VFN2 Series Adjustable Frequency AC Motor Drives Instruction Manual

Table of Contents

N2 Series

Thank you for purchasing this Drivecon variable frequency AC drive. When properly installed, operated and maintained, the inverter will provide a lifetime of reliable operation. It is mandatory that the person who operates, inspects, and maintains this equipment thoroughly reads and understands this manual.

This instruction manual has been designed to serve as self-supporting guide for the proper installation. Feel free to contact either your local supplier or Drivecon Corporation should you need any assistance.

Please read and understand this manual before operating.

This will ensure safe and reliable operation of inverter.

NOTES FOR SAFE OPERATION are classified as "WARNING" or "CAUTION"

WARNING

Indicates a potentially dangerous situation which, if not avoided, could result in death or serious injury to personnel.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in a minor or moderate injury to personnel and damage to equipment.
It may also be used to alert against unsafe practices.
Even items described in **CAUTION** may result in a vital accident in some situations. In either case, follow these important notes.

NOTE: These are steps to be taken to insure proper operation.

RECEIVING:

CAUTION
Do not install or operate any inverter which is damaged or has missing parts.
Failure to observe this caution may result in personal injury or equipment damage.

Installation

CAUTION

Lift the cabinet by the base. When moving the unit never lift by the front cover. This may result in dropping the unit and damage to the unit.

e   Mount the inverter on nonflammable material (i.e. metal). Failure to observe this caution can result in fire.

e   When mounting units in an enclosure, install a fan or other cooling device to keep the intake of air temperature below 40°C. Overheating may cause a fire or damage to unit.

WIRING

WARNING

e   Only commence wiring after verifying that the power supply is turned OFF. Failure to observe this warning can result in electrical shock or fire.

e   Wiring should be performed only by qualified personnel. Failure to observe this warning can result in electrical shock or fire.

e   When wiring the emergency stop circuit, check the wiring thoroughly before operation. Failure to observe this warning can result in personal injury.

e   Make sure to ground the terminal. (E)
(Ground resistance 200V class: 100 ohm or less, 400V class: 10 ohm or less)
Failure to observe this warning can result in an electrical shock or a fire.

CAUTION

e   Verify that the inverter rated voltage coincides with the AC power supply voltage. Failure to observe this caution can result in personal injury or a fire.

e   Do not perform a withstand voltage test of the inverter. It may cause semi-conductor elements to be damaged.

e   To connect a braking resistor, braking resistor unit or braking unit, follow the procedures described in Appendix F. Improper connection may cause a fire.

e   Tighten terminal screws to the specified tightening torque. Failure to do so can result in fire.

e   Never connect the AC main circuit power supply to output terminals T1(U), T2(V) and T3(W). The inverter will be damaged and void the warranty. AC main power connection L1, L2 and L3 (L1 and L2 for 240V single phase input) Motor connections T1, T2 and T3.

OPERATION

WARNING

e   Only turn ON the input power supply after replacing the front cover. Do not remove the cover while current is flowing.

DO NOT touch any circuit components while AC main power is ON or immediately after main AC power is disconnected from the unit. You must wait until the LED on the control board extinguishes. Failure to observe this warning can result in an electrical shock.

e   When the retry function (Fn35) is selected, do not approach the inverter or the load, since it may restart suddenly after being stopped. (Construct maching system so as to assure safety to personnel, even if the inverter should restart.) Failure to observe this warning can result in personal injury.

e   Since the stop button can be disabled by a function setting, install a separate emergency stop switch. Failure to observe this warning can result in personal injury.

CAUTION

e   Never touch the heatsink or discharging resistor since the temperature is very high. Failure to observe this caution can result in harmful burns to the body.

e   Since it is easy to change operation speed from low to high speed, verify the safe working range of the motor and machine before operation. Failure to observe this caution can result in personal injury and machine damage.

e   Install a holding brake separately if needed. Failure to observe this caution can result in personal injury.

e   Do not change signal operation. The machine or inverter may be damaged.

e   All the constants of the inverter have been preset at the factory. Do not change settings unnecessarily.

MAINTENANCE AND INSPECTION

WARNING

e   Never touch high-voltage terminal in the inverter. Failure to observe this warning can result in an electrical shock.

e   Replace all protective covers before powering up the inverter. To remove the cover, make sure to shut OFF the molded case circuit breaker.
Failure to observe this warning can result in electrical shock.

e   Perform maintenance or inspection only after verifying that the CHARGE LED goes OFF, after the main circuit power supply is turned OFF.
The capacitors are still charged and can be dangerous.

e   Only authorized personnel should be permitted to perform maintenance, inspections or parts replacement. (Remove all metal objects
(watches, bracelets, etc.) before operation.) (Use tools which are insulated against electrical shock) Failure to observe this warning can result in an electrical shock.

CAUTION

e   The control PC board employs CMOS IC's. Do not touch the CMOS elements. They are easily damaged by static electricity.

e   Do not connect or disconnect wires or connectors while power is applied to the circuit. Failure to observe this caution can result in personal injury.

OTHERS

WARNING

e   Never modify the product. Failure to observe this warning can result in electrical shock or personal injury and will void the warranty.

IT IS STRONGLY RECOMMENDED THAT YOU READ AND UNDER-STAND THIS MANUAL TO OBTAIN OPTIMUM OPERATION FROM YOUR INVERTER.

General Precautions

e   Some drawings in this manual are shown with the protective cover or shields removed, in order to describe with more clarity. Make sure all covers and shields are replaced before operating this product.

e   This manual may be modified when necessary due to improvements in the product. Modifications are denoted by a revision manual No.

e   To order a copy of this manual, contact Drivecon Corporation at 1-800-374-8266.

e   Drivecon is not responsible for any modification of the product made by the user, since this will void the warranty.

Section 1 Introduction

1.1   General

Drivecon N2 series are high performance general purpose inverters that incorporate a high efficiency Pulse Width Modulated (PWM) design and IGBT technology. The output closely approximates a sinusoidal current wave form to allow variable speed control of any conventional squirrel cage induction motor.

1.2   Receiving

The unit has been put through demanding tests at the factory prior to shipment.

Before unpacking please check the following:

1. Identify the description of the product found on the label with your purchase order.
2. Inspect for transport damage. (serious damage of carton may lead to unit damage)

Please check the following after unpacking:

a. Check if the specifications (current & voltage) on the front cover match your application requirement.

b. Check all the electrical connections and screws.

c. Verify ther is no visible damage to any of the components.

If any part of the inverter is damaged or lost, please notify the carrier and your dealer immediately.

IMPORTANT!

Please check the following after supplying power:

a) Check Fn23 to meet 50Hz/60Hz rated output frequency system.
b) Check Fn70 to set motor rated current. (If needed)
c) Check Fn30 to adjust voltage of input power supply.

Section 2:   Installation

2.1   Location

Proper location of the inverter is imperative to achieve specified performance & normal operation life expectancy. Inverter should always be installed in areas where the following conditions exist:

Ambient operating temperature range:

Enclosed type:-10° to 40°C (14 to 104°F)
Open chassis type: -10° to 50°C (14 to 122°F)
Rating of enclosures are NEMA1/IP20.
Protected from rain and moisture.
Shielded from direct sunlight.
Free from metallic particles and corrosive gas.
Free from excessive vibration. (Below 0.5G)

2.2   Clearance

For cooling and maintenance purpose, sufficient clearance (as shown in figure 2.1) around inverter is necessary to keep effective ventilation. Inverter must be installed with heat sink fins oriented vertically.

Fig. 2.1
Location and Positioning of inverter.

INVERTER

4"

4"

4"   4"

VENTILATION
-10° ~+40°

2"

VERTICAL
HEATSINK FINS

(a) Front view   (b) Side view
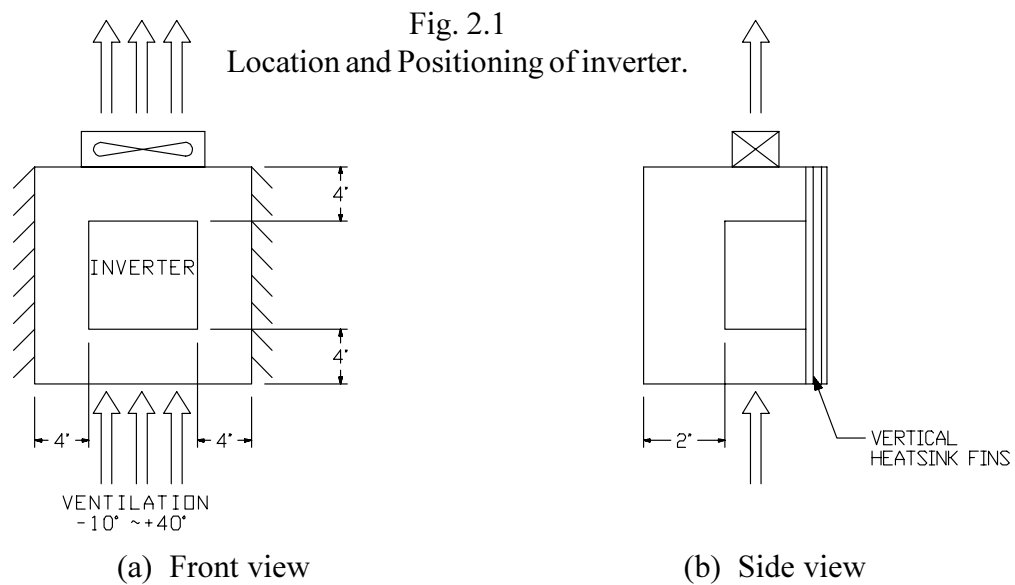
2.3   Wiring

2.3.1   Circuit Breaker Selection

WARNING: To guarantee the safety of equipment, circuit disconnecting means and branch circuit protection between power source and inverter is necessary. The branch circuit protection can either be in the form of thermal magnetic moulded case circuit breaker (MCCB) or current limiting time delay fuse protection. Please follow all national and local electric codes.

Units rated for 240VAC input are suitable for use on a circuit capable of delivering not more than 5000RMS symmetrical amperes, 240V maximum. Units rated for 480VAC input are suitable for use on a circuit capable of delivering not more than 5000RMS symmetrical amperes, 480V maximum.

CAUTION: DO NOT connect power source to inverter output terminal (T1, T2, T3) otherwise the unit will be damaged.
NEVER install Magnetic Contactor (MC) between inverter output terminal and motor. The transient de-energizing surge of magnetic contactor will destroy the unit or lead inverter to trip.
Tables 3.3a and 3.3b shown below provides the suggested rating of MCCB or MC for each of the inverter ratings.

You should install RC surge absorbers across the coils of any control relays or contactors installed within the system of the inverter. Metal Oxide Varistors (MOV's) alone are not acceptable. See figure below for the proper surge absorbers.
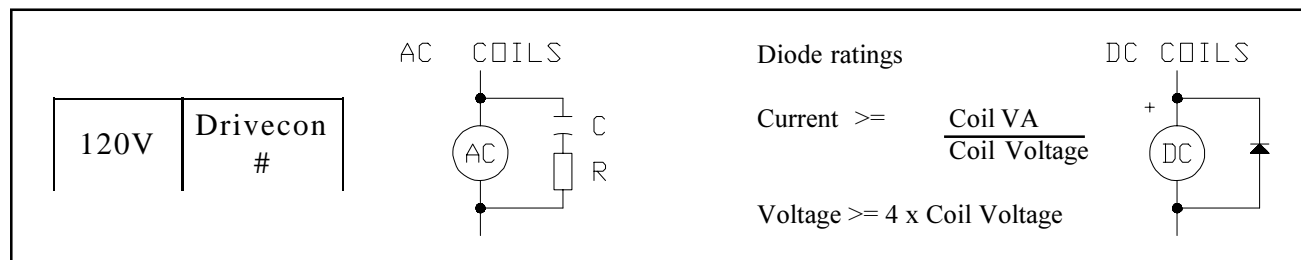
2.3.2   Wire Size

The wire used in the main power circuit should be sized according to Tables 3.3a and 3.3b shown below. Use copper conductors only, size field wiring based on 75°C wire only.

Table 3.3a N2-2XX Series

Inverter type		N2-204	N2-207	N2-215	N2-222	N2-237	N2-255	N2-275	N2-2110	N2-2150	N2-2220
MCCB/ fuse rating *3		10A	10A	20A		30A	40A	50A	80A	100A	150A
MC (A/B IEC rated)		100A09ND3			100A12ND3	100A18ND3	100A30ND3	100A38ND3	100A60ND3	100A75ND3	100B110ND3
Wire Size *1 (minimum)	TM1	14 AWG			12 AWG		10 AWG	8 AWG	6 AWG	4 AWG	2 AWG
	TM2/TB1	18 AWG									
Screw *2 Terminal size	TM1 (torque)	M4 (10.5 in.-lbs.)					M6 (39 in.-lbs.)		M6 (22 in.-lbs.)	M8 (53in.-lbs.)	M8 (53in.-lbs.)
	TM2 (torque)	M3 (7 in.-lbs.)									
	TB1 (torque)	Wire clamp type captive screw (10 in. - lbs.)									

Table 3.3b N2-4XX Series

Inverter type		N2-404	N2-407	N2-415	N2-422	N2-437	N2-455	N2-475	N2-4110	N2-4150	N2-4220
MCCB / fuse rating *3		10A				15A	20A	30A	40A	50A	75A
MC (A/B IEC rated)		100A09ND3					100A12ND3	100A18ND3	100A30ND3	100A38ND3	100A45ND3
Wire Size *1 (minimum)	TM1	14 AWG					12 AWG		10 AWG	8 AWG	4 AWG
	TM2/TB1	18 AWG									
Screw *2 Terminal size	TM1 (torque)	M4 (16 in.-lbs)							M6 (22 in.-lbs.)		
	TM2 (torque)	M3 (7 in. - lbs.)									
	TB1 (torque)	Wire clamp type captive screw. (10 in. - lbs.)									

NOTE: *1 Use copper conductors only, minimum size listed, size field wiring based on 75°C wire only.

*2 Use only U.L. listed field wiring lug kits or U.L. listed ring terminals.

*3 For maximum protection of inverter a current limiting type fuse should be used. Recommended supplier is Gould type ATM. Equivalent values from other manufacturers may be substituted.

2.3.3 Grounding

Connect positive earth ground using terminal E on the Main Circuit terminal (TM1).

CAUTION: Ground wire size should be in accordance with NEC regulations or at least 14 AWG minimum. The lead length should be kept as short as possible.

NOTE: Ground resistance to building earth should be below 100 ohm. Provide extra ground collector shoe if unsure of ground on crane itself.

NOTE: NEVER ground inverter along with welding machines, large current motors....etc.

NOTE: Where several inverter units are used together all of them should be directly grounded to a common point. Please follow the grounding instructions shown in Fig. 3.4.

WARNING: Never ground or connect terminal N of inverter to neutral.
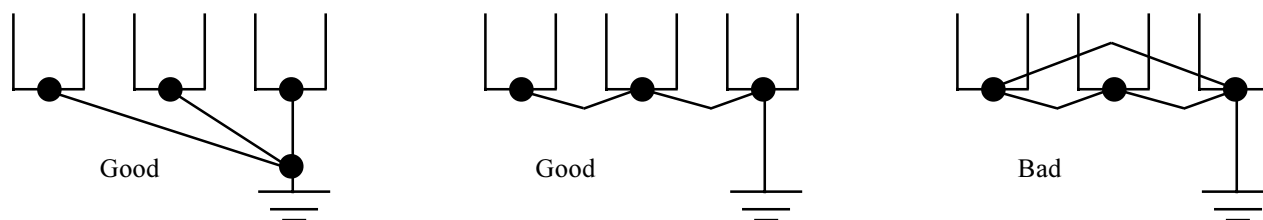
Fig. 3.4a Grounding of Multiple inverters.

2.3.4 Location of Terminal Block

N2-407 shown. Models differ according to capacity.

AC LINE
L1, L2, L3

EXTERNAL BRAKE
RESISTOR P, R
OR
EXTERNAL BRAKE UNIT
AND RESISTOR P, N

MOTOR
T1, T2, T3
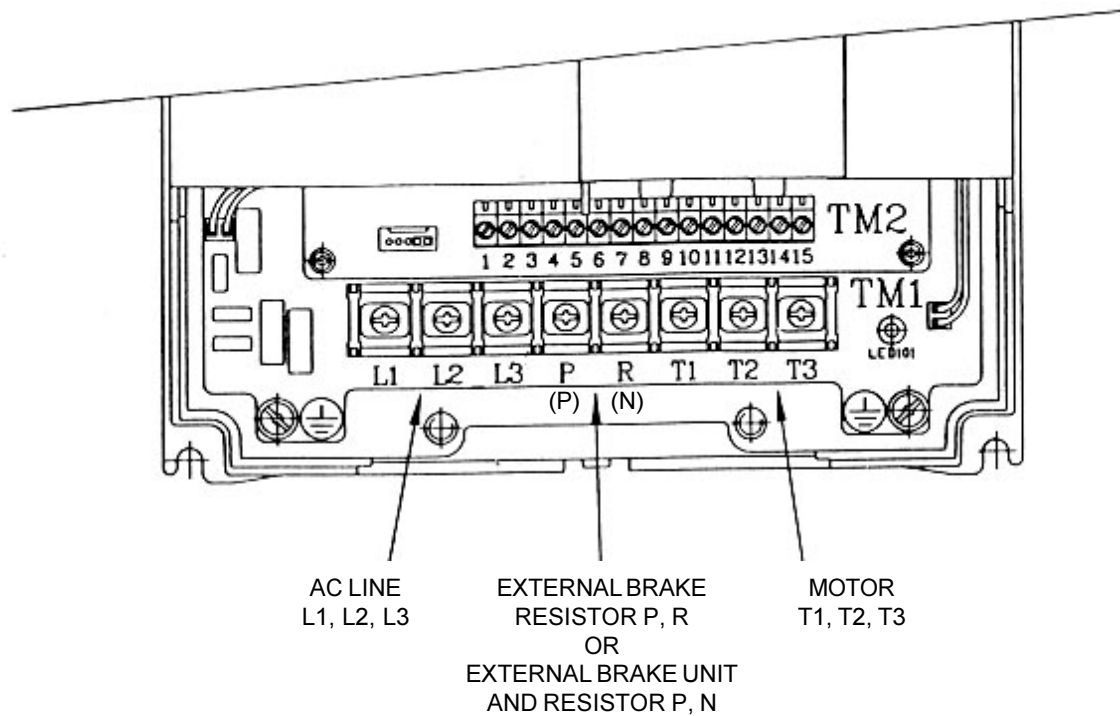
Terminations to inverter must be made with either listed field wiring lug kits or listed crimp type ring terminals.

Note: N2 models 204 through 275 and 407 through 475 have internal D.B. modules. All other larger N2 units require an external D.B. unit furnished separately.

B. Power wiring

Power wiring are the wires that are connected to terminals L1, L2, L3, T1, T2, T3, P, R. Power wiring must be selected as follows:

1. Use copper conductors only. Size field wiring based on 75°C wire only.
2. Wire voltage rating must be a minimum of 300V for 230VAC systems, and 600V for 460VAC systems.

C. Control wiring

This is wiring connected to the control terminal strip (TM2). It must be selected as follows:

1. Use copper conductors only. Size field wiring based on 75°C wire only.
2. Wire voltage rating must be a minimum of 300V for 230VAC systems, and 600V for 460VAC systems.
3. Control wiring should not be run in the same conduit or raceway with power or motor wiring.

D.   External Brake Resistor Ratings

Model #	ohms	wattage
N2-204M	200	60
N2-207M	200	60
N2-215M	100	150
N2-222M	70	200
N2-407M3	750	60
N2-415M3	400	150
N2-422M3	250	200
N2-437M3	150	300

VFN2 230V series optional dynamic brake resistors (Internal D.B. resistor must be disconnected when installing external resistor)

VFD MODEL	D.B. module	RESISTOR MODEL	OPEN	PERFORATED	LOUVERED
VFN2-204-M	internal	DBK1-110-400-*	150.00	195.00	195.00
		DBKC1-110-400-*	220.00	265.00	265.00
VFN2-207-M	internal	DBK1-110-400-*	150.00	195.00	195.00
		DBKC1-110-400-*	220.00	265.00	265.00
VFN2-215-M	internal	DBK1-110-400-*	150.00	195.00	195.00
		DBKC1-110-400-*	220.00	265.00	265.00
VFN2-222-M	internal	DBK1-70-400-*	150.00	195.00	195.00
		DBKC1-70-400-*	220.00	265.00	265.00
VFN2-237-M3	internal	DBK1-46-800-*	170.00	250.00	250.00
		DBKC1-46-800-*	240.00	320.00	320.00
VFN2-255-M3	internal	DBK1-46-800-*	170.00	250.00	250.00
		DBKC1-46-800-*	240.00	320.00	320.00
VFN2-275-M3	internal	DBK1-46-800-*	170.00	250.00	250.00
		DBKC1-46-800-*	240.00	320.00	320.00
VFN2-2110-M3	external	DBK1-30-800-*	170.00	250.00	250.00
		DBKC1-30-800-*	240.00	320.00	320.00
VFN2-2150-M3	external	DBK1-20-800-*	170.00	250.00	250.00
		DBKC1-20-800-*	240.00	320.00	320.00
VFN2-2220-M3	external	DBK1-15-1.0K-*	220.00	340.00	340.00
		DBKC1-15-1.0K-*	290.00	410.00	410.00
DBK- Resistor and overload with N.C. contact, DBKC resistor and overload with form C contact.					

See resistor DATA SHEET for overload amperage ratings. A thermal overload
    is required for each resistor and is supplied loose for customer's panel mounting.
A 3 phase line disconnect contactor on input side of VFN2 is to be opened if thermal overload trips.
Consult Drivecon for 3 pole contactor prices and ratings.
Resistors are sized for 100% braking torque for a maximum of 10% duty cycle.

Consult factory for higher brake torque or cycle rates.

*		Enclosure options
*	-O	Open
*	-P	Perforated
*	-L	Louvered

Prices are subject to change without notice.
June 1, 1998

VFN2 460V series optional dynamic brake resistors (Internal D.B. resistor must be disconnected when installing external resistor)

VFD MODEL	D.B. module	RESISTOR MODEL	OPEN	PERFORATED	LOUVERED
VFN2-407-M3	internal	DBK1-450-400-*	150.00	195.00	195.00
		DBKC1-450-400-*	220.00	265.00	265.00
VFN2-415-M3	internal	DBK1-450-400-*	150.00	195.00	195.00
		DBKC1-450-400-*	220.00	265.00	265.00
VFN2-422-M3	internal	DBK1-300-400-*	150.00	195.00	195.00
		DBKC1-300-400-*	220.00	265.00	265.00
VFN2-437-M3	internal	DBK1-160-500-*	170.00	250.00	250.00
		DBKC1-160-500-*	240.00	320.00	320.00
VFN2-455-M3	internal	DBK1-120-500-*	170.00	250.00	250.00
		DBKC1-120-500-*	240.00	320.00	320.00
VFN2-475-M3	internal	DBK1-90-500-*	170.00	250.00	250.00
		DBKC1-90-500-*	240.00	320.00	320.00
VFN2-4110-M3	external	DBK1-60-1.2K-*	220.00	340.00	340.00
		DBKC1-60-1.2K-*	290.00	410.00	410.00
VFN2-4150-M3	external	DBK1-40-1.6K-*	270.00	430.00	430.00
		DBKC1-40-1.6K-*	340.00	500.00	500.00
VFN2-4220-M3	external	DBK1-30-2.4K-*	370.00	610.00	610.00
		DBKC1-30-2.4K-*	440.00	680.00	680.00

DBK - Resistor and overload with N.C. contact, DBKC resistor and overload with form C contact.

