EV INVERTER SERIES

Operating Manual

110V	**1Ø**	**0.2 - 1HP**
		0.2 – 0.75kW
230V	**1Ø /3Ø**	**0.2 - 3HP**
		0.2 – 2.2kW
460V	**3Ø**	**1 - 3HP**
		0.75 – 2.2kW

TECO Westinghouse

Revision: 1.04.00

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Introduction

The **EV Inverter** series is state of the art design using the latest control and power technologies. It is designed to operate and control 3Ø induction motors in the range of 0.25 to 3hp and voltage class of 230 or 460VAC. The inverter can operate either in *V/ f* or *open loop vector mode* settable via programming. There are two sets of parameters, **F** Basic, and **C** Advanced, allowing for flexible control in many different applications. The membrane keypad in combination with a 3 digit 7 segment display allow for ease of programming and monitoring.

An optional communications module can be used for control and parameter setting using the MODBUS RTU protocol. The **EV** has been designed with easy access to the input power, output motor, and control terminals.

Before proceeding with the set-up and installation please take time to review this manual to ensure proper operation and above all else, personnel safety.

SAFETY FIRST!

Section 1 - *Safety Precautions*

1.1 Preface

To ensure your safety and to avoid damage to the equipment, please read this manual thoroughly before making any connections. Should there be any questions or problems in using the product that cannot be resolved with the information provided in this manual, contact your nearest representative for further guidance.

The inverter is an electrical product and as such, lethal voltages are present at various points. For your safety, there are symbols as shown below that appear in this manual to remind you to pay attention to safety instructions on handling, installing, and operating the inverter. Please follow the instructions to insure the highest level of safety.

DANGER ***Indicates a potential hazard that could cause death or serious personal Injury.***

CAUTION ***Indicates that the inverter or the mechanical system might be damaged.***

Danger

- ***After the power has been turned OFF, wait <u>at least 5 minutes</u> until the charge indicator extinguishes completely before touching any wiring, circuit boards, or components.***

1.2 Receiving and Inspection

Caution

All inverters have been tested for functionality prior to shipment. Please check the following when you receive and unpack the inverter:

- Check the nameplate to insure the model and capacity of the inverter are the same as those specified in your purchase order.
- Check for any damages as the result of transportation. If there is damage, ***do not*** apply power, and immediately contact your representative.

1.3 Installation and Pre-operation

Caution

- The inverter should be installed in a dry and dust-free area.
- The inverter should be installed on a nonflammable surface such as metal.
- The inverter may be operated up to an altitude of 1000m. Above 1000m it must be de-rated. *(Please consult factory)*
- If several inverters are to be placed in the same enclosure, additional cooling may be needed to keep the surrounding temperature below 50°C to avoid overheating or possible fire.
- ***Do not*** connect T1, T2, and T3 terminals of the inverter to the AC power supply.
- CMOS ICs on the inverter's main board are susceptible to static electricity. ***Do not*** touch the main circuit board without proper precautions.
- ***Do not*** perform dielectric tests on parts inside the inverter as the high voltage will easily destroy semiconductor parts.
- Wiring size and insulation type, as well as placement of the inverter, should conform to applicable codes for a particular installation.
- Control wiring should be kept separate from power wiring and cabling. In some applications it may be necessary to use shielded cable for the control wiring and / or the power cabling to avoid performance issues.

Danger

- ***Do not*** modify any internal wiring, circuits, or parts. Connect the ground terminal of the inverter properly. For 200V class Rg =< 100Ω, 400V class Rg =< 10Ω.

1.4 During Power ON

Caution

The display will flash the input voltage for about 2 seconds when power is applied.

Danger

- To avoid damage to the control circuitry resulting from transient voltages, ***do not*** plug or un-plug any connectors or connect or disconnect any wiring to or from the inverter when power is present.
- ***Do not*** change out parts and or check signals on circuit boards during the inverter operation.
- When power interruption to the inverter is momentary, the inverter has sufficient power storage to ride through and continue operation. However, when power loss interruption is longer than 2 seconds (the larger the horsepower, the longer the time); the inverter does not have enough stored power to maintain control. Therefore, when power is restored, the inverter restart is controlled as follows:
  1 - ***Will not*** automatically run after restart if Run Command Source parameter F04=000 keypad *(Factory Default*).
  2 - ***Will not*** automatically run after restart if Run Command Source parameter F04=001 external terminal (switch) is ***off***.
  3 - ***Will*** automatically ***run*** after restart if Run Command Source parameter F04=001 external terminal (switch) is ***on*** and parameters F41=000. (Auto Restart after power loss)
- When removing or installing the keypad operator, turn ***OFF*** power first, and follow the instruction diagram to avoid improper operation.

