	1 - 5 (1-10)	5	
Torque compensation	13	Torque compensation gain	0.1%	0.0 - 10.0%	0.0%	*1
Stop method	14	0: Decelerate stop 1: Free run stop	1	0 - 1	0	
DC braking setting	15	DC braking time	0.1s	0.0 - 25.5s	0.5s	
	16	DC braking injection frequency	0.1Hz	1 - 10Hz	1.5Hz	
	17	DC braking level	0.1%	0.0 - 20.0%	8.0%	
Electronic thermal overload protection	18	Protection based on motor rated current	1%	50 - 200%	100%	
Multifunction input connection point	19	Multifunction input terminal 1 function	1: Jog 2: Sp1 3: Emergency stop 4: Extern. Base Block 5: Reset 6: Sp2			2	
	20	Multifunction input terminal 2 function			5	
Multifunction output	21	Multifunction output terminal	1: Operating 2: Frequency reached 3: Fault		3	
Reverse instruction	22	0: REV run enabled 1: REV run disabled	1	0 - 1	0	
Momentary power loss	23	0: Enabled 1: Disabled	1	0 - 1	0	

Function	FN	Function Description	Unit	Range	Factory setting	Note
Auto restart	24	Number of Auto-restart times	1	0 - 5	0	
Factory setting	25	010: Parameter initialization to 50Hz system 020: Parameter initialization to 60Hz system				*2
Sp2 Frequency	26	Sp2 Frequency	0.1Hz	1.0-200Hz	20	
Sp3 Frequency	27	Sp3 Frequency	0.1Hz	1.0-200Hz	30	
Direct start	28	0: active 1: inactive	1	0-1	34	*4
Software version	29	CPU program version				
Fault trace	30	Last 3 malfunction memory				

NOTES!
*1: Indicate that this parameter can be adjusted during running mode
*2: Please refer to Fn_25
*3: If the setting range is above 100 , the setting unit becomes 1.
*4: New function for CPU verstion V2.1 and higher.

3.4   Parameter function description

Fn_00 Factory adjustment parameter. Do not change.

Fn_01 : Accelerate time = 0.1 - 999 sec
Fn_02 : Decelerate time = 0.1 - 999 sec

1. Accelerate/decelerate time calculation formula:

$$\text{Accelerate time} = \text{Fn\_01} \times \frac{\text{Setting Frequency}}{60 \text{ Hz}}$$

$$\text{Decelerate time} = \text{Fn\_02} \times \frac{\text{Setting Frequency}}{60 \text{Hz}}$$

> **Fn_03 : Operation mode selection =**
> **0 : Forward / Stop , Reverse / Stop**
> **1 : Run / Stop , Forward / Reverse**

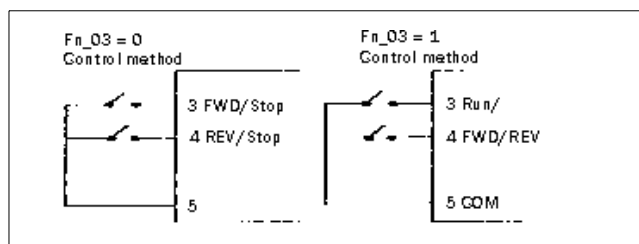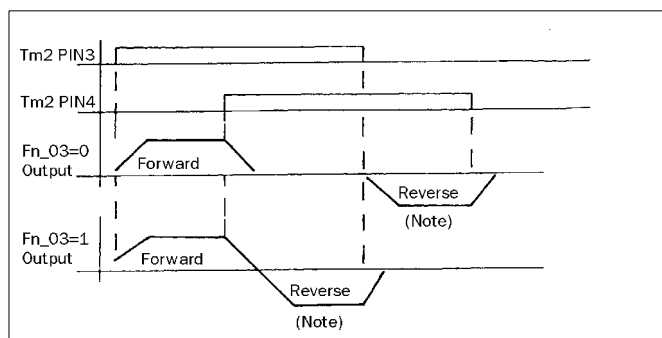**NOTE! Fn_03 take effect only when Fn_10 = 1 (external operation control)**

Fig. 18

Fig. 19

NOTE! Reverse command is ignored when Fn_22 = 1

Although there is no Forward/Reverse push button on the digital control panel, it is possible to adjust forward/reverse function by changing Fn_04 setting.