See resistor DATA SHEET for overload amperage ratings. A thermal overload
is required for each resistor and is supplied loose for customer's panel mounting.
A 3 phase line disconnect contactor on input side of VFN2 is to be opened if thermal overload trips.

Consult Drivecon for 3 pole contactor prices and ratings.

Resistors are sized for 100% braking torque for a maximum of 10% duty cycle.

Consult factory for higher brake torque or cycle rates.

*   Enclosure options
*   -O   Open
*   -P   Perforated
*   -L   Louvered

Prices are subject to change without notice.
June 1, 1998

Caution: N2 inverters are not provided with Overspeed Protection or equivalent. N2 inverters do not incorporate current limiting control or equivalent.

6. Caution

6.1   **Do not** touch any circuit components while AC power is on or immediately after the main AC power is disconnected from the unit. You must wait until the LED on the control board is no longer lit.

6.2   Do not make any interconnection to the circuit before inverter is disconnected from AC power line. Failure to adhere to this warning could result in serious or lethal injury.

7. Only intended for use in a Pollution Degree 2 Macro-Environment or equivalent.

2.4 Specification

2.4.1 Basic specification

Model number	N2-204M	N2-207M	N2-215M	N2-222M	N2-237M3	N2-255M3	N2-275M3	N2-2110M	N2-2150M	N2-2220M
Horsepower	1/2 HP	1 HP	2 HP	3 HP	5HP	7.5HP	10HP	15HP	20HP	30HP
Rated motor (KW)	0.4	0.75	1.5	2.2	3.7	5.5	7.5	11	15	22
Rated current (A)	3.1	4.5	7.5	10.5	17.5	26	35	49	64	87
Rated output (KVA)	1.2	1.7	2.9	4	6.7	9.9	13.3	18.7	24.4	33.2
Input voltage	1/3 phase(s) 200~240 ± 10%, 50/60Hz ±5% (3 phases only for N2-237 and above)									
Output voltage	3 phases 0~200~240V (proportional to input voltage)									
Momentary power loss ride through time.	1 sec.	1 sec.	2 sec.	2 sec.	2 sec.	2 sec.	2 sec.	2 sec.	2 sec.	2 sec.
Dimensions H x W x D (in)	6.38 x 4.21 x 5.33	6.38 x 4.21 x 5.33	7.24 x 5.87 x 6.02	8.46 x 7.28 x 6.60	8.46 x 7.28 x 6.60	11.81 x 7.87 x 7.83	11.81 x 7.87 x 7.83	15.75 x 9.84 x 9.45	15.75 x 9.84 x 9.45	15.75 x 9.84 x 9.45

Model number	N2-404M3	N2-407M3	N2-415M3	N2-422M3	N2-437M3	N2-455M3	N2-475M3	N2-4110M	N2-4150M	N2-4220M
Horsepower	1/2 HP	1 HP	2 HP	3 HP	5 HP	7.5 HP	10 HP	15 HP	20 HP	30 HP
Rated current (A)	2.3	2.3	3.8	5.2	8.8	13	17.5	25	32	48
Rated motor (KW)	0.75	0.75	1.5	2.2	3.7	5.5	7.5	11	15	22
Rated output (KVA)	1.7	1.7	2.9	4	6.7	9.9	13.3	19.1	24.4	36.6
Input voltage	3 phases 380~460V ± 10%, 50/60Hz ± 5%									
Output voltage	3 phases 0~380~460V (proportional to input voltage)									
Momentary power loss ride through time.	1 sec.	1 sec.	1 sec.	2 sec.	2 sec.	2 sec.	2 sec.	2 sec.	2 sec.	2 sec.
Dimensions H x W x D (in)	7.24 x 5.87 x 6.22			8.46 x 7.28 x 6.60		11.81 x 7.87 x 7.83			15.75 x 9.84 x 9.45	

2.4.2　Functional specification

			Specification
Control characteristics	**Carrier frequency**		1-12KHz
	Frequency control range		0.1-400Hz
	Frequency accuracy		Digital: 0.01% (-10~40°C); Analog: 0.4% (25± 10°C)
	Frequency resolution		0.01Hz with computer or PLC control, 0.1Hz with keypad control when frequency above 100Hz.
	Frequency setting signal		0-5V/0-10V/4-20mA
	Accel. / Decel time		0.1-3600 sec. with 2 S curves.
	Braking torque		About 20% (built-in Braking transistor)
	V/F pattern		18 patterns, one curve programmable.
Protection Function	**Instantaneous overcurrent**		Approximately 100% rated current.
	Overload		Inverter: 150% / 1 minute.
	Motor overload protection		Electronic thermal overload relay.
	Overvoltage		200V series: DC bus exceeds 427V 400V series: DC bus exceeds 854V
	Undervoltage		200V series: DC bus drop < 200V 400V series: DC bus voltage drop < 400V
	Momentary power loss		0~2 seconds: inverter can be restarted by speed search.
	Heat sink fin overheat		Protected by thermistor.
Operation	**Input signal**	Operation signal	Forward / Reverse operation, individual command.
		Reset	Released protection while the protective function is operating.
		Multifunction input	Refer to function illustration of Fn56.
	Output signal	Multifunction	Refer to function illustration of Fn61.
		Fault output	250VAC 1A, 30VDC 1A or less.
	Built-in function		Frequency reference bias/gain; up/lower limit; manual torque boost; frequency meter calibrating gain; auto restart attempt; skip frequency; S-curve.
	Digital operator monitor		Frequency command, output frequency, speed, output curren output voltage, P-N bus voltage, rotating direction.
	Analog operator monitor		Analog output (0-10V), possible to select output frequency and setting frequency & output voltage & P-N bus voltage.
Environment condition	**Location**		Indoor (protected from corrosive gas and dust)
	Ambient temperature		-10°C~40°C
	Humidity		0-95% (non condensing)
	Vibration		0.5G
Enclosure			IP20
EMC			EN 50081-1, EN 50082-2 (with optional filter) *1
LVD			prEN 50178
UL			UL # 508

*1 220V class, N2-237M3 and above are not CE complied.

Section 3   Connection Diagram. Terminals and mounting dimensions

3.1   Interconnection
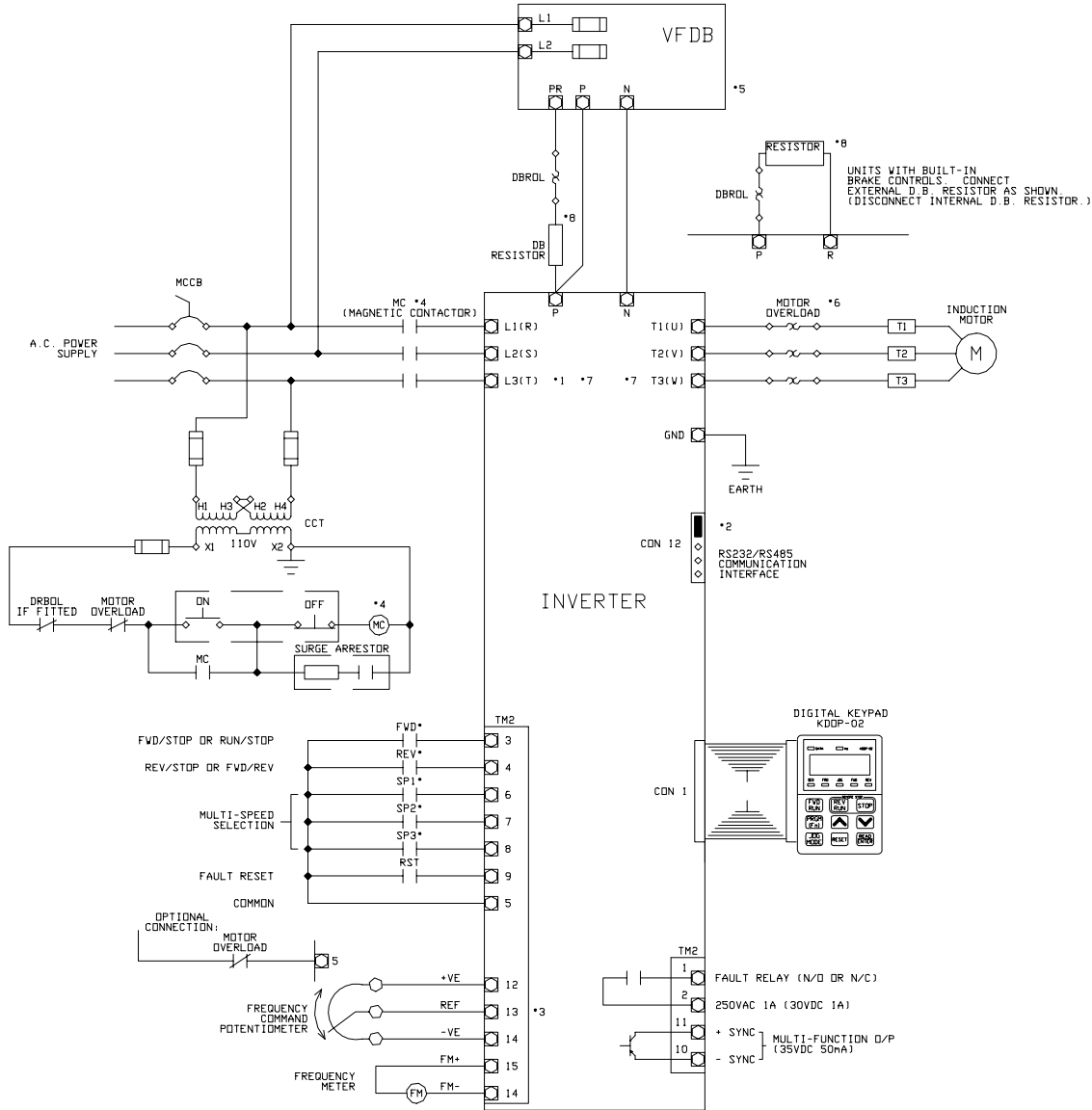
Note: 1. In single phase applications, connect AC power supply to L1 and L2.

2. Use jumper to short PIN1 and PIN2 when CON12 is not used.

3. Do not connect wiper of frequency command potentiometer to terminal 12 or 14 of TM2. This will damage the inverter.

4. MC use is optional depending upon application, if not used: wire motor overload contacts in series with terminal 5 common of inverter's control wiring or terminal ACN of D61536 120V isolator.

5. Built in brake unit not provided on units N2-2110 or N2-4110 and larger. Connect braking unit and resistors as shown.

6. Motor overload is optional.

7. See page 7a, 7b for tightening torque values of TM1 screw terminals.

8. Use high temperature wire near resistor elements such as SRML.

9. Terminals SP2-SP5 are multi-function terminals which can be defined to user preferences.

10.   All coils are to have suppressors.

11.   Specify part number D61537 for 24VAC control voltage.

WARNING: Wiring diagrams differ per application. Please consult system wiring diagrams or Drivecon Corporation. Insure wiring conforms with all applicable industry and safety standards.

11

3.2   Function description of N2 terminals

3.2.1   Function description of main circuit terminals (TM1)

Symbol	Function description
L1 (R)	Input terminals of AC line power: single phase: L1/L2 three phase: L1/L2/L3
L2 (S)	
L3 (T)	
P (P)	External braking resistor terminals. Up to 10HP (External brake unit terminals. 15-30HP)
R (N)	
T1 (U)	Output terminals to motor.
T2 (V)	
T3 (W)	

3.2.2   Function description of control terminals (TM2)

	Symbol		Function description
1	TRIP RELAY		Fault relay output terminals: (refer to Fn97, 98) Contact rating: 250VAC/ 1A (30V DC/ 1A)
2			
3	FWD		Operation control terminals (Refer to Fn03)
4	REV		
5	COM		Common for terminal 3/4/6/7/8/9
6	SP1		Multifunction input terminals (refer to Fn56)
7	SP2		
8	SP3		
9	RESET		Reset terminals (refer to Fn16)
10	SYN-		Negative terminal for multi-function output (Fn61)
11	SYN+		Positive terminal for multi-function output (Fn61)
12	+VE	+5V	Power terminal of potentiometer (Pin 3)
13	REF	Analog reference	Analog frequency signal input terminal (Fn26) (pin 2 of potentiometer or positive terminal of 0-5V/0-10V/4-20mA)
14	-VE / FM-	Analog common	Common tderminal for analog frequency. (pin 1 of potentiometer or negative terminal of 0-5V/0-10V/4-20mA)
15	FM+	Analog output (+)	Multi-function output terminal (Refer to Fn46) range of output signal: 0-10VDC

3.2.3 Function description of jumper

JUMPER1	JUMPER2	Remote freq command signal	Remark
1 2 3	1 2 3	0-5V DC analog signal	Only applicable when Fn 11 is set to 2
1 2 3	1 2 3	0-10V DC analog signal	
1 2 3	1 2 3	0~20mADC analog signal	

13
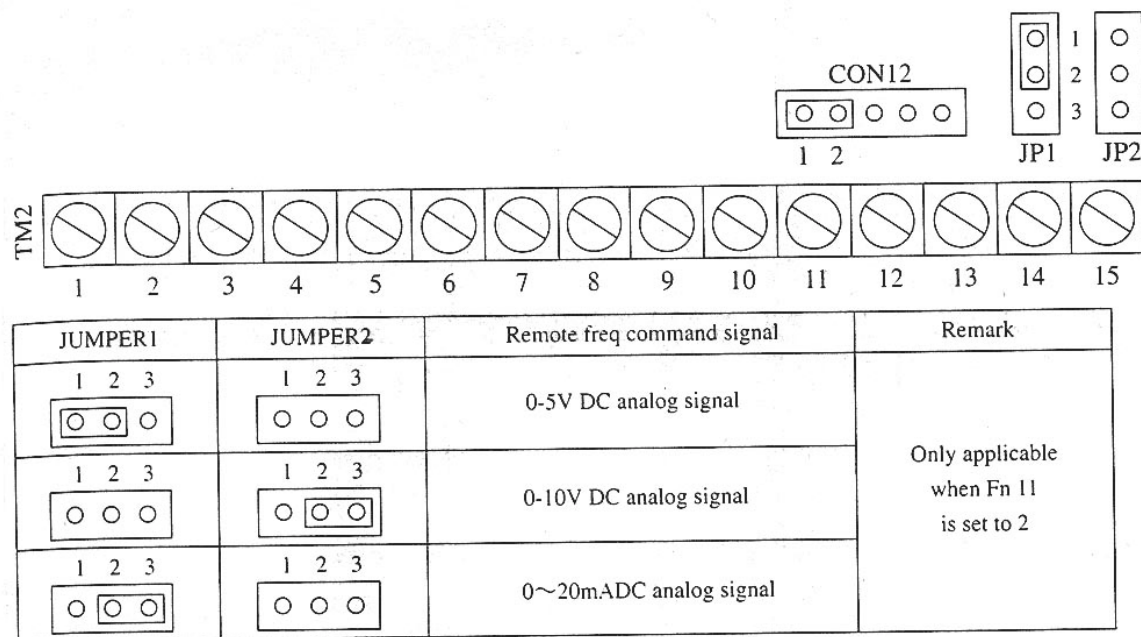
3.3   Mounting dimensions
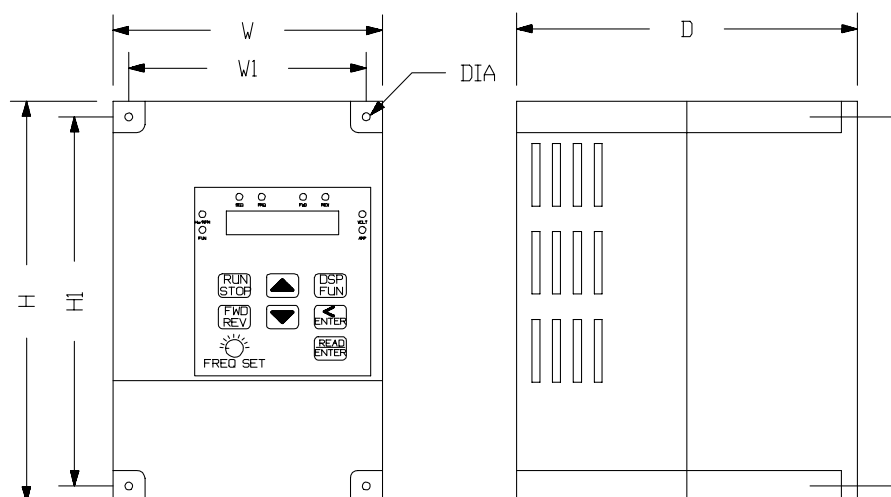
Voltage	Model	Weight (Lbs.)	Chassis Dimension (inches)			Mounting Dimensions (inches)		Hole diameter (inches)
			H	W	D	W1	H1	DIA
N2 230V series	N2-204-M	3.1	6.38	4.21	5.33	3.78	5.91	0.216
	N2-207-M	3.1	6.38	4.21	5.33	3.78	5.91	0.216
	N2-215-M	5.5	7.24	5.87	6.02	5.43	6.85	0.216
	N2-222-M	8.8	8.46	7.28	6.6	6.85	8.07	0.216
	N2-237-M3	8.8	8.46	7.28	6.6	6.85	8.07	0.216
	N2-255-M3	15	11.81	7.87	7.83	7.32	11.26	0.216
	N2-275-M3	16	11.81	7.87	7.83	7.32	11.26	0.236
	N2-2110-M3	28	15.75	9.84	9.45	9.29	15.16	0.236
	N2-2150-M3	36	15.75	9.84	9.45	9.29	15.16	0.275
	N2-2220-M3	40	15.75	9.84	9.45	9.29	15.16	0.275
N2 460V series	N2-404-M3	5.3	7.24	5.87	6.22	5.43	6.85	0.275
	N2-407-M3	5.3	7.24	5.87	6.22	5.43	6.85	0.216
	N2-415-M3	5.3	7.24	5.87	6.22	5.43	6.85	0.216
	N2-422-M3	8.4	8.46	7.28	6.6	6.85	8.07	0.216
	N2-437-M3	8.8	8.46	7.28	6.6	6.85	8.07	0.216
	N2-455-M3	15.4	11.81	7.87	7.83	7.32	11.26	0.236
	N2-475-M3	16.1	11.81	7.87	7.83	7.32	11.26	0.236
	N2-4110-M3	28	15.75	9.84	9.45	9.29	15.16	0.275
	N2-4150-M3	36	15.75	9.84	9.45	9.29	15.16	0.275
	N2-4220-M3	40	15.75	9.84	9.45	9.29	15.16	0.275

3.4   Connection to Peripheral Devices

Examples of connection between the inverter and typical peripheral devices are shown below. Use this illustration to gain an understanding of the overall equipment configuration.

Power supply

Molded-case circuit
breaker or ground
fault interrupter

Magnetic con-
tactor

AC reactor for power
factor improvement

Input noise filter

DC reactor for power
factor improvement

N2-Inverter

Ground

Output noise filter

3 phase squirrel cage induction motor

Ground
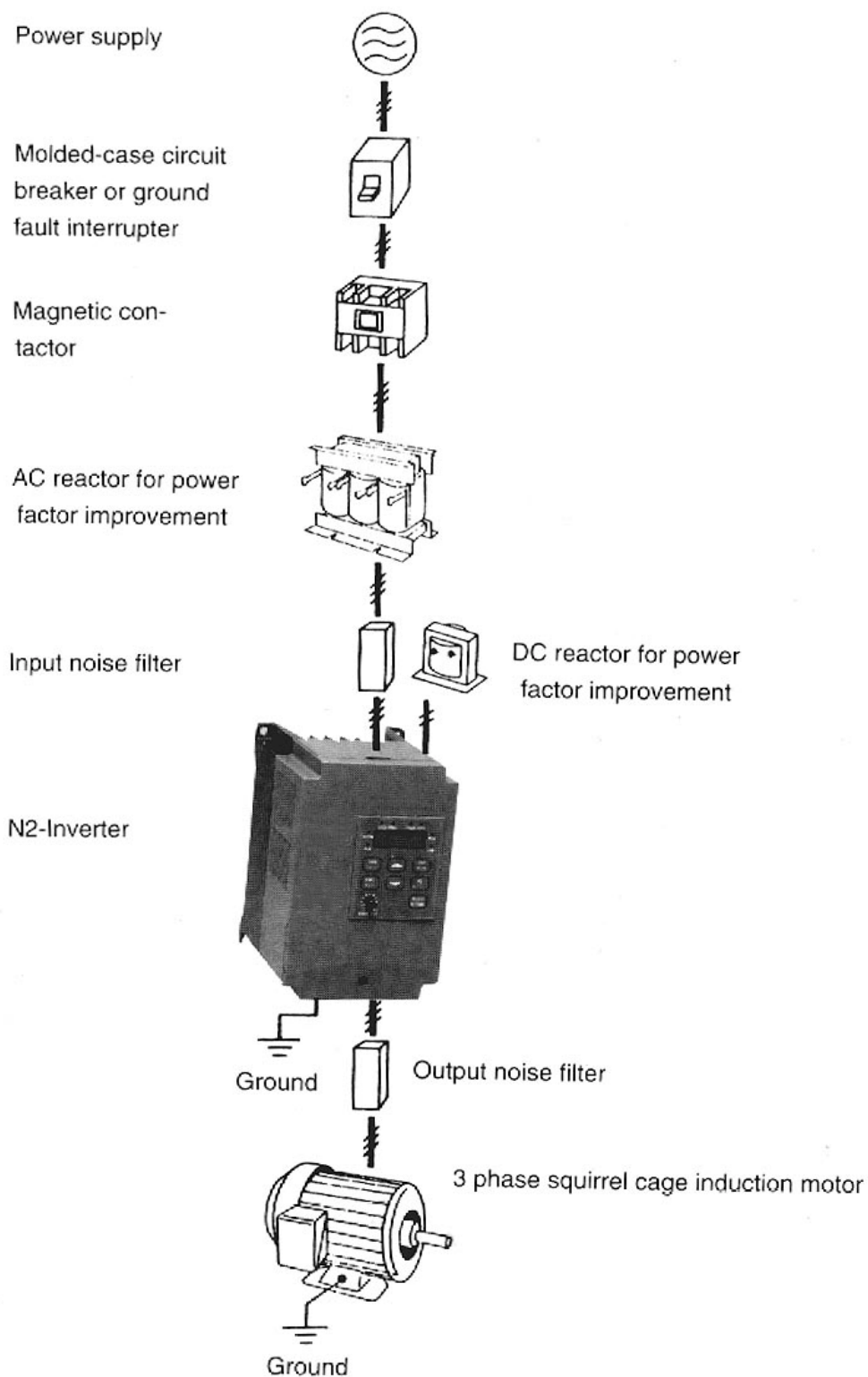
Section 4 Keypad control functions

4.1 Digital operator function illustration

Operation status indicators.

Display Hz or RPM

Programming indicator.

Run / Stop selection.

Forward / Reverse selection.

Speed potentiometer.

Detachable cable.
Optional cable extension and bezel kit available.

Large clearly visible 4 digit red LED display.

Display voltage value (V)

Display current value (A)

Program command key, enters program sequence.

Cursor up and down to change frequency or other setpoints.

Shift / Reset key.

Read / Write key for recalling or storing data.