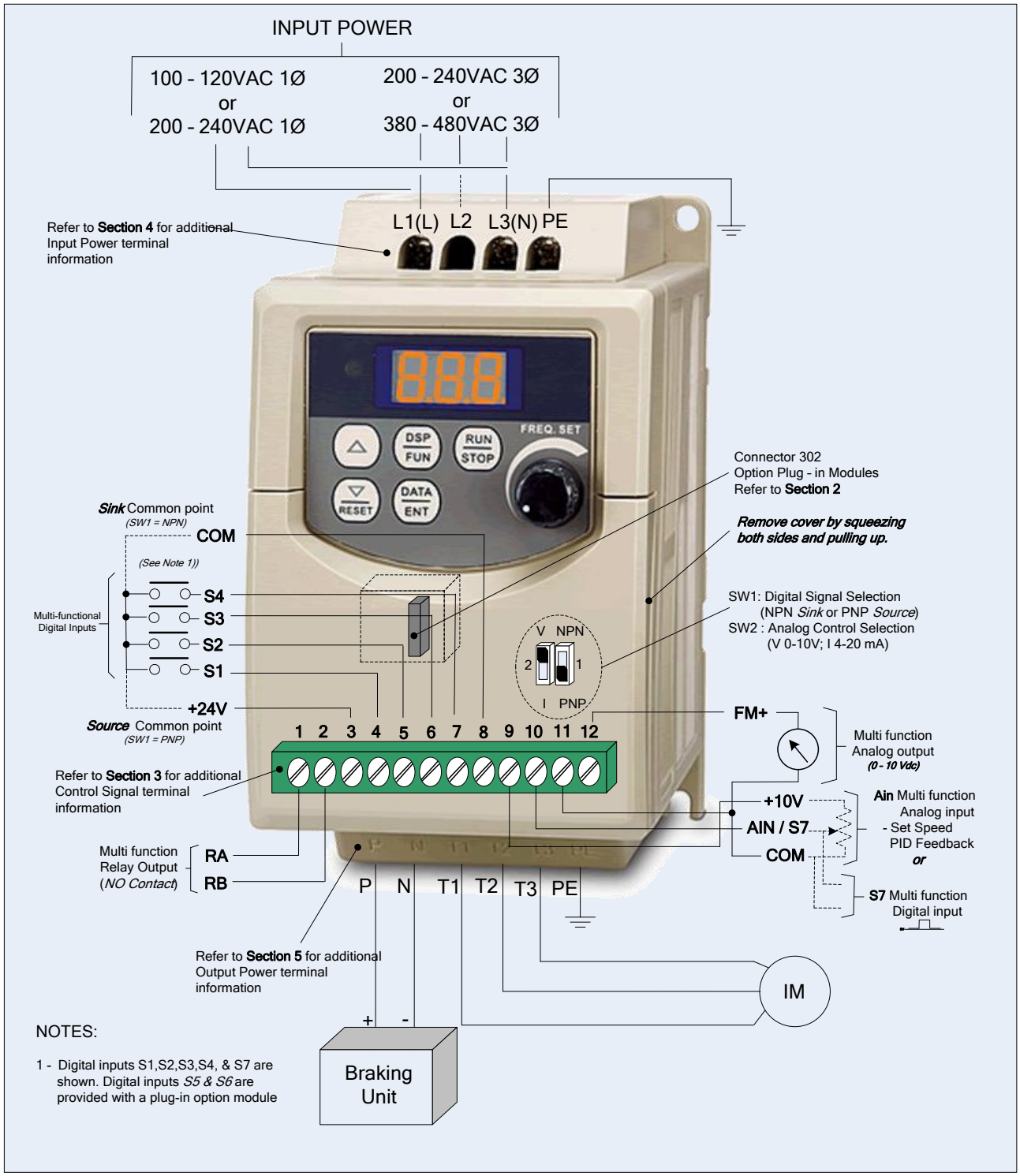


Fig. 1 EV Inverter Pictorial Wiring Diagram

Section 2 - *Option Modules*

The following Option Modules are available for the **EV** Inverter series. They are easily installed and are inserted into connector CON 302 by removing the front cover.

