FM50
FLUXMASTER

Instruction Manual & User Manual

TECO ⓦ Westinghouse

www.tecowestinghouse.com

FLUXMASTER 50 INSTRUCTION MANUAL

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To fully employ all functions of this AC drive, and to ensure the safety for its users, please read through this operations manual in detail. Should you have any further questions, please feel free to contact your local distributor or regional sales representative.

1. SAFETY PRECAUTION

The AC Drive is a power electronic device. For safety reasons, please read carefully those paragraphs with "WARNING" or "CAUTION" symbols. They are important safety precautions to be aware of while transporting, installing, operating, or examining the AC drive. Please follow these precautions to ensure your safety.

⚠ **WARNING** Personal injury may result from improper operation.

⚠ **CAUTION** The AC Drive or mechanical system may be damaged by improper operation.

⚠ WARNING

❚ Do not touch the PCB or components on the PCB right after turning off power and before the charging indicator goes off.

❚ Do not attempt to wire circuits while power is on. Do not attempt to examine the components and signals on the PCB while the AC drive is operating.

❚ Do not attempt to disassemble or modify internal circuitry, wiring, or components of the AC drive.

❚ The grounding terminal of the AC drive must be grounded properly with 200V class type III standard.

❚ This is a product of the restricted sales distribution class according to EN61800-3.

❚ This product may cause radio interference. The user may be required to take adequate measures for RFI protection.

⚠ CAUTION

❚ Do not attempt to perform dielectric strength tests on internal components of the AC Drive. There are sensitive semiconductor-devices vulnerable to high voltages.

❚ Do not connect the output terminals: T1 (U), T2 (V), and T3 (W) to AC power input.

❚ The CMOS IC on the primary PCB of the AC drive is vulnerable to static electrical charges. Do not touch the primary PCB of the AC drive.

2. Examination Before Installation

Every AC Drive has been fully tested and examined before shipment. Please carry out the following examination procedures after unpacking your FM50 AC Drive.

⏐ Check to see if the model number of the AC Drive matches the model number that you ordered.

⏐ Check to see whether any damage occurred to the AC Drive during shipment. Do not connect the AC Drive to the power supply if there is any sign of damage.

Contact your local distributor or regional sales representative if you find any abnormal conditions as mentioned above.

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1. Safety Precautions

1.1 Precautions For Operation Before Turning On Power

⚠ CAUTION

Choose the appropriate power source with correct voltage settings for the input voltage specification of the AC drive.

⚠ WARNING

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

⚠ CAUTION

▮ Do not attempt to transport the FM50 by the front of the cover. Securely hold AC Drives by the heat-sink mounting chassis to prevent it from falling. This may cause personal injury or damage to the AC drive.

▮ Install the drive onto a firm metal base plate or another non-flammable type material. Do not install the drive on or near any flammable material.

▮ An additional cooling fan may need to be installed if several drives are installed on one control panel. The temperature inside an enclosed panel should be below 40 ˚C (104 ˚F) to avoid overheating.

▮ Turn off the power supply before proceeding to remove or perform any work on any panel. Carry out installation procedures according to instructions given. This will help avoid a situation resulting in an operational malfunction.

▮ The AC Drive is suitable for use on a circuit capable of delivering not more than 5000 RMS symmetrical amperes.

▮ This product is not provided with overspeed protection.

▮ This product is only intended for use in a clean, dust and moisture free environment.

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When Power is Applied

⚠ WARNING

❚ Do not attempt to install or remove input or output connectors of the AC drive when the power supply is turned on. Otherwise, it may be damaged due to the surge peak caused by the insertion or removal of power.

❚ When momentary power loss is longer than 2 seconds (the larger the horsepower, the the longer the time), the AC drive does not have enough storage power to control the circuit; therefore, when power is restored, the operation of the AC drive is based on the setup of F_10 and the condition of external switch. This is considered to be a restart as pertaining to the following paragraphs.

❚ When the momentary power loss is short, the AC drive still has enough storage power to control the circuit; therefore, when power is restored, the drive will automatically start operation again depending on the setup of F_23. When restarting the drive, the operation is based on the setup of F_10 and the condition of external switch (FWD/REV button). Attention: the restart operation is determined by F_23 and F_24.

(1)   When F_10=0, the AC drive will not start in restart mode.

(2)   When F_10=1 and the external switch (FWD/REV button) is OFF, the inverter will not start in restart mode.

(3)   When F_10=1 and the external switch (FWD/REV button) is ON, the inverter will start automatically in restart mode. Attention: Based on safety, please turn off the external switch (FWD/REV button) after power loss to avoid possible damage to the machine and personnel after sudden restoration of power.

Under Operation

⚠ WARNING

Do not use a separate device to switch motor ON or OFF during operation. Otherwise, the AC drive may experience an overcurrent breakdown.

⚠ WARNING

❚ To avoid personal injury caused by electrical shock, do not remove the front cover of the AC drive while the power is ON.

❚ When the automatic restart function is enabled, the motor and machinery will be restarted automatically.

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⚠ CAUTION

❚ Do not touch the heatsink base during operation.

❚ The FM50 can be easily operated from a low-speed to high-speed range. Please reconfirm the operating range of the motor and machinery you are controlling.

❚ Do not examine the signals on the PCB of the AC drive during operation.

❚ All AC drives are properly adjusted and factory set before delivery.

⚠ CAUTION

Do not proceed with disassembly or examination procedure before ensuring that the power is off and the Power LED is extinguished.

⚠ CAUTION

AC drive ambient temperature should be within temp: +14˚F ~ +104˚F (-10˚C ~ +40˚C), humidity under 95% RH without condensing.

⚠ CAUTION

After the removal of shield sticker, the AC drive ambient temperature should be within +14˚F ~ +122˚F (-10˚C ~ +50˚C) and humidity under 95% RH without condensing. In addition, the FM50 should be free from dripping water and or metal dust.

1.2 Environmental Precautions
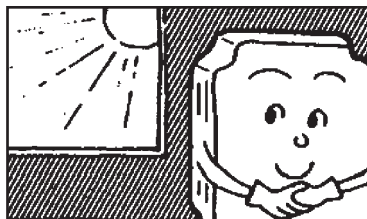
Avoid direct sunlight
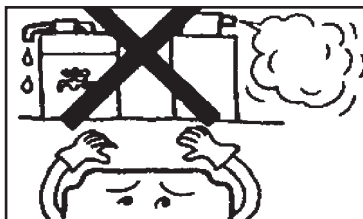
Keep away from corrosive gases or liquids

Keep away from oil grease and gas
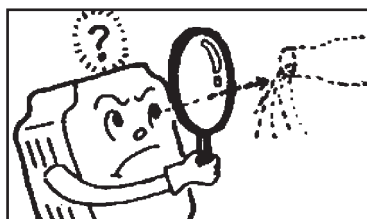
Keep away from salty environments

Keep away from rain or where dripping water may get into the AC Drive

Avoid dusty environments
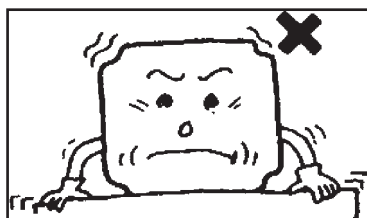
Avoid excessive vibration

Avoid exessive direct heat
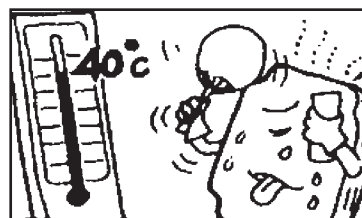
Avoid high temperature environments
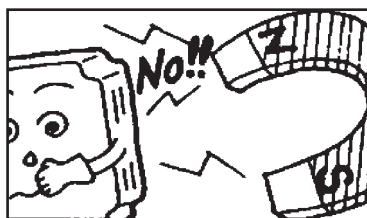
Keep away from high electromagnetic waves
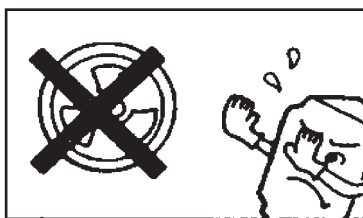
Keep away from radioactive matter
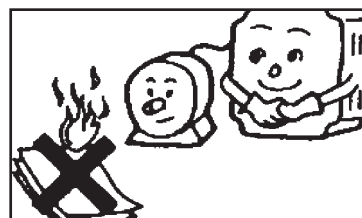
Keep away from flammable material

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2. Hardware Instructions and Installation

2.1 Operational Environment

The installation site of the FM50 is very important. It relates directly to the functionality and the life span of your AC drive. Please carefully choose an installation site that meets the following requirements:

- Mount the unit vertically

- Environment temperature: +14˚F ~ +104˚F (-10˚C ~ +40˚C) (without shield sticker: +14˚F ~ +122˚F (-10˚C ~ +50˚C)

- Avoid placing FM50 close to any heating equipment

- Avoid dripping water or humid environment

- Avoid direct sunlight

- Avoid oil, grease, and gas

- Avoid contact with corrosive gases and liquids

- Prevent foreign dust, flecks, or metal scraps from contacting the AC drive

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

- Avoid excessive vibration; if vibration cannot be avoided, an anti-rattle mounting device should be installed to reduce vibration.

- If the FM50 is installed in an enclosed control panel, please remove the shield sticker located at the top of the AC drive. This will allow additional airflow and cooling.

External Fan Placement Needs To Be Located Over The Top Of The FM50

Cooling Fan   Cooling Fan   Cooling Fan   Cooling Fan

Correct Alignment   Incorrect Alignment   Correct Alignment   Incorrect Alignment
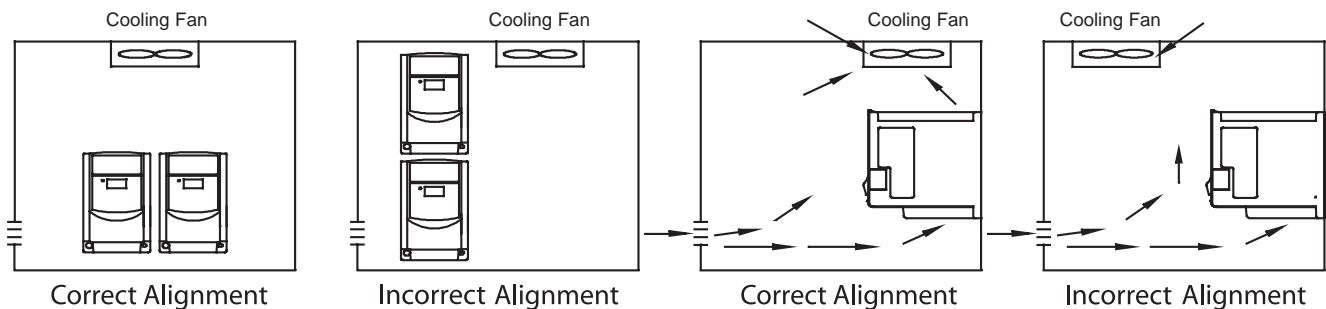
- For proper Installation of the FM50, you must place the front side of the AC Drive facing front and the top of the AC drive in the up direction for better heat dissipation.

- Installation must be compliant to the following requirements.

Ventilation & Installation Direction
Front View

Side View
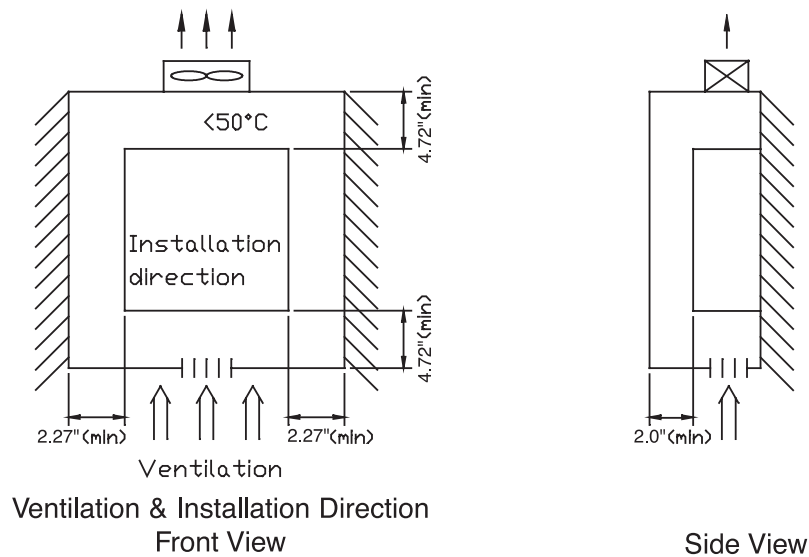
Note: Maximum temperature in the enclosure is 122˚F (50˚C) with Shield Sticker removed

2.2 Sample Model No. Identification

FM50	X	XX	X(X)

Drive Type

Voltage
1 = 115V
2 = 230V
4 = 460V

Horsepower

P2 = $^1/_4$ HP
03 = 3HP

C = Chassis
N4 = NEMA 4
OC = Chassis with Filter
N4FS = NEMA 4 with Operator Devices

10
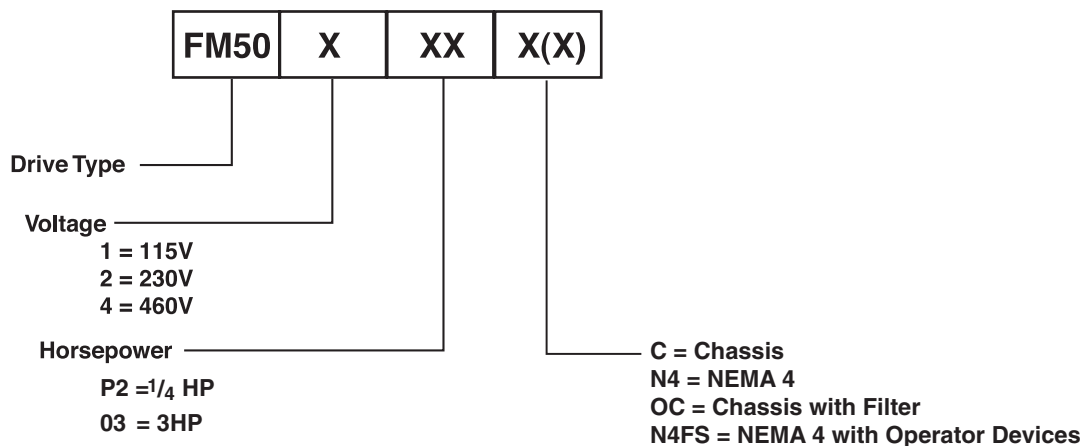
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2.3 SPECIFICATIONS

2.3.1 Product Specifications

Model: FM50		1P2-X	1P5-X	101-X
Suitable Motor Power Rating (KW)		0.2	0.4	0.75
Rated	Motor (HP)	1/4	1/2	1
	Output Current (A)	1.4	2.3	4.2
	Capacity (KVA)	0.53	0.88	1.6
	Weight (lb)	2	2	2
Input Voltage Max.		Single Phase 100-120V (+10%, -15%), 50 / 60Hz (+/-5%)		
Output Voltage Max.		Three Phase 200-240V (Proportional to input voltage)		
Dimension H*W*D (inches)		5.20 x 2.84 x 4.65		
EMC Specification		Without Filter		

Model: FM50		2P2-X	2P5-X	201-X	202-X	203-X
Suitable Motor Power Rating (KW)		0.2	0.4	0.75	1.5	2.2
Rated	Motor (HP)	$^1/_4$	$^1/_2$	1	2	3
	Output Current (A)	1.4	2.3	4.2	7.5	10.5
	Capacity (KVA)	0.53	0.88	1.6	2.9	4.0
	Weight (lb)	2	2	2	5	5
	Input Voltage Max.	Single/Three Phase 200-240V (+10%, -15%), 50 / 60Hz (+/-5%)				
Output Voltage Max.		Three Phase 200-240V (Proportional to input voltage)				
Dimension H*W*D (inches)		5.20 x 2.84 x 4.65			5.63 x 4.65 x 4.65 x 6.77	
EMC Specification		Without Filter				

Model: FM50		401-X	402-X	403-X
Suitable Motor Power Rating (KW)		0.75	1.5	2.2
Rated	Motor (HP)	1	2	3
	Output Current (A)	2.3	3.8	5.2
	Capacity (KVA)	1.7	2.9	4.0
	Weight (lb)	4	4	4
	Input Voltage Max.	Three Phase 380-480V (+10%, -15%), 50 / 60Hz (+/-5%)		
Output Voltage Max.		Three Phase 380-480V (Proportional to input voltage)		
Dimension H*W*D (inches)		5.63 x 4.63 x 6.77		
EMC Specification		Without Filter		

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2.3.2 Functional Specifications

Item		Specification
Input Signal Type		(SOURCE) input (External 24VDC Input is allowed) (PNP type)
Control Method		Sinusoidal wave PWM control
Frequency Control	Frequency Range	1 ~ 200Hz*[1]
	Resolution Setting	Digital: 0.1Hz (1 ~ 99.9Hz); 1Hz (100 ~ 200Hz) Analog: .06Hz / 60Hz
	Keypad Setting	Directly setup by ▲ ▼ buttons.
	External Signal Setting	0 ~ 10V, 4 ~ 20mA, 0 ~ 20mA
	Other Function	Frequency upper and lower limit
Control Characteristics	Carrier Frequency	4 - 16KHz*[2]
	Accel/Decel Time	0.1 ~ 999 Sec
	V/F Pattern	6 Patterns
	Torque Control	Adjustable Torque boost level (manual torque boost)
	Multi-Function Input	2 Programmable Inputs, to be used as multi-speed 1(SP.1) / multi-speed 2(SP.2) *1/ Jog / External emergency stop / External Base Block Command/ Reset Command
	Multi-Function Output	One output contact available as Fault / Running / At speed signals.
	Braking Torque	1P2~101/2P2~201: Approximately 20% 202/203/401/402/403: 20% ~ 100%, built-in braking transistor
	Built-In Functions	Decelerate or free run stop, Auto reset, DC braking frequency / Voltage / Time can be setup by constants.
Display		Three digit 7 segment LED display frequency / functions constants / fault record /CPU version.
Operating Temperature		14 ~ 104˚F (-10 ~ 40˚C); 14 ~ 122˚F (-10 ~ 50˚C) without shield sticker
Humidity		0 ~ 95% RH non-condensing.
Vibration		Under 1G (9.8m/S^2)
EMC Specification		EN50081-1, EN50081-2, EN50178, EN61800-3 + All
UL		UL508C
Protection Function	Overload Protection	150% for 1 minute
	Overvoltage	DC Bus voltage > 410V(100/200 series); DC Bus voltage > 800V(400 series)
	Undervoltage	DC Bus voltage < 200V(100/200 series); DC Bus voltage < 400V(400 series)
	Momentary Power Loss	Power-loss 0 ~ 2 sec: AC drive can be restarted with Speed Search.
	Stall Prevention	During Acceleration / Deceleration/ Constant speed
	Output Short-circuit	Electronic circuit protection
	Ground Fault	Electronic circuit protection
	Other Protection	Heatsink overheat protection, Current limit
Installation		Direct installation or DIN rail (Option).