4.2 Digital operator operation

● : LED ON
○ : LED blinking
*1: Display will blink and show setting value of Fn_30
*2: Display will change to next mode when operated or DSP pressed
*3: Mode decided by Fn_51
*4: ENTER is not required during stop
*5: Display is decided by Fn_47

16

4.2.1 Changing the Function Parameters (effective in program mode)

Key Operation	Description	Digital Operator Display
1. DSP FUN	* Enter program mode * Display the current function code	ON ● FUN F □ □-0-
2. Ａ or Ｖ	* Press Ａ or Ｖ to select the desired function code	ON ● FUN F □ □-3-
3. READ ENTER	* Display the current function parameter * FUN lamp blink	Blink ● FUN F □ □-1-
4. Ａ or Ｖ	* Press Ａ or Ｖ to change the displayed function parameter	Blink ● FUN □ □ □-2-
5. < RESET	* Press this Digit selection key to moves the blinking digit. The blinking digit can be changed.	Blink ● FUN · □ □-0-2
6. READ ENTER	* Press READ ENTER to save the displayed function parameter into memory. * FUN lamp ON * Digital operator displays the current function code.	End ↓ 0.5 sec ON ● FUN F □ □-4-
7. Repeat Step 1~6	* Changing another function parameter	
8. DSP FUN	* Function parameter setting procedure ends. * Enter Operation mode. * Digital operator display the current freq.	ON ● Hz/RPM -6-0.0-0-

17

4.2.2 Function Parameter Reference

Example: Check frequency reference upper limit (Fn6) & lower limit (Fn7)

Key Operation	Description	Digital Operator Display
1. DSP / FUN	* Enter program mode. * Display the current function code.	● FUN F□□□
2. △ or ▽	* Select the Fn6 by pressing △ or ▽ desired function code.	● FUN F□□6
3. READ / ENTER	* Display the parameter of Fn6. * FUN lamp blink.	● FUN 60.0□
4. Repeat Step 1-3	* Display the parameter of Fn7.. * FUN lamp blink.	● FUN □□.□□
5. DSP / FUN	* Function parameter reference procedure ends. * Enter Operation mode. * Digital operator displays the current greq.	ON ● Hz/RPM 60.00

* If function parameters can't be changed and "LOC" is displayed, this means function parameter is locked. Please set Fn_4 set to 0000 to release function parameter lock.

4.2.3 Inverter Operation Monitor

Example: Check output voltage, DC voltage, Output current, Please set Fn47 to 0111.

Key Operation	Description	Digital Operator Display
1. DSP / FUN	* Display output AC voltage.	219u ● VOLT
2. DSP / FUN	* Display DC voltage.	317U ● VOLT
3. DSP / FUN	* Display output current.	□□.□A ● AMP
4. DSP / FUN	* Display frequency.	● Hz/RPM 60.00
5. DSP / FUN	* Display function code.	● FUN F□□□
DSP / FUN	Repeat 1-5 display the monitor value.	

4.3 Function list and description
4.3.1 Function list

Function	Fn xx	Description	Set Unit	Range	Factory Setting	Remark
Capacity	0	Capacity selection	1	1-18	*3	
Accel. /	1	Accel. Time 1	0.1 sec	0.1-3600 sec	10 sec	*1
Decel. time	2	Decel. Time 1	0.1 sec	0.1-3600 sec	10 sec	*1
Remote Operation Select	3	xx00 : FWD/STOP, REV/STOP xx01 : FWD/REV, RUN/STOP xx10 : 3 wire control mode x0xx : REV command enable x1xx : REV command disable 0xxx : Setting frequency will remain at last output frequency when inverter stops and Fn_11 = 3 1xxx : Setting frequency will be 0 (zero) when inverter stops and Fn_11 = 3			0000 —	
Parameter Lock Select	4	xxx0 : Enable (Fn 17 - 25) xxx1 : Disable (Fn 17 - 25) xx0x : Enable (Functions except Fn 17 - 25) xx1x : Disable (Functions except Fn 17 - 25)			0000	
V/F Pattern	5	V/F pattern selected	1	0-18	9 / 0	*4
Freq. Limit	6	Freq. output upper limit	0.01 Hz	0-400 Hz	60 / 50	*4
	7	Freq. output lower limit	0.01 Hz	0-400 Hz	0 Hz	
Speed Agreed detection	8	Up-to desired frequency setting	0.01 Hz	0-400 Hz	0 Hz	
	9	Up-to frequency setting detection width	0.01 Hz	0-30 Hz	0 Hz	
Control Mode Select	10	0 : Digital operator Control 1 : Remote Control			0	
Freq. Command Method Select	11	0 : Run by Fn 25 1 : Run by VR on digital operator 2 : Run by VR on TM2 (terminal 12-14) or analog signal 3 : Run by multi-function input freq. Command (terminal 6-8)			0	

19

Stall Prevention	12	xxx0 : Stall prevention during accel. enable			0000	
		xxx1 : Stall prevention during accel. disable				
		xx0x : Stall prevention during decel. enable			—	
		xx1x : Stall prevention during decel. disable				
		x0xx : Stall prevention during running enable				
		x1xx : Stall prevention during running disable				
		0xxx : Stall prevention decel. time set by Fn 02				
		1xxx : Stall prevention decel. time set by Fn 15				
	13	Stall prevention starting level during accel	1 %	30-200 %	110 %	
	14	Stall prevention level during running	1 %	30-200 %	160 %	
	15	Decel time during stall prevention	0.1 sec	0.1-3600 sec	3 sec	*1
Direct start & Reset & numbers of input signal scanning	16	xxx0 : Direct start enable when remote RUN command ON			0000	
		xxx1 : Direct start disable when remote RUN command ON				
		xx0x : Reset effective only if remote RUN command OFF				
		xx1x : Reset effective disregard of remote RUN command condition				
		00xx : TM2 will scan 10 times				
		01xx : Tm2 will scan 5 times				
		10xx : Tm2 will scan 3 times				
		11xx : TM2 will scan 1 time				
Multi-Speed	17	Multi-speed 1	0.01 Hz	0-400 Hz	5.00 Hz	*1
	18	Multi-speed 2	0.01 Hz	0-400 Hz	10.00 Hz	*1
	19	Multi-speed 3	0.01 Hz	0-400 Hz	20.00 Hz	*1
	20	Multi-speed 4	0.01 Hz	0-400 Hz	30.00 Hz	*1
	21	Multi-speed 5	0.01 Hz	0-400 Hz	40.00 Hz	*1
	22	Multi-speed 6	0.01 Hz	0-400 Hz	50.00Hz	*1
	23	Multi-speed 7	0.01 Hz	0-400 Hz	60.00 Hz	*1
Jog freq.	24	Jog freq. reference	0.01 Hz	0-400 Hz	2.00 Hz	*1
Master freq.	25	Master freq. reference from digital operator	0.01 Hz	0-400 Hz	5.00 Hz	*1
Analog input freq. command	26	Freq. reference	0.01 Hz	0.0-400 Hz	0 Hz	*1
	27	Voltage reference ratio 1	0.1 %	0-100.0 %	0 %	*1
	28	Voltage reference ratio 2	0.1 %	0-999.9 %	100 %	*1
	29	Positive / Negative direction	1	0 : Positive 1 : Negative	0	*1
Power voltage	30	Voltage of power supply	0.1 V	200 - 480 V	*3	

Momentary power loss	31	Momentary power loss ride through time	0.1 sec	0-2 sec	0.5 sec	
	32	xxx0 : Disable xxx1 : Enable			0	
	33	Reserved				
Auto restart	34	Auto restart interval	0.1 sec	0-800 sec	0 sec	
	35	No. of auto restart attempt	1	0-10	0	
Motor pole	36	No. of motor poles	2 P	2-8 pole	4P	
V/F pattern	37	Max. freq.	0.01 Hz	50-400 Hz	60 / 50 Hz	*4
	38	Max. voltage ratio	0.1%	0-100%	100%	
	39	Mid. freq.	0.01 Hz	0.11-400 Hz	3.07 2.5Hz	*4
	40	Mid. voltage ratio	0.1%	0-100%	7.5 %	
	41	Voltage ratio at 0.1 Hz	0.1%	0-100%	7.5%	
Start freq.	42	Start freq. adjustment	0.01 Hz	0.1-10 Hz	1 Hz	
Carrier freq.	43	Carrier freq. adjustment	1	0-15	14	
Stopping mode	44	xxx0 : Decel. to stop xxx1 : Free run to stop			0000	
Multi-function analog output selection (terminal 14 & 15)	45	Gain of multi-function analog output	1%	0-200 %	100%	*1
	46	0 : Output freq. (Fn 6 max.) 1 : Set freq. (Fn 6 max.) 2 : Output voltage (Vac) 3 : DC voltage (Vpn)			0	*1
Display mode	47	xxx0 : Output voltage (Vac) display disable xxx1 : Output voltage (Vac) display enable xx0x : DC voltage display disable xx1x : DC voltage display enable x0xx : Output current (Iac) display disable x1xx : Output current (Iac) display enable			0000	*1

Dynamic braking & Priority of Stopping & Speed search & AVR control	48	xxx0 : Enhanced braking capacity xxx1 : Standard braking capacity xx0x : STOP key effective in remote control mode xx1x : STOP key ineffective in remote control mode x0xx : Speed search controlled by terminals on TM2 x1xx : Speed search effective when inverter start 0xxx : AVR function effective 1xxx : AVR function ineffective			0000 —	
Accel./Decel. time 2	49	Accel. time 2	0.1 sec	0.1-3600 sec	10.0 sec	*1
	50	Decel. time 2	0.1 sec	0.1-3600 sec	10.0 sec	*1
Display mode	51	Display mode selection	1	0-5	0	*1
	52	Line speed display	1	0-9999	1800	*1
DC Braking	53	DC Braking time	0.1 sec	0-25.5 sec	0.5 sec	
	54	DC Braking injection freq.	0.1 Hz	0.1-10 Hz	1.5 Hz	
	55	DC Braking level	0.1 %	0-20 %	8 %	
Multi function input	56	Multi-input 1 (terminal 6)	00 : SP1 01:SP2 02 : SP3 03 : Jog		00	
	57	Multi-input 2 (terminal 7)	04 : Accel / Decel time selection 05 : External emergency stop		01	
	58	Multi-input 3 (terminal 8)	06 : External base block 07 : Speed search 08 : Energy saving 09 : control signal selection 10 : Communication selection 11 : Accel. / Decel. Prohibit 12 : Up command 13 : Down command 14 : Sequence Control 15 : Master / Auxiliary speed 16-31 : Change 00-15 from Normal open to normal close		02	
	59	Reserved				
	60	Reserved				

Multi-function output	61	Multi-output 1 (terminal 11 & 10)	00 : Run mode 01 : Up to desired freq. 02 : Set freq. Fout=Fn_08+/-Fn-09 03 : Freq. Detection Fout>Fn_08 04 : Freq. Detection Fout<Fn_08 05 : Over torque detection 06-11 : Change 00-05 from (N/O) to (N/C)		00 _	
	62	Reserved				
	63	Reserved				
	64	Reserved				
Prohibit Freq. control	65	Setting prohibited freq. 1	0.01 Hz	0-400 Hz	0 Hz _	
	66	Setting prohibited freq. 2	0.01 Hz	0-400 Hz	0 Hz	
	67	Setting prohibited freq. 3	0.01 Hz	0-400 Hz	0 Hz	
	68	Setting prohibited freq. range	0.01 Hz	0-10 Hz	0 Hz	
Electronic thermal protection	69	xxx0 : Electronic thermal motor protection enable xxx1 : Electronic thermal motor protection disable xx0x : Electronic thermal characteristics in accordance with standard motor xx1x : Electronic thermal characteristics in accordance with special motor x0xx : Inverter protection OL : 103 % continues 150 % for one minute x1xx : Inverter protection OL : 113 % continues 123 % for one minute 0xxx : Free run to stop after electronic thermal motor protection is energized 1xxx : Operation continued after electronic thermal motor protection is energized			0000	
Electronic thermal overload reference current	70	Motor rated current	0.1 A	-	depend on motor spec.	
Torque boost control	71	x0xx : Torque boost enable x1xx : Torque boost disable 1xxx : Manual torque boost				
	72	Torque boost gain	0.1 %	0.0-10.0 %	0.0 %	*1
	73	Reserved				

	74	Reserved				
	75	Motor current without load	0.1A		depend on motor spec.	
Slip compensation	76	Motor rated slip	0.01 Hz	0.00-6.00 Hz	0.00 Hz	*1
Overtorque control	77	xxx0 : Overtorque detection disable xxx1 : Overtorque detection enable xx0x : Enable only if at set freq. xx1x : Enable during operation x0xx : Operation continued after overtorque is detected x1xx : Free run to stop after overtorque is detected			0000	
	78	Overtorque detection level	1 %	30-200 %	160 %	
	79	Overtorque detection time	0.1 sec	0-25 sec	0.1 sec	
S curve	80	S curve time 1 in the period of accel./decel. Time 1	0.1 sec	0-4 sec	0.2 sec	
	81	S curve time 2 in the period of accel./decel. Time 2	0.1 sec	0-4 sec	0.2 sec	
Energy saving	82	xx00: Energy saving disable xx01: Energy saving controlled by multi-input terminals only if at preset freq.			0000	
	83	Energy saving gain	1 %	0-100 %	80 %	*1
Sequence control	84	xxx0 : Process timer disable xxx1 : Process timer enable xx0x : Set freq. output after process timer finishes counting xx1x : Zero speed output after process timer finishes counting			0000	
	85	Process timer 1	0.1 sec	0-3600 sec	0 sec	
	86	Process timer 2	0.1 sec	0-3600 sec	0 sec	
	87	Process timer 3	0.1 sec	0-3600 sec	0 sec	
	88	Process timer 4	0.1 sec	0-3600 sec	0 sec	
	89	Process timer 5	0.1 sec	0-3600 sec	0 sec	
	90	Process timer 6	0.1 sec	0-3600 sec	0 sec	
	91	Process timer 7	0.1 sec	0-3600 sec	0 sec	
Vibration control	92	Vibration control times	1	1-100	5	*1
	93	Vibration control gain	0.1 %	0-100 %	0 %	*1
	94	Vibration control bias	1 %	0-30 %	0 %	*1
	95	Parameters for factory adjustment.				
	96	Do Not change .				

Fault contact control	97	xxx0 : Fault contact is not energized during auto restart operation			0000	
		xxx1 : Fault contact is energized during auto restart operation				
		xx0x : Fault contact is not energized during momentary power loss detection				
		xx1x : Fault contact is energized during momentary power loss detection				
		x0xx : Fault contact isn't energized during external Emergency Stop				
		x1xx : Fault contact is energized during external Emergency Stop				
		0xxx : Fault contact is not energized during external base block				
		1xxx : Fault contact is energized during external base block				
	98	xxx0 : Fault contact is not energized after overtorque is detected			0000	
		xxx1 : Fault contact is energized after overtorque is detected				
		xx0x : Fault contact is not energized after electronic thermal motor protection is acting				
		xx1x : Fault contact is energized after electronic thermal motor protection is acting				
		x0xx : Fault contact is normal open (N/O)				
		x1xx : Fault contact is normal close (N/C)				
		0xxx : Fault contact is not energized after electronic thermal inverter protection is acting				
		1xxx : Fault contact is energized after electronic thermal inverter protection is acting				
Communication parameter control	99	Reserved				
	100	Communication identified no.	1	1-32	*3	*2
	101	Baud rate of communication	1	0 : 4800 bps	*3	*2
				1 : 9600 bps		
				2 : 19200 bps		
				3 : 38400 bps		
	102	xxx0 : 1 stop bit			*3	*2
		xxx1 : 2 stop bits				
		xx0x : Even parity				
		xx1x : Odd parity				
		x0xx : Without parity				
		x1xx : With parity				
		0xxx : 8 bits data				
		1xxx : 7 bits data				
	103-106	For factory setting only				*3

	107	Reserved			–	
	108	reserved				
	109	Reserved				
	110	Reserved				
	111	Reserved				
	112	Reserved				
	113	Reserved				
	114	Reserved				
	115	Reserved				
	116	Reserved				
	117	Reserved				
	118	Reserved				
	119	Reserved				
	120	Reserved				
	121	Reserved				
	122	Reserved				
Factory setting	123	1111 : Reset to factory setting (for 60Hz power system) 1110 : Reset to factory setting (for 50Hz power system).			0000	
CPU version	124	CPU version			*3	
Fault sequence reference	125	Record of last three fault indication			1. --- 2. --- 3. ---	

*1:　　Setting can be changed during run mode.
*2:　　Settings can not be changed in communication mode.
*3:　　Settings will not change with "Reset to factory setting" function.
*4:　　Refer to function description of Fn123.

Setting range:

The setting of accel. / decel. time and frequency are only 4 digits when set by keypad (for example: 3599 sec./ 399.9Hz), but 5 digits (for example: 3599.9 sec. or 399.99Hz) when controlled by pro-grammable controller (PLC) or computer communication mode.

4.3.2 Function Description

Fn00: Capacity selection= 1-40

Fn00	Model No.	Fn00	Model No.
1	N2-204M	10	N2-404M3
2	N2-207M	10	N2-407M3
3	N2-215M	11	N2-415M3
4	N2-222M	12	N2-422M3
5	N2-237M3	13	N2-437M3
6	N2-255M3	14	N2-455M3
7	N2-275M3	15	N2-475M3
8	N2-2110M3	16	N2-4110M3
9	N2-2150M3	17	N2-4150M3
40	N2-2220M3	18	N2-4220M3

Fn01: Acceleration time 1= 0.1-3600 sec.
Fn02: Deceleration time 1= 0.1-3600 sec.
Fn49: Acceleration time 2= 0.1-3600 sec.
Fn50: Deceleration time 2= 0.1-3600 sec.
Fn80: S curve time 1 in the period of Accel. / decel.   time 1= 0-4 sec.
Fn81: S curve time 2 in the period of Accel./ decel.   time 1= 0-4 sec.

1. Formula for calculating accel./decel. time

$$\textbf{Accel. time = Fn01 (or Fn49) x } \frac{\textbf{Preset frequency}}{\textbf{60Hz}}$$

$$\textbf{Decel. time = Fn02 (or Fn50) x } \frac{\textbf{Preset frequency}}{\textbf{60Hz}}$$

2. Accel. time 1 or 2\ decel. time 1 or 2\ S curve 1 or 2 can be controlled by on/off signal of external input terminal as long as Fn56, Fn57, or Fn58 is set to 4.

3. S curve will be disabled, which means linear acceleration and deceleration, when Fn80/ Fn81 is set to 0.

4. Acceleration and deceleration curve will be as indicated below if time of S curve (Fn80 \ Fn81) is greater than 0.

OUTPUT FREQUENCY
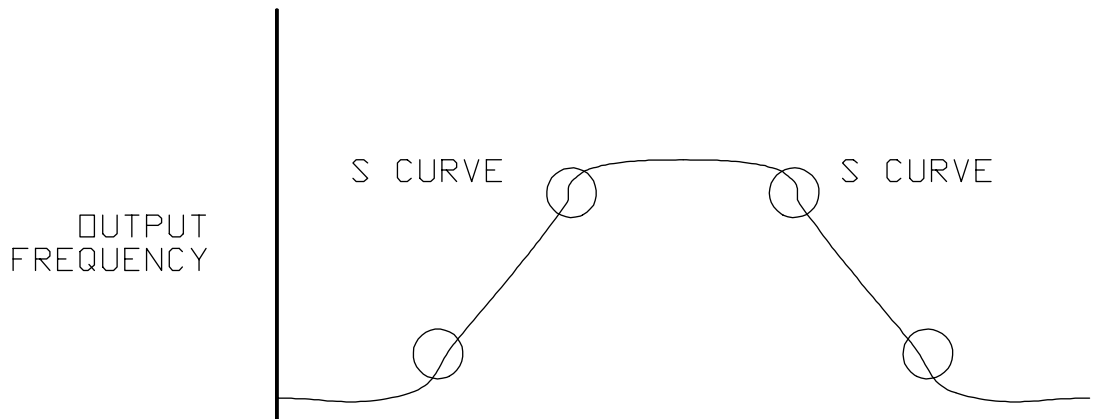
S CURVE   S CURVE

5.   Actual accel. / decel. time= preset accel./ decel. time + S curve time if ignoring stall situation.

Fn03: Remote operation select=

> **xx00: FWD/STOP, REV/STOP**
> **xx01: FWD/REV, RUN/STOP**
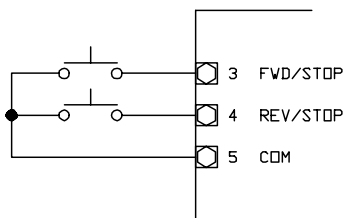> **xx10: 3 wire control mode**
> **x0xx: REV command enable**
> **x1xx: REV command disable**
> **0xxx: During Fn11=3 (TM2 up/down control), the setting frequency will remain at the last operation frequency when stop.**
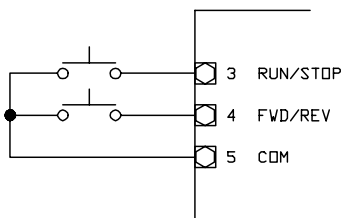> **1xxx: During Fn11=3 (TM2 up/down control), the setting frequency will be back to 0 when stop.**

Remark: 1: Fn03 will be enabled only when Fn10=1 (remote control).
             2: "STOP" key on digital operator can be used for emergency stop
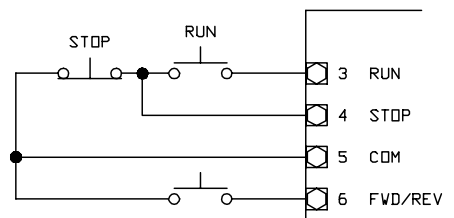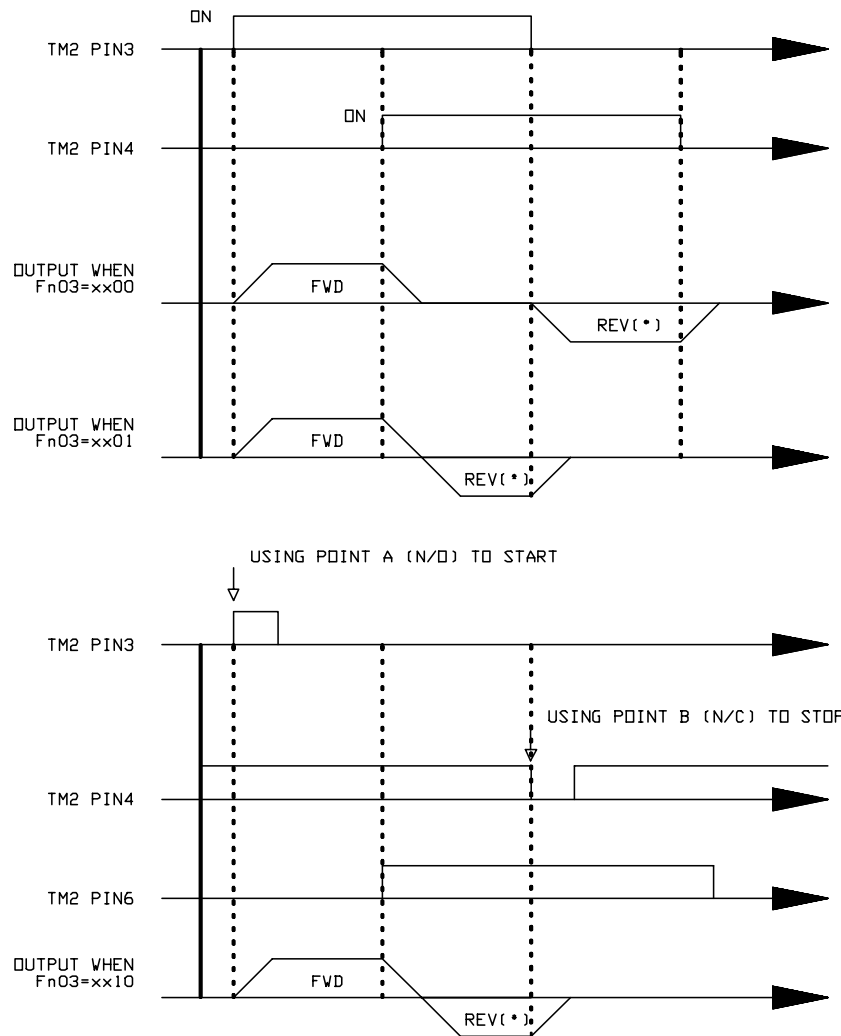   (Refer to Fn48), when Fn10=1.