NOTE! When Fn_22 =1: Reverse disabled, the Fn_04 can not be set to 1. Then keypad indication would display "LOC".

Adjust Fn_05 = 1-6 to select one of six fixed V/F pattern. (refer to following tables).

Specification	50 Hz System		
Application	General Application	High starting torque	Decreasing torque
Fn_5	1	2	3
V/F pattern	V (%) 100 B C Hz 1 2.5 50 120	V (%) 100 B C Hz 1 2.5 50 120	V (%) 100 B C Hz 1 25 50 120
Specification	60 Hz System		
Application	General Application	High starting torque	Decreasing torque
Fn_5	4	5	6
V/F pattern	V (%) 100 B C Hz 1 3.0 60 120	V (%) 100 B C Hz 1 3.0 60 120	V (%) 100 B C Hz 1 30 60 120

Fn_5	B	C
1/4	10%	8%
2/5	15%	10.5%
3/6	25%	7.7%

> **Fn_06 : Frequency upper limit = 1 - 200 Hz**
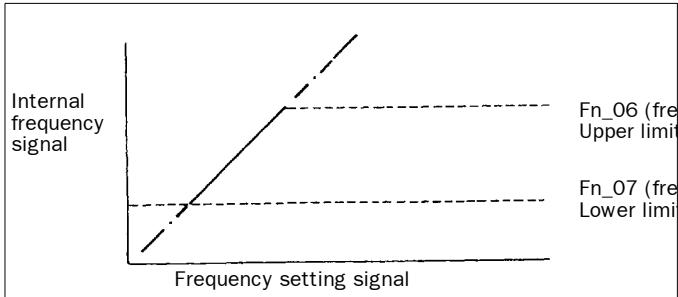> **Fn_07 : Frequency lower limit = 0 - 200 Hz**

Fig. 20

NOTE! If Fn_07 = 0 Hz, and the frequency instruction is equal to 0Hz, the inverter will stop at 0 speed.
If Fn_07 > 0 Hz, and the frequency instruction $\geq$ Fn_07, the inverter will output according to Fn_07 setting.

> **Fn_08 : SP1 frequency = 1 - 200 Hz**
> **Fn_09 : Jog frequency = 1 - 200 Hz**

1. When Fn_19 or Fn_20 = 2 and multifunction input terminal is ON, the inverter operate at Sp1 frequency (Fn_08)

2. When Fn_19 or Fn_20 = 1 and multifunction input terminal is ON, the inverter operate at Jog frequency (Fn_09)

3. The priority of reading frequency setting is : Jog $\rightarrow$ Sp1 $\rightarrow$ Keypad setting or external frequency signal

> **Fn_10 : Operation Control**
> **= 0 : Operation instruction is setup by Keypad**
> **= 1 : Operation instruction is setup by external terminal**

NOTE! When Fn_10=1 (external operation control), emergency stop on the keypad is enabled.

> **Fn_11 : Frequency control**
> **= 0 : Frequency instruction is setup by Keypad**
> **= 1 : Frequency instruction is setup by VR or analog**
>   **signal on TM2**

NOTE! When Jog frequency or Sp1 frequency is switched on, the frequency is setup by Sp1 speed, the +/- buttons on the keypad are disabled. Original setting will be restored after Sp1 connection is OFF.
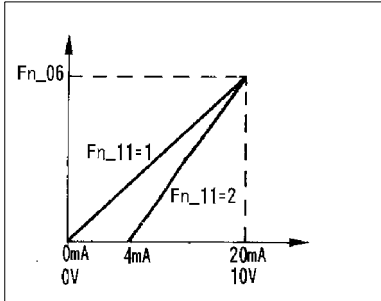

Fig. 21

NOTE! During the acceleration after operating instruction and the accele-ration/ deceleration after Sp1 change the buttons on the keypad are disabled.