Note: *1: CPU version v1.9 and above.

*2: Carrier Frequency Range: CPU Version v1.6 is 4 ~ 8kHz.

CPU Version v1.9 and above are 4 ~ 16kHz.

2.3.3 Options and Wiring Specifications

Molded-Case Circuit Breaker / Magnetic Contactor

❚ Warranty does not apply to damage caused by the following situations:

(1) Damage to the AC drive caused by the lack of appropriate molded-case circuit breaker or when an oversized circuit is installed between the power supply and the AC drive.

(2) Damage to the AC drive caused by the magnetic contactor, phase advancing capacitor, or surge-protector installed between the AC drive and the motor.

Model Type	1P2/1P2/2P2/2P5	101/201/202	203	401/402/403
Molded-Case Circuit Breaker	15A	20A	30A	15A
Primary Circuit Terminal (T1) (L1) (T2) (L2) (T3)	Wire Dimension (#14 AWG) 2.0mm^2 Terminal Screw M3	Wire Dimension (#14 AWG) 2.0mm^2 Terminal Screw M3/M4	Wire Dimension (#12 AWG) 3.5mm^2 Terminal Screw M4	Wire Dimension (#12 AWG) 3.5mm^2 Terminal Screw M4
Signal Terminal (TM2) 1~11	Wire Dimension 0.75 mm^2 (#18 AWG), Terminal Screw (M3)			
Recommended Wire Type	Use Copper Conductors Only. Size Field Wire Based on 167˚F (75˚C) Wire Only. Wire Voltage Rating Must Be a Minimum of 300V.			

❚ Please utilize three-phase squirrel-cage induction motor with appropriate capacity.

❚ If the AC drive is used to drive more than one motor, the total capacity must be smaller than the capacity of the AC drive. Additional thermal overload relays must be installed in front of each motor. Set Fn_18 at 1.0 times of the rated value specified on the motor nameplate at 50Hz, 1.1 times of the rated value specified on the motor nameplate at 60Hz.

❚ Do not install phase advancing capacitors, LC, or RC components between the AC drive and the motor.

2.3.4 Application and Recommendations for Installing Auxiliary Equipment

From the Power Source:

❚ Apply the power source at the correct rated voltage to prevent damage to the AC drive.

❚ A Power Disconnect or Circuit breaker must be installed between the AC power supply and the AC drive.

Molded-Case Circuit Breaker:

❚ Utilize an appropriate circuit breaker that is suitable for the rated voltage and current ratings of the AC drive, to switch ON/OFF the power supply to the AC drive, and as additional protection for the AC drive.

❚ Do not operate the circuit breaker to switch ON or OFF the AC drive. The circuit breaker should be used only to supply input power and should not be used for operational sequences.

Ground Fault Circuit Breaker:

❚ To ensure personnel safety, a ground fault circuit breaker should be added to prevent false operation caused by leakage current.

Magnetic Contactor:

❚ The Magnetic Contactor is not required for standard operation. To utilize external control, automatic restart, or breaking controller, the magnetic contactor must be added at the primary side.

❚ Do not operate the magnetic contact to switch ON or OFF the AC drive.

Power Quality Improvement AC Reactor:

❚ If a large capacity power source is applied (over 600KVA), an additional AC reactor may be added to improve the power factor.

Inverter:

❚ Power supply input terminals L1 and L2 are not differentiated on phase sequence. They can be arbitrarily connected.

❚ Output terminal T1, T2, and T3 should be connected to the U, V, and W terminals of the motor respectively. If motor turns in opposite direction of the inverter command, exchange two of the three wire connections to correct this problem.

❚ Output terminal T1, T2, and T3 should never be connected to power source. Otherwise, damage to the AC drive could result.

❚ Properly ground the grounding terminal in compliance to 200V class type three grounding. (The 400V class type has special grounding.)

External wiring should be carried out in accordance with the following requirement. Check and reassure the wiring is correct after completion.

(Do not utilize the control circuitry buzzer to check the wiring).

EMI Connections:

It is very important that the connections between the AC drive, the shielded motor cable, and the EMI filters are tested as follows.

- Use a metal grounding plate and place the AC drive and the EMI filter on the plate.

- Use a shielded motor cable with 4 connectors (U, V, W, & Earth). Don't use the shielding as safety earth (shield is high frequency earth).

- Remove any paint around the two metal coupling nut holes to ensure that the metal coupling nuts (and the shielding) make contact with the AC drive and the motor.

- Don't solder a conductor to the shielding.

- Use a metal clamp to connect the shielding from the motor cable with the metal grounding plate. This ensures a perfect high frequency earth connection between AC drive, grounding plate and EMI filter.

- Keep the distance between the AC drive and EMI filter as short as possible (< 11.8"). If longer, use a shielded cable with a metal coupling nut and a metal clamp to connect the shielded cable to the AC drive and metal grounding plate.

- The only earth connection between the LISN and the test plate should be via the EMI filter.

- Use a motor rated at or below the AC drive rating.

- Install a noise filter for AC drive on the output side of the primary circuit to suppress conducting noise.
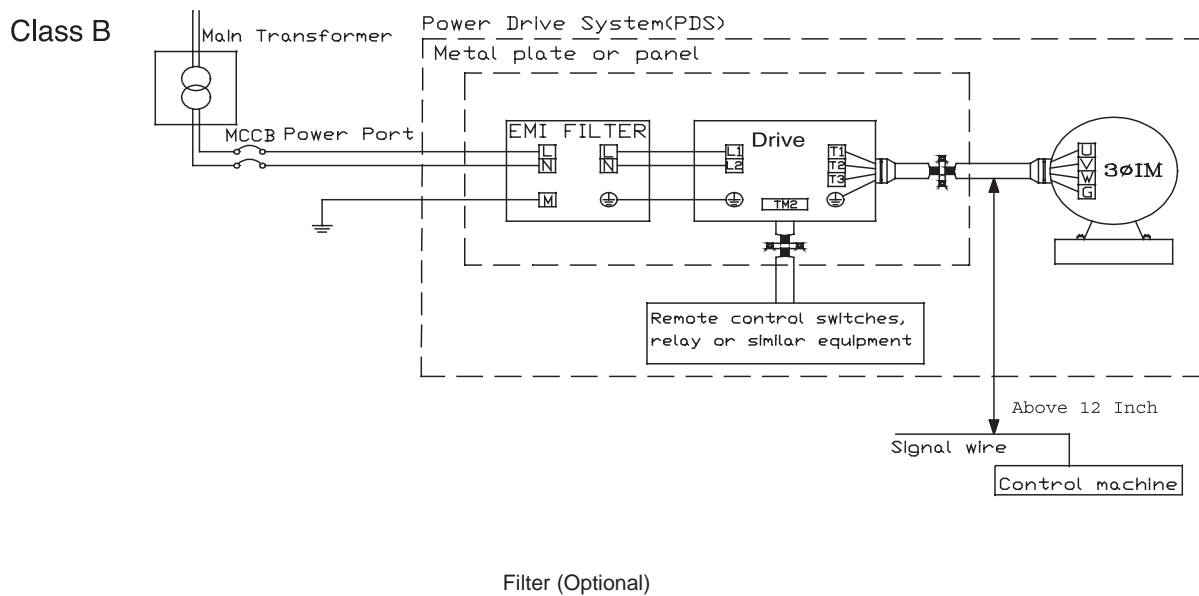
Filter (Optional)

❚ When the distance between the AC drive and motor is longer than 330ft (100m) cable wire should be carefully chosen to reduce the wiring resistance below 3% and the voltage drop (V) = $\sqrt{3}$ x Wire resistance (52/ft) x wire length (ft) x current.

❚ Control circuitry wiring must be separately terminated and away from the primary power circuitry and other high-voltage or large-current power lines to avoid noise interference.

❚ To reduce the noise interference and avoid possible operational problems, shielded twisted pair cable should be used to wire the control circuitry. Please refer to following diagram. Connect the shield wire to the grounding terminal. Connect only one end of the shield.

Shielding   Glove

To Inverter Terminal

To Control Machine

Connect Shield

Do not connect the Shielding Wire at this end

Wrapped with Insulating Tape

Connect to system grounding terminal
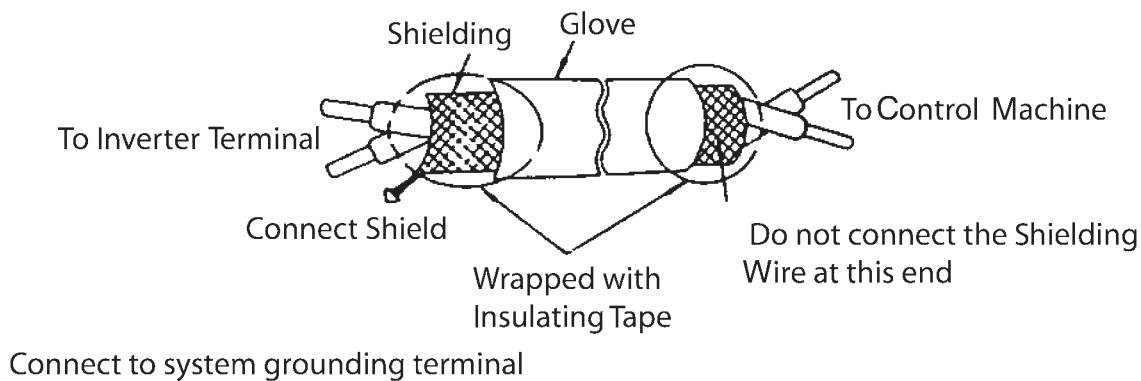
❚ **Wiring distance of 164ft (50m) or under is recommended.**

❚ The grounding terminal of the AC Drive 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 AC drive must not be grounded together with other large current loads (such as soldering machines or large current motors). They should be grounded separately.
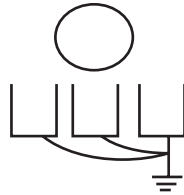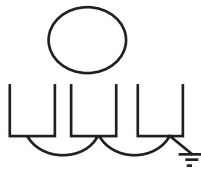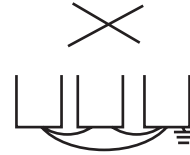
(a) correct   (b) correct   (c) incorrect

❚ Ground circuit must not be formed when grounding several AC drives together.

(D) Wire specification. Apply appropriate wire with correct diameter for primary power circuitry and control circuitry in compliance with NEC or other applicable codes.

2.4 Wiring Diagram
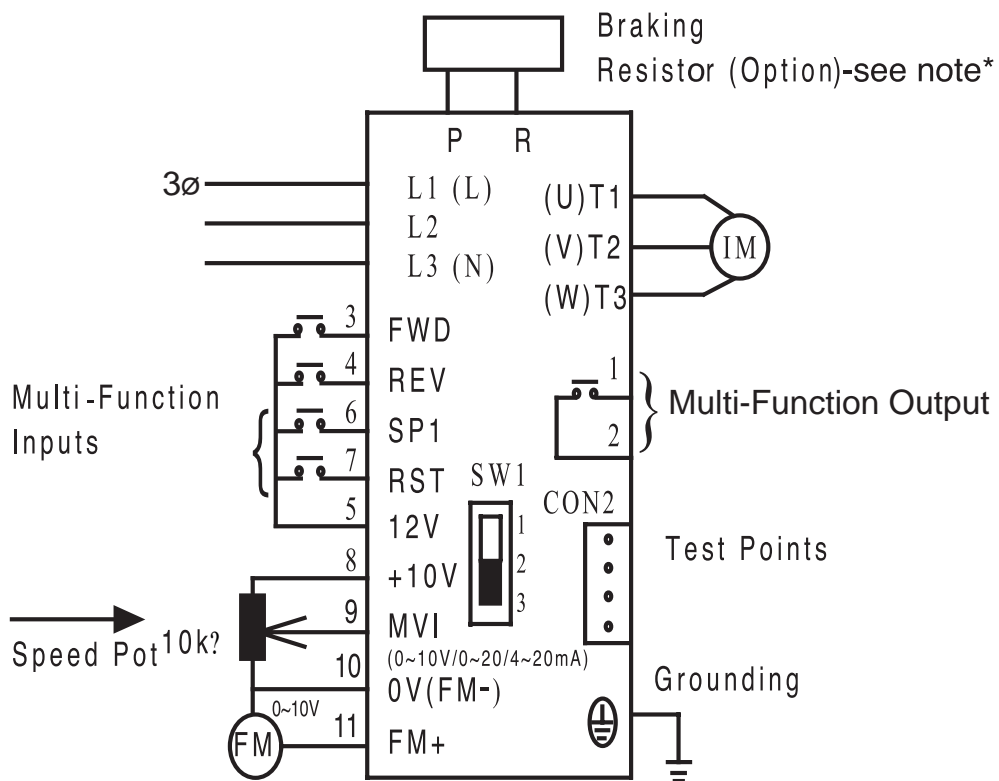
Wire Terminations to the AC drive must be made with either UL listed field wiring lugs or UL listed crimp type ring terminals.

*Note: Only for 230V 2,3HP and 460V 1-3HP models.