Fn03=xx00   Fn03=xx01   Fn03=xx10

ON

TM2 PIN3

ON

TM2 PIN4

OUTPUT WHEN
Fn03=xx00

FWD

REV(*)

OUTPUT WHEN
Fn03=xx01

FWD

REV(*)

USING POINT A (N/O) TO START

TM2 PIN3

USING POINT B (N/C) TO STOP

TM2 PIN4

TM2 PIN6

OUTPUT WHEN
Fn03=xx10

FWD

REV(*)

Remark: Reverse command disable when Fn03=x1xx

Fn04: Parameter lock select=

                    xxx0: Disable (Fn17-25)
                    xxx1: Enable (Fn17-25)
                    xx0x: Disable (Functions except Fn17-25)
                    xx1x: Enable (Functions except Fn17-25)

V/F pattern setting:

Fn05	**:**	**V/F pattern select**	**=**	**0-18**
Fn30	**:**	**Voltage of power supply**	**=**	**200-480V**
Fn37	**:**	**Maximum frequency**	**=**	**50-400Hz**
Fn38	**:**	**Maximum voltage ratio**	**=**	**0-100%**
Fn39	**:**	**Middle frequency**	**=**	**0.11-400Hz**
Fn40	**:**	**Middle voltage ratio**	**=**	**0-100%**

Fn41 :   Voltage ratio at 0.1Hz   =   0-100%
Fn48 :   AVR control   =   0xxx, AVR function effective

1. V/F pattern can be manually set if Fn05=18. Please refer to Fn37 and Fn41.
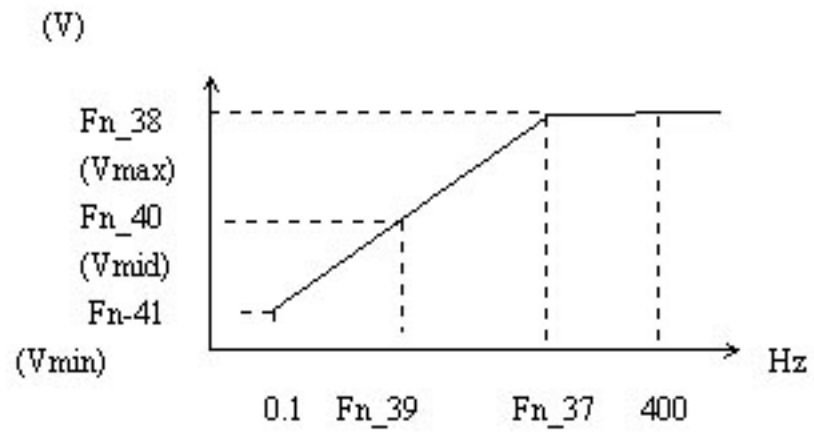
2.   Fn05=0-17 fixed V/F pattern curve (refer to the following table)

	Fn_05	50 Hz	Fn_05	60 Hz
FOR GENERAL PURPOSE	0	(V) 100% B C / 0.1 2.5 50 400 Hz	9	(V) 100% B C / 0.1 3 60 400 Hz
HIGH STARTING TORQUE	1 2 3	(V) 100% B C / 0.1 2.5 50 400 Hz	10 11 12	(V) 100% B C / 0.1 3 60 400 Hz
VARIABLE TORQUE OPERATION	4 5	(V) 100% B C / 0.1 25 50 400 Hz	13 14	(V) 100% B C / 0.1 30 60 400 Hz
CONSTANT HP OPERATION	6 7 8	(V) 100% B C / 0.1 5 50 400 Hz	15 16 17	(V) 100% B C / 0.1 6 60 400 Hz

N2-204M~N2-437M3

Fn05	B	C
0/9	7.50%	7.50%
1/10	10.00%	7.50%
2/11	15.00%	7.50%
3/12	20.00%	7.50%
4/13	17.50%	7.50%
5/14	25.00%	7.50%
6/15	15.00%	7.50%
7/16	20.00%	7.50%
8/17	20.00%	7.50%

N2-237M3~N2-475M3

Fn05	B	C
0/9	7.50%	7.50%
1/10	9.00%	7.50%
2/11	10.50%	7.50%
3/12	12.00%	7.50%
4/13	17.50%	7.50%
5/14	25.00%	7.50%
6/15	10.40%	7.50%
7/16	13.00%	7.50%
8/17	15.40%	7.50%

N2-2110M3~N2-4220M3

Fn05	B	C
0/9	6.50%	6.50%
1/10	7.50%	6.10%
2/11	8.50%	5.50%
3/12	9.50%	4.90%
4/13	20.00%	6.10%
5/14	25.00%	5.80%
6/15	10.00%	5.10%
7/16	12.00%	4.70%
8/17	14.00%	4.20%

3.   AVR (Automatic Voltage Regulation) will determine actual output voltage, e.g. Fn05=18:

a.   Fn48   =   0xxx, AVR will be effective, output voltage of inverter will be regulated as follows:
        Vmax=Fn38 x Fn30,   Vmin=Fn40 x Fn30,   Vmin=Fn41 x Fn30

b.   Fn48   =   1xxx, AVR will be ineffective, output voltage will vary with input voltage:
        Vmax=Fn38 x Vin (input voltage), Vmid=Fn40 x Vin
        Vmin=Fn41 x Vin

Fn06 :   Frequency output upper limit   =   0-400Hz
Fn07 :   Frequency output lower limit =0-400Hz
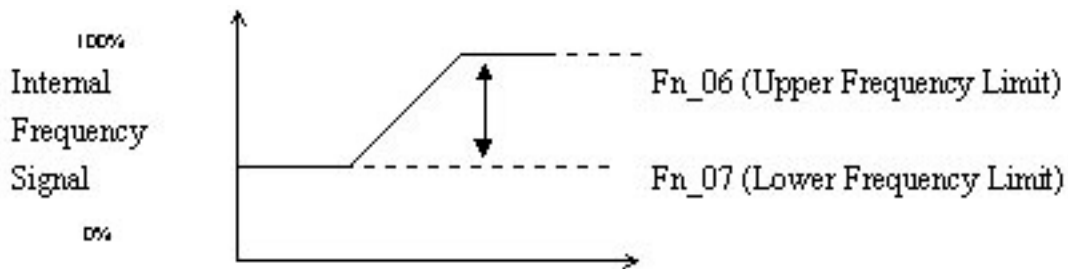
Remark: If Fn07=0Hz, inverter output will stop when the frequency command is set to 0Hz.
          If Fn07>0Hz, inverter output will run at the frequency by Fn07 if frequency command is
          lower than the frequency of Fn07.

Multi-function output: Speed agreed detection.
Fn08 :   Up to frequency setting =   0-400Hz
Fn09 :   Up to frequency setting detection width   =   0-30Hz
Fn61 :   Multi-function output
        = 00 :   Run mode
        = 01 :   Up to desired frequency
        = 02 :   Set frequency Fout = Fn08 ± Fn09
        = 03 :   Frequency detection Fout>Fn08
        = 04 :   Frequency detection Fout < Fn08
        = 05 :   Over torque detection
        = 06-11: Change 00-05 (N/O) to (N/C)

32

Remark: If Fn61=6-11. Terminals 10/11 are normally opened during power off, and normally closed during power on.

Fn10 : Control mode select = 0 : Digital operator control

STOP key can be used for emergency stop during remote control (Fn10=1). (Refer to Fn48)

Fn11 : Frequency command method select = 0 : Run by Fn25
                                          = 1 : Run by VR on digital operator
                                          = 2 : Run by VR on TM2 (terminal 12-14)
                                          = 3 : Run by multi-function input frequency command (terminal 6-8)

1. When Fn11=1, Fn56-Fn58=15
    Frequency is set by VR on digital operator if multi-function input is OFF; Frequency is set by VR on terminal block (TM2) or other analog signals if multifunction input is ON.

2. When Fn11=2,   Fn56-Fn58=15
    Frequency is set by VR on terminal block (TM2) or other analog signals if multi-function input is OFF; frequency is set by VR on digital operator if multi-function is ON.
3. Please refer to Fn56-Fn58 for UP/DOWN terminals.

Remark 1: Frequency will be controlled by multi-speed setting when jog or multi-speed are engaged. Up and down arrow keys on digital operator and up/down control of TM2 will be ineffective as long as multi-speed is ON. Frequency will be back to preset value after multi-speed is OFF.
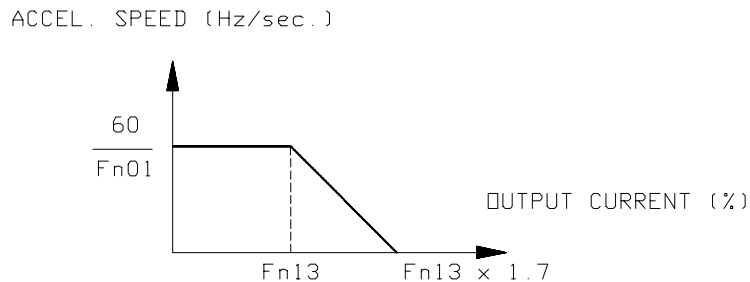
Remark 2: Up and down arrow keys and up/down control of TM2 will also be ineffective when accel./ decel. during run mode or during the period of switching multi-speed.

Stall prevention during Accel. / Decel. / Running.

Fn12 : xxx0 : Stall prevention during accel. enable
**   xxx1 : Stall prevention during accel. disable**
**   xx0x : Stall prevention during decel. enable**
**   xx1x : Stall prevention during decel. disable**
**   x0xx : Stall prevention during running enable**
**   x1xx : Stall prevention during running disable**
**   0xxx : Stall prevention decel. time set by Fn02.**
**   1xxx : Stall prevention decel. time set by Fn15.**

Fn13 : Stall prevention level during accel.: 30%-200%
Fn14 : Stall prevention level during running: 30%-200%
Fn15 : Decel time during stall prevention: 0.1 sec.-3600 sec.

1. If acceleration time is not long enough, overcurrent will occur during acceleration. Inverter will prolong acceleration time to prevent trip when acceleration time is too short.
2. If deceleration time is not long enough, overvoltage will occur on DC BUS. Inverter will prolong decel. time to prevent "OV" trip when deceleration time is too short.
3. In order to prevent abnormal overload trip during running (e.g. stall or rough operation), inverter will lower output frequency in accordance with deceleration time set by Fn02 (or Fn15 when Fn12 is 1xxx) when operation current is over the value set by Fn14. Inverter will return to normal operating frequency automatically after current is back to normal condition.


```
ACCEL. SPEED (Hz/sec.)



          60
          ──
         Fn01
                                   OUTPUT CURRENT (%)



              Fn13      Fn13 x 1.7
```

Fn16 : xxx0 : Direct start enable when remote RUN command ON
xxx1 : Direct start disable when remote RUN command ON
xx0x : Reset effective only if remote RUN command OFF
xx1x : Reset effective regardless of remote RUN command condition
00xx : TM2 terminal will scan 10 times
01xx : TM2 terminal will scan 5 times
10xx : TM2 terminal will scan 3 times
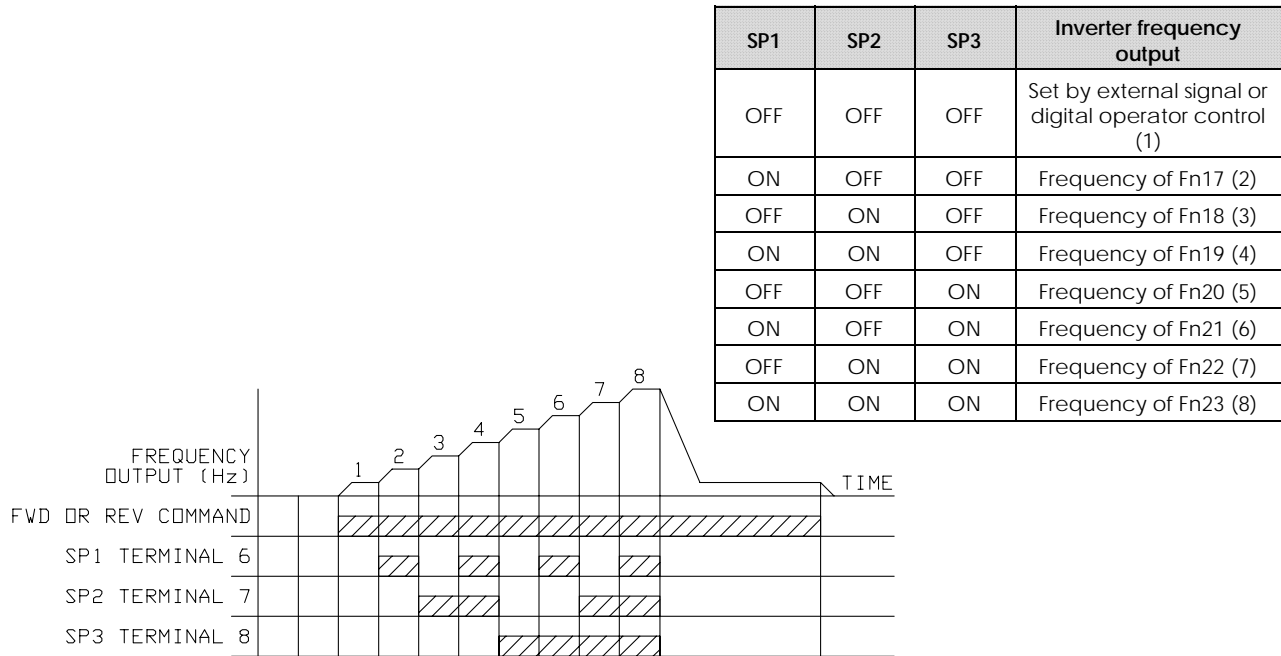**11xx : TM2 terminal will scan once**

1. When Fn16= xxx1 and control mode is remote control (Fn10=1), inverter cannot start if RUN switch is on when power is engaged and "STP1" will be flashing. On digital operator RUN switch must be turned OFF and turned ON again, then inverter can start.

2. Scanning numbers of TM2 input signal on terminal 3/4/5/6/7/8 (FWD/REV/SP1/SP2/SP3/RESET) are decided by Fn16. If TM2 detect same input signals for n times in a row, inverter will treat the signal as normal signal and execute it. On the other hand, if TM2 detect the same input signals that are less than n times, TM2 will esteem the signals as noise.
(n=10/5/3/1). Remark: The scan time is 2 ms.

Multi-speed and timer control

Fn17~Fn23 : multispeed 1 ~ multispeed 7 = 0-400Hz
Fn24 : Jog frequency reference = 0-400Hz
Fn25 : Master frequency reference from digital operator = 0-400Hz
Fn84 : Process timer disable

34

xxx1   :   **Process timer enable**
xx0x   :   **Set frequency output after process timer finishes counting**
xx1x   :   **Zero speed output after process timer finishes counting**
Fn85 ~ Fn91 :   **Process timer 1 ~ Process timer 7= 0-3600 sec.**

1. Inverter will be operated under Jog frequency (Fn24) when Fn56-Fn58 is set to 3 and multi-function input terminal is on.
2. Inverter will be operated under multispeed frequency when Fn56-Fn58 is set to 0-2 and multi-function input terminal is on.

SP1	SP2	SP3	Inverter frequency output
OFF	OFF	OFF	Set by external signal or digital operator control (1)
ON	OFF	OFF	Frequency of Fn17 (2)
OFF	ON	OFF	Frequency of Fn18 (3)
ON	ON	OFF	Frequency of Fn19 (4)
OFF	OFF	ON	Frequency of Fn20 (5)
ON	OFF	ON	Frequency of Fn21 (6)
OFF	ON	ON	Frequency of Fn22 (7)
ON	ON	ON	Frequency of Fn23 (8)

3. If Fn84=xxx1, Fn56-Fn58=0-2 or 16-18 and pulse signal is received on multi-function input. Inverter will run at a certain time (set by Fn85~Fn91) at a certain frequency (set by Fn17~Fn23) then return to frequency set by keypad or external VR or jump back to 0 speed (Fn84=xx1x or xx0x).
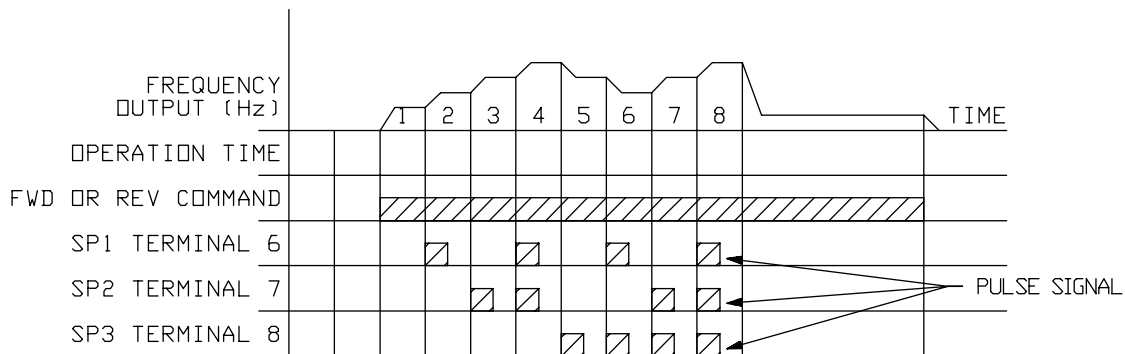
4. If Fn84=xxx1, Fn56-Fn58=14 or 30 and pulse signal is received on multi-function input. Inverter will operate in process 1.......2......3......4........ sequence until all process timer is over then returns to frequency set by keypad or external VR or jump back to 0 speed (Fn84=xx1x or xx0x). VR (Fn84=xx0x) or jump back to 0 speed (Fn84=xx1x)

```
FREQUENCY
OUTPUT [Hz]         | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 1 |  TIME
                          Fn  Fn  Fn Fn  Fn  Fn Fn
OPERATION TIME            88  86  87 88  89  90 91

FWD OR REV COMMAND

SEQUENCE CONTROL            PULSE SIGNAL
```
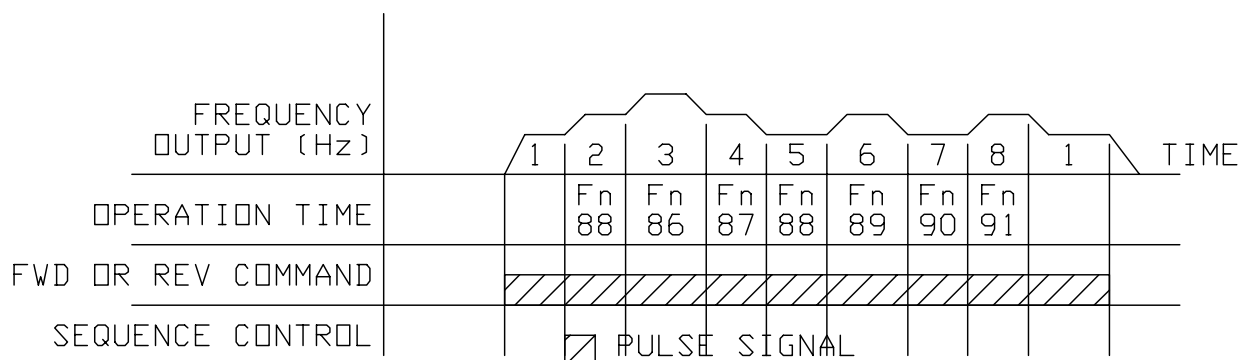
Output frequency (Hz)	Operation time	Process
Fn25 (1)		
Fn17 (2)	Fn85	1
Fn18 (3)	Fn86	2
Fn19 (4)	Fn87	3
Fn20 (5)	Fn88	4
Fn21 (6)	Fn89	5
Fn22 (7)	Fn90	6
Fn23 (8)	Fn91	7

5. New speed setting and timer can not insert into ongoing timer and speed.
6. Priority of frequency reading is as follows: JOG....Multispeed setting....Digital operator frequency set by digital operator or external frequency signal.

Analog frequency signal control

Fn26 :   Frequency reference   :   0.0-400Hz
Fn27 :   Voltage reference ratio 1   :   0.0-100%
Fn28 :   Voltage reference ratio 2   :   0.0-999.9%
Fn29 :   Positive/ Negative direction :   0: Positive   1: Negative

% OF FREQUENCY SETTING SIGNAL   % OF FREQUENCY SETTING SIGNAL
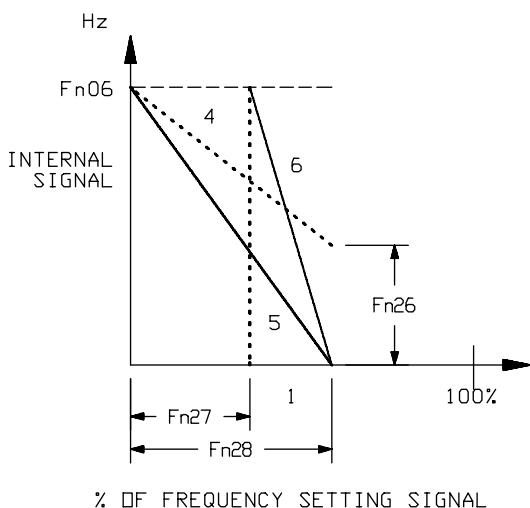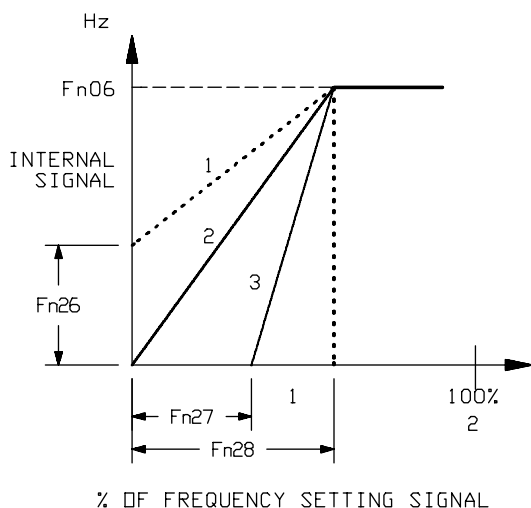
	Fn26	Fn27	Fn28	Fn29
curve 1	set frequency	set 0	set %	0
curve 2	set 0	set 0	set %	0
curve 3	set 0	set %	set %	0
curve 4	set frequency	set 0	set %	1
curve 5	set 0	set 0	set %	1
curve 6	set 0	set %	set %	1

1.   Fn26/27/28/29 will be effective only when Fn11=1 or 2
         (frequency set by digital operator or terminal analog frequency signal control.)
2.   Fn27 can be set as follows (curve 3):
         a. If signal is 1~5V, Fn27 will equal to the voltage of 0Hz divided by 5V.
         b. If signal is 4~20mA, Fn27 will equal to the current of 0Hz divided by 20mA.
         c. If signal is 0~10V, same method as above.
3.   Setting of Fn28: If signal is 0~20 mA, Fn28 will equal to the current of Fn06 divided
         by 20mA.