Fn_12 : Carrier frequency = 1 - 5

Fn_12	Carrier frequency
1	4 kHz
2	5 kHz
3	6 kHz
4	7.2 kHz
5	8 kHz
6	10 kHz
7	12 kHz
8	14.4 kHz
9	15 kHz
10	16 kHz

Although an IGBT type frequency inverter can provide low noise environment under operation, it is possible that the high carrier frequency may interfere with external electronic components (or other controller) or even cause vibration on the motor. Adjusting the carrier frequency can correct this situation.

NOTE! If Fn_12=10 inverter must operate at low load.

Fn_13: Torque compensation gain = 0 - 10 %

The inverter output voltage according to the B, C point on the V/F pattern (refer to Fn_05 description) can be added by the Fn_13 settings to enhance the output torque

NOTE! When Fn_13 = 0, the torque boost function is disabled.

> **Fn_14 Stopping method = 0 : Decelerate stop**
> **1 : Free run stop**
> **Fn_15 DC braking time = 0 - 25.5 sec**
> **Fn_16 DC braking starting frequency = 1 - 10 Hz**
> **Fn_17 DC braking level = 0 - 20 %**

If Fn_14 = 0

When the inverter is stopped, it decelerates to the frequency set by Fn_16 and the output voltage level set by Fn_17; after the time duration set by Fn_15, the inverter goes into complete stop.

If Fn_14 = 1

The inverter stops immediately after receiving a stop command. The motor freewheels.

> **Fn_18: Motor rated current = 0 - 200 %**

Function of the electronic thermal protecting motor is as follow:

1. Motor rated current = Inverter rated current x Fn_18
   Fn_18 = Motor rated current / inverter rated current

2. When the load is within 100% of the motor rated current, the operation continues. When the load reaches 150% of the motor rated current the operation may continue for only 1 minute. (refer to curve (1) in Fig. 22)

3. After activating the electronic thermal protection, the inverter is cut off immediately. The OL1 is flashing. To resume operation, push RESET button or activate external reset terminal.

4. When the motor is operating at low speed, the heat dissipation efficiency is lowered. The electronic thermal activation level is reduced also (change from curve (1) to curve (2) in Fig. 22). Choose appropriate Fn_05 setting according to applied motor to reach a better protection.

Function of the electronic thermal protecting inverter is as follow:

1. When the load is within 103% of the inverter rated current, the operation continues. When the load reaches 150% of rated current of the inverter, operation may continue for 1 minute only (refer to curve (1) of Fig. 22)

2. After the activation of the electronic inverter thermal protection, the inverter is cut off immediately. The OL2 is flashing. To resume the operation, push RESET button or activate external reset terminal.

Fn_05=1,2,3 – 50 Hz standard motor

Fn_05=4,5,6 – 60 Hz standard motor
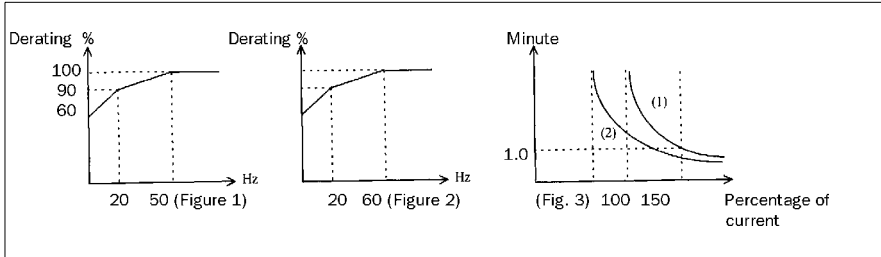
Fig. 22

Fn_19: Multifunction input terminal 1 function = 1-5 (1-6)
Fn_20: Multifunction input terminal 2 function = 1-5 (1-6)

1. Fn_19, Fn_20 =1 : JOG

2. F_19, F_20=2 or 6 Multi-speed control:

Table 1   Fn_19 and Fn_20=6

TM2 SP1 Terminal	TM2 RESET Terminal	Output frequency
ON	OFF	F_08
OFF	ON	F_26
ON	ON	F_27

Table 2   Fn_19 and Fn_20=2

TM2 SP1 Terminal	TM2 RESET Terminal	Output frequency
ON	OFF	F_26
OFF	ON	F_08
ON	ON	F_27

NOTE! Fn_19, F_20=2 or 6 are only available in models DFE23-08/10.