External 24V Supply

```
                                        TM2

                          ┌──────3───┬──────────┐
                ┌───o  o───┤          │  FWD     │
                │          │   4      │          │
                ├───o  o───┤          │  REV     │
       +        │          │   6      │          │
     24V ⊖      ├───o  o───┤          │  SP1     │
       ‒        │          │   7      │          │
                ├───o  o───┤          │  RST     │
                │          │  10      │          │
                └──────────┴──────────┤  0V      │
                                      └──────────┘
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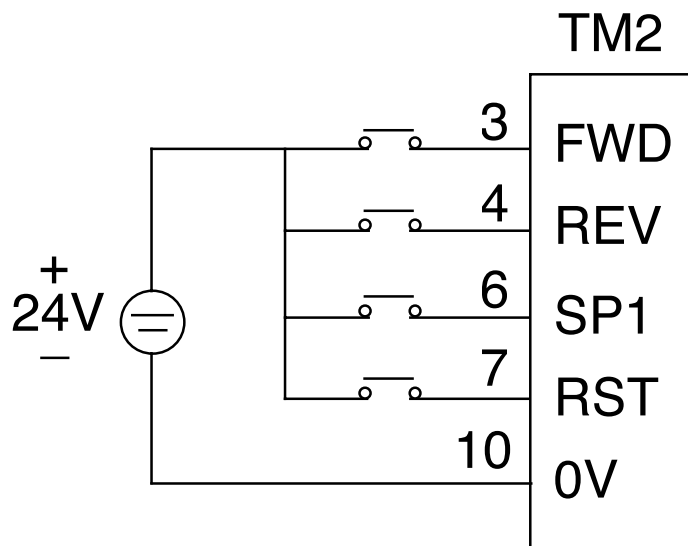
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Inverter Terminal Descriptions, Primary Circuitry Terminal Block (TM1) Description
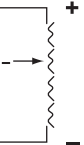
Terminal Symbol	Function Description
L1/L (R)	Primary power source input to Drive
L2 (S)	Single phase: L1/L2 or L/N
L3/N (T)	Three phase: L1/L2/L3
P	External braking resistor terminal
R	(230V, 2/3HP and 460V, 1-3HP models only)
T1 (U)	
T2 (V)	Inverter output to Motor
T3 (W)	

Tightening torque for TM1 is 1lb-ft or 12lbs-in (all 115VAC models and 230V 1/4 - 1HP)
Tightening torque for TM1 is 1.3lbs-ft or 16lbs-in (230V 2, 3HP and 460V 1-3HP)
* Wire voltage rating must be a minimum of 300V(200V series)/600V(400V series)

Control Circuitry Terminal Block (TM2) Description

Terminal Symbol		Function Description	
1	TRIP	Fault relay output terminal (Multi-Function output terminal) (see parameter F_21)	
2	RELAY	Connection point rated capacity 250VAC/1A (30VDC/1A)	
3	FWD (FW)	Operation control terminals (see parameter F_03)	
4	REV (RE)		
5	+ 12V(12)	Common point for terminals 3 / 4 / 6 / 7	
6	SP1(SP)	Multi-Function input terminals (see parameter F_19)	
7	RESET(RS)		
8		+10V	Power terminal for potentiometer (Pin 3)
9		Analog input wire Wiper	Analog frequency signal input terminal (Pin 2 of potentiometer or positive terminal of 0~10V / 4~20mA / 0~20mA)
10	0V(FM -)	Analog common	Analog signal common point (Pin 1 of potentiometer) or negative terminal of 0~10V / 4~20mA / 0~20mA
11	FM+	Analog output positive connection point	Analog frequency signal output terminal Output terminal signal is 0 ~ 10VDC/Fn_6

Tightening torque for TM2 is 0.42lb-ft or 5.03lbs-in.
* Wire voltage rating must be a minimum of 300V.
* Control wiring should not run in the same conduit or raceway with any power or motor wiring.
* Single Input and Output Terminals (TM2) Ratings are ALL Class 2.
* Use copper conductors only. Size field wiring based on 167˚F (75˚C) wire only.

SW1 Function Description

Switch 1	External Signal Type
I ↑ 1 2 3 V ↓	0 ~ 20mA analog signal (When F_11 is set to 1) 4 ~ 20mA analog signal (When F_11 is set to 2)
I ↑ 1 2 3 V ↓	0 ~ 10VDC analog signal (When F_11 is set to 1)

2.5 Dimensions & Location of Terminal Block

115V 1/4 - 1HP, 230V 1/4 - 1HP models
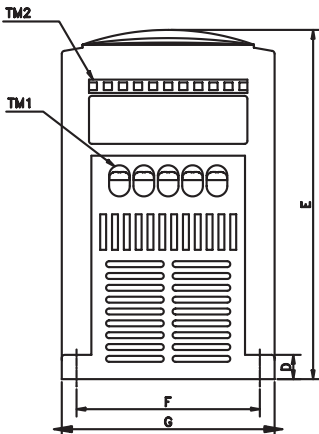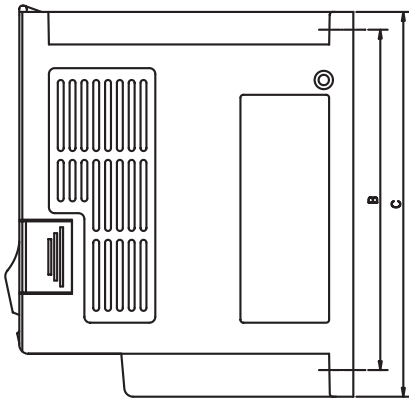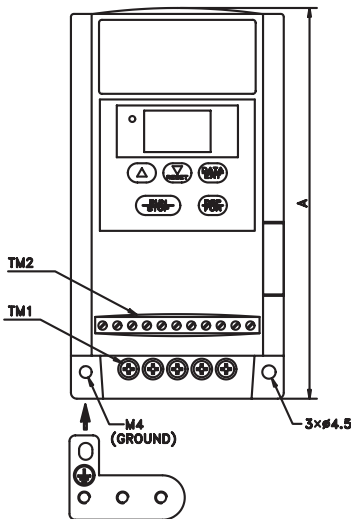
Unit: inches

Dimensions / Model	A	B	C	D	E	F	G
1/4 - 1HP	5.20	4.57	5.12	0.32	4.65	2.40	2.83

NOTE: For safety reasons, we strongly recommend removing the M4 grounding screw, then attach the enclosed "metal frame grounding terminal" on the same location to make a grounding bar to ensure proper grounding.

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230V, 2, 3HP, 460V 1 - 3HP

Unit:inches

MODEL	DIMENSIONS	A	B	C	D
2,3HP		5.63	5.02	5.51	0.32

MODEL	DIMENSIONS	E	F	G
2,3HP		6.76	4.25	4.65
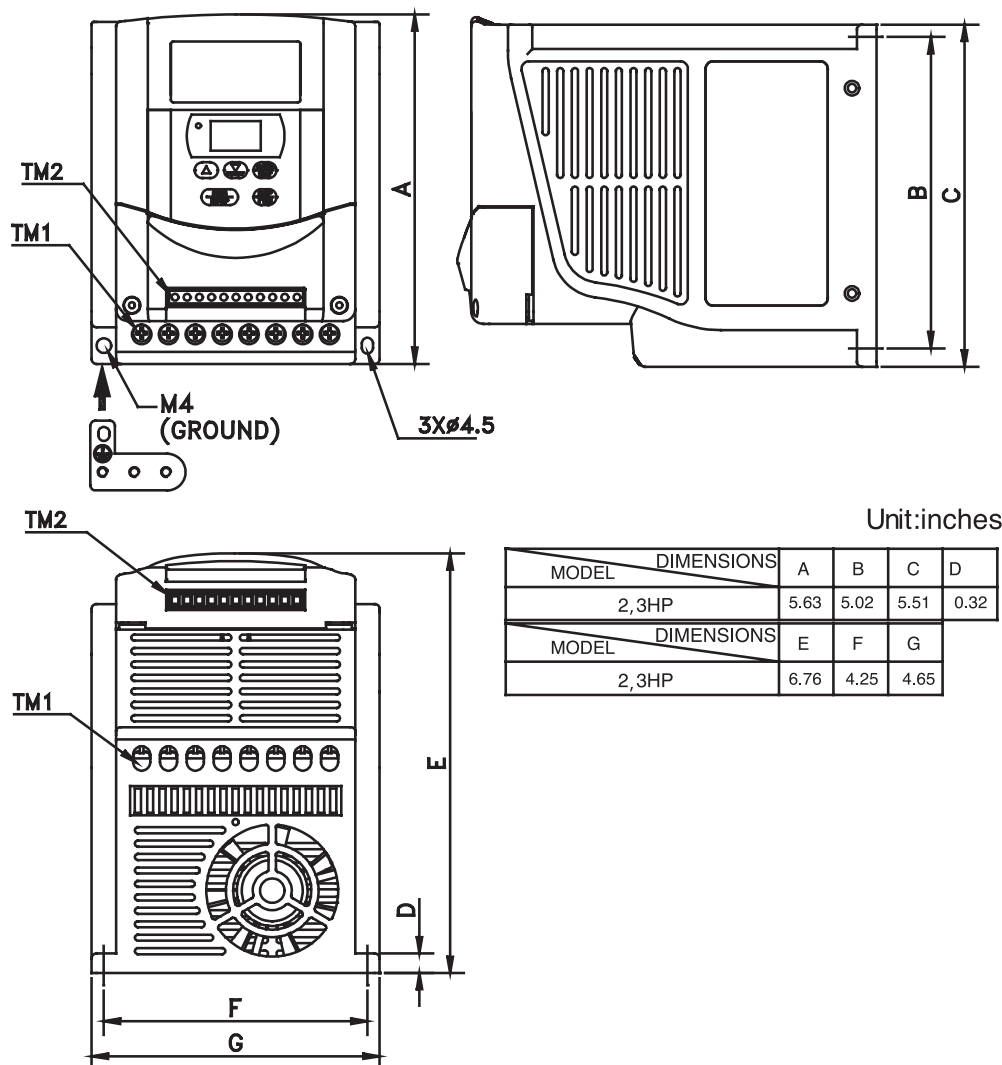
Dimensions & Installation of Class B Filter
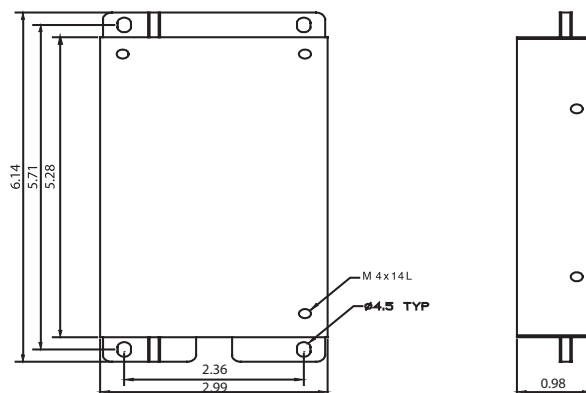
DIMENSIONS

FM50 NEMA 4X (IP65 Indoor Duty) with operators (115V, 230V 1/4 - 1HP models)
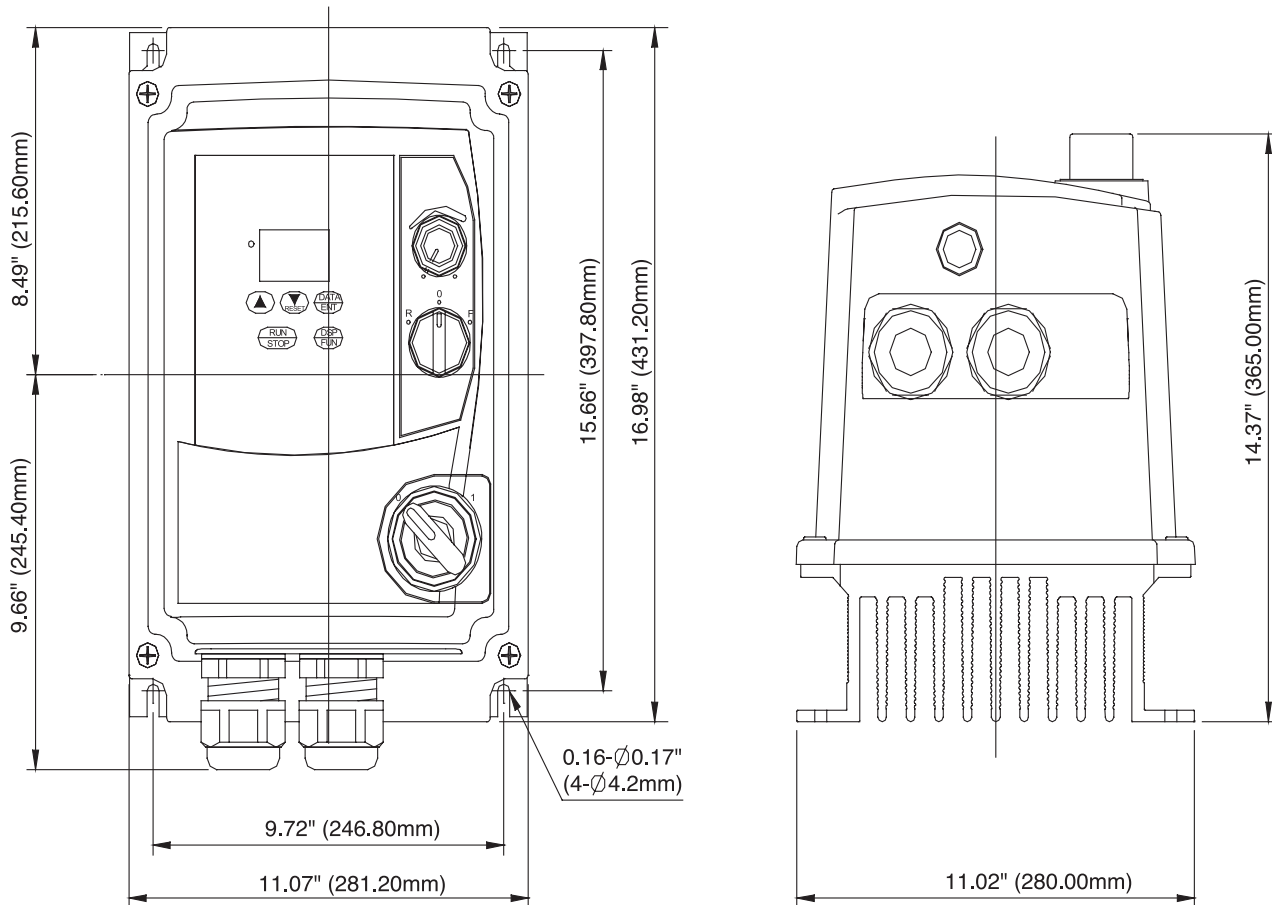
INSTALLATION

FM50 NEMA 4X (IP65 Indoor Duty) with operators (115V, 230V, 1/4 -1HP models)
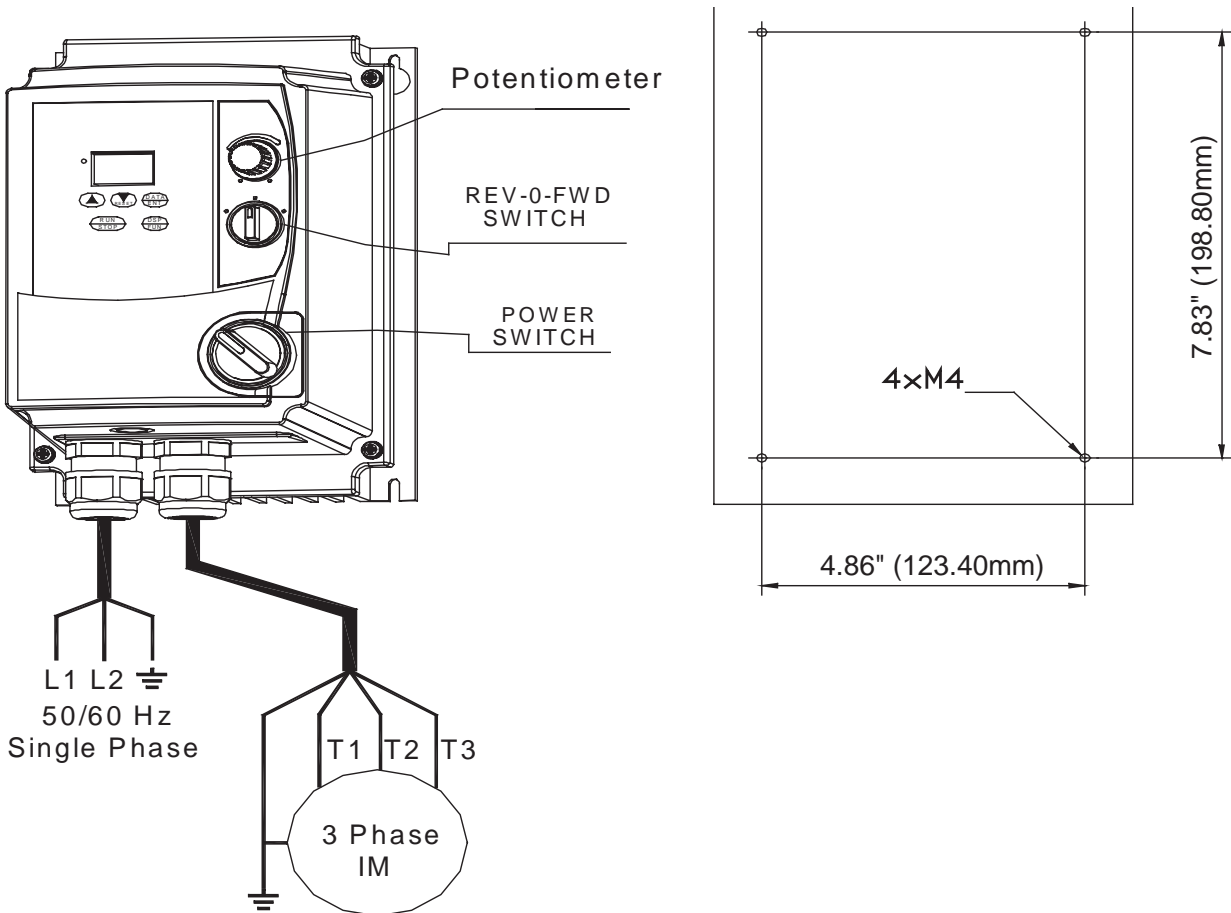
NOTE :
1. Power switch, REV-0-FWD switch and potentiometer are only available for NEMA 4X units with operator devices
2. Power supply cable: #14 AWG (2.0mm^2)
3. Motor cable: #16 AWG (1.25mm^2)
4. Tightening torque values for terminals
    (1). Power/Motor cable (plug-in) terminal: 4.34in-lb (5kg-cm)
    (2). Remote control wire: 3.47in-lb (4kg-cm)

CONNECTION

Circuit Diagram

FM50 NEMA 4X (IP65 Indoor Duty) with operators (115V, 230V, 1/4 - 1HP models)
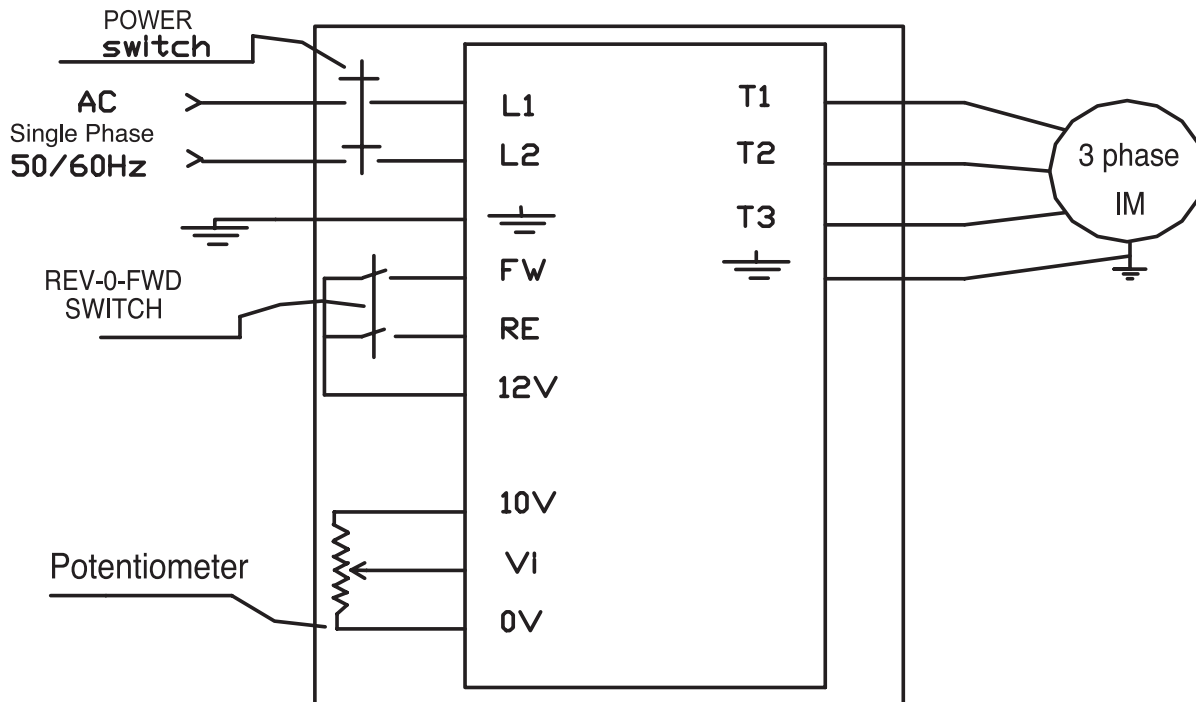
NOTE :
1. Power switch, REV-0-FWD switch and potentiometer are only for NEMA 4X units with operator devices.
2. Power supply cable: #14 AWG (2.0mm^2)
3. Motor cable: #16 AWG (1.25mm^2)
4. Tightening torque value for terminals:
    (1). Power/Motor cable (plug-in) terminal: 4.34in-lb (5kg-cm)
    (2). Remote control wire: 3.47in-lb (4kg-cm)
    (3). Outer cover (M4): 5.20in-lb (6kg-cm)
5. Input source: single-phase (L1, L2, ⏚), make sure that it is connected to the appropriate power supply.
6. Output motor: three-phase (⏚, T1, T2, T3)

⚠ CAUTION

- Do not start or stop the AC drive using the main circuit power.
- NEMA 4X with operators: Always maintain REV-0-FWD switch at 0 position. This will ensure that the AC drive is stopped before power up after power supply interruption. Otherwise, injury may result to personnel.

CONNECTION

FM50 NEMA 4X (IP65 Indoor Duty) (115V, 230V, 1/4 - 1HP models)

4 x Outer cover screw

Power supply cable

Motor cable   TM1 terminals

L1
L2

Power supply cable
L1,L2,

T1 T2
T3

Motor cable
,T1,T2,T3

MOUNTING

L1
L2

Power supply cable
L1,L2,

200mm —— Cutting Length of cable shield

T1 T2
T3

Motor cable
,T1,T2,T3

Note:
TM2 Remote control cable should be connect to ground screw

Cable shielding connected to ground clamp

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CONNECTION

FM50 NEMA 4X (IP65 Indoor Duty) with operators (115V, 230V, 1/4 - 1HP models)

4 x Outer cover screw

Power supply cable

Motor cable   Plug-in terminals

Power supply cable L1,L2,

Motor cable ,T1,T2,T3

MOUNTING

200mm —— Cutting Length of cable shield

L1
L2

Power supply cable L1,L2,

T1
T2
T3

Motor cable ,T1,T2,T3

Note:
TM2 Remote control cable should be connect to ground screw

Cable shielding connected to ground clamp

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DIMENSIONS

FM50 NEMA 4X (IP65 Indoor Duty) with operators (230V 2, 3HP, 460V 1 - 3HP models)

INSTALLATION

FM50 NEMA 4X (IP65 Indoor Duty) with operators (230V 2, 3HP, 460V 1 - 3HP models)

POWER
SWITCH

Potentiometer

REV-0-FWD
SWITCH

4×M4

274.5mm

210.0mm

L1 L2 L3
220 ~ 240V
380 ~ 460V
*Single/Three Phase

T1 T2 T3

3 Phase
IM

NOTE :
1. Power switch, REV-0-FWD switch and potentiometer are only for NEMA 4X units with operator devices.
2. Power supply cable: 230V #12 AWG (3.5mm^2); 460V #16 AWG (1.25mm^2)
3. Motor cable: 230V #14 AWG (2.0mm^2); 460V #16 AWG (1.25mm^2)
4. Tightening torque values for terminals:
    (1). Power/Motor cable (TM1, TM3) Terminal: 6.94in-lb (8kg-cm)
    (2). Remote control wire: 3.47in-lb (4kg-cm)
    (3). Outer cover (M4): 6.94in-lb (8kg-cm)

*Models FM50-202-N4FS & FM50-203-N4FS with operator devices are single phase input only.

CONNECTION

Circuit Diagram

NEMA 4X (IP65 Indoor Duty) with operators (230V 2, 3HP, 460V 1 -3HP models)
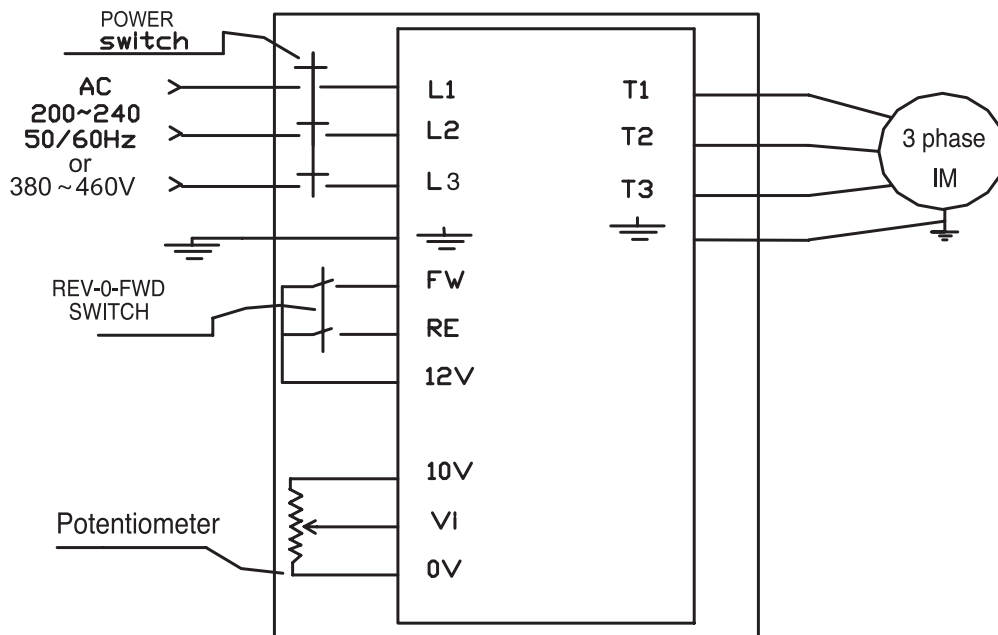
NOTE :
1. Power switch, REV-0-FWD switch and potentiometer are only for NEMA 4X units with operator devices
2. Power supply cable: #12 AWG (3.5mm^2)
3. Motor cable: #16 AWG (1.25mm^2)
4. Tightening torque values for terminals:
    (1). Power/Motor cable (plug-in) terminal: 4.34in-lb (5kg-cm)
    (2). Remote control wire: 3.47in-lb (4kg-cm)
    (3). Outer cover (M4): 5.20in-lb (6kg-cm)
5. Input source: single-phase or three-phase (L1, L2, L3,) ensuring that it is connected to a 200/230V or a 400/460V supply.
(Models FM50-202-N4FS & FM50-203-N4FS with operator devices are single phase input only).
6. Output motor: three-phase (T1, T2, T3)

⚠ CAUTION

- Do not start or stop the AC drive using the main circuit power.
- NEMA 4X with operators: Always maintain REV-0-FWD switch at 0 position. This will ensure that the AC drive is stopped before power-up again after power supply interruption. Otherwise, injury may result to personnel.

CONNECTION

FM50 NEMA 4X (IP65 Indoor Duty) (230V 2,3HP, 460V 1 -3HP models)
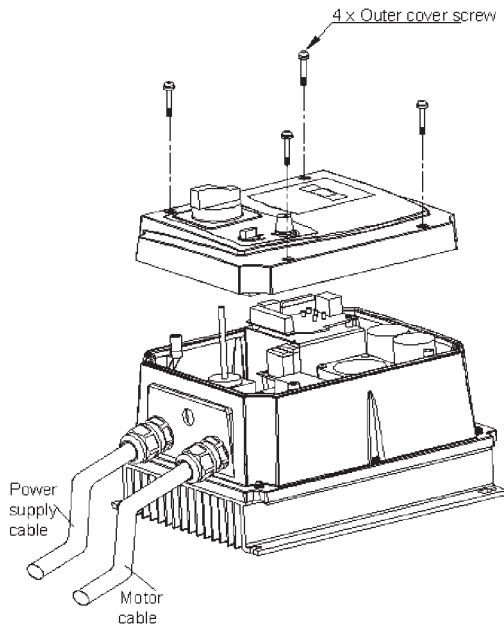
MOUNTING
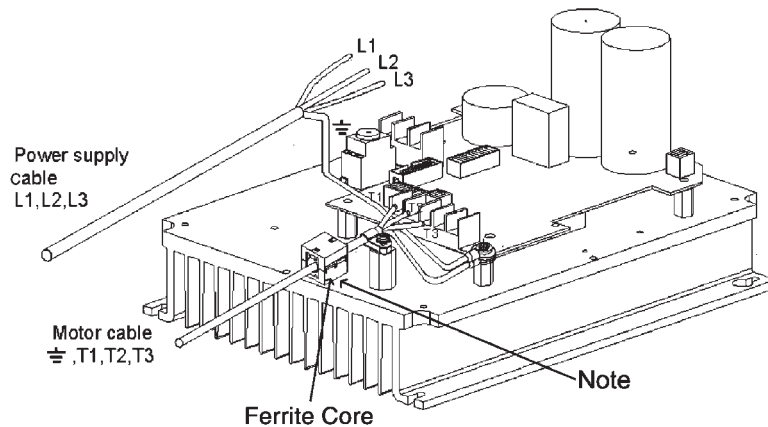
NOTE:
For ALL MODELS WITH FILTERS, additional items will be found inside the box including: QTY 1 of EMC waterproof conformed (IP65) ferrite core; QTY 1 of metal fastener; QTY 1 of MF Zin 5-C screw.

⚠ CAUTION

If the EMC regulation must be met, constrain the motor cables with the ferrite core onto the motor cable outside the plastic enclosure as indicated in the above diagram.

Please Note: The length of the motor cable CANNOT exceed 5M under EMC regulation.

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CONNECTION

FM50 NEMA 4X (IP65 Indoor Duty) with operators (230V 2,3HP, 460V 1 -3HP models)
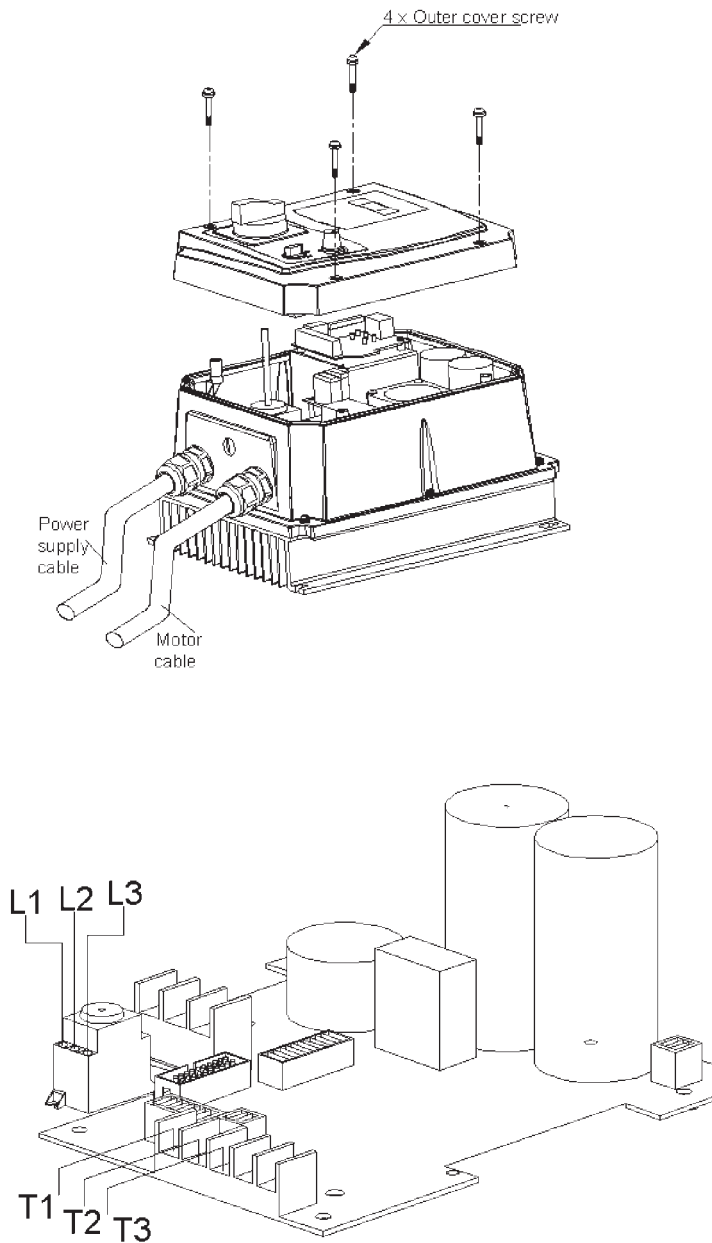
EMC MOUNTING

NEMA 4X (IP65 Indoor Duty) with operators ((230V 2,3HP, 460V 1 -3HP models)
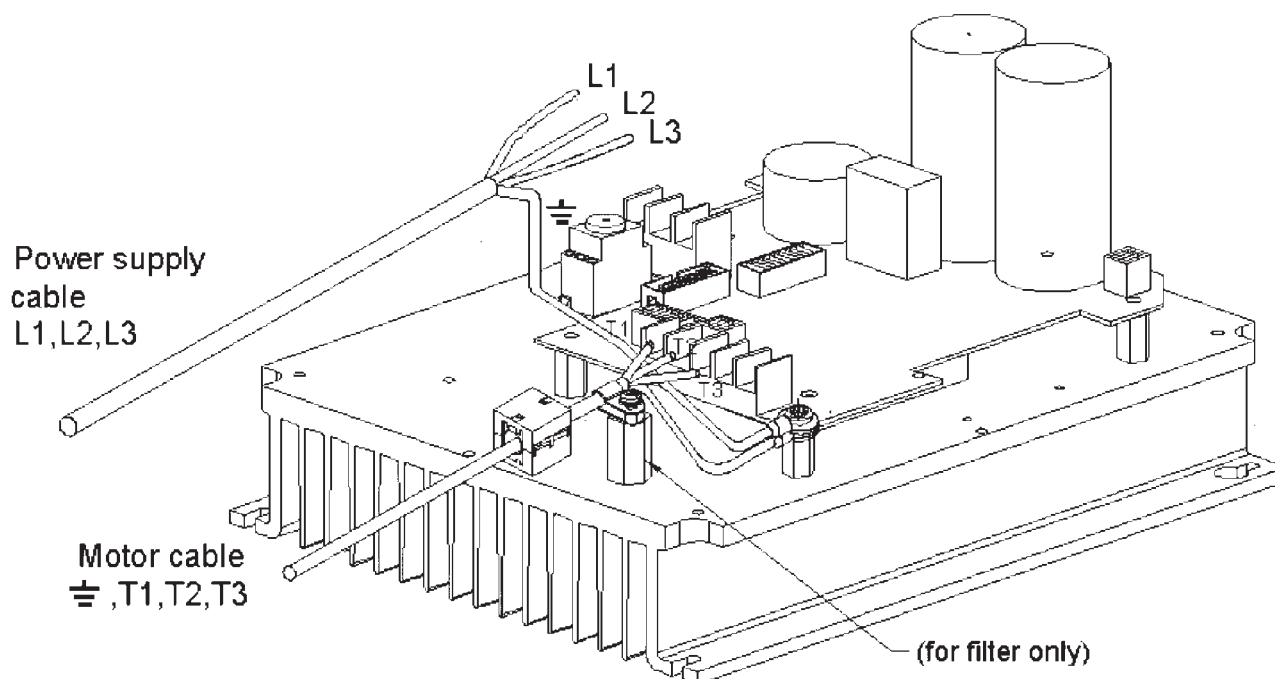
2.6 Mounting Instructions
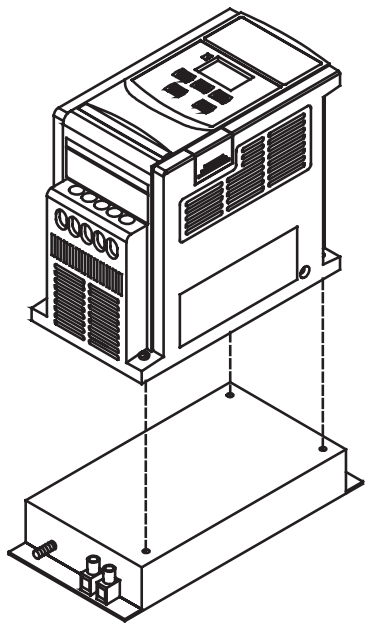
AC Drive with class B filter mounted
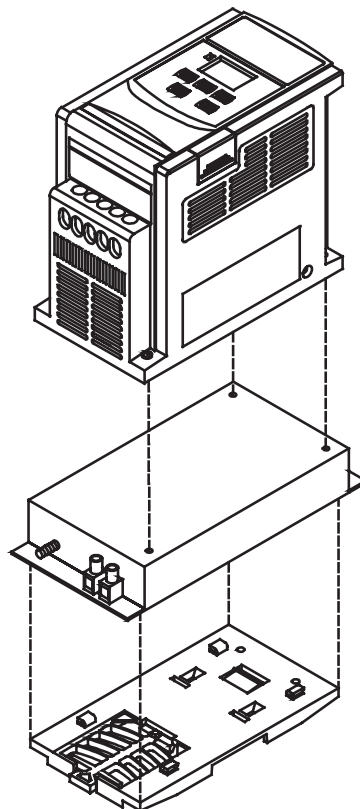
AC Drive with class B filter & Din rail mounting kit.

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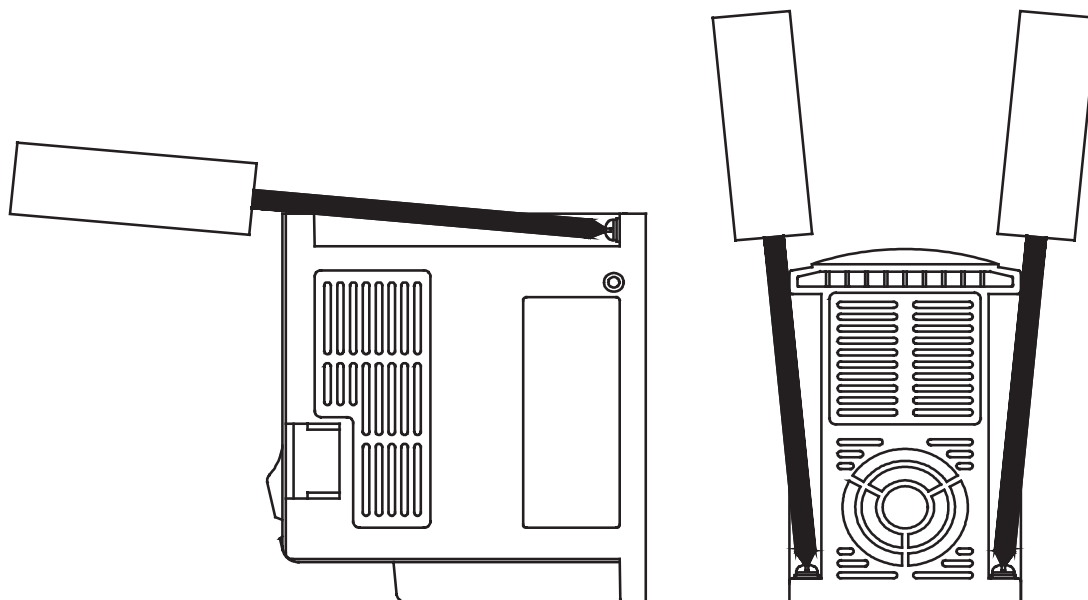
Din Rail Mounting Diagram

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

Step 2 -
Push the DIN rail forward until the middle rib grips firmly with back panel
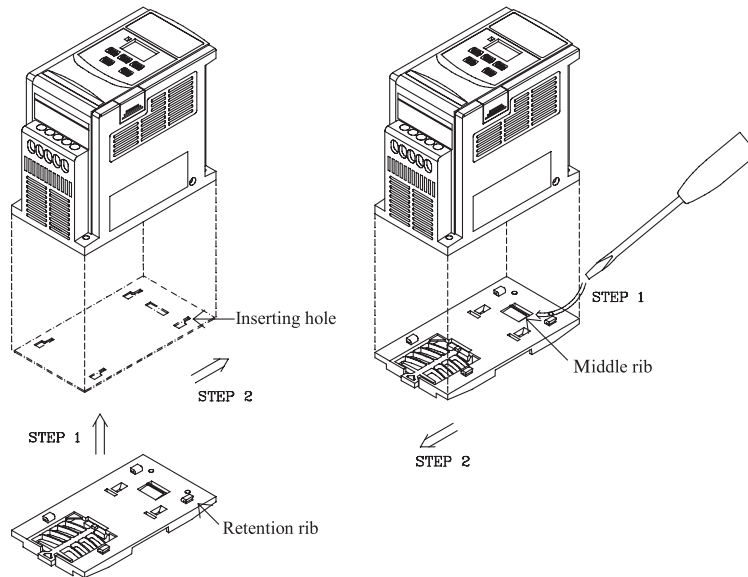
Step1-
Use a small screwdriver, inserting it into the middle rib of DIN rail and press the screwdriver in order to remove the DIN rail from the AC drive

Inserting hole

Middle rib

STEP 1

STEP 2

STEP 1

STEP 2

Retention rib

DIN Rail Installation

A mounting clamp and a 1.38" width rail must be used to install the drive on the rail.

Installing Drive
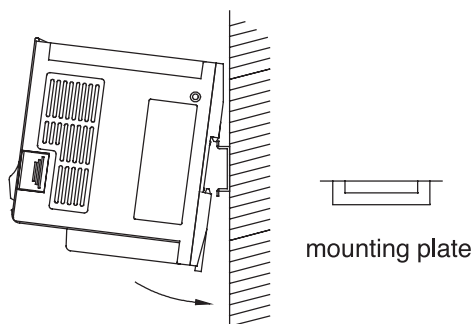
mounting plate

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

Dismounting Drive

② ① screwdriver

pull mounting plate
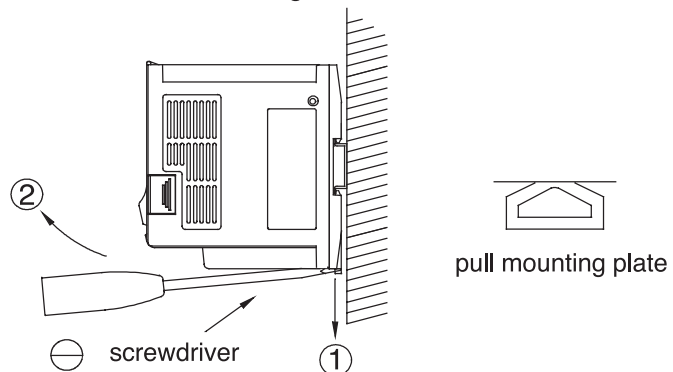
1. Pull the mounting plate downward.
2. Rotate the inverter module to dismount it.

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3. Software Index

3.1 Keypad Operating Instructions

Keypad Description
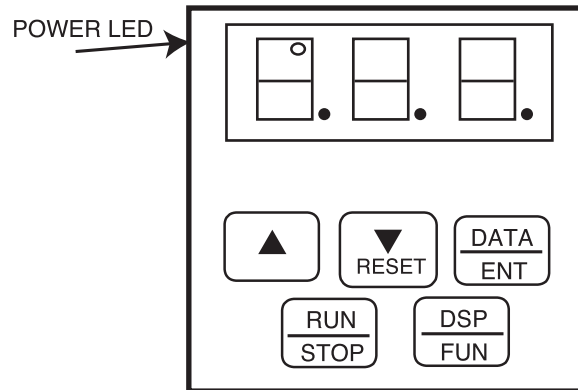
⚠ CAUTION

To avoid damage, do not operate keypad by screwdriver or other sharp-ended tool.

Keypad Operation Flowchart
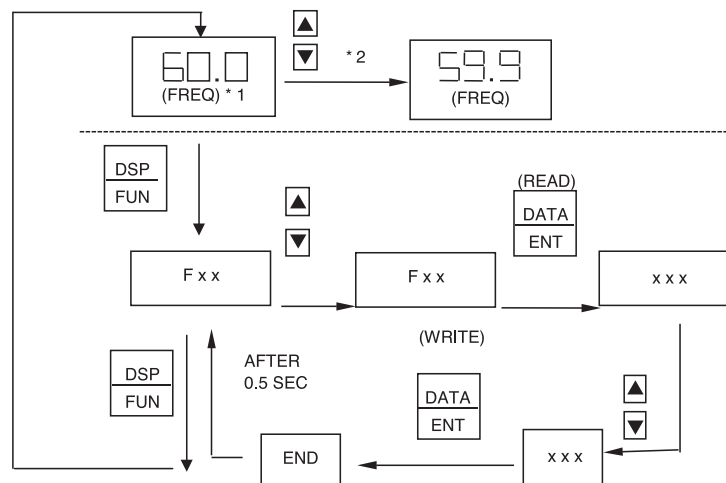
Note 1: Displays setting of frequency when stopped. Displays output frequency when running.

Note 2: The setting of the frequency can be modified either when stopped or when running.

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3.2 Parameter List

Function	F_	Function Description	Unit	Range	Factory Setting	Page	Note
Factory Setting	0	Factory Adjustment					
Accel. Time	1	Accel. Time	0.1Sec	0.1 ~ 999S	5.0	37	*1 *3
Decel. Time	2	Decel. Time	0.1Sec	0.1 ~ 999S	5.0	37	*1 *3
Operation Mode	3	0: Forward / Stop, Reverse / Stop 1: Run/Stop, Forward / Reverse	1	0 ~ 1	0	38	
Motor Rotation Direction:	4	0: Forward 1: Reverse	1	0 ~ 1	0	38	*1
V/F Pattern	5	V/F pattern setting	1	1 ~ 6	1/4	39	*2
Frequency Upper/Lower Limit	6	Frequency upper limit	0.1Hz	1 ~ 200	50/60Hz	40	*2 *3
	7	Frequency lower limit	0.1Hz	1 ~ 200	0.0Hz	40	*3
SP1 Frequency	8	SP1 frequency	0.1Hz	1 ~ 200	10Hz	40	*3
JOG Frequency	9	JOG frequency	0.1Hz	1 ~ 200	6Hz	40	
Start / Stop Control	10	0: Keypad 1: Terminal (TM2)	1	0 ~ 1	0	41	
Frequency Control	11	0: Keypad 1: Terminal (0~10V / 0~20mA) 2: Terminal (4~20mA)	1	0 ~ 2	0	41	
Carrier frequency Control	12	Carrier Frequency Setting	1	1 ~ 5 (1~10)*4	5	42	*4
Torque Compensation	13	Torque compensation gain	0.1%	0.0 ~ 10.0%	0.0%	42	*1
Stop Method	14	0: Controlled deceleration stop 1: Coast to stop	1	0 ~ 1	0	43	
DC Braking Setting	15	DC braking time	0.1S	0.0 ~ 25.5S	0.5S	43	
	16	DC braking injection frequency	0.1Hz	1 ~ 10Hz	1.5Hz	43	
	17	DC braking level	0.1%	0.0 ~ 20.0%	8.0%	43	
Electronic Thermal Overload Protection	18	Protection based on motor rated current	1%	50 ~ 100% (0~200)	100%	44	*4
Multi-Function Input Connection Point	19	Multi-Function input terminal 1 (SP1) function	1: Jog 2: SP1 3: Emergency Stop 4: External Base Block 5: Reset 6: SP2*4		2	33	
	20	Multi-Function input terminal 2 (RESET) function			5	45	
Multi-Function Output	21	Multi-Function output terminal	1: Operating 2: Frequency Agreed 3: Fault		3	46	

Function	F_	Function Description	Unit	Range	Factory Setting	Note	Page
Reverse Lock-Out	22	0: REV run 1: REV run Lock-Out	1	0 ~ 1	0	46	
Momentary Power Loss	23	0: Enabled 1: Disabled	1	0 ~ 1	0	46	
Auto Restart	24	Number of Auto-restart times	1	0 ~ 5	0	47	
Restore factory settings	25	010: Constants initialization to 50Hz system 020: Constants initialization to 60Hz system				47	*2
SP2 Frequency	26	SP2 frequency	0.1Hz	1.0 ~ 200Hz	20	48	*4
SP3 Frequency	27	SP3 frequency	0.1Hz	1.0 ~ 200Hz	30	48	*4
Power Up Start	28	0: Enable 1: Disable	1	0 ~ 1	1	48	*4
Software Version	29	CPU program version				48	
Fault Log	30	Fault log for three faults.				48	

NOTE:

*1 : Parameters that can be adjusted while running the drive.

*2 : Please refer to parameters F_25.

*3 : If the setting range is above 100, the setting unit becomes 1.

*4 : New features for CPU versions V2.1 and above.

3.3 Parameter Function Description

F_00 Factory Adjustment Parameter. Do not change.

F_01 : Acceleration Time = 0.1 ~ 999 sec
F_02 : Deceleration Time = 0.1 ~ 999 sec

1. Acceleration / Deceleration time calculation formula:

$$\text{Acceleration time} = \frac{\text{F\_01} \times \text{Frequency Setting}}{60\text{Hz}}$$

$$\text{Deceleration time} = \frac{\text{F\_02} \times \text{Frequency Setting}}{60\text{Hz}}$$
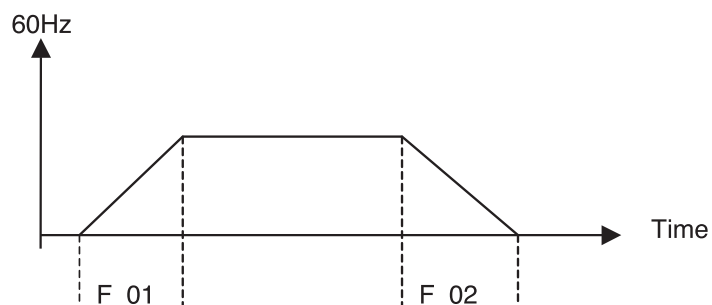
F_03: Operation Mode Selection = 0 : Forward / Stop, Reverse / Stop
1: Run / Stop, Forward / Reverse

NOTE 1: F_03 takes effect only when F_10 = 1 (external operation control)

F_03 = 0 control method — 3 FWD /Stop, 4 REV /Stop, 5 COM

F_03 = 1 control method — 3 Run / Stop, 4 FWD/ REV, 5 COM

TM2 PIN3 — ON
TM2 PIN4 — ON
F_03 = 0 Output — Forward / Reverse
F_03 = 1 Output — Forward / Reverse
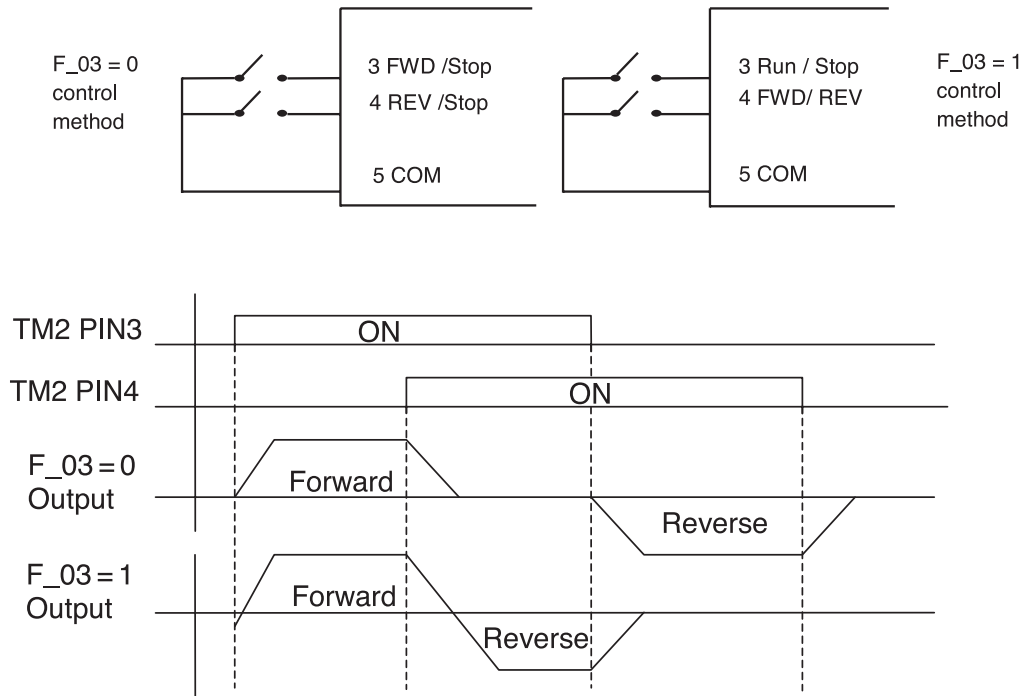
Note: Reverse command is ignored when F_22 = 1 (Reverse lockout)

F_04: Motor Rotation Direction Setting =   0: Forward
1: Reverse

Although there is no Forward / Reverse pushbutton on the digital control panel, it is possible to adjust forward / reverse function by changing the F_04 setting.

NOTE: When F_22 = 1: Reverse is disabled. F_04 cannot be set to 1.

The keypad indication will display "LOC".

NOTE: F_04 takes effect only when F_10 = 0 (Keypad start/stop control mode)

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F_05: V/F Pattern Setting = 1 ~ 6

Select F_05 = 1 - 6 to select one of the six preset V/F patterns (refer to the following tables).

Specification Application F_5	General Application 1	50Hz System High Starting Torque 2	Decreasing Torque 3
50Hz System V/F pattern			
Specification Application F_5	General Application 4	60Hz System High Starting Torque 5	Decreasing Torque 6
60Hz system V/F pattern			

F_5	B	C
1/4	10%	8%
2/5	15%	10.5%
3/6	25%	7.7%

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F_06: Frequency Upper Limit Range = 1 ~ 200Hz
F_07: Frequency Lower Limit Range = 1 ~ 200Hz

F_06: Factory setting refer to F_25.
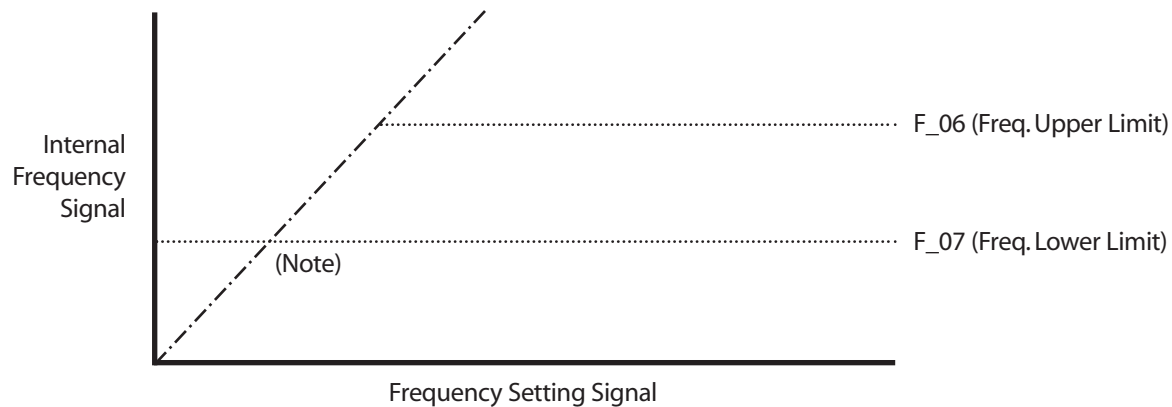
NOTE:
If F_07 = 0Hz, the frequency instruction is equal to 0Hz; the AC drive will stop at 0 speed.
If F_07 > 0Hz, the AC drive will output a minimum speed according to the setting in F_07.

F_08: SP1 Frequency = 1 ~ 200Hz
F_09: JOG Frequency = 1 ~ 200Hz

---

1. When F_19 or F_20 = 2 (multi-function input setting) and the multi-function input terminal is ON, the inverter operates at SP1 frequency (F_08).

2. When F_19 or F_20 = 1 (multi-function input setting) and the multi-function input terminal is ON, the inverter operates at JOG frequency (F_09).

3. When multi-function input terminals 1 and 2 are configured for SP1 frequency and JOG frequency, the priority of the frequency setting is: JOG, SP1, Keypad setting, external frequency signal using a speed pot.

F_10: Start / Stop Control = 0 : Keypad
                          = 1: Terminal (TM2)

NOTE: When F_10 = 1 (Terminal Control), emergency stop on the Keypad is enabled.
To avoid injuries to personnel or equipment damage when F_10 = 1, please refer to the descriptions of F_23/24 (Momentary power loss ride-through and number of auto restart attempts).
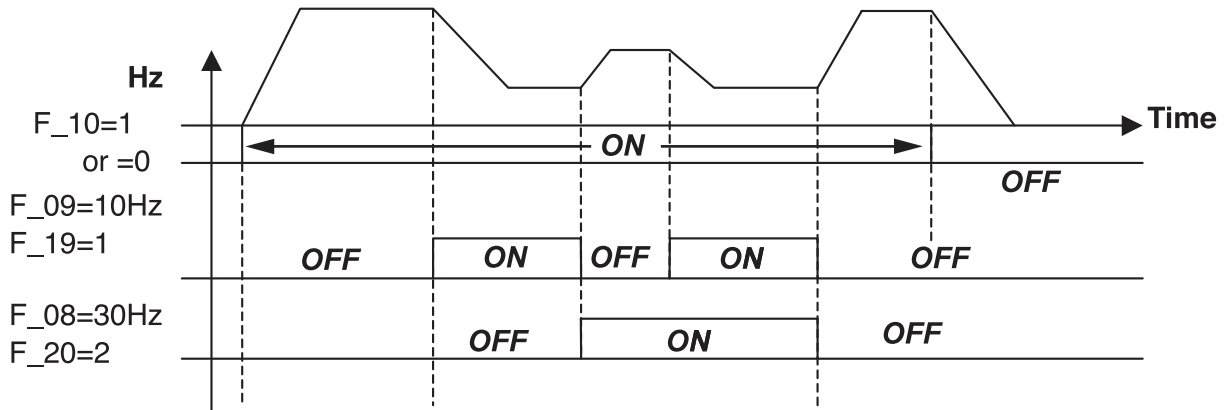
Priority of selections for JOG, multi-function, and keypad/external frequencies

F_11: Frequency Control = 0 : Keypad
                         = 1: Analog Speed Pot Terminal (TM2) (0 ~ 10V / 0-20mA)
                         = 2: Analog Speed Pot Terminal (TM2) (4-20mA)

NOTE 1:
If the jog when start/stop control is set to keypad run or SP1 frequency is switched on, the frequency is set by SP1 speed and the frequency set up via the ▼▲ buttons on the keypad are disabled. Original settings will be restored after the SP1 connection or jog input is removed.

NOTE 2:
During the contact closure of the jog function, the keypad control remains inactive until the jog contact connection is reopened.

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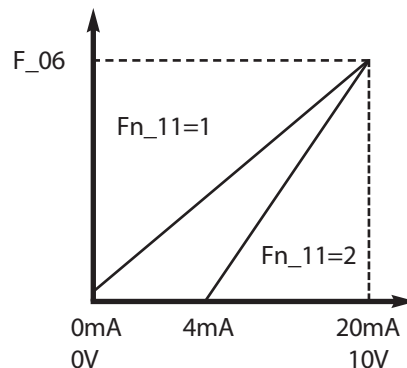
FLUXMASTER 50 INSTRUCTION MANUAL

F_12: Carrier Frequency = 1 ~ 10

F_12	Carrier Frequency	F_12	Carrier Frequency	F_12	Carrier Frequency
1	4 kHz	5	8 kHz	9	15 kHz*1
2	5 kHz	6	10 kHz*1	10	16 kHz*1
3	6 kHz	7	12 kHz*1		
4	7.2 KHz	8	14.4 kHz*1		

NOTE:
*1: Available for CPU version V1.9 and above.
2:   If F_12 = 7~10, the inverter must operate with light loads.

Although an IGBT TYPE AC drive can provide a low audible noise level during its operation, it is possible that the switching of the high carrier frequency may interfere with external electronic components (or other controllers) or even cause vibration in the motor. Adjusting the carrier frequency can usually correct this problem.

F_13: Torque Compensation Gain = 0 ~ 10%

To enhance AC drive output torque patterns according to the B, C voltage points on the V/F pattern (refer to F_05 description) and the (F_13) for this feature.
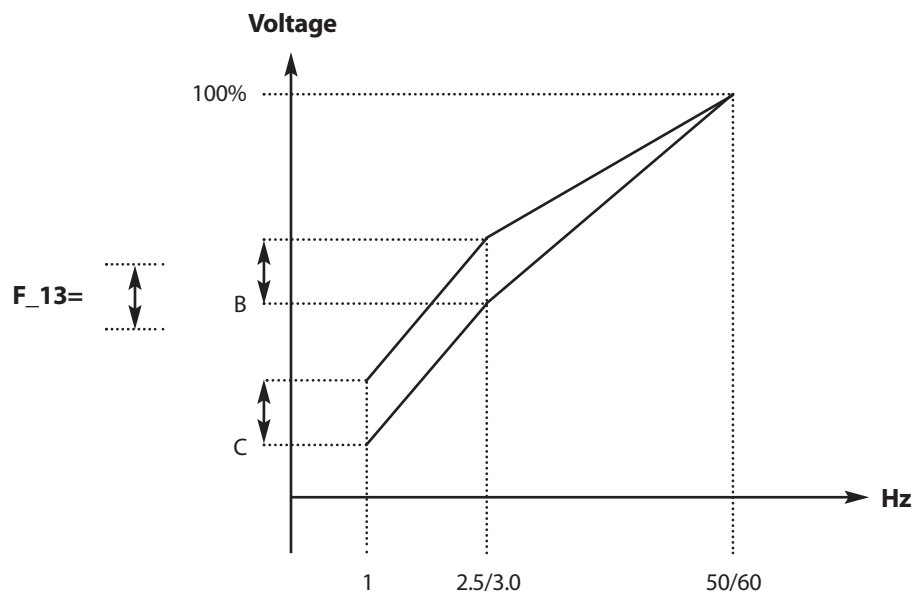
NOTE: When F_13 = 0, the torque boost function is disabled.

> **F_14 Stopping Method = 0 : Controlled deceleration stop**
> **= 1 : Coast to stop**
> **F_15 DC Braking Time = 0 ~ 25.5 sec**
> **F_16 DC Braking Starting Frequency = 1 ~ 10Hz**
> **F_17 DC Braking Level = 0 ~ 20%**

If F_14 = 0

When the AC drive receives the stop command, it decelerates to the preset frequency set by F_16. After this, the output voltage level that is set in F_17 will determine the amount of DC voltage that is injected into the motor. The time duration to perform this stopping function is set in F_15.

Run Command

Output Frequency   Deceleration Time

DC Braking Frequency

DC Braking Time
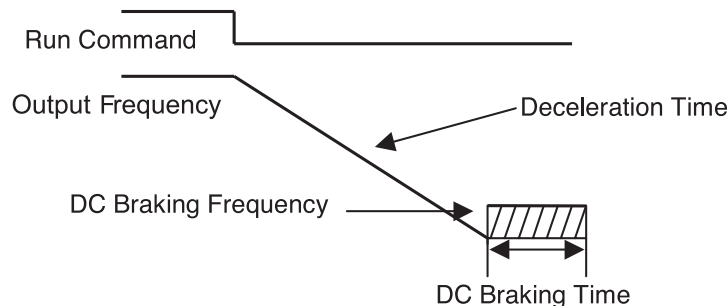
If F_14 = 1

The inverter stops output immediately after receiving the stop command. The motor will enter into a coast to stop state until it comes to a complete stop.

> **F_18: Motor Rated Current = 50 ~ 200%**

1. The electronic thermal overload protection for the motor is as follows:

(1) Motor rated current = AC drive rated current x F_18. (F_18 = Motor rated current / AC drive rated current)

(2) When the load is within 100% of the motor's rated current, the operation continues. When the load reaches 150% of the motor's rated current, the operation is allowed to continue for 1 minute. (Refer to curve (1) in Figure 3)

(3) After protecting the motor with the electronic thermal switch activated, the AC drive is cut off immediately. The OL1 light will flash. To resume operation, push the RESET button or activate an external reset contact wired to Terminal 2.

(4) When the motor is operating at low speeds, the heat dissipation efficiency is lower. The electronic thermal activation level is also reduced. (to change from curve (1) to curve (2) in Figure 3. Choose the appropriate F_05 setting according to the applied motor to reach the desired performance.

2. The electronic thermal protection for the AC Drive is as follows:

(1) When the load is within 103% of the AC drive rated current, the operation continues. When the load reaches 150% of rated current of the AC drive, the operation will continue for 1 minute. (Refer to curve (1) of figure 3)

(2) After the activation of the electronic thermal switch, the AC drive is shut off immediately. (The OL2 light will flash) To resume the operation, push RESET button or activate an external reset contact wired to Terminal 2.

F_05 = 1,2,3
50Hz standard motors

F_05 = 4,5,6
60Hz standard motors

(Figure 1)

(Figure 2)

In Percentage of Current

(Figure 3)
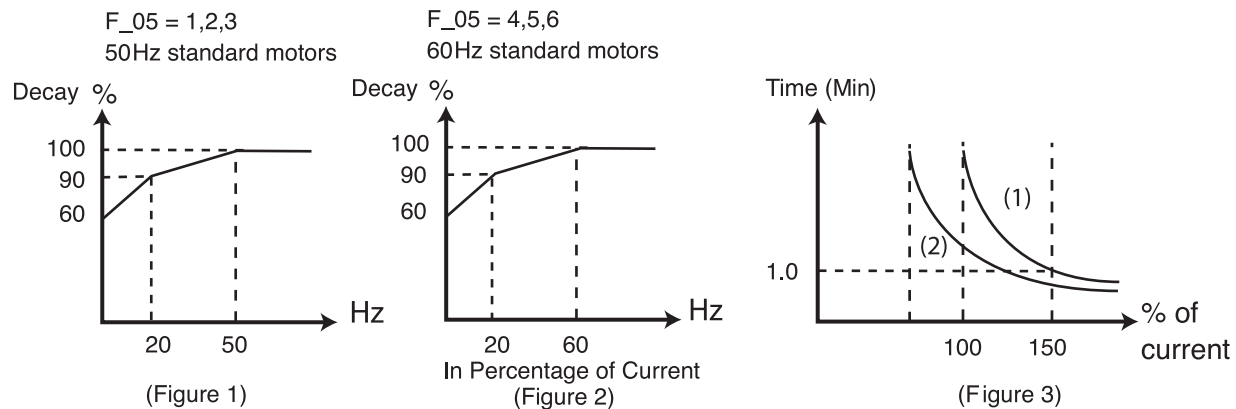
F_19: Multi-Function Input Terminal 1 = 1~ 5 (1 ~ 6: CPU version v1.9 and above)
F_20: Multi-Function Input Terminal 2 = 1~ 5 (1 ~ 6: CPU version v1.9 and above)

1. **F_19 = 1 or F_20 = 1: JOG control (refer to F_09; Jog Frequency Setting):**
2. **F_19, F_20 = 2 or 6 Multi-speed control (refer to F_08, F_26, F_27; Multi-speeds 1-3 settings):**
   F_19 = 2 & F_20 = 6:

TM2 SP1 Terminal	TM2 SP1 Terminal	Output Frequency
ON	OFF	F_08
OFF	ON	F_26
ON	ON	F_27

F_19=6 & F_20=2:

TM2 SP1 Terminal	TM2 SP1 Terminal	Output Frequency
ON	OFF	F_26
OFF	ON	F_08
ON	ON	F_27

3. F_19, F_20 = 3: External Emergency Stop

When the external emergency stop signal is activated, the AC drive proceeds to decelerate and stop, (ignoring the stopping method setting of F_14). The AC drive E.S. light will flash after stopping. After the emergency stop signal is deactivated, turn the RUN switch OFF and then ON again to cycle it in the terminal mode. (F_10 = 1) Or press the RUN key in the keypad mode (F_10 = 0). The AC drive will then resume operation and restart. If the emergency stop signal is removed before the AC drive stops, the AC drive will still execute the emergency stop.

4. F_19, F_20 = 4: External Base Block (Immediate Shut Down)

When the external base block signal is activated, the AC drive output will be immediately shut off (ignoring the stopping method setting of F_14) and flash b.b. Light. After the base block signal is deactivated, turn the RUN switch OFF and then ON again (F_10 = 1) or press the RUN key (F_10 = 0), the inverter will restart from the original starting frequency.

External Emergency Stop

External Base Block
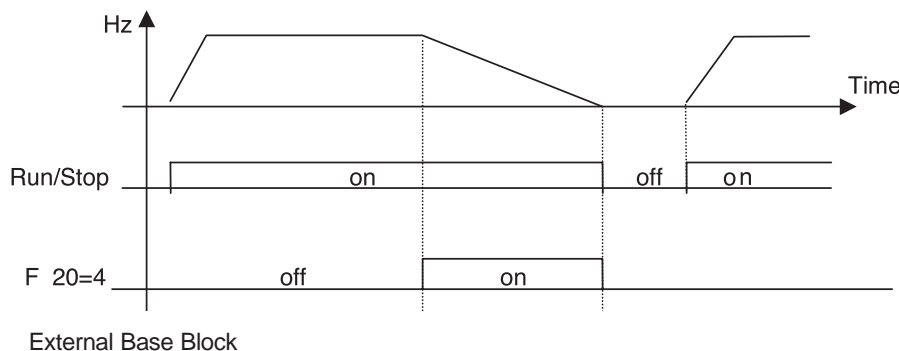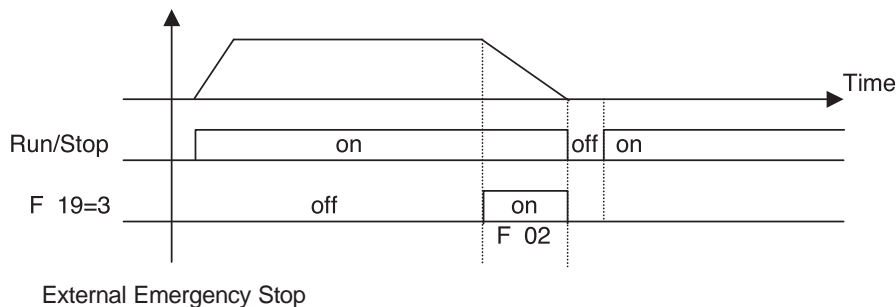
5. F_19, F_20 = 5: Auto Reset when AC drive faults.

F_21: Multi-Function Output Terminal Control = 1 ~ 3

1. F_21 = 1: Run mode signal
2. F_21 = 2: At Frequency Speed Signal
3. F_21 = 3: Fault signal

Terminals 1 and 2 of TM2 are activated for the following faults: CPF, OL1, OL2, OCS, OCA, OCC, Ocd , Ocb ,OVC , LVC , OHC.
Refer to Section 4 for information on faults.

F_21=1
Terminal 1 & 2

F_21=2
Terminal 1 & 2
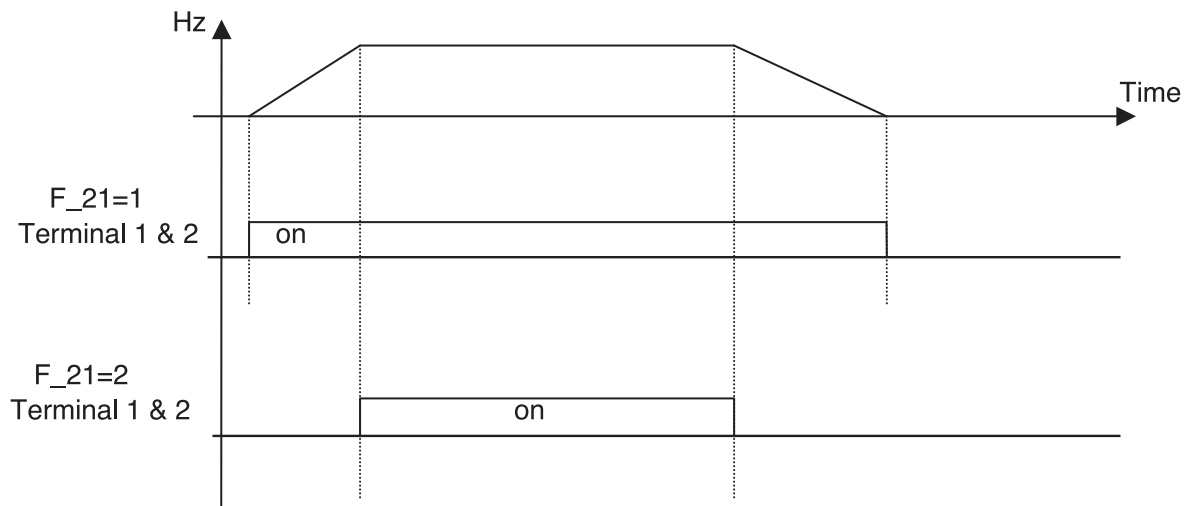
F_22: Reverse Lockout	= 0: REV run command enabled
	= 1: REV run command Lockout

NOTE:
When F_04 (motor rotation direction) is set to 1 (reverse), F_22 cannot be set to 1. In order to properly lockout a motor direction, F_04 must be set at 0 before setting F_22 to 1.

F_23: Auto-restart after Momentary Power Loss = 0: Auto-restart enabled
= 1: Auto-restart disabled

1. When the AC power supply is temporarily below low voltage protection levels due to low line supply or unusually large demands on the power supply system, the AC drive will stop immediately. If the voltage level recovers within 2 seconds, the AC drive can restart by using its speed search program.

2. When F_23 = 0:
   (1) If the momentary power loss is less than 2 seconds, the AC drive resumes operation automatically via speed search at 0.5 seconds after power up. The number of auto restart times is not limited by F_24.

   (2) If the momentary power loss is long, the operation of the AC drive is based on the setting of F_10 and the condition of the external switch.

   (3) If the time of momentary loss is between the above two conditions, whether the AC drive will auto-restart depends on F_24:
   F_24 = 0: Auto-restart disabled.
   F_24 = 1 ~ 5: Auto-restart enabled 1~5 times.

3. When F_23 = 1,
    (1) Power up after momentary power loss, the AC drive will not start. Even if F_24 > 0.
    (2) If the momentary power loss is long, the AC drive must be restarted manually. The operation of the AC drive is based on the setup of F_10 and the condition of external switch.

4. When restarting the AC drive, the operation of the AC drive is based on the setup of F_10 (start/stop control) and the condition of external switches (FWD/REV button).
    (1) When F_10 = 0, the AC drive will not restart.
    (2) When F_10 = 1 and the external switch (FWD/REV button) is OFF, the AC drive will not restart.
    (3) When F_10 = 1 and the external switch (FWD/REV button) is ON, the AC drive will automatically restart.
        Attention: Based on safety issues, please turn off the external switch (FWD/REV button) after power loss to avoid possible damage to personnel and the machine after sudden regeneration of power.

F_24: Number of Auto-Restart Times = 0 ~ 5

1. When F_24 = 0, the AC drive will not auto-restart after a fault recovery. (Except for momentary power loss, please refer to F_23 for details)

2. When F_24 = 1~5: the AC drive will resume operation via speed search at 0.5 seconds under auto-restart after fault recovery. (Except for momentary power loss, please refer to F_23 for details).

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

4. If either of following situations should develop, the auto restart times will be reset:
    (1) No additional faults (in operation or stop) occurs within 10 minutes.
    (2) Press RESET button.

F_25: Restore to Factory Settings	= 010: Constants initialization to 50Hz system = 020: Constants initialization to 60Hz system

1. When F_25 is set to 010, all parameters are restored to factory settings. The settings of F_05 = 1 and F_06 = 50. F_25 is restored back to 000 after the reset process is complete. (50Hz operation)

2. When F_25 is set to 020, all parameters are restored to factory settings. The settings of F_05 = 4 and F_06 = 60. F_25 is restored back to 000 after the reset process is complete. (60Hz operation)

F_26: SP2 (1 ~ 200Hz) , Multi-speed 2 (Refer to F_19 / F_20)

F_27: SP3 (1 ~ 200Hz) , Multi-speed 3 (Refer to F_19 / F_20)

F_28: Power Up Start   = 0 : Power Up start enabled when remote Run command on
= 1 : Power Up start disabled when remote Run command on

(CPU version V2.1 and above)

When F_28 = 1 and control mode is remote control (F_10 = 1), the AC drive can not start if the RUN switch is ON when power is engaged. The run signal must be toggled off then on to run the AC drive.

F_29: CPU Program Version

F_30: Fault log for last three faults

1. Last three faults: indicate the sequence of the occurrence of faults by the location of decimal point. **x.xx** indicates a recently occurred fault. **xx.x** indicates the prior fault event. **xxx**. Indicates the earliest fault in the record.

2. After entering the F_30 function, the x.xx trip record will be displayed first. After that, press ▲ button and you can read activity in a chronological order. **xx.x ➔ xxx**. ➔ **x.xx ➔xxx,** consecutively.

3. After entering F_30 function, if the RESET button is pressed, the trip record will be cleared. (Indication display **-.--, --.-,** and **---.** results)

4.   When the content of trip indicates O.CC, it will indicate the latest trip code is OC-C and so on.

1. Non-Resettable Faults

INDICATION	CONTENT	POSSIBLE CAUSE	COUNTERMEASURE
CPF	Program error	Outside noise interference	Install 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. Examine the power supply 2. Return the AC drive 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 AC drive for repair
OH	AC drive over-heat while not operating	1. Detection circuit defective. 2. Environment overheat or poor ventilation	1. Return the AC drive for repair 2. Improve ventilation

2. Manually Resettable Faults (Not Auto-resettable)

INDICATION	CONTENT	POSSIBLE CAUSE	COUNTERMEASURE
OC	Overcurrent at stop condition	Detection circuit malfunction	Return the AC drive for repair
OL1	Motor overload	1. Loading too large 2. Improper V/F model setting (F_05) 3. Improper F_18 setting (Motor Rated Current)	1. Increase capacity of motor 2. Adjust to use a proper V/F curve setting 3. Adjust F_18 according to instruction
OL2	AC drive overload	1. Loading too large 2. Improper V/F model setting (F_05)	1. Increase capacity of AC drive 2. Adjust to use a proper V/F curve setting

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FLUXMASTER 50 INSTRUCTION MANUAL

3. Manual and Auto-reset Faults

INDICATION	CONTENT	POSSIBLE CAUSE	COUNTERMEASURE
OCS	Transient overcurrent at start	1. Motor coil short-circuit with external casing 2. Motor connection wire short-circuit with grounding 3. Transistor module damaged	1. Examine motor 2. Examine wiring 3. Replace transistor module
OCA	Overcurrent at acceleration	1. Acceleration time setting too short 2. Improper V/F function selection 3. Applied motor capacity exceeds AC drive capacity	1. Adjust acceleration time to longer setting 2. Adjust to a proper V/F curve 3. Replace and install another AC drive with appropriate capacity
OCC	Overcurrent at steady speed	1. Transient change in load 2. Transient change in power supply	1. Examine the loading configuration 2. Install inductor on power supply input side
OCd	Overcurrent at deceleration	Deceleration setting too short	Adjust to a longer acceleration time
OCb	Overcurrent at braking	DC Braking frequency, braking voltage, or braking time setting too long	Adjust to reduce settings of DC Braking F_15, F_16, or F_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 a longer deceleration time 2. Install a inductor on the power supply input side 3. Increase the capacity of AC drive
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 AC drive 4. Install a reactor on the power supply input side
OHC	Heat-sink over heated at operation	1. Loading too heavy 2. Ambient temperature too high or poor ventilation	1. Examine the load 2. Increase capacity of AC drive 3. Improve ventilation

INDICATION	CONTENT	DESCRIPTION
SP0	Zero Speed Stopping	When speed F_11 = 0, Frequency lower limit F_7 = 0 and frequency setting < 1Hz When speed F_11 = 1, Frequency lower limit F_7 < (F_6/100), and frequency setting <Frequency upper limit (F_6/100)
SP1	Failure to start directly	1. If the inverter is set to external operation (F_10 = 1) and direct start is disabled (F_28 =1), the AC drive cannot be started and will flash SP1 when the run command is attempted after applying power (see descriptions of F_28 power-up start). 2. Direct start is possible when F_28 = 0.
SP2	Keypad emergency stop	The inverter setup to external operation (F_10 = 1). If the STOP key in the keypad is pressed during operation, the AC drive stops according the stop method F_14 and flashes SP2 after stop. The RUN switch must be turned OFF then 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 AC drive decelerates and stops. E.S. flashes after AC drive stops. (Refer to instruction for F_19 for detail).
b.b.	External BASE BLOCK	When the external BASE BLOCK signal is activated through the multi-function terminal, the AC drive stops output immediately and flashes b.b. for indication. (Refer to instruction for F_19 for detail)

Keypad Operation Error Instruction

INDICATION	CONTENT	POSSIBLE CAUSE	COUNTERMEASURE
LOC	Motor direction locked	1. Attempt to reverse direction when F_22 reverse disable = 1 2. Attempt to set F_22 to 1 when F_04 = 1	1. Adjust F_22 to 0 2. Adjust F_04 to 0 (motor rotation direction)
Er1	Keypad operation error	1. Press ▲ or ▼ keys when F_11 = 1 or under SP1 operation 2. Attempt to modify F_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 F_11 = 0 (keypad model) 2. Do not modify F_29 3. Modify in stop mode only
Er2	Parameter setting error	1. F_6 < F_7 (upper frequency limit< lower frequency limit)	1. Set F_6 > F_7

CONDITION	CHECK POINT	COUNTERMEASURE
Motor Inoperative	Is the power source voltage delivered to L1, L2 terminal (is the charging indicator illuminated)?	❚ Check if the power source is on. ❚ Turn power source OFF and then ON again. ❚ Reconfirm the power voltage level.
	Is there voltage output from output terminal T1, T2 and T3?	❚ Turn power source OFF and then ON again.
	Is the motor wired correctly?	❚ Check motor wiring.
	Is there any abnormal condition in the AC drive?	❚ Refer to fault handling instructions to examine and correct wiring. Check parameter F_22
	Has reverse rotation been disabled?	
Motor Inoperative	Is the analog frequency setting loaded?	❚ Check to see if wiring for analog frequency input signal is correct.
	Is the operation mode setting correct?	❚ Check if the frequency input setting voltage is correct.
Motor runs in opposite direction	Is wiring on the output terminals T1, T2 and T3 correct?	❚ Correct with motor rotation direction setting (Fn_04) or FWD/REV key
	Is the wiring for the forward and reverse signals correct?	❚ Wiring should be in accordance with the U, V, W terminals of motor.
Motor run speed does not change	Is the wiring for analog frequency input correct?	❚ Examine the wiring and correct it.
	Is the operation mode setting correct?	❚ Check the Operation panel.
	Is the loading too heavy?	❚ Reduce loading.
Motor runs 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 significantly reduced?	❚ Cheek wiring to motor. Check DC bus voltage.
Abnormal speed variation at operation	Is the loading too heavy?	❚ Reduce loading variation.
	Is the loading variation too large?	❚ Increase AC drive and motor capacity.
	Is the input power source steady and stable?	❚ Install AC reactor on the power supply input side.

4. Troubleshooting Procedures

4.1 Flow Chart

(Continued)

(Continued)