Remark: Signals of VR on TM2 and Digital operator are 0~5V; Analog input terminal of terminal
               block can accept 0~5V/0~10V/0~20mA signals.

Remark: Fn28 must be greater than Fn27.

Fn30: Refer to Fn05

Restart after momentary power loss

Fn31: Momentary power loss ride through time: 0-2 sec.
Fn32: xxx0: Disable
        xxx1: Enable

1.   Inverter will stop when voltage is lower than low voltage protection level. Inverter can
        restart automatically by speed search if power can be restored in the time set by Fn31.
2.   Time for momentary power loss will be varied by each model, range will be restored from
        0.7 sec. to 2 sec.
3.   Inverter will trip after power loss if Fn32=xxx0, LV-C will show on digital operator, and
        inverter cannot restart (Fn34, Fn35 ineffective)
4.   When Fn32=xxx1, Number of auto restarts will be unlimited if time of power loss is less
        than the setting in Fn31; Number and time of auto restarts will be determined by the setting
        of Fn34 and Fn35 if time of power loss is greater than the setting of Fn31.

Fn33: Reserved

Auto restart
Fn34: Auto restart interval: 0-800 sec.
Fn35: Number of auto restart attempts (0-10) times.

1.   Auto restart will be ineffective if Fn35=0.
2.   If Fn35>0, Fn34=0, inverter will use speed search to pull the frequency back to the
        frequency before the trip from free run status in 0.5 sec. and then accel. or decel. to preset
        frequency.
3.   If Fn35>0, Fn34>0, Inverter will free run for a certain period (set by Fn34) and then accel or
        decel from Fn42 to preset frequency.
4.   Auto restart will be ineffective during decel period after stop command or DC braking.
5.   Number of auto restarts will be reset under following conditions:
        (1) Fault is not detected for 10 minutes (either on run or stop mode)
        (2) Press "Reset" key or reset terminal of terminal block is on.
6.   Fn97= xxx0:   Faulty terminal will disable when auto restart is working.
        Fn97= xxx1:   Faulty terminal will enable when auto restart is working.

Display mode control

Fn36: Number of motor poles=2-8 poles.
Fn47: xxx0: Output voltage display (Vac) disable;   xxx1: enable
          xx0x: DC voltage display (Vpn) disable;   xx1x: enable
          x0xx: Output current (Iac) disable: x1xx: enable

Fn51=0: Display frequency (Hz); display preset frequency during stop mode and operation
            frequency during run mode.
      1. Display RPM of motor; number of poles set by Fn36.
      2. Line speed display mode: in integral (xxxx)
      3. Line speed display mode: in one digit decimal (xxx.x)
      4. Line speed display mode: in two digits decimal (xx.xx)
      5. Line speed display mode: in three digits decimal (x.xxx)
Fn52= Line speed display in accordance with maximum output frequency (Fn06)

(RPM)= $\underline{120}$ x frequency; Line speed = $\underline{freq.}$ x Fn52 (decimal digits decided by Fn51)
          Fn36   Fn06

Contents of display can be switched by DSP FUN key either in run mode or stop mode.
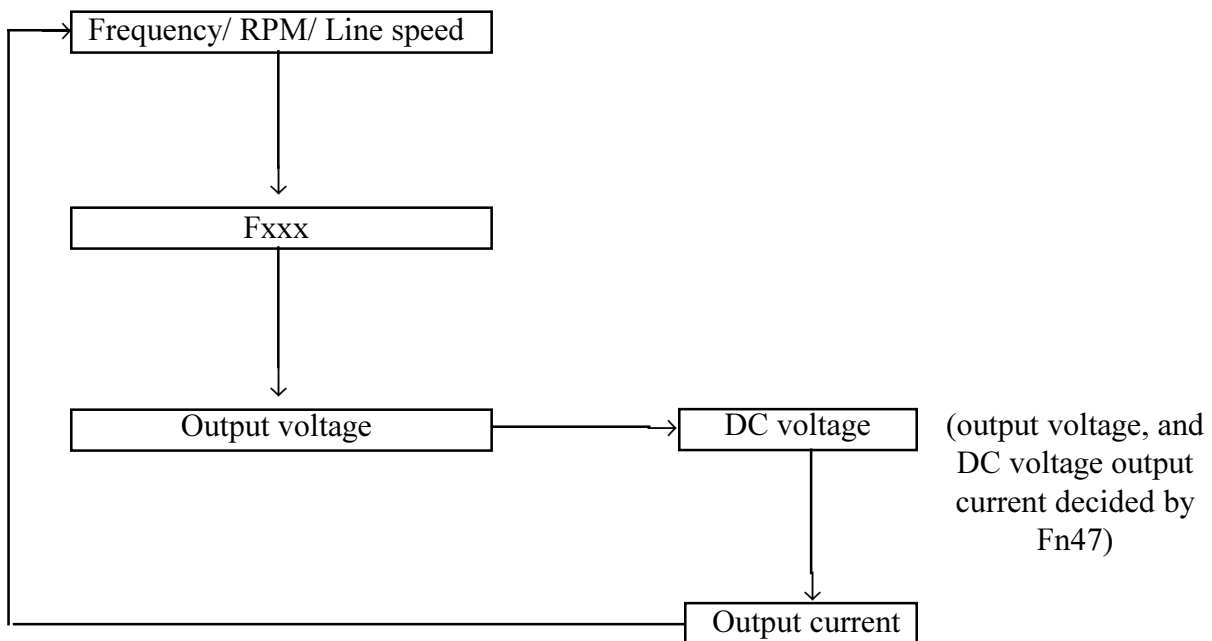
Fn37-Fn41:   Please refer to Fn05

Fn42:   Start frequency adjustment=0.1-10Hz

Inverter can accept the following application: Inverter can start at 5Hz then operate in the range of 0.1~60Hz if Fn07=0Hz, Fn42=5Hz.

Fn43: Carrier frequency= 0-15

Fn43	Carrier Freq.	Fn43	Carrier Freq.	Fn43	Carrier Freq.	Fn43	Carrier Freq.
0	1 KHz	4	2.4 KHz	8	4.8 KHz	12	8 KHz
1	1.2 KHz	5	3 KHz	9	5 KHz	13	9 KHz
2	1.8 KHz	6	3.6 KHz	10	6 KHz	14	10 KHz
3	2 KHz	7	4 KHz	11	7.2 KHz	15	12 KHz

IGBT type Inverters can provide low audible motor noise operation. However, high carrier frequency may lead to interference to external electronics equipment. Therefore, carrier frequency adjustment necessary to limit interference.

Stopping mode and braking resistor protection.

Fn44 = xxx0 : Decel. to stop
       = xxx1 : Free run to stop
Fn53 : DC braking time= 0-25.5 sec.
Fn54 : DC braking injection frequency= 0.1-10Hz
Fn55 : DC braking level= 0-20%

If Fn44= xxx1, inverter will cut off output after receiving instruction, motor will free run to stop. If Fn44=xxx0, inverter will decelerate to frequency set by Fn54 after receiving instruction, then output voltage level set by Fn55. Inverter will stop after the period set by Fn53.

Multi-function analog output.

Fn45 : Gain of multi-function analog output= 0-200%
Fn46 : Multi-function analog output selection= 0-3
          0: Output freq. (Fn06 max.): 10Vdc/Fn06
          1: Set frequency (Fn6 max.): 10Vdc/ Fn06
          2: Output voltage (Vac): 10Vdc/ Fn30
          3: DC voltage (Vpn): 10Vdc/450Vdc (10Vdc/900Vdc for 400V series)

Multifunction output on TM2 is 0~10 Vdc analog output, Output mode can be set by Fn46. Function of Fn45 is as follows:

1. Fn45 can be used to calibrate external meters or other peripherals.

Fn47: Refer to Fn36

Dynamic braking and priority of stopping and speed search and AVR control.

Fn48= xxx0: Enhanced braking capacity.
xxx1: Standard braking capacity.
xx0x: Stop key effective in remote control mode.
xx1x: Stop key ineffective in remote control mode.
x0xx: Speed search controlled by terminals on TM2.
x1xx: Speed search effective when inverter start.
0xxx: AVR function effective.
1xxx: AVR function ineffective.

1.   Fn48= xxx0, Inertia energy of load can be used up by motor via output voltage adjustment during deceleration.
2.   Fn48=xx0x, "STOP" key on digital operator can be used for emergency stop even during remote control (Stopping mode set by Fn44); External switch must be turned OFF then ON again for restarting inverter.
3.   Fn48=x0xx, Speed search will be effective if multi-function input Fn56-58 are 07 or 23 and multifunction input terminal operated, otherwise, inverter will start based on start frequency.
4.   Speed search will search from preset frequency during operation.
5.   Please refer to Fn05 (V/F pattern) for AVR function.

Fn49, Fn50: Please refer to Fn01.
Fn51, Fn52: Please refer to Fn36.
Fn53-Fn55: Please refer to Fn44.

Multifunction input (Fn56-Fn58)

00: SP1 (Multi-speed 1)   :   Please refer to Fn17
01: SP2 (Multi-speed 2)   :   Please refer to Fn17
02: Sp3 (Multi-speed 3)   :   Please refer to Fn17
03: Jog operation   :   Please refer to Fn17

04: Accel./ Decel. time selection : **Please refer to Fn01-point 2**
05: External emergency stop
06: External baseblock
07: Speed search : **Please refer to Fn48**
08: Energy saving mode : **Please refer to Fn82**
19: Control signal selection
10: Communication control mode selection
11: Accel. / Decel. prohibit
12: UP command
13: DOWN command
14: Sequence control : **Please refer to Fn17 and Fn84~Fn91**
15: Master/ Aux. speed selection : **Please refer to Fn11**
16-31: Change 00-15 (N/O - normally open contact) to (N/C - normally closed contact)

Remark: Fn56 will be effective if terminal 6 is used for 3-wire control.

1. There are 32 kinds of functions which can be selected as above by terminals 6, 7, 8.
2. Fn56 - Fn58= 5, 6, 9, 10, 11, 12, 13

a. Fn56-Fn58=5: External emergency stop.
As soon as external emergency stop signal is received, inverter will decel. to stop (regardless of the setting of Fn44) and the display will blink "E.S." After this signal is removed, either turn OFF Run command then turn ON again (Fn10=1) or to press RUN key (Fn10=0), inverter will restart from start frequency.
If the Emergency Stop signal is removed before inverter stops, inverter will still execute emergency stop. Fault contact is controlled by Fn97 as follows:

Fn97- x0xx: Fault contact is not energized after external emergency stop signal is received.
Fn97- x1xx: Fault contact is energized after external emergency stop signal is received.

b. Fn56-Fn58=6: External baseblock.
As soon as external baseblock signal is applied, inverter output is shut off (regardless of the setting of Fn44) and the display will blink "b.b." After baseblock input is removed, either turn OFF Run command then turn ON again (Fn10=1) or to press RUN key (Fn10=0), inverter will restart from start frequency.

Fault contact is controlled by Fn97 as follows:

Fn97- 0xxx: Fault contact is not energized after external baseblock.
    1xxx: Fault contact is energized after external baseblock.

c. Fn56-Fn58=9: Control signal selection
Multi-input terminal OFF: Operation command/ Freq. command is from digital operator or remote control (TM2)- according to the settings of Fn10/ Fn11.
Multi-input terminals ON: Operation command/ Freq. command is from digital operator- regardless of the settings of Fn10/ Fn11.

d. Fn56-Fn58=10: Communication control mode selection
Multi-input terminal OFF: During communication, inverters can receive Run/ Freq. signals from control unit (PC or PLC). Parameters can be changed by control unit. Run/Freq. signals from keypad and TM2 will be ineffective. Keypad can be used for displaying Voltage/Current/Frequency or emergency stop but can not be used for changing parameters.
Multi-input terminal ON: During communication, the operation command/ freq. command is controlled by inverter itself, control unit is just for reading parameters.

e. Fn56-Fn58=11: Accel./Decel. prohibit
Inverter will stop accelerating/ decelerating when accel./decel. prohibit signal is received. When the signal is removed, inverter continues accelerating/ decelerating.
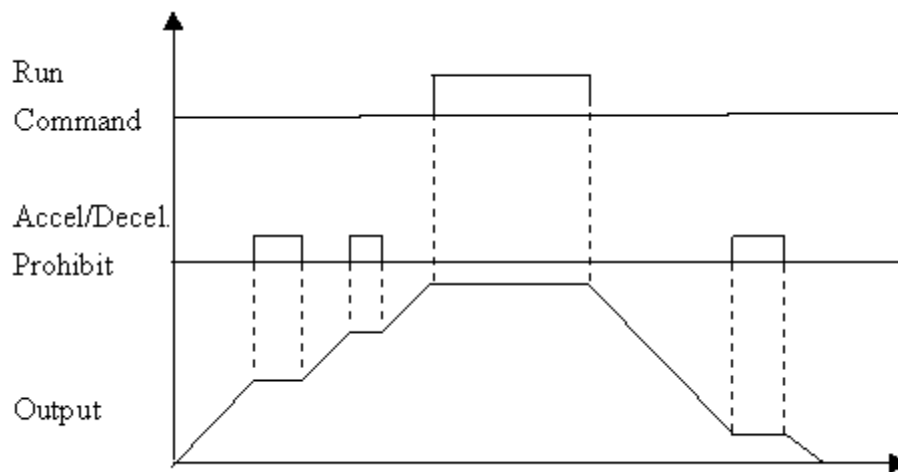
*: When "Run" command is off, Accel/ Decel prohibit command is ineffective.

f. Fn56-Fn58=12, 13: UP/ DOWN command
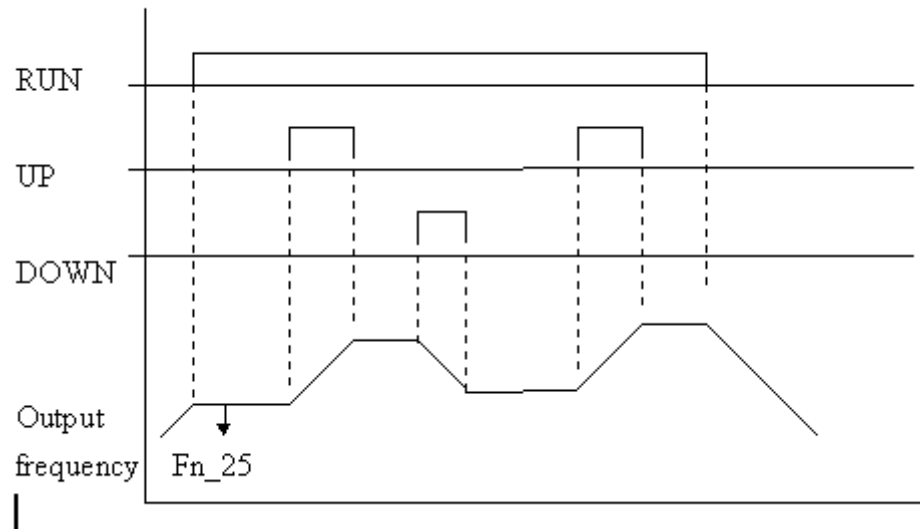
(1) The function is available only when Fn11=3. Other frequency setting will be ineffective.

(2) When Fn03=0xxx, inverter will accelerate to the frequency set by Fn25 after operation terminal is on, then remain at the constant speed. If UP (DOWN) terminal engages, inverter starts accelerating (decelerating). If UP (DOWN) signal disappears, inverter will stay at the final frequency. Once the operating signal is off, inverter will decelerate to stop or stop immediately (decided by Fn44), the operation frequency will be recorded in Fn25. Terminal UP/ DOWN control is ineffective during stop mode. The setting frequency must be changed by Fn25 through digital operator.

(3) When Fn03=1xxx, inverter will start from 0Hz, UP/DOWN control is same as described in (2). When operating the signal is off, frequency will go back to 0. Every operation will start from 0 speed.

(4) UP and DOWN commands are ineffective if these two commands are applied at the same time.

(5) "Zero speed stop" control is possible if DOWN command is on constantly.
 Inverters start to run in "zero speed stop" mode if UP command is on.

Fn59-Fn60   :   Reserved

Fn61   :   Please refer to Fn08

Fn62-Fn64   :   Reserved

Prohibited frequency control (Fn65-Fn68)

Fn65 :   Setting prohibited freq. 1:   0-400Hz
Fn66 :   Setting prohibited freq. 2:   0-400Hz
Fn67 :   Setting prohibited freq. 3:   0-400Hz
Fn68 :   Setting prohibited freq. range   :   0-10Hz

Example: When Fn65=10.0Hz, Fn66=20.0Hz, Fn67=30.0 Hz, Fn68=2.0Hz
         The skip frequency ranges are: $10Hz \pm 2\ Hz = 8$-$12Hz$
                                              $20\ Hz \pm 2\ Hz = 18$-$22Hz$
                                              $30\ Hz \pm 2\ Hz = 28$-$32Hz$

Electronic thermal protection (motor and inverter) (Fn69-Fn71)

Fn69 :   xxx0   Electronic thermal motor protection effective.
               xx0x   Electronic thermal motor protection ineffective.
               xx1x   Electronic thermal characteristics in accordance with special motor
               x0xx   Motor protection OL: 103% continues, 150% for one minute.
               x1xx   Motor protection OL: 113% continues, 123% for one minute.
               0xxx   Free run to stop after electronic thermal motor protection is energized.
               1xxx   Operation continued after electronic thermal motor protection is energized.

1. The functions of electronic thermal motor protection are as follows:

a.   Fn69=x0xx: To protect motor under normal machinery load. When motor output current
        exceeds 103%, motor protection electronic thermal characteristics start operating. Motor
        protection (OL1) operates at 150% for one minute to shut off inverter output. (refer to curve
        (1) of Fig. 4)

Fn69=x1xx: To protect motor under HVAC load (Fan, Pump,...etc.)
             When motor ouput current exceeds 113%, motor protection electronic thermal
             characteristics start operating. Motor protection (OL1) operates at 123% for one
             minute to shut off inverter output.

b.   When motor runs with low speed, the capacity to dissipate heat is not as good as motor
        running with rated frequency. The level to energize the electronic thermal relay should be
        adjusted accordingly. (Please refer to Fig. 4 Curve (1) should be adjusted to curve (2)) To
        protect the motor, select appropriate settings of Fn05 and Fn69 according to the
        specifications of motor. (refer to Fig. 1, 2, 3)

c.   When Fn69=xx0x, Fn05=18, set Fn37 to the rated frequency of motor.

d.   Fn69=0xx0:   After electronic thermal motor protection is energized, inverter baseblocks immediately and display blinks "OL1": To start the inverter, it is necessary to press RESET key or turn on the remote control RESET terminal.
Fn69=1xx0:   After electronic thermal motor protection is energized, inverter continues running and display starts blinking "OL1" until current is lower than 103% or 113% rating (depending on Fn69).

2. The functions of the electronic thermal inverter protection are as follows.

a.   Inverter continues running when current is under 110% rating; inverter runs for one minute only when current is at 150% rating.

b.   Fn71=xxx0:   After electronic thermal inverter protection is energized, inverter baseblocks immediately and display blinks "OL2". To start the inverter, it is necessary to press RESET key or turn on the remote control RESET terminal.

Fn71=xxx1:   After electronic thermal inverter protection is energized, inverter continues running and display starts blinking "OL2" until current is lower than 110% rating.
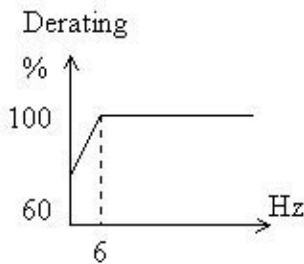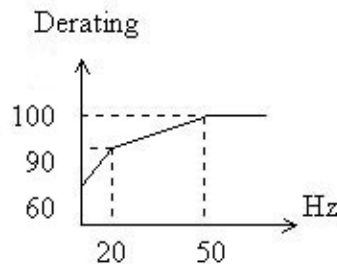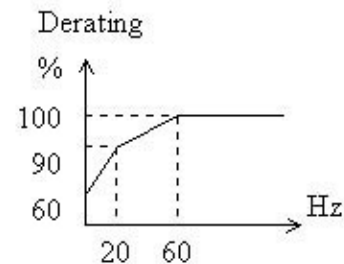
FIG. 1	FIG. 2	FIG. 3
Fn69=xx1x	Fn69=xx0x, Fn05=0-8	Fn69=xx0x, Fn05=9-17
special motor for inverter	50Hz standard motor	60Hz standard motor

FIG. 4
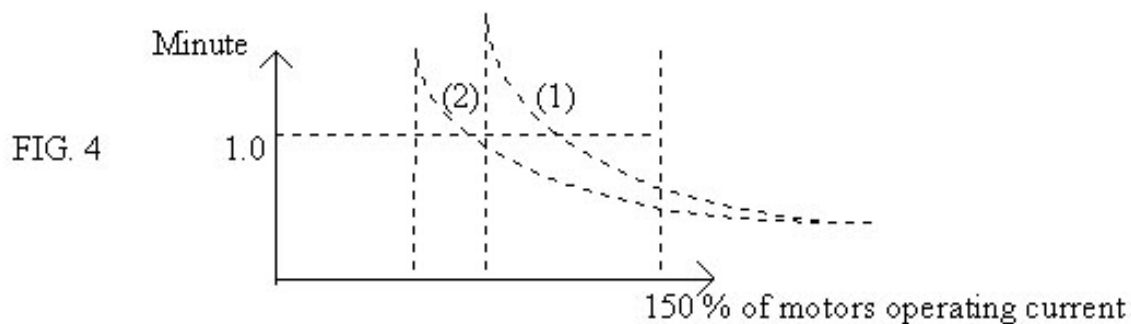
Torque boost control (Fn71-Fn73)

Fn71 :   **x0xx   Torque boost enable.**
            x1xx   Torque boost disable.
            1xxx   Manual torque boost.

Fn72 :   **Torque compensation gain: 0-10%**

Fn73 :   **Reserved**

Fn71=   **x1xx: Torque boosts are ineffective.**
            1xxx: Torque boost is adjusted according to the settings of V/F pattern (Fn05)
and Fn72.

Fn74 :   **Reserved**

Slip Compensation Fn75-Fn76

Fn75 :   **Motor no load current.**
Fn76 :   **Motor rated slip: 0-6 Hz.**

Slip compensation freq. = [(output current- Fn75)/(Fn70-Fn75)] x Fn76
* Fn70= motor rated current.

The approximate value of Fn76= Fn36*/120 x (motor asynchronous speed* - motor rated speed)
* Fn36= motor pole.
* Motor asynchronous speed (RPM)= 120/ Fn36 x motor rated freq. (50 or 60 Hz)

Overtorque control (Fn77-Fn79)

Fn77 :   **xxx0**   **Overtorque detection disable.**
                   xx0x   **Enable only if at set freq.**
                   xx1x   **Enable during operation.**
                   x0xx   **Operation continued after overtorque is detected.**
                   x1xx   **Free run to stop after overtorque is detected.**
Fn78 :   **Overtorque detection level: 30-200%**
Fn79 :   **Overtorque detection time: 0-25 sec.**

1. Definition of overtorque: the output current (rated current is 100%) remains above overtorque detection level (Fn78) during overtorque detection time (Fn79).

2. Fn77= x0x1: When overtorque occurs, inverter continues running and display starts blinking "OL3" until output current is lower than Fn78 setting.