3. Fn_19, Fn_20 =3: External emergency stop signal

When the external emergency stop signal is activated, the inverter generates a decelerate stop (ignoring the setting in Fn_14) and flash E.S. after stop. After the emergency stop signal is deactivated, turn the RUN switch OFF and then ON again (Fn_10 =1), or push the RUN key (Fn_10=0). The inverter will then resume operation and restart. If the emergency stop signal is removed before the inverter stops, the inverter will still execute the emergency stop.

4. Fn_19, Fn_20 =4: External Base Block (immediate shut off)

When the external base block signal is activated, the inverter output will be immediately shut off (ignoring setting in Fn_14) and flash b.b. After the base block signal deactivated, turn the RUN switch OFF and then ON again (Fn_10 = 1) or push the RUN key (Fn_10=0), the inverter will restart from the starting frequency.

5. Fn_19, Fn_20 = 5: Reset inverter trip.

Fn_21: Multi-function output terminal = 1 - 3

1. Fn_21 = 1: Run mode signal
2. Fn_22 = 2: Frequency agreed signal
3. Fn_21 = 3: Fault signal

Fn_22:Reverse instruction
  = 0 : REV command enabled

NOTE! When Fn_04 is set to 1 (reverse), Fn_22 can not be set to 1, indication displays "LOC". Fn_04 must be changed to 0 before setting Fn_22 to 1.

Fn_23: Restart after momentary power loss
= 0 : Restart enabled

1. When AC power supply is temporary lower then the low voltage protection level because of a power dip, the inverter will stop immediately. If the power source resumes within 2 seconds, the inverter can restart by SPEED SEARCH (start tracing from the breaking frequency), otherwise the inverter will trip on "LV-C".

2. When Fn_23 =0, if the transient power off duration is less than 2 sec., the inverter resumes operation via speed search at 0.5 sec after power up. The restart time is not limited by Fn_24. If the transient power off duration is longer than 2 sec., it is up to the setting of Fn_24 to decide if the inverter can be automatically restarted.

3. When Fn_23 = 1, the inverter will trip immediately after the transient power off and indicate LV-C. It can not be restarted. (Not controlled by Fn_24)

Fn_24: Number of Auto-restart times = 0-5

1. When Fn_24 = 0, the inverter will not automatically reset after trip.

2. When Fn_24 > 0 , the inverter will resume operation via SPEED SEARCH at 0.5 second after trip and return to the operating frequency before the trip. After that, the inverter will accelerate or decelerate to the prevailing frequency setting.

3. When the inverter is set to deceleration or DC braking, the transient restart procedure is not performed.

4. When either of the following situations occur, the transient restart count will be reset:
   (1) No additional malfunction (in operation or stop) occurs within 10 minutes.
   (2) Press RESET button or external terminal RESET is ON.

Fn_25 : Factory settings function
= 010 : Constants initialization to 50Hz system
= 020 : Constants initialization to 60Hz system

1. When Fn_25 is set to 010, all parameters are restored to the factory settings for 50Hz systems. The settings of Fn_05 =1 and Fn_06 = 50. Fn_25 is restored back to 000 after the reset process is completed.

2. When Fn_25 is set to 020, all parameters are restored to factory settings for 60Hz systems. The settings of Fn_05 =4 and Fn_06 = 60. Fn_25 is restored back to 000 after the reset process complete.

Fn_26: Sp2, Multi-speed 2 (Reference for Fn_19, Fn_20)

Fn_27: Sp3, Multi-speed 3 (Reference for Fn_19, Fn_20)

Fn_28: Direct start
0: Direct start possible when remote control
1: Direct start impossible when reamote control
    (CPU version V2.1 or higher)

If the start signal is activated at power up an alarm is set. To enable automatic restart at power up set Fn_28=0.

Fn_29: Software (program) version

Fn_30: Fault trace

1. Fault trace: indicate the sequence of the occurrence of malfunctions by the location of decimal point. **x.xx** indicates a recent malfunction. **xx.x** indicates the last malfunction that happened. **xxx**. indicates the earliest malfunction in the record.

2. After entering the Fn_30 function, the **x.xx** record will be displayed first. After that, press + button to read out
xx.x:-->:xxx.:-->:x.xx -->,,, consecutively.