```
┌─────────────────────┐
│ Examine AC Drive    │
│ parameters          │
└─────────────────────┘
          │
┌─────────────────────┐
│ Carry out parameter │
│ initialization      │
└─────────────────────┘
          │
┌─────────────────────┐
│ Designate operation │
│ control method      │
└─────────────────────┘
          │
┌─────────────────────┐
│ Frequency instruction│
│ setting             │
└─────────────────────┘
          │
    ◇ Does the             NO    ┌─────────────────────┐
    controller display  ───────→ │ Replace control board│
    frequency setting?           └─────────────────────┘
          │
    ◇ Is there            NO    ┌─────────────────────┐
    voltage output on  ───────→ │ Replace control board│
    UVW terminals?              └─────────────────────┘
          │ YES
┌─────────────────────┐
│ Connect to motor and│
│ proceed with operation│
└─────────────────────┘
          │
    ◇ Is there            YES
    any abnormality   ───────→
    indication?
          │ NO
    ◇ Is                  NO
    output current of all ───────→
    phases balanced?
          │ YES
┌─────────────────────┐
│ The Drive is        │
│ Operating Correctly │
└─────────────────────┘
```

◇ Does replacing control board correct the problem?
- No, The problem is not corrected
- Yes, the problem has been corrected

The Drive is defective
Detailed examination is required.

Error handling of fault indication of OC.OL