Fn77=x1x1:   When overtorque occurs, inverter baseblocks immediately and display blinks "OL3". To start running, it is necessary to press RESET key or turn on remote control RESET terminal.

3. When Fn61-Fn63 (multi-function output terminal control) is set to 05, the multi-function output provides an overtorque detection signal. Overtorque detection output signal is available only if Fn77=xxx1.

Fn80, Fn81: Please refer to Fn01

Energy saving control (Fn82-Fn83)

Fn82 :   **xx00**   **Energy saving disable**
                   xx01   **Energy saving controlled by multi-input terminals only if at set freq.**
Fn83 :   **Energy saving gain: 0-100%**

1. This function is applied to Fan/ Pump or loads with high inertia. In these applications, high starting torque is necessary, but torque is smaller while running at constant speed. Fn83 can be used to save energy by adjusting suitable gain (voltage level) at constant speed.

2. Energy saving function is available only if Fn56-Fn58 (multi-function input) is set to 08 or 24.

3. Fn82= xx01, Fn56-Fn58=08: If multi-function input terminal is ON, output voltage will decrease gradually (to previous output voltage x Fn83). When the input terminal is off, output voltage will increase to previous voltage gradually.

Remark: The speed of above mentioned voltage which goes up or down is the same as that of Speed search.

Fn84-Fn91   :   Please refer to Fn17

Vibration prevention control (Fn92-Fn94)

Fn92 :   Vibration prevention times : 1-100
Fn93 :   Vibration prevention gain   : 0-100%
Fn94 :   Vibration prevention bias   : 0-30%

1. Adjusting Fn92 (unit: 2ms) to 1/4 of machine's vibration cycle can provide the optimal performance.

2. Adjusting Fn92 according to the amplitude of vibration can reduce vibration to minimum.

Fn95 :   Reserved
Fn96 :   Reserved

Fault contact control (Fn97-Fn98)

Fn97 :   xxx0   Fault contact is not energized during auto restart option.
**   xxx1   Fault contact is energized during auto restart operation.**
**   xx0x   Fault contact is not energized during momentary power loss detection.**
**   xx1x   Fault contact is energized during momentary power loss detection.**
**   x0xx   Fault contact is not energized after external emergency stop signal is received.**
**   x1xx   Fault contact is energized after external emergency stop signal is received.**
**   0xxx   Fault contact is not energized during external baseblock.**
**   1xxx   Fault contact is energized during external baseblock.**
Fn98 :   xxx0   Fault contact is not energized after overtorque (OL3) is detected.
**   xxx1   Fault contact is energized after overtorque (OL3) is detected.**
**   xx0x   Fault contact is not energized after electronic thermal motor protection (OL1) is activated.**

xx1x Fault contact is energized after electronic thermal motor protection. (OL1) is activated.

x0xx Fault contact is normally open (N/O)

x1xx Fault contact is normally closed (N/C)

0xxx Fault contact is not energized after electronic thermal inverter protection (OL2) is activated.

1xxx Fault contact is energized after electronic thermal inverter protection (OL2) is activated.

Fn97= xxx0: During auto restart operation, fault contact is not energized
(except for OL1/ OL2/ OL3) until Fn35 (auto restart times) decreases to 0.

Fn99 Reserved

Communication mode (Fn100-Fn102)

Fn100 : Communication identification no.: 1-32
Fn101 : Baud rate of communication: 0/1/2/3 (4800/9600/19200/38400)
Fn102 : Communication agreement:

xxx0: 1 stop bit	**x0xx: Without parity**
xxx1: 2 stop bits	**x1xx: With parity**
xx0x: Even parity	**0xxx: 8 bits data**
xx1x: Odd parity	**1xxx: 7 bits data**

1. **RS-485 communication: (RS485 interface is required: RS-485-N2)**

    a. One to one control: Using PC, PLC or control devices to control one inverter (Fn100 set to 1~32)

    b. One to multiple control: Using PC, PLC or control devices to control multiple units of inverters (Up to 32 inverters can be controlled simultaneously, set Fn100 to specified number)

    c. In one to multiple control case: If computer send a code 33 to inverter, all linked inverters (up to numbers of 32) can be controlled by remote no matter how many set in Fn100.

2. **RS-232 communication (RS232 interface is required: RS-232-N)**
    One to one control: Using PC, PLC, or control devices to control one inverter (Fn100 set to 1~32)

Remark:
    a. Baud rate and communication agreement must be set to the same level between PC, PLC and inverters.
    b. ASCII CODE is used for N2 communication.
    c. Fn10, Fn11 will be ineffective for inverter operation and frequency control in communication mode.
    d. Frequency signal will be controlled by Fn06, Fn07 in communication mode.
    e. PC will request data from inverter automatically to obtain information. (STATUS_LED, Vac, Vpn, Iac, Freq., RPM)
    f. Inverter will double confirm the validity of new parameter when set by PC.
    g. Please refer to the manual of RS-232-N2 and RS-485-N2 for detail function and protocol.

Fn103-Fn122 : Reserved

Factory setting (Fn123)

1. All parameters will be reset to factory setting value if Fn123 set to 1111. Some of the parameters will be reset to specific value: Fn05=0, Fn06=50, Fn37=50, and Fn39=2.5. The value of Fn123 will default to 0000 automatically after reset.

CPU version (Fn124)
Fault sequence reference (Fn125)

In order to simplify troubleshooting, inverter memorizes the last three fault codes automatically in its EEPROM memory. Press up and down arrow keys on the digital operator to refer to the faults recorded.
For instance:

1. LV-C : The first fault code (the latest one) is low voltage.
2. OC-d : Over current during deceleration.
3. - - - - : No fault condition (only two faults occurred)

4.4 Changing PC board

Use the following procedure to install a new PC board.
1.   Set Fn95 to 1111
2.   Set Fn00 to match the specified model (Refer to Fn00)
3.   Set Fn95 to 1111
4.   Detect the P-N DC voltage and input the value into Fn96. (P is on TM1, N is the test pin on main board.

Section 5:   Failure Indication

5.1   Faults which can not be reset by keypad button or terminal input

Fault Code	Content	Probable Cause	What to do
CPF	CPU software error	1. High electronic noise.	1. Install RC type suppressor on all contactor / brake coils.
EPR	EEPROM error	1. EEPROM is damaged.	1. Change EEPROM
OV	Over Voltage in stop mode	1. Detection circuit is damaged.	1. Notify your supplier to check.
LV	Low voltage in stop mode	1. Input voltage is too low. 2. Current limit resistor (R1) or fuse burned out - 400V series inverter. 3. Detection circuit is damaged.	1. Correct input voltage. 2. Change current limit resistor or fuse. 3. Notify your supplier to check.
OH	Heatsink Over Heat in stop mode	1. Detection circuit is damaged. 2. Ambient temperature is too high or ventilation is poor.	1. Notify your supplier to check. 2. Lower ambient temperature or improve ventilation.

5.2 Faults which can be auto-reset keypad button or terminal input

Fault Code	Content	Probable Cause	What to do
OC-S	Over Current during starting	1. Motor is short circuited. 2. Motor has ground fault. 3. Inverter transistor module is damaged.	1. Check and fix motor. 2. Remove the grounding point. 3. Change transistor module.
OC-A	Over Current during Acceleration.	1. Accel. time is set too short. 2. Inappropriate V/F pattern selection. 3. Motor capacity exceeds inverter rating.	1. Extend accel. time. 2. Select the optimum V/F pattern. 3. Select a larger HP inverter.
OC-C	Over Current during constant speed.	1. Load changes excessively. 2. Input voltage fluctuates excessively.	1. Check the load condition. 2. Install a reactor between power supply and inverter.
OC-d	Over Current during Decel.	1. Decel. time is set too short.	1. Extend decel. time.
OC-b	Over Current during Braking.	1. Braking freq. is set too high. 2. Braking voltage is set too high. 3. Braking time is set too long.	1. Reduce braking frequency. 2. Lower braking voltage. 3. Shorten braking time.
OV-C	Over Voltage during constant speed.	1. Decel. time is set too short or load inertia is too high. 2. Input voltage fluctuates.	1. Extend decel. time 2. Set Fn48=xxx0 3. Add external braking resistor or module. 4. Install a reactor between power supply and inverter. 5. Select a larger HP inverter.
LV-C	Low Voltage during constant speed.	1. Input voltage is too low. 2. Input voltage fluctuates excessively.	1. Correct input voltage or extend Fn31. 2. Extend accel. time 3. Select a larger HP inverter. 4. Install a reactor between power supply and inverter.
OH-C	Over Heat during constant speed.	1. Load is too high. 2. Ambient temperature is too high or ventilation is poor.	1. Investigate load condition. 2. Select a larger HP inverter. 3. Lower ambient temperature or improve ventilation.

5.3   Faults which can be reset by keypad button terminal input, but cannot be auto-reset.

Fault Code	Content	Probable Cause	What to do
OC	Over current during stop mode.	Detecting circuit failure.	1. Send inverter back for repairing.
OL1	Motor overload.	1. Load is too high. 2. Inappropriate V/F pattern selection. 3. Incorrect Fn69, Fn70 setting.	1. Select a larger HP inverter. 2. Select optimum V/F pattern. 3. Select correct Fn69 and Fn70 setting.
OL2	Inverter overload.	1. Load is too high. 2. Inappropriate V/F pattern selection.	1. Select a larger HP inverter. 2. Select optimum V/F pattern.
OL3	Overtorque.	1. Load is too high. 2. Inappropriate V/F pattern selection. 3. Fn78, Fn79 are set too low.	1. Select a larger HP inverter. 2. Select optimum V/F pattern 3. Select appropriate Fn78 and Fn79 settings.

5.4 Special Condition Indication

Fault Code	Content	Illustration
STP0	Zero speed stop	1. Fn11=0 or 3, Fn07<0.1Hz, and setting frequency <0.1Hz; Fn11=1 or 2, Fn07<(Fn06/100), and setting frequency<(Fn06/100)
STP1	Direct start disable.	1. Power switched on while remote RUN switched on (Fn10=1) and direct start is prohibited. (Fn16=xxx1). Inverter can not be started and will display STP1. (Refer to Fn16) 2. Inverter can be started directly when Fn16=xxx0.
STP2	Emergency stop command by STOP key	1. Emergency stop via digital operator in remote control mode (Fn10=1) by pressing STOP key (Fn48=xx0x). Once STOP key is pressed during operation, inverter will stop according to the setting of Fn44 and display STP2. Inverter will not restart until Run switch is turned off and then turned on again. 2. If inverter is under communication control and Fn48=xx0x, once STOP key is pressed, inverter will stop according to the setting of Fn44 and display STP2. Inverter will not restart until computer sends Stop command followed by a RUN command. 3. STOP key can not be used for emergency stop when Fn48=xx1x.
E.S.	Emergency stop command by remote control	1. Emergency stop vial remote control mode (multi-function input terminals), inverter will decelerate to stop and display E.S.
b.b.	External baseblock.	External abnormal signal baseblocks inverter via multi-function input terminals. (please refer to Fn56-58)

5.5   Digital Operator Operation Failure Indication

Fault Code	Content	Probable Cause	What to do
LOC	Parameter / freq./ REV direction is locked.	1. Try to change parameter / frequency when Fn04=xxx1 or xx1x. 2. Try to run in REV direction when Fn03=x1xx.	1. Set Fn04=xxx0 or xx0x. 2. Set Fn03=x0xx.
Err1	Operation error	1. Try to change frequency by pressing up or down arrow keys when Fn11>0. 2. Try to change Fn124. 3. Try to change functions which cannot be changed during operation.	1. Set Fn11=0. 2. Fn124 (CPU version) cannot be changed. 3. Change those functions in stop mode.
Err2	Setting error	1. Fn07 is in the range of Fn65 ± Fn68, Fn66 ± Fn68 or Fn67 ± Fn68. 2. Fn06< or equal to Fn07. 3. Fn70 < or equal to Fn75. 4. Fn27 > or equal to Fn28.	1. Adjust Fn65-Fn68 or Fn07 setting. 2. Fn06>Fn07. 3. Fn70>Fn75. 4. Fn27<Fn28.
Err3	Setting error	1. V/F curve is set too steep when Fn05=18. 2. Analog frequency signal is set too steep.	1. (Fn38-Fn40) / (Fn37-Fn39) < or equal to 65, (Fn40-Fn41) / (Fn39-0.1) < or equal to 65. 2. (Fn06-Fn26) / (Fn28-Fn27) < or equal to 65.
Err4	Setting error	1. Incorrect settings of Fn37-Fn41.	1. Fn37> Fn39 > 0.1 Hz. Fn38 > or equal to Fn40 > or equal to Fn41.
Err5	Parameters setting error	1. Under disable condition. 2. Amend Fn101 or Fn102 during communication.	1. Set enable before communication.. 2. Fn101, Fn102 should be amended before communication.
Err6	communication error	1. Connection error. 2. Improper parameters. 3. Checksum error. 4. Agreement error.	1. Investigate connection. 2. Check Fn101, Fn102. 3. Check communication agreement. 4. Check communication agreement.
Err7	Parameter setting error	1. Attempt to change Fn00 or Fn96. 2. The value in Fn96 is far from the value of detected voltage.	1. Refer to 2.3 "Changing control boards" 2. Check PN voltage circuit.

Section 6   Maintenance

<div style="border:2px solid red;">

⚡ DANGER! ⚡

Hazardous voltage within can cause serious injury or death. Operating drive from keypad may disable safety circuits and result in danger or injury. Only qualified personnel should work on this equipment after familiarization with its operation. Turn OFF and lock out power at main panel. Allow capacitors to bleed off prior to servicing.

</div>

Inverter requires almost no routine checks. It will function efficiently and its normal operation lifetime will be longer if if is kept clean, cool and dry.
Especially check for tightness of electrical connections, discololoration or other signs of overheating. During service inspection, turn off AC main circuit power and wait for charging indicator LED 101 to extinguish (or at least 10 minutes) before touching any circuit components. Failure to adhere to this warning could result in serious or lethal injuries.

(1)   Clean up internal dust and dirt
(2)   Check for tightness of electrical connection.
(3)   Perform meggar test
    (a)   Remove all connection wires from the complete unit when doing meggar test.
    (b)   Meggar test can be applied on main circuit. Note! Never do meggar test on control circuit. The insulation resistance of DC500V tester should be more than 5M ohm.
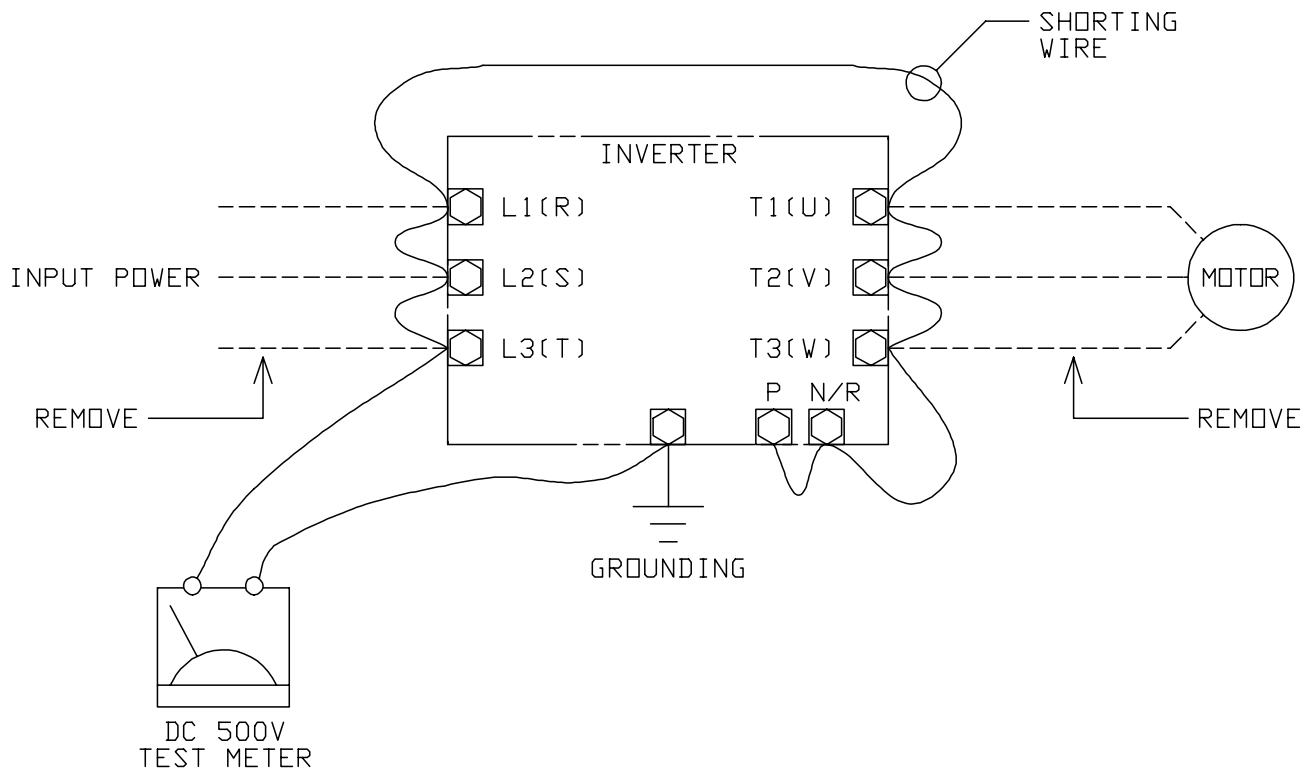
Note: Never conduct a meggar test on control circuit! Damage will result to inverter.

57

Appendix A ZCT

Ground Fault Protection when motor is running.

If a "ground fault" occurs while motor is running, transient surge currents will destroy the power section of inverter. Inverter offers an optional ZCT protection unit to detect the surge current and disable the output section whenever ground fault occurs.

⚡ ⚠ DANGER! ⚡

Hazardous voltage within can cause serious injury or death. Operating drive from keypad may disable safety circuits and result in danger or injury. Only qualified personnel should work on this equipment after familiarization with its operation. Turn OFF and lock out power at main panel. Allow capacitors to bleed off prior to servicing.

Installation:

1. Disconnect inverter from power source
2. Make sure that the charge lamp (LED 101) extinguishes or wait at least 10 minutes before taking next step.
3. Disconnect and thread output line (T1, T2 & T3) through ZCT and connect ZCT to CON4. (as shown on diagram)
* Be sure to thread all T1, T2, & T3 through ZCT.
* Max. cross section of T1, T2, & T3 should be <= 10 AWG.
4. Reconnect output lines (T1, T2, T3) back in proper sequence.
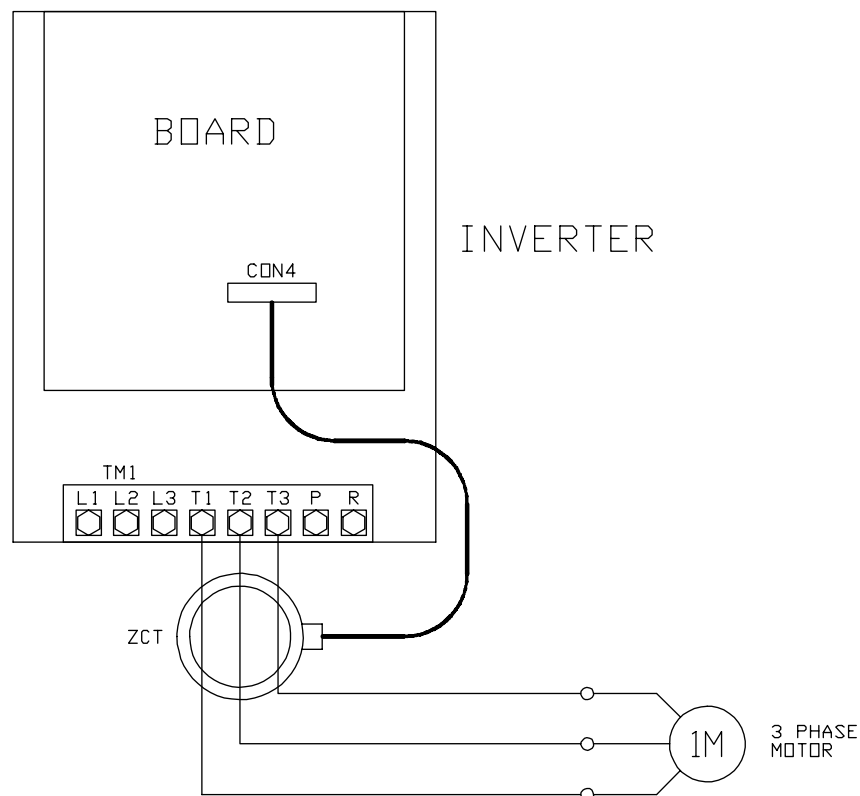
Appendix B: Electromagnetic compatibility (EMC) of inverter

Similiar to all modern PWM variable speed drives, inverters use fast switching of high voltage and current to achieve high efficiency and reduce motor noise. This results in electromagnetic interference (EMI) and radio frequency interference (RFI). For operational reasons the interference may need to be suppressed.

EC DIRECTIVES

Inverters are able to comply with the EC Directives 89/336/EEC, 92/31/EEC, 93/68/EEC on limits to EMI and RFI with the use of optional filters. Inverters will be able to comply with LVD: 73/23/EEC, 93/68/EEC in 1997. Independent testing has demonstrated compliance to the following standards when the optional filters are used. The following are the test standards compiled:

EMI (EMISSION)

EN 55081-1: 1992
EN 50081-2: 1993

EMS (IMMUNITY)

EN 50082-1: 1992
EN5 0082-2: 1995

LVD (SAFETY)

prEN50178: 1995

A. FILTERING SELECTION

Model #	Rating	Inverter Model
N2F-2102	1 phase, 220~250V/ 10A	N2-204, N2-207
N2F-2202A	1 phase, 220~250V/ 10A	N2-215
N2F-2202B	1 phase, 220~250V/ 10A	N2-222
N2F-4103A	3 phase, 380~460V/ 10A	N2-407, N2-415
N2F-4103B	3 phase, 380~460V/ 10A	N2-422, N2-437
N2F-4203	3 phase, 380~460V/ 20A	N2-455, N2-475
N2F-4553	3 phase, 380~460V/ 55A	N2-4110, N2-4150, N2-4220

B.   Interconnection diagrams for filters N2-200 series and 400 series.

N2-200 series interconnection:

```
POWER SUPPLY

          MAIN TRANSFORMER

                                  POWER DRIVE SYSTEM (PDS)

                              EMI FILTER      INVERTER
   MCCB                        L      L'      L1      T1         U
                               N      N'      L2      T2         V    M  3 PHASE
   POWER PORT                  PE     GND     GND     T3         W       MOTOR
                                                      GND        G
                                              TM2

                              METAL PLATE OR PANEL

                                                 REMOTE CONTROL SWITCHES,
                                                 RELAY, OR SIMILAR
                                                 EQUIPMENT
   EARTH PORT

              EARTH
```

N2-400 series interconnection:

```
POWER SUPPLY

          MAIN TRANSFORMER

                                  POWER DRIVE SYSTEM (PDS)

                              EMI FILTER      INVERTER
   MCCB                        L1     L1      L1      T1         U
                               L2     L2      L2      T2         V    M  3 PHASE
                               L3     L3      L3      T3         W       MOTOR
   POWER PORT                  PE     GND     GND     GND        G
                                              TM2

                              METAL PLATE OR PANEL

                                                 REMOTE CONTROL SWITCHES,
                                                 RELAY, OR SIMILAR
                                                 EQUIPMENT
   EARTH PORT

              EARTH
```

ADDITIONAL PRECAUTIONS TO LIMIT EMI AND RFI

1. Earth
1.1   For inverters:

In any cubicle, a single low-impedance earth point or busbar is required in order to put to earth directly and independently for varied circuit.