3. After entering Fn_30 function, if the RESET button is pressed, all three malfunction records will be cleared. Indication display **-.--, --.-**, and **---**.

4. When the contents of malfunction memory indicates O.CC, it means the latest malfunction code is OC-C and so on.

4. TROUBLESHOOTING

4.1 Manual reset inoperative errors

Indication	Content	Possible Cause	Countermeasure
CPF	Program error	Outside noise interference	Place a RC surge absorber in parallel with the noise generating magnetic contact
EPR	EEPROM error	EEPROM defective	Replace EEPROM
OV	Voltage too high while not operating	1. Power source voltage too high. 2. Detection circuitry defective	1. Examining the power supply 2. Return the inverter for repair
LV	Voltage too low while not operating	1. Power source voltage too low. 2. Detection circuitry defective.	1. Examining the power supply 2. Return the inverter for repair
OH	Inverter over heat while not operating	1. Detection circuit defective. 2. Environment overheat or poor ventilation	1. Return the inverter for repair 2. Improve ventilation

4.2 Manual reset operative errors (Auto-Reset disabled)

Indication	Content	Possible Cause	Countermeasure
OC	Overcurrent at stop condition	Detection circuit malfunction	Return the inverter for repair
OL1	Motor over-load	1. Loading too large 2. Improper V/F model setting 3. Improper Fn_18 setting	1. Increase capacity of motor 2. Adjust to use a proper V/F curve setting 3. Adjust Fn_18 according to instruction
OL2	Inverter over-load	1. Loading too large 2. Improper V/F model setting	1. Increase capacity of inverter 2. Adjust to use a proper V/F curve setting

4.3   Manual Reset and Auto-Reset Operative errors

Indication	Content	Possible Cause	Countermeasure
OCS	Transient over-current start-ing machine	1. Motor coil short-circuited to external casing 2. Motor connection wire short-circuit with grounding 3. Transistor module damaged	1. Examining motor 2. Examining wiring 3. Replace transistor module
OCA	Overcurrent at acceleration	1. Acceleration time setting too short 2. Improper V/F feature selection 3. Applied motor capacity exceeds inverter capacity	1. Adjust acceleration time to longer setting 2. Adjust to a proper V/F curve 3. Replace and install another inverter with appropriate capacity
OCC	Overcurrent at steady speed	1. Transient alteration of the loading 2. Transient alteration of the power supply	1. Examining the loading configuration 2. Install inductor on the power supply input side
OCd	Overcurrent at deceleration	Deceleration setting too short	Adjust to use a longer acceleration time
OCb	Overcurrent at braking	DC Braking frequency, braking voltage, or braking time setting too high	Adjust to reduce settings of Fn_15, Fn_16, or Fn_17
OVC	Overvoltage at operation/deceleration	1. Deceleration time setting too short or inertial loading too large 2. Power supply voltage variation too large	1. Adjust to use a longer deceleration time 2. Install an inductor on the power supply input side 3. Increase the capacity of inverter
LVC	Insufficient voltage level at operation	1. Power supply voltage too low 2. Power supply voltage variation too large	1. Improve power source quality 2. Adjust to use a longer acceleration time 3. Increase capacity of inverter 4. Install a reactor on the power supply input side
OHC	Heat sink over heated at oper-ation	1. Loading too heavy 2. Ambient temperature too high or poor ventilation	1. Examine the loading 2. Increase capacity of inverter 3. Improve ventilation

4.4   Special Conditions

Indication	Content	Description
SP0	Zero Speed Stopping	When Fn_11 = 0, Fn_7= 0 and frequency setting < 1 Hz When Fn_11 = 1, Fn_7<(Fn_6/100), and frequency setting <(Fn_6/100)
SP1	Do not start automatically	If the inverter is in remote control (Fn_1=1) and direct start is not selected (Fn_28=1) the inverter will not start. Set Fn_28=0.
SP2	Keypad emergency stop	The inverter setup to external operation (Fn_10=1). If the STOP key in the keypad is pressed during operation, the inverter stop according the setting in Fn_14 and flashes SP2 after stop. The RUN switch must be turned OFF than ON to restart the machine.
E.S.	External emergency stop	When the external emergency stop signal is activated through the multi-function input terminal, the inverter decelerates and stops. Inverter flashes E.S. after stop. (Refer to instruction for Fn_19 for detail).
b.b	External BASE BLOCK	When the external BASE BLOCK signal is activated through the multi-function terminal, the inverter stops the motor output immediately and flash b.b. for indication. (refer to instruction for Fn_19 for detail)