```
            ┌─────────────────┐
            │ Inverter displays│
            │ Fault indication │
            │     OC.OL.       │
            └─────────────────┘
                    │
            ┌───────────────┐   NO    ┌──────────────────┐
            │ Is the primary│────────▶│ Replace I.G.B.T. │
            │ circuit I.G.B.T.│        └──────────────────┘
            │    normal?    │
            └───────────────┘
              │ YES
            ┌───────────────┐   NO    ┌──────────────────────┐
            │ Is the appearance│──────▶│ Replace defective PCB│
            │    normal?    │         └──────────────────────┘
            └───────────────┘
              │ YES
            ┌───────────────┐
            │ Switch ON power│
            │    supply     │
            └───────────────┘
                    │
            ┌───────────────┐  YES
            │ Is there any  │────────────────┐
            │ Fault indication?│             │
            └───────────────┘                ▼
              │ NO              ┌───────────────────┐   NO    ┌──────────────────┐
            ┌───────────────┐   │ Is the current    │────────▶│ Replace detector.│
            │ Input operation│  │ detector normal?  │         └──────────────────┘
            │ instruction   │   └───────────────────┘
            └───────────────┘      │ YES
              │ YES              ┌────────────────────┐
            ┌───────────────┐    │ Replace control board.│
            │ Input frequency setting│ └────────────────────┘
            └───────────────┘
                    │
            ┌───────────────┐   NO    ┌──────────────────────┐
            │ Is the output frequency│▶│ Replace control board│
            │   displayed?  │         └──────────────────────┘
            └───────────────┘
              │ YES
            ┌───────────────┐   NO    ┌──────────────────────┐
            │ Is there output│───────▶│ Replace control board│
            │ voltage on UVW│         └──────────────────────┘
            │  terminals?   │
            └───────────────┘                  │
              │ YES              ┌──────────────────────────┐  NO
            ┌───────────────┐    │ Does replacing           │─────┐
            │ Connect motor and│  │ control board correct this│    │
            │ proceed with operation.│ │     Problem?         │    │
            └───────────────┘    └──────────────────────────┘    │
                    │                        │ YES               │
            ┌───────────────┐   YES          │                   │
            │ Is there any Fault│─────────────┘                   │
            │  indication?  │                                     │
            └───────────────┘                                     │
              │ NO                                                │
            ┌───────────────┐   NO                                │
            │ Is output     │──────────────────────┐             │
            │ current of all phases│                │             │
            │ balanced condition?│                  ▼             ▼
            └───────────────┘          ┌──────────────────────────┐
              │ YES                     │ Drive is defective       │
            ┌───────────────┐          │ Detailed examination is required.│
            │ The Drive is  │          └──────────────────────────┘
            │ operating correctly│
            └───────────────┘
```

Error handling of fault indication of OV.LV