Inverter itself must be put to earth independently, no other equipment should share the earth connection of inverter (except motor); all circuits have to connect to external earth through copper bar.

Note: The system needs to be checked from time to time to ensure a good connection to earth.

1.2   For induction motor

For electrical safety reason, motor must connect to earth with a cable even when motor is fixed on metal construction. The best way is to use green line of the 4-core motor cable to connect between the frame of the motor and the earth of the inverter. Please avoid putting the motor to earth via busbar.

1.3   For control circuit

If the control circuit of inverter link to any control switches, relays or other similar equipment, be sure the screened control line is put to earth on single end only. (a clean earth far from inverter is recommended)

1.4   For Shielding System

In order to have a very low HF-impedance screening sheath, a metal clamp and special adapter are required and the paint on the surface of metal has to be removed.

2.   Shielding

2.1   Inverter will emit EMI via interconnection cable, therefore all motor cables, control cables, and signal cables must be screened unless the length of the cable is less than 1 meter.

2.2   The screened motor cable must be put to the earth on both ends. The shorter the cable the better to reduce the stray inductance and capacitance effect.

3.   Segregation

3.1   All signal cable and control cable must be separated from unscreened motor cable and unfiltered power line. The distance should be more than 30cm. The control cable and power cable should be put perfectly vertical when those two cable crossing each other.

Warning!

EMI filter can only be used in 3 phase supplies which are nominally balanced with respect to earth. Never apply EMI filter in a grounded delta supply system.

Appendix C: Troubleshooting procedure
(1) Motor doesn't work

```
                              ┌─────────────────┐
            Yes               │   Is MCCB on?   │
     ┌────────────────────────┤                 │
     │                        └────────┬────────┘
     │                                 │ No
     │                                 ▼
     │                        ┌─────────────────┐   No   ┌──────────────────┐
     │                        │ Can MCCB be     ├───────▶│  Short circuits. │
     │                        │ turned on?      │        └──────────────────┘
     │                        └────────┬────────┘
     │                         Yes     │
     └─────────────────────────────────┤
                                        ▼
                              ┌─────────────────┐   No   ┌──────────────────┐
                              │ Are the input   ├───────▶│ › Unstable power │
                              │ power L1 (R),   │        │   source.        │
                              │ L2(S), L3(T)    │        │ › Defective      │
                              │ stable?         │        │   wiring.        │
                              └────────┬────────┘        └──────────────────┘
                        Yes (± 10% of normal condition)
                                        ▼
                              ┌─────────────────┐   No   ┌──────────────────┐
                              │ Is there any    ├───────▶│ Inverter is      │
                              │ display on      │        │ damaged.         │
                              │ keypad?         │        └──────────────────┘
                              └────────┬────────┘
            Yes                        │
     ┌───────────────────────────────▶│
     │                                 ▼
     │                        ┌─────────────────┐   No   ┌──────────────────┐
     │                        │ Is inverter     ├───────▶│ Press "RUN" to   │
     │                        │ under "RUN"     │        │ operate motor.   │
     │                        │ command?        │        └──────────────────┘
     │                        └────────┬────────┘
     │                         Yes     │
     │                                 ▼
┌──────────────┐   No        ┌─────────────────┐
│ Correct      │◀────────────┤ Are the         │
│ parameters.  │             │ parameters set  │
└──────────────┘             │ correctly?      │
                             └────────┬────────┘
                              Yes     │
                                      ▼
                             ┌─────────────────┐   Yes  ┌──────────────────┐
                             │ Is there any    ├───────▶│ Refer to fault   │
                             │ fault showing   │        │ indication to do │
                             │ on display?     │        │ troubleshooting. │
                             └────────┬────────┘        └──────────────────┘
                              No      │
                                      ▼
                             ┌─────────────────┐   No   ┌──────────────────┐
                             │ Is there any    ├───────▶│ Inverter is      │
                             │ output on       │        │ damaged.         │
                             │ T1(U), T2(V),   │        └──────────────────┘
                             │ and T3(W)?      │
                             └────────┬────────┘
                              Yes     │
                                      ▼
                             ┌─────────────────┐   No   ┌──────────────────┐
                             │ Are output      ├───────▶│ Inverter is      │
                             │ voltage T1(U),  │        │ damaged.         │
                             │ T2(V) and T3(W) │        └──────────────────┘
                             │ balanced?       │
                             └────────┬────────┘
                              Yes     │     The output voltage is balanced when it is
                                      │     ± 3% of maximum output voltage without load.
                                      ▼
                             ┌─────────────────────────┐
                             │ › Motor over loaded or  │
                             │   shaft locked.         │
                             │ › Motor is damaged.     │
                             │ › Defective wiring.     │
                             └─────────────────────────┘
```
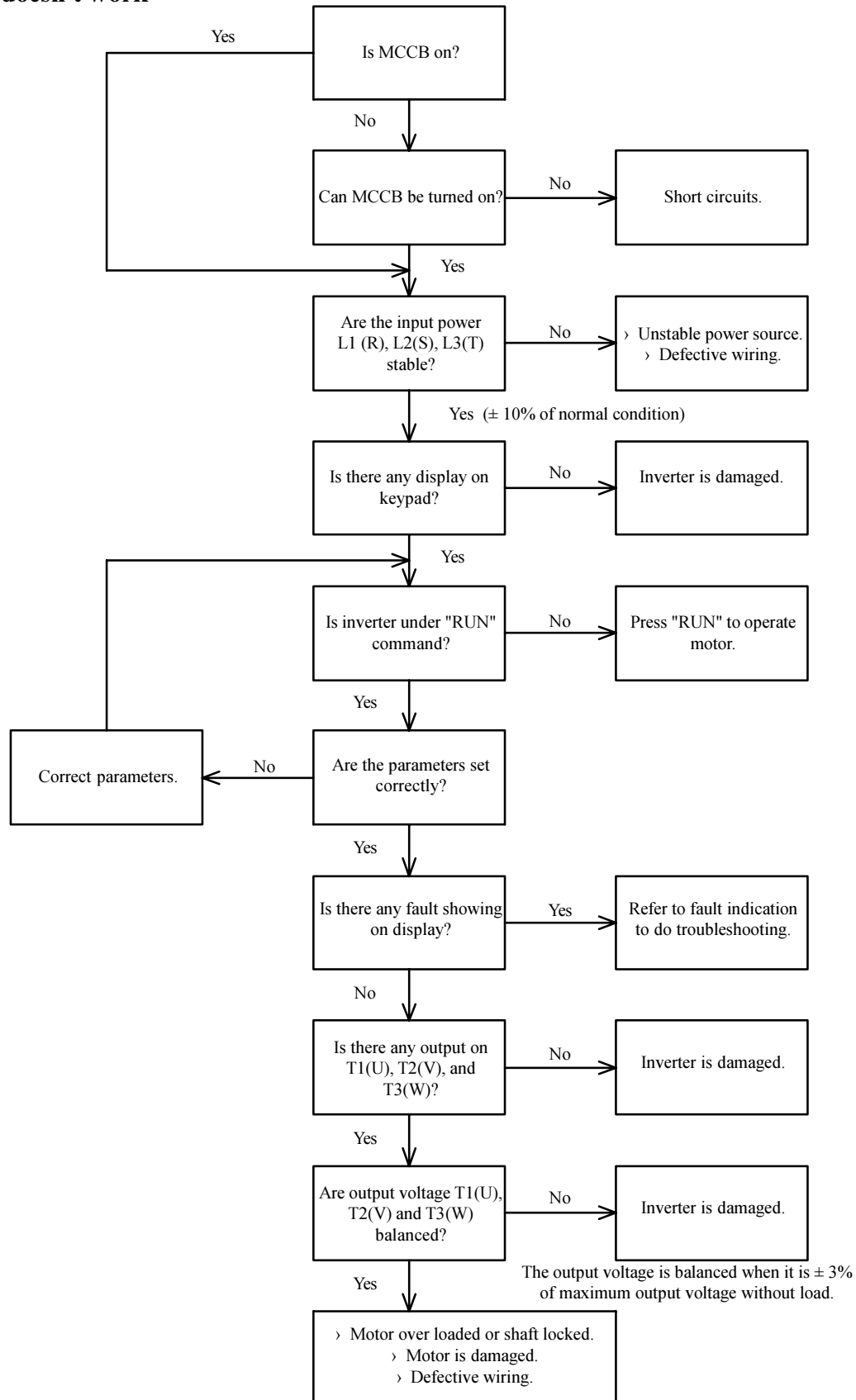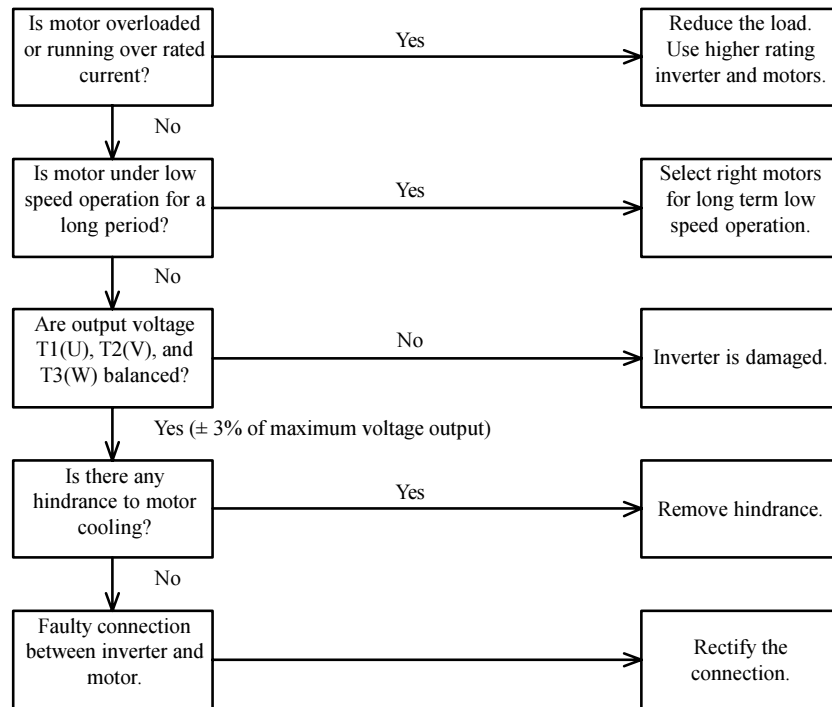
(2) Motor overheated

Is motor overloaded or running over rated current?	→Yes→	Reduce the load. Use higher rating inverter and motors.

↓No

Is motor under low speed operation for a long period?	→Yes→	Select right motors for long term low speed operation.

↓No

Are output voltage T1(U), T2(V), and T3(W) balanced?	→No→	Inverter is damaged.

↓Yes (± 3% of maximum voltage output)

Is there any hindrance to motor cooling?	→Yes→	Remove hindrance.

↓No

Faulty connection between inverter and motor.	→	Rectify the connection.

(3) Motor does not run smoothly

During accel. decel.?	→Yes→	Is Accel/ Decel time set properly	→No→	Increase Accel/ Decel time

(Is Accel/Decel time set properly) →Yes→ › Reduce load › Use higher rating inverter and motors

↓No

Are output voltages T1(U), T2(V), T3(W) balanced?	→No→	Inverter is damaged.

↓Yes (± 3% of maximum voltage output)

Does the load vary frequently?	→Yes→	Install a flywheel.

↓No

Is gear and transmission system vibrating excessively.	→Yes→	Improve mechanical system.

↓No

→	Inverter is damaged.

Appendix D: Digital operator remote cable (NW 300X)
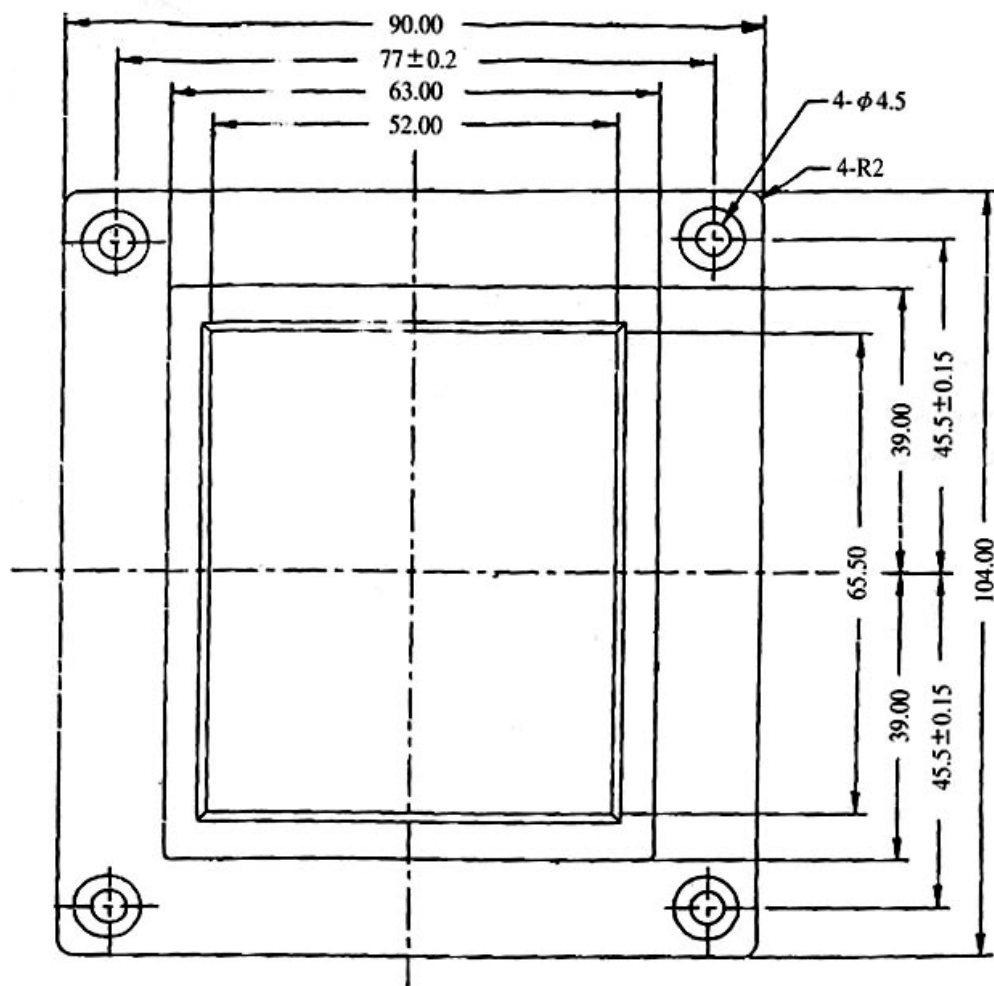
(1)   Contents

Plastic housing for
digital operator.

1.   front side
2.   Digital operator NDOP-01
3.   rear side

4.   Remote cable:
      NW3001 (1m)
      NW3002 (2m)
      NW3003 (3m)

5.   Remote cable adaptor

6, 7, 8 Accessory screws
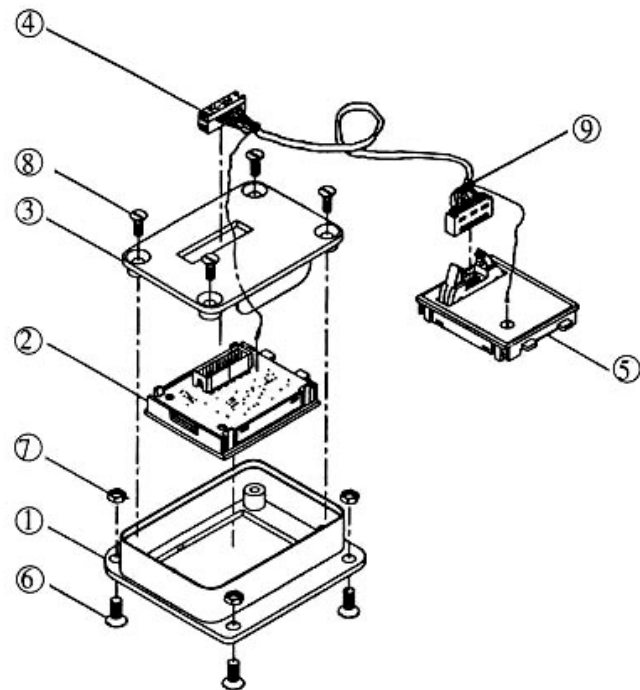
(2)   Installation

1.   Turn the power off, and make sure inverter power indicator (LED101) is off.

2.   Remove digital operator (2) and grounding wires (PE) from inverter.

3.   Put the digital operator (2) into plastic housing (1), (3), then use screw (8) to assemble the housing as shown above.

4.   Put the remote cable adapter (5) into the inverter.

5.   Connect terminal (4) of remote cable to adapter (5), and connnect the grounding wire also.

6.   Connect the other side of the terminal (9) of remote cable to adapter (5), and connect the grounding wire also.

7.   Use accessory screws (6), (7) to fix the remote operator to the panel.

8.   To avoid interference, proper grounding on inverter enclosure is necessary.
      (Grounding resistance must be less than 100 ohm, diameter of grounding wire must be bigger than 2mm^2)
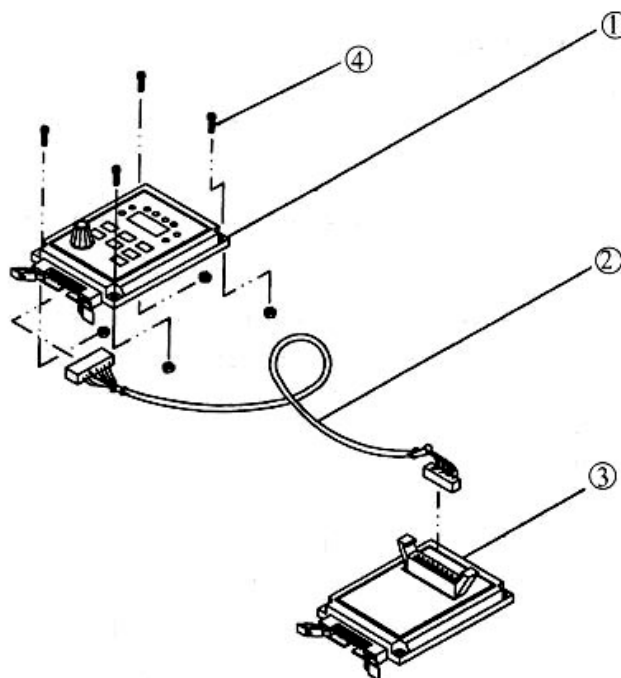
NDOP-01   Mounting dimensions   unit: mm

Appendix E: Digital operator remote cable (NW 300XA)
for N2-255M3~N2-2220M3, N2-455M3~N2-4220M3 use.

(1)   Contents

1.   Digital operator NDOP-02

2.   Remote cable:
NW3001 (1m)
NW3002 (2m)
NW3003 (3m)

3.   Remote cable adaptor

4.   Accessory screws

(2)   Installation

1.   Turn the power off, and make sure inverter power indicator (LED101) is off.

2.   Remove digital operator (1) from inverter.

3.   Put the digital operator (3) into the inverter.

4.   Connect both sides of the remote cable. (2)

5.   Use accessory screws (4) to fix the digital operator (1) to the panel.

NDOP-02   Mounting dimensions   unit: inches
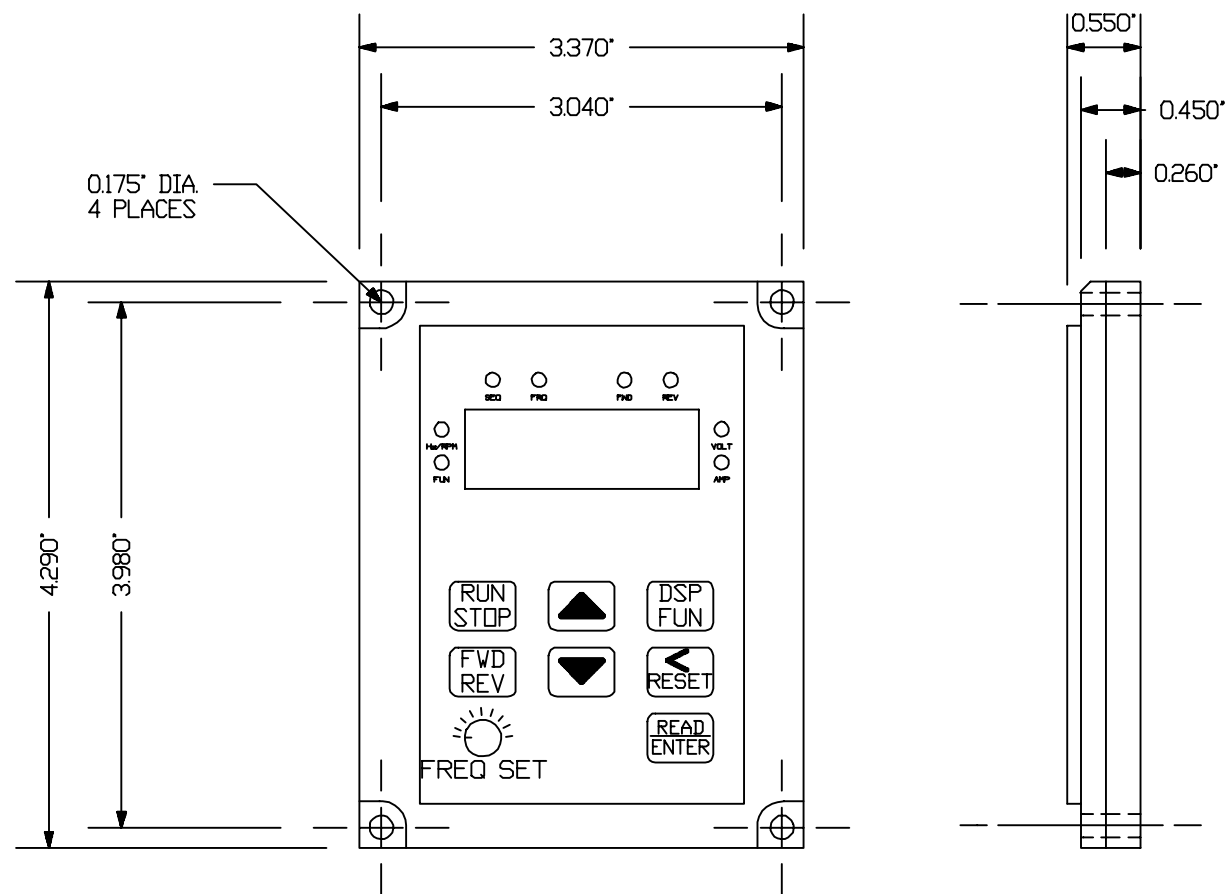
Appendix F: Braking Resistor, AC Reactor

Model	Built in Braking Transistor	Built in Braking Resistor	Braking Torque	Braking Resistor Code. No.	AC Reactor	
					Current (A)	Inductance (mH)
N2-204-M	O	X	20%	BRN2-201	2.5	4.2
N2-207-M	O	X	20%	BRN2-201	5	2.1
N2-215-M	O	X	20%	BRN2-202	10	1.1
N2-222-M	O	X	20%	BRN2-203	15	0.71
N2-237-M3	O	X	20%	BRN2-205	20	0.53
N2-255-M3	O	X	20%	BRN2-208	30	0.35
N2-275-M3	O	X	20%	BRN2-210	40	0.265
N2-2110-M3	X	X	20%	X	60	0.18
N2-2150-M3	X	X	20%	X	80	0.13
N2-2220-M3	X	X	20%	X	120	0.09
N2-404-M3	O	X	20%	BRN2-401	2.5	8.4
N2-407-M3	O	X	20%	BRN2-401	2.5	8.4
N2-415-M3	O	X	20%	BRN2-402	5	4.2
N2-422-M3	O	X	20%	BRN2-403	7.5	3.6
N2-437-M3	O	X	20%	BRN2-405	10	2.2
N2-455-M3	O	X	20%	BRN2-408	15	1.42
N2-475-M3	O	X	20%	BRN2-410	20	1.06
N2-4110-M3	X	X	20%	X	30	0.7
N2-4150-M3	X	X	20%	X	40	0.53
N2-4220-M3	X	X	20%	X	60	0.36

O: as standard   X: as optional

DC Reactor

| Model	Current (A)	Inductance (mH)
N2-2110-M3	55	0.67
N2-2150-M3	73	0.5
N2-2220-M3	109	0.33
N2-4110-M3	29	2.6
N2-4150-M3	38	1.9
N2-4220-M3	57	1.3

When using the DC Reactor. Remove the command bar between P1 and P, then wire the DC Reactor to the two terminals.