4.5   Keypad Errors

Indication	Content	Possible Cause	Countermeasure
LOC	Motor direction locked	1. Attempt to reverse direction when Fn_22=1 2. Attempt to set Fn_22 to 1 when Fn_04 = 1	1. Adjust Fn_22 to 0 2. Adjust Fn_04 to 0
Er1	Keypad operation error	1. Press + or - keys when Fn_11=1 or under sp1 operation 2. Attempt to modify Fn_29 3. Attempt to modify parameter that is not allowed to be modified during operation (refer to parameter list)	1. Use + or - keys to adjust frequency setting only after Fn_11=0 2. Do not modify Fn_29 3. Modify in stop mode
Er2	Parameter setting error	1. Fn_6≤Fn_7	1. Fn_6 > Fn_7

4.6   General troubleshooting

Abnormality	Check Point	Countermeasure
Motor inoper- ative	Is power source voltage delivered into L1, L2 terminal (is the charg- ing indicator illuminated)?	Check if the power source switched on. Turn power source OFF and then ON again. Reconfirm the power voltage level. Check to see if the mounting screw is secured.
	Is there voltage output from out- put terminal T1, T2, T3?	Turn power source OFF and then ON again.
	If the load is too heavy and blocks the motor?	Reduce load to start motor.
	Is there any abnormal condition of the inverter?	Refer to description of error codes.
	Is the forward or reverse instruc- tion loaded?	Check and correct wiring.
Motor inoper- ative	Is the analog frequency setting loaded?	Check to see if wiring for analog frequency input signal is correct? Check if the frequency input setting voltage is correct?
	If the operation mode setting cor- rect?	Operate by digital?
Motor oper- ate in oppo- site direction	Is wiring on the output terminals T1, T2 and T3 correct?	Wiring should be in accordance with the U, V, W terminals of motor.
	Is the wiring for the forward and reverse signals correct?	Examining the wiring and correct it.
Motor opera- tion speed fixed	Is the wiring for analog frequency input correct?	Examining the wiring and correct it.
	Is the operation mode setting cor- rect?	Operation panel operation mode setting check.
	Is the loading too heavy?	Reduce loading
Motor opera- tion at speed too high or too low	Is the specification of motor (poles, voltage) correct?	Reconfirm motor specification.
	Is the gear ratio correct?	Reconfirm gear ratio
	Is the highest output frequency setting correct?	Reconfirm highest output frequency
	Is the voltage on motor side reduced extremely?	Check V/Hz ratio
Abnormal speed varia- tion at opera- tion	Is the loading too heavy?	Increase inverter and motor capacity
	Is the loading variation too large?	Reduce loading variation
	Is the input power source steady and stable?	Install AC reactor on the power supply input side

5 .   O P T I O N S

5.1   EMC Filter (class B) dimensions

Model	Dimension (mm)	Current(A)	Inverter model
E2F-2102	156X76X25	10A	DFE23-01 DFE23-02 DFE23-04
E2F-2202	170x122x33	20A	DFE23-08 DFE23-10

5.2   DIN RAIL specification

Model	Dimension (mm)	Inverter model
ALL	130x72x7.5	DFE23-01 DFE23-02 DFE23-04

6. PARAMETER LIST

Fn_##	Value	Fn_##	Value	Fn_##	Value
Fn_00		Fn_11		Fn_22	
Fn_01		Fn_12		Fn_23	
Fn_02		Fn_13		Fn_24	
Fn_03		Fn_14		Fn_25	
Fn_04		Fn_15		Fn_26	
Fn_05		Fn_16		Fn_27	
Fn_06		Fn_17		Fn_28	
Fn_07		Fn_18		Fn_29	
Fn_08		Fn_19		Fn_30	
Fn_09		Fn_20			
Fn_10		Fn_21			