```
                    ┌─────────────────────┐
                    │  Drive display OV.LV │
                    └─────────────────────┘
                               │
                          ◇ Is there              YES    ┌──────────────────────┐
                          any visual breakage?  ──────→  │ Replace defective board │
                               │ NO                      └──────────────────────┘
                    ┌─────────────────────┐
                    │     Switch ON       │
                    │   power supply      │
                    └─────────────────────┘
                               │
                          ◇ Is there any          YES    ┌──────────────────────┐
                          Fault indication?     ──────→  │  Replace control board │
                               │ NO                      └──────────────────────┘
                    ┌─────────────────────┐
                    │  Input operation    │
                    │   instruction       │
                    └─────────────────────┘
                               │
                    ┌─────────────────────┐
                    │  Input frequency    │
                    │   instruction       │
                    └─────────────────────┘
                               │
                          ◇ Is the output        NO     ┌──────────────────────┐
                          frequency of controller ───→  │  Replace control board │
                          displayed?                    └──────────────────────┘
                               │ YES
                          ◇ Is there             NO      ┌──────────────────────┐
                          output voltage on T1, T2, ──→  │  Replace control board │
                          and T3 terminals?             └──────────────────────┘
                               │ YES
                    ┌─────────────────────┐               ◇ Is the problem      NO
                    │ Connect motor. Is the│               corrected by replacing ──→
                    │  motor operating?   │                control board?
                    └─────────────────────┘                     │ YES
                               │
                          ◇ Is there any Fault   YES
                          indication?          ──────→
                               │ NO
                          ◇ Is output           NO
                          current of all phases ──────→
                          balanced?
                               │ YES                      ┌──────────────────────┐
                    ┌─────────────────────┐               │ The Drive is defective │
                    │    The Drive is     │               │ Detailed examination   │
                    │ operating correctly │               │ is required.           │
                    └─────────────────────┘               └──────────────────────┘
```

(1). Motor inoperative