Braking Resistor

Model	Braking Resistor Model	Applicable Motor unit (KW)	Specification of Resistor		Loading Tome Rate (% ED)	Braking Torque (%)
			(W)	(ohm)		
N2-204-M	BRN2-201	0.375	60	200	8	218
N2-207-M	BRN2-201	0.75	60	200	8	119
N2-215-M	BRN2-202	1.5	150	100	10	119
N2-222-M	BRN2-203	2.2	200	70	9	116
N2-237-M3	BRN2-205	3.7	300	40	8	119
N2-255-M3	BRN2-208	5.5	500	25	8	125
N2-275-M3	BRN2-210	7.5	600	20	8	119
N2-404-M3	BRN2-401	0.75	60	750	8	125
N2-407-M3	BRN2-401	0.75	60	750	8	125
N2-415-M3	BRN2-401	1.5	150	400	10	119
N2-422-M3	BRN2-403	2.2	200	250	8	128
N2-437-M3	BRN2-405	3.7	300	150	8	127
N2-455-M3	BRN2-408	5.5	500	100	8	125
N2-475-M3	BRN2-410	7.5	600	80	8	119

*1   Braking start voltage for 385/770Vdc for N2- 200/400V series.
*2   Braking resistor interconnection.
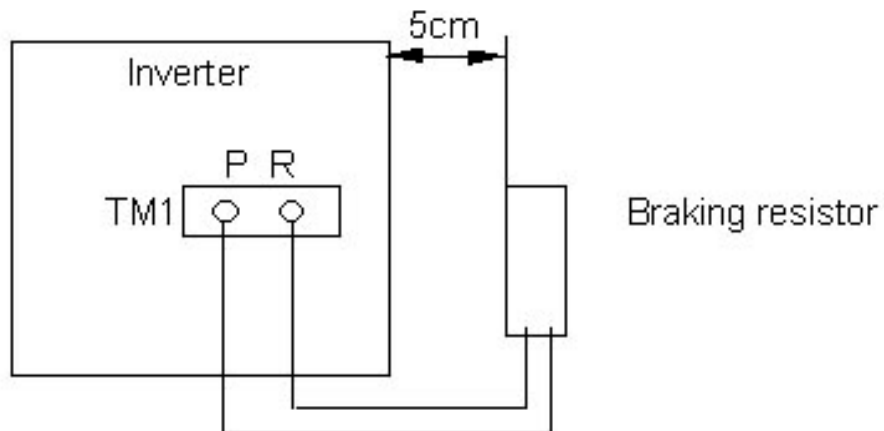
Braking Resistor Dimensions (mm)
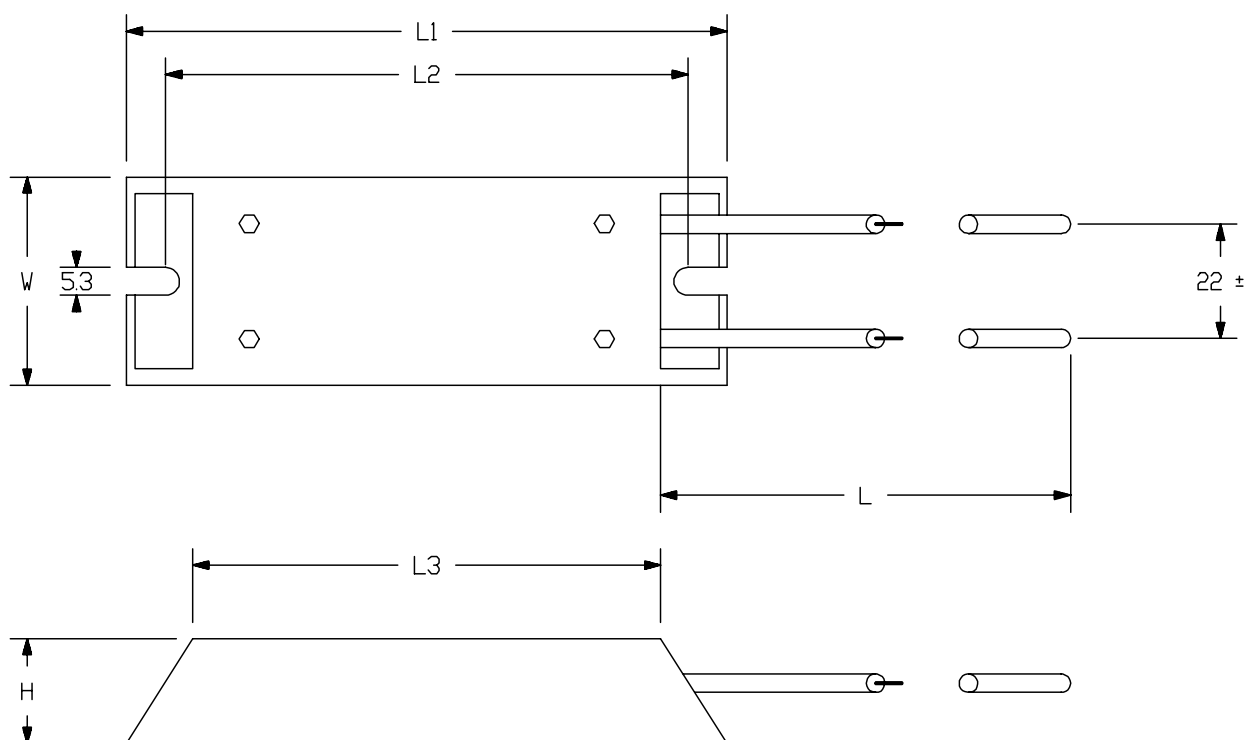
Type	Dimensions					
	L1±2	L2±2	L3±2	W±1	H±1	L+10 L-5
BRN2-201 BRN2-401	115	100	80	40	20	400
BRN2-202 BRN2-402	215	200	175	40	20	400
BRN2-203 BRN2-403	165	150	125	60	30	400
BRN2-405 BRN2-205	215	200	175	60	30	400
BRN2-208 BRN2-210 BRN2-408 BRN2-410	335	320	295	60	30	400

Drivecon Corporation

<u>D61536 120VAC 'DIRECT COMMAND' INPUT ISOLATOR</u>
<u>(D61537 24VAC 'DIRECT COMMAND' INPUT ISOLATOR)</u>
For use with VFN2

<u>FUNCTION</u>

The D61536 120VAC (D61537 24VAC) input isolator is designed to mount directly on the control terminal strip (TM2) of VFN2 model inverters. The function of the D61536 (D61537) is to allow direct connection to 120VAC (24VAC) control inputs while providing filtering and isolation to the VFN2. Each of 6 input lines are optically isolated from the corresponding logic level output. A S.P.S.T. relay is provided for output of either running mode, at constant speed, or up to speed. A convenient terminal strip (TB1) is provided for 120VAC (24VAC) input signal connections. Also included on the D61536 (D61537) are red LED indicators that will illuminate when the respective input terminal is activated [F, R, 2, 3, 4 and 5]. A green LED indicator will illuminate when the D61536 (D61537) programmable output relay is activated.

<u>MOUNTING</u>

Refer to diagram D61536-1 for description of mounting procedures. The D61536 (D61537) mounts directly to the VFN2's control terminal strip (TM2). The terminal strip connections provide support for the printed circuit board and 12 connection points: FWD, REV, COM, SP1, SP2, SP3, RST, SYN-, SYN+, 12, 13, & 14. A single flying wire lead connects to CON2 pin1 on the VFN2 main control board to provide +24vdc power to the D61536 Isolator board. This lead has a separable connector to facilitate removal if necessary.

<u>MOUNTING INSTRUCTIONS</u>

<u>DANGER!</u> **Hazardous voltage within can cause serious injury or death. Operating the drive from the keypad may disable safety circuits and result in danger or injury. Only qualified personnel should work on this equipment after familiarization with its operation. Turn OFF and lock out power at main panel. Allow internal capacitors to discharge prior to servicing.**

Insure all power sources are removed from the VFN2 and that the D.C. bus is discharged prior to handling the VFN2 inverter.

1. Remove the cover of the VFN2 inverter to expose the main printed circuit board terminal strip (TM2).

2. Connect all wires to lower power terminal strip (TM1) first since this terminal strip will not be   accessible once the D61536 (D61537) is installed. Keep wire length as short as possible to prevent interference with D61536 (D61537). Follow the VFN2 connection diagram for wiring connection.

3. The D61536 (D61537) has twelve [12] metal connection terminals that fit into terminal strip (TM2) of the VFN2 main control board. The left hand terminal of the D61536 (D61537) goes into terminal 3 of the VFN2 main control board. The twelve (12) pins of the D61536 (D61537) align with and go into terminals 3 through 14 on the VFN2 main control board terminal strip (TM2). Make sure that the corresponding terminals are aligned correctly.

4. Connect the red wires together with the male / female connector.

5. Wire 120VAC input signals to D61536 (D61537) terminal strip (TB1). Wire gauge is size 24AWG to 14AWG maximum. Only a single wire is permitted in each terminal for wires larger than 18AWG.

6. Replace cover.

CONNECTION

CAUTION: This solid state isolator will be damaged if the output (connection to drive terminals) are wired in parallel with any external circuits.

Two directions, multi-function 1, 2 & 3 and reset can be controlled directly from 120VAC (24VAC) control signals. The following chart defines the input to output relationship.

D61536 Input (D61537) Terminal TB1		Output Function
F	(1)	FORWARD command
R	(2)	REVERSE command
2	(3)	Multi-function 1
3	(4)	Multi-function 2
4	(5)	Multi-function 3
5	(6)	Reset
ACN	(7)	120VAC (24VAC) neutral
RLA	(8)	Output relay N.O.
RLC	(9)	Output relay common

The input terminal block (TB1) will accept 24AWG-14AWG wire maximum.

SPECIFICATIONS

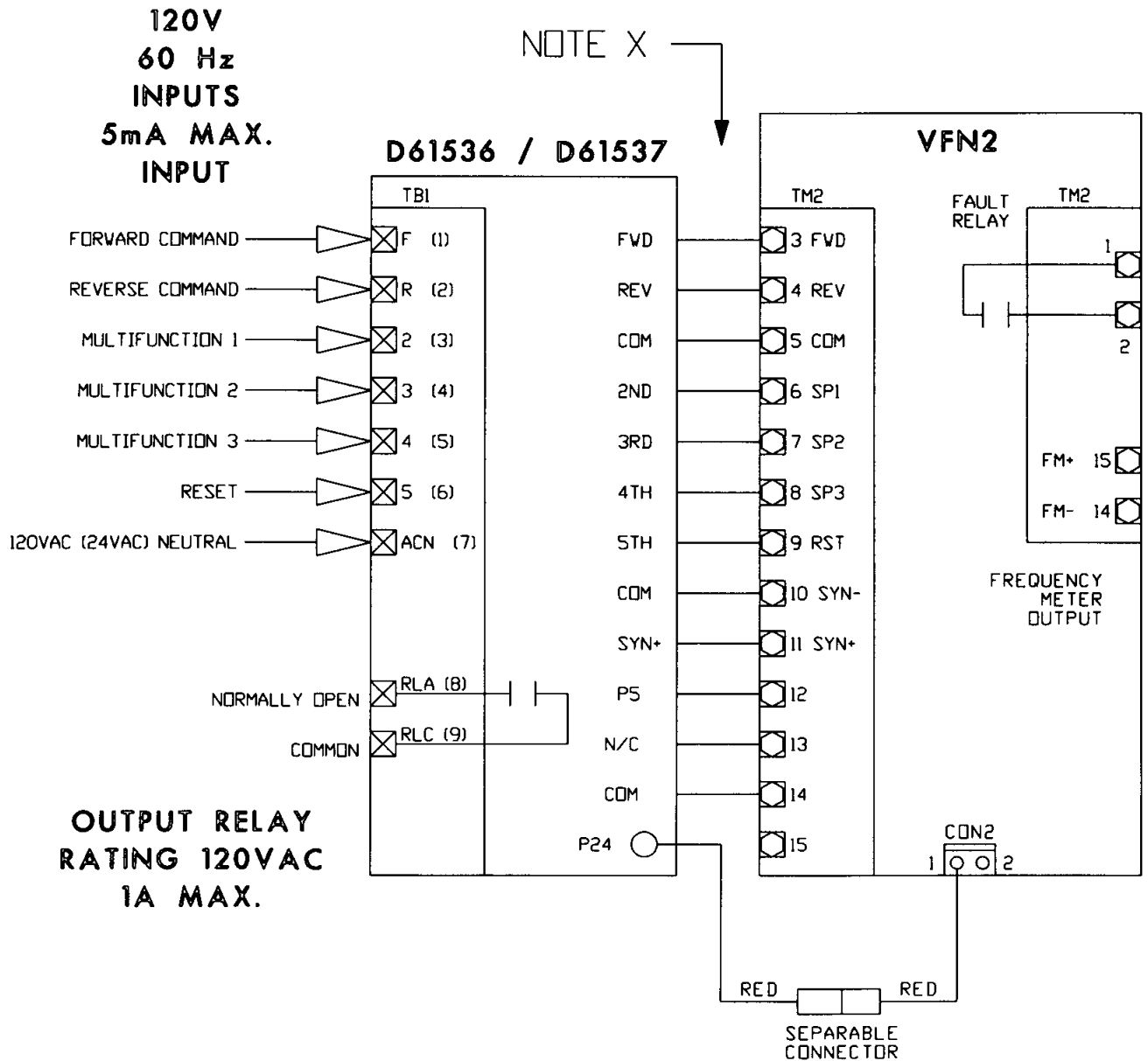|	
Input voltage	120VAC (24VAC) $\pm$ 10% max. variance
Input frequency	50/60Hz $\pm$ 2%
Input current	5mA max. per input
Relay type	S.P.S.T. form A
Relay rating	120V AC 1 amp maximum
	100V DC .2 amp maximum
Response time	On 15mS Off 40mS
Relay response time	On 10mS Off 10mS
Operating temperature	-20 to 50 deg. C

Should any problem exist or assistance is required contact:

Drivecon Corporation
820 Lakeside Drive
Gurnee, IL 60031
PH: (847) 855-9150
FAX: (847) 855-9650
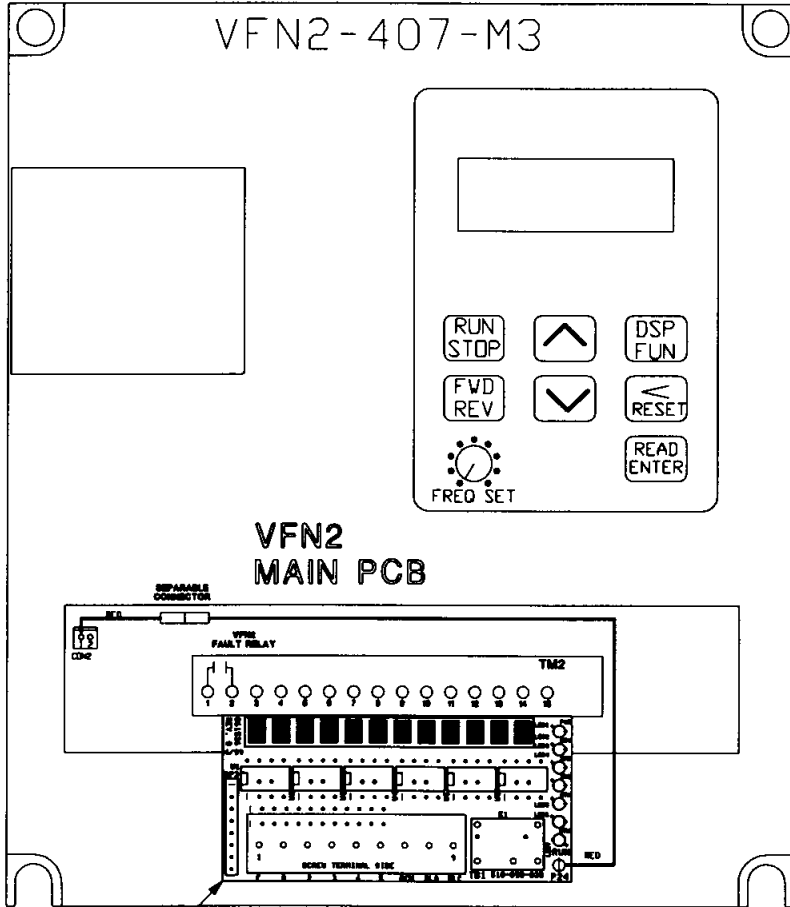
D61536 / D61537
'DIRECT COMMAND'
P.C.B. CONNECTIONS

120V
60 Hz
INPUTS
5mA MAX.
INPUT

NOTE X

D61536 / D61537

VFN2

TB1

FORWARD COMMAND — F (1)
REVERSE COMMAND — R (2)
MULTIFUNCTION 1 — 2 (3)
MULTIFUNCTION 2 — 3 (4)
MULTIFUNCTION 3 — 4 (5)
RESET — 5 (6)
120VAC (24VAC) NEUTRAL — ACN (7)

NORMALLY OPEN — RLA (8)
COMMON — RLC (9)

FVD
REV
COM
2ND
3RD
4TH
5TH
COM
SYN+
P5
N/C
COM
P24

TM2

3 FVD
4 REV
5 COM
6 SP1
7 SP2
8 SP3
9 RST
10 SYN-
11 SYN+
12
13
14
15

FAULT
RELAY

TM2

1
2

FM+ 15
FM- 14

FREQUENCY
METER
OUTPUT

CON2
1 2

RED   RED

SEPARABLE
CONNECTOR

**OUTPUT RELAY
RATING 120VAC
1A MAX.**

NOTE X: DO NOT MAKE ANY EXTERNAL CONNECTIONS
IN PARALLEL WITH ISOLATOR PCB'S OUTPUT

74

# D61536 / D61537 'DIRECT COMMAND' ISOLATOR MOUNTING DIAGRAM.

NOTE: VFN2-407 SHOWN. OTHER MODELS MAY DIFFER IN APPEARANCE.
SHOWN WITH COVER REMOVED.

VFN2-407-M3

RUN/STOP △ DSP/FUN

FWD/REV ▽ </RESET

FREQ SET READ/ENTER

VFN2 MAIN PCB

REMOVE D61536 / D61537 FROM MAIN PCB TERMINAL STRIP TM2 TO INSTALL MAIN POWER AND MOTOR WIRING AT TERMINAL TM1. DO NOT PRY THE D61536 / D61537 UP TO GAIN ACCESS TO TM1 TERMINALS.

METAL FINGER TERMINALS THAT FIT INTO VFN2 MAIN PCB TERMINALS 3 THROUGH 14.
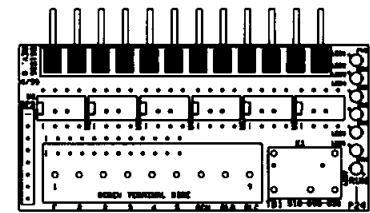
WIRING INPUT TO D61536 [D61537]

D61536
120V INPUT
ISOLATOR

D61537
24VAC INPUT
ISOLATOR

1.) REMOVE COVER OF VFN2 INVERTER TO EXPOSE MAIN PCB.

2.) CONNECT POWER WIRES TO TM1 OF VFN2.

3.) PLACE D61536 (D61537) IN CORRESPONDING TERMINALS OF TM2 AND TIGHTEN TERMINAL SCREWS

4.) CONNECT 120V INPUT WIRES TO TB1 OF D61536

5.) REPLACE COVER.

D61536 120VAC D61537 24VAC INPUT TERMINAL (TB1)		FUNCTION	VFN2 FUNCTION CODES
F	(1)	120V (24V) IN- FWD	Fn03
R	(2)	120V (24V) IN- REV	Fn03
2	(3)	120V (24V) MULTIFUNCTION #1	Fn56
3	(4)	120V (24V) MULTIFUNCTION #2	Fn57
4	(5)	120V (24V) MULTIFUNCTION #3	Fn58
5	(6)	120V (24V) RESET	-
ACN	(7)	120V (24V) NEUTRAL INPUT	
RLA	(8)	120V (24V) RELAY N.O.	Fn61
RLC	(9)	RELAY COMMON	Fn61

PARAMETERS TABLE

CUSTOMER				MODEL #			
APPLICATION				TELEPHONE #			
ADDRESS							

Fn_#	VALUE	Fn_#	VALUE	Fn_#	VALUE	Fn_#	VALUE
Fn_00		Fn_32		Fn_64		Fn_96	
Fn_01		Fn_33		Fn_65		Fn_97	
Fn_02		Fn_34		Fn_66		Fn_98	
Fn_03		Fn_35		Fn_67		Fn_99	
Fn_04		Fn_36		Fn_68		Fn_100	
Fn_05		Fn_37		Fn_69		Fn_101	—
Fn_06		Fn_38		Fn_70		Fn_102	
Fn_07		Fn_39		Fn_71		Fn_103	
Fn_08		Fn_40		Fn_72		Fn_104	
Fn_19		Fn_41		Fn_73		Fn_105	
Fn_10		Fn_42		Fn_74		Fn_106	
Fn_11		Fn_43		Fn_75		Fn_107	
Fn_12		Fn_44		Fn_76		Fn_108	
Fn_13		Fn_45		Fn_77		Fn_109	
Fn_14		Fn_46		Fn_78		Fn_110	
Fn_15		Fn_47		Fn_79		Fn_111	
Fn_16		Fn_48		Fn_80		Fn_112	
Fn_17		Fn_49		Fn_81		Fn_113	
Fn_18		Fn_50		Fn_82		Fn_114	
Fn_19		Fn_51		Fn_83		Fn_115	
Fn_20		Fn_52		Fn_84		Fn_116	
Fn_21		Fn_53		Fn_85		Fn_117	
Fn_22		Fn_54		Fn_86		Fn_118	
Fn_23		Fn_55		Fn_87		Fn_119	
Fn_24		Fn_56		Fn_88		Fn_120	
Fn_25		Fn_57		Fn_89		Fn_121	
Fn_26		Fn_58		Fn_90		Fn_122	
Fn_27		Fn_59		Fn_91		Fn_123	
Fn_28		Fn_60		Fn_92		Fn_124	
Fn_29		Fn_61		Fn_93		Fn_125	1.
Fn_30		Fn_62		Fn_94		Fn_125	2.
Fn_31		Fn_63		Fn_95		Fn_125	3.

Drivecon

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