Caution - ***When installing option modules, make sure that power has been removed from the inverter and that the charge indicator is extinguished before proceeding.***

The front cover is removed by using finger pressure to push in on the sides of the cover and lifting up. After the option module has been installed, replace the cover before powering-up the inverter. *Do not operate the inverter with the cover removed.*

Option Part Number		Description	FIG. No.
SIF - 485		RS485 Interface	2.2
SIF - 232		RS232 Interface	2.3
SIF - MP		Copy Module	2.4
SDOP – LED – 2M		Remote Keypad	2.5
SIF – IO		I/O Expansion	2.6
PDA Link	SIF - 232	RS232 Interface	2.7
	JNSWPDA	PDA Cable Interface	

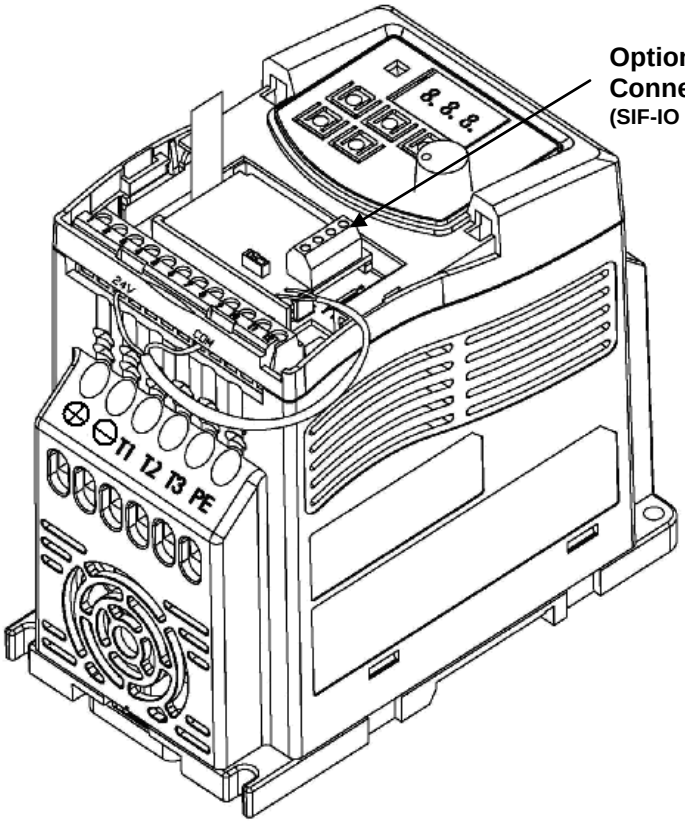
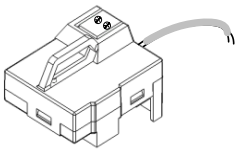


Fig. 2.1 Option Card Installation and Wiring

NOTE: Use isolated RS232 / RS485 converter connections between PC and option card to avoid equipment damage.



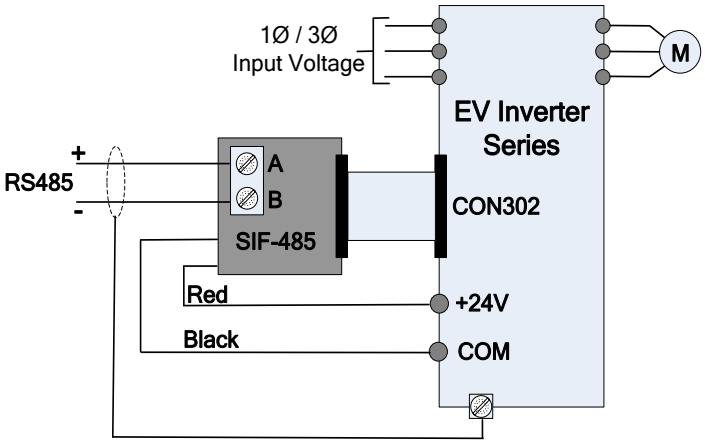
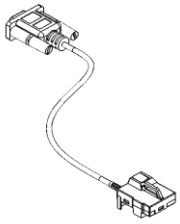


Fig. 2.2 RS485 Interface P/N SIF-485

NOTE: Use isolated RS232 / RS485 converter connections between PC and option card to avoid equipment damage.