```
                    ┌─────────────────┐
          YES       │ Is the circuit  │
      ┌─────────────│ breaker (MCCB)  │
      │             │ switched ON?    │
      │             └─────────────────┘
      │                      │ NO
      │             ┌─────────────────┐
      │             │ Does the        │    NO    ┌──────────────────────┐
      │             │ MCCB stay on    │──────────│ Wiring short-circuit  │
      │             │ without tripping?│         └──────────────────────┘
      │             └─────────────────┘
      └──────────────────────┤
                    ┌─────────────────┐
                    │ Is the          │
                    │ voltage between │    NO    ┌──────────────────────┐
                    │ L1-L2 power input terminals│ Power source         │
                    │ normal?         │──────────│ abnormality          │
                    └─────────────────┘          │ Poor wiring          │
                             │ YES               └──────────────────────┘
                    (within +/- 10% of nominal value)
                    ┌─────────────────┐    NO    ┌──────────────────────┐
                    │ Is Power LED off ?│────────│ FM50 malfunction     │
                    └─────────────────┘          └──────────────────────┘
                             │
                    ┌─────────────────┐    NO    ┌──────────────────────┐
                    │ Is the operation │─────────│ Place the operation  │
                    │ switch on the RUN│         │ switch to RUN        │
                    │ position?        │         │ position.            │
                    └─────────────────┘          └──────────────────────┘
                             │ YES
                    ┌─────────────────┐    NO    ┌──────────────────────┐
                    │ Is there        │──────────│ FM50 malfunction     │
                    │ any output voltage on│      └──────────────────────┘
                    │ motor T1-T2-T3? │
                    └─────────────────┘
                             │
                    ┌─────────────────┐    NO    ┌──────────────────────┐
                    │ Is the          │──────────│ FM50 malfunction     │
                    │ T1-T2,T2-T3,T3-T1│         └──────────────────────┘
                    │ output voltage balanced?│
                    └─────────────────┘
```

YES (When the motor is not connected, and the voltage differences between wires are within +/- 3%, consider system as balanced.

```
                    ┌──────────────────┐
                    │ Motor overload   │
                    │ Defective motor  │
                    │ Poor wiring      │
                    └──────────────────┘
```

(2). Motor overheat

```
┌─────────────────────┐                          ┌──────────────────────┐
│     Is there        │         YES              │  Reduce loading      │
│ overloading condition├─────────────────────────┤  Increase FM50 and   │
│ or does the load current                       │  motor capacity      │
│  exceeds rated      │                          └──────────────────────┘
│    current?         │
└─────────────────────┘
          │ NO

┌─────────────────────┐         YES              ┌──────────────────────┐
│ Extended operation  ├─────────────────────────┤  Select another motor │
│   at low speeds?    │                          └──────────────────────┘
└─────────────────────┘
          │ NO

┌─────────────────────┐         NO               ┌──────────────────────┐
│     Is the          ├─────────────────────────┤  FM50 malfunction     │
│ voltage level between                          └──────────────────────┘
│ T1-T2, T2-T3, and T3-T1
│    normal?          │
└─────────────────────┘
          │ YES

┌─────────────────────┐         YES              ┌──────────────────────┐
│    Is there         ├─────────────────────────┤  Remove obstacles     │
│ anything that might │                          │ affecting motor cooling│
│  affect motor       │                          └──────────────────────┘
│   cooling?          │
└─────────────────────┘
          │ NO

┌─────────────────────┐         YES              ┌──────────────────────┐
│  Poor connection    ├─────────────────────────┤  Correct the connection│
│ between FM50 and motor                         └──────────────────────┘
└─────────────────────┘
```

(3). Unstable motor operation

```
Does this occur          YES      Is the                 No     Increase or decrease
during acceleration or  ────────  acceleration/        ──────   acceleration /
deceleration ?                    deceleration time setting      deceleration time
                                  appropriate?
     │                                 │
    NO                                YES              Reduce load Increase
     │                                 │               FM50 and motor capacity
     │
Is the                   NO                            FM50 malfunction
voltage level          ────────────────────────────
between T1-T2, T2-T3, and
T3-T1 normal?

     YES (The differences between different wires are within ±3%)

Is there any loading     YES                           Reduce loading
variation condition?   ────────────────────────────   variation or install
                                                       fly wheel
     │
    NO
     │
Is there                 YES                           Improve mechanical
any excess vibration   ────────────────────────────   system
at transmission parts
such as gears?
     │
    NO                                                 FM50 malfunction
   ────────────────────────────────────────────────
```

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Routine and Periodical Examination

AC Drive requires routine and periodical examination and maintenance. Carry out the examination only after the " Power LED " indicator goes off for at least 5 minutes.

| Maintenance Item	Maintenance Description	EXAMINATION Period Routine	EXAMINATION Method 1 Year	Examination	Criterion	Countermeasure
Installation Site Environment	Reconfirm environment temperature and humidity	❍		Refer to installation instructions and measure with thermometer and hygrometer	Temperature: -10~40˚C Humidity: under 95% non-condensing	Improve environment Installation site environment
	Check and remove any flammable material nearby	❍		Visual inspection	No foreign object	
AC Drive Installation and Grounding	Is there any abnormal vibration on the installation site?	❍		Visual and audio Inspection	No foreign object	Tighten loose screws
	Is the grounding resistance within acceptable range?		❍	Measure resistance by multi-meter	Resistance under 100 ohm to ground	Improve grounding
Input Power Source Voltage	Is the voltage of the primary circuitry normal?	❍		Measure voltage by multi-meter	Voltage level conforming specification	Improve input power source
AC Drive Terminal Mounting Screws	Are the tightened parts secured?		❍	Visual inspection. Use screwdriver to verify screw tightness	No abnormality	Tighten loose screw or return for repair
	Is there any sign of breakage on the terminal panel?		❍			
	Is there any visible rust?		❍			
Internal Wiring of Inverter	Is it deformed or skewed?		❍	Visual inspection	No abnormality	Replace or return for repair
	Is the insulation of wire broken?		❍			
Heatsink	Is it accumulating dust or dirt?	❍		Visual inspection	No abnormality	Clean up dust or dirt
PCB	Is it accumulating conductive metals or oils?		❍	Visual inspection	No abnormality	Clean up or replace PCB
	Is there any overheated or burnt components?		❍			
Cooling Fan	Is there any abnormal vibration or noise?		❍	Visual and audio inspection	No abnormality	Replace cooling fan
	Is it accumulating dust or dirt?	❍		Visual inspection		Clean up
Power Component	Is it accumulating dust or dirt?		❍	Visual inspection	No abnormality	Clean up
Capacitor	Is there any sign of strange odor or leakage?	❍		Visual inspection	No abnormality	Replace capacitor or inverter
	Is there any sign of swelling or bulging?	❍				

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4.3 Maintenance and Examination

Frequent examination and maintenance is not required for the FM50. To maintain appropriate reliability, please proceed with the following periodical examination. Remember to turn off the power supply and wait until the Power LED goes off before proceeding. (Due to the large amount of residual charge in the internal capacitors.)

(1) Clean out internal dust and dirt.
(2) Check mounting screws on every terminal and part. Tighten loose screws.
(3) Dielectric strength test
    (a) Remove all conducting wires between the Drive and the outside world. Power must be turned OFF.
    (b) The dielectric strength test inside the Drive should be carried out only for FM50 major circuitry. Use a DC 500V: high resistance meter. Measured resistance should be higher than 100M ohm.
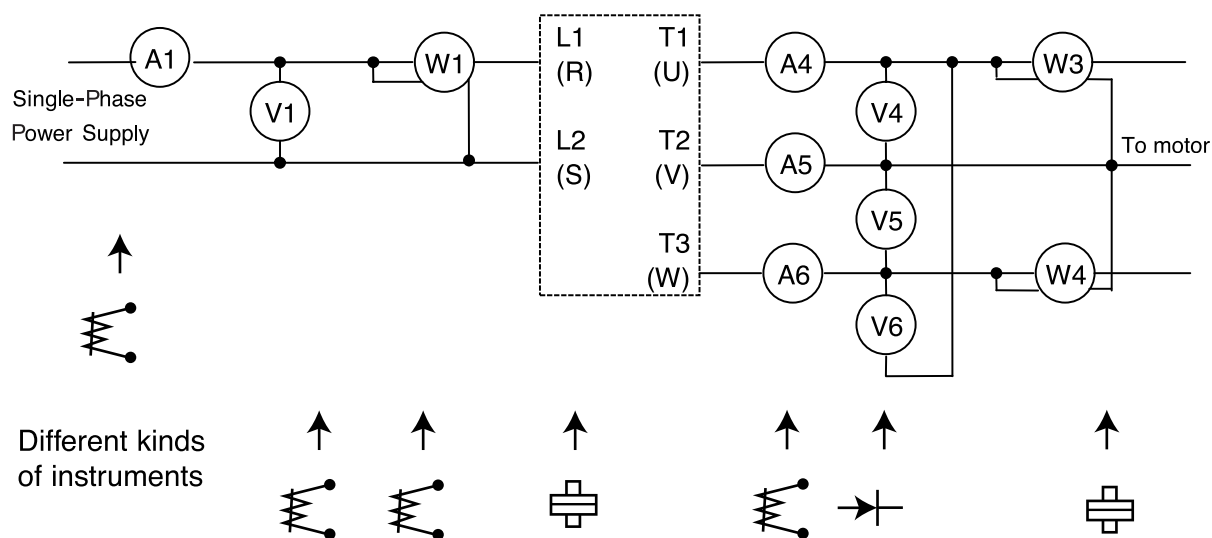
⚠ CAUTION

Do not perform dielectric strength test to the control circuit.
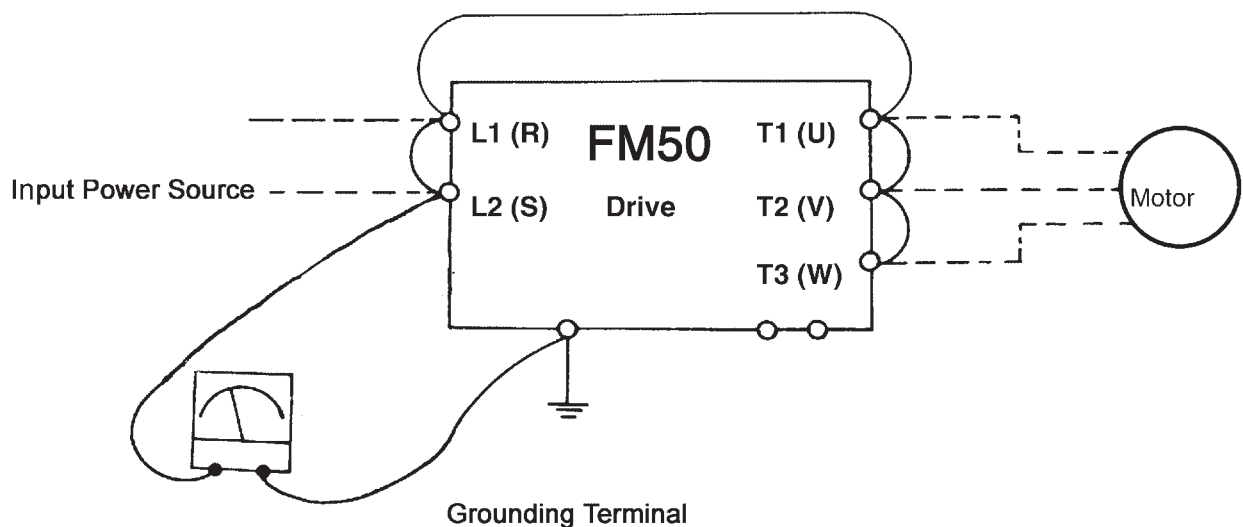
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4.4 Voltage Current Measurement

The voltage and current measurement on the primary and secondary side of the AC drive may be different due to instrumentation variations. Refer to following diagram for measurement:

MEASUREMENT	MEASURING POINT	INSTRUMENT	NOTE (MEASUREMENT CRITERION)
Input Voltage Vl	V1	Moving-iron	
Input Current Ii	A1	Moving-iron	
Input Power Pi	W1	Power-meter	P=W1
Input Power Factor PFi	Calculate power factor by the input voltage, input current and input power.		
Output Voltage Vo	V4 V5 V6	Rectifier (Moving iron not allowed)	Maximum voltage difference between wires under 3%
Output Current Io	A4 A5 A6	Moving-iron	Under the drive's rated current
Output Power Po	W3 W4	Power-meter	Po=W3+W4
Output Power Factor	$PFo = \dfrac{Po}{\sqrt{3}V0 \cdot Io} \times 100\%$		

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4.5 EMI Filter (Class B) Specification

Model	Dimension (in)	Current (A)	Inverter model
MSDF-2102	6.14 x 3.0 x 0.99	10A	FM50-2P2 FM50-2P5 FM50-201
MSDF-2202	6.77 x 4.73 x 0.43	20A	FM50-202 FM50-203
MSDF-4103	6.77 x 4.73 x 0.43	10A	FM50-401 FM50-402 FM50-403

4.6 Din Rail Specification

Model	Dimension (in)	FM50 model
FM50-DIN-201	5.12 x 2.83 x 0.30	ALL FM50 MODELS

4.7 of Braking Resistor and Input Reactor Specification

Model	Braking Transistor Built-in	Braking Resistor Built-in	Braking Torque	Braking Resistor Model	Input AC Reactor Current (A)	Inductance (mH)
FM50-2P2	X	X	20%	Note 1	3	7.0
FM50-2P5	X	X	20%	Note 1	5.2	4.2
FM50-201	X	X	20%	Note 1	9.4	2.1
FM50-202	❍	X	20%	BRN2-202	19	1.1
FM50-203	❍	X	20%	BRN2-203	25	0.71
FM50-401	❍	X	20%	BRN2-401	2.5	8.4
FM50-402	❍	X	20%	BRN2-402	5.0	4.2
FM50-403	❍	X	20%	BRN2-403	7.5	3.6

❍: Built-in X: Not Built-in

Note 1: No transistor and resistor built-in.

4.8 Braking Resistor Specification

Model of	Braking Resistor Model	Motor (HP)	Specification of Braking Resistor (W)	(Ω)	Braking Resistor ED(%)	Braking Torque (%)
FM50-202	FM100-2BR2	2	150	100	10	119
FM50-203	FM100-2BR3	3	200	70	9	116
FM50-401	FM100-4BR1	1	60	750	8	125
FM50-402	FM100-4BR2	2	150	400	10	119
FM50-403	FM100-4BR3	3	200	250	8	128

Note:

1. Braking level: 385/770VDC for FM50-200/400 series
2. Braking resistor mounting is below:
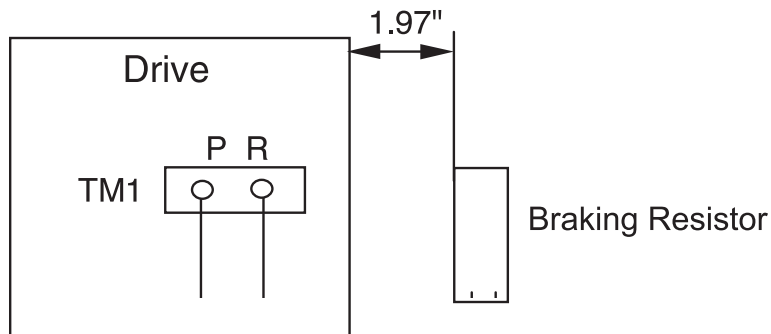
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Special Condition Description

Customer		Model	
Application		Telephone	
Address			

F_##	Value Setting	F_##	Value Setting	F_##	Value Setting
F_00		F_11		F_22	
F_01		F_12		F_23	
F_02		F_13		F_24	
F_03		F_14		F_25	
F_04		F_15		F_26	
F_05		F_16		F_27	
F_06		F_17		F_28	
F_07		F_18		F_29	
F_08		F_19		F_30	
F_09		F_20			
F_10		F_21			

Notes

Notes

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