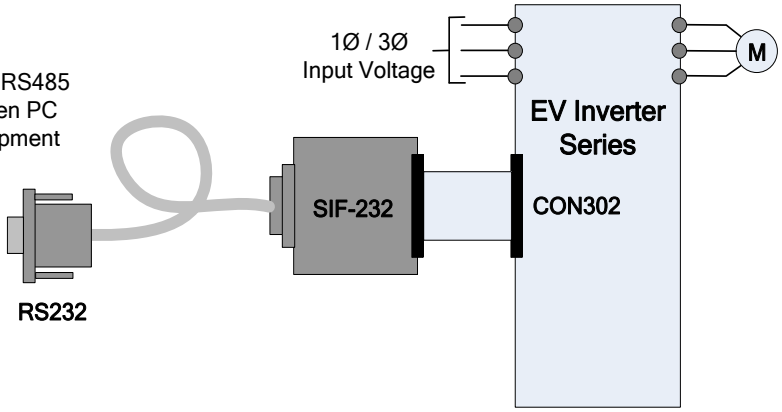
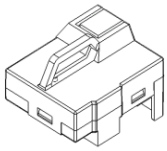


Fig. 2.3 RS232 Interface P/N SIF-232



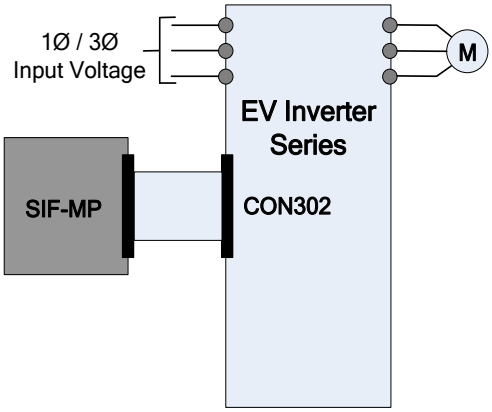


Fig. 2.4 Copy Module P/N SIF-MP

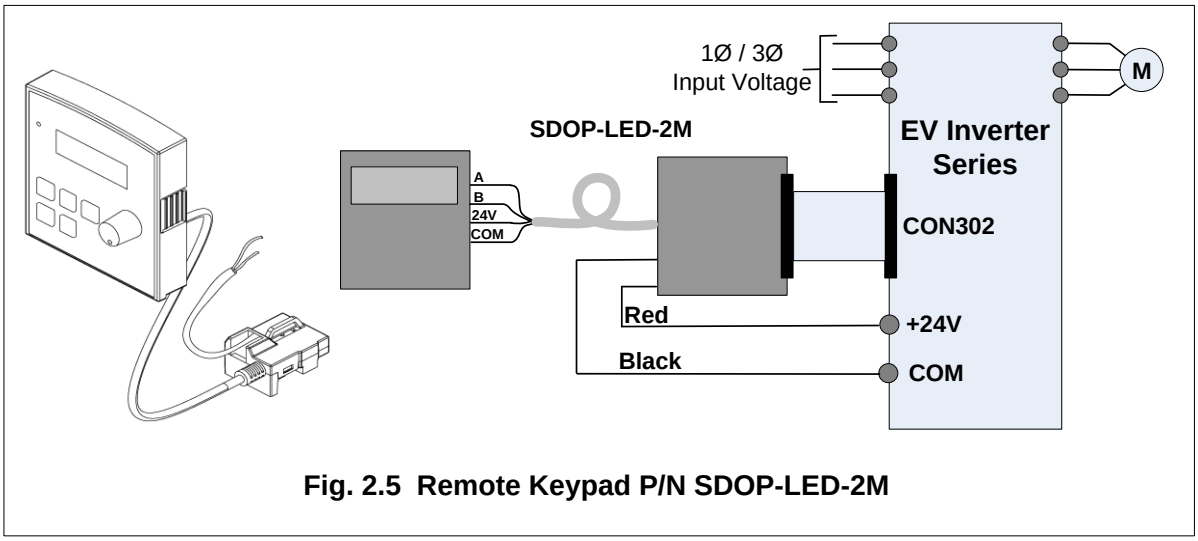


Fig. 2.5 Remote Keypad P/N SDOP-LED-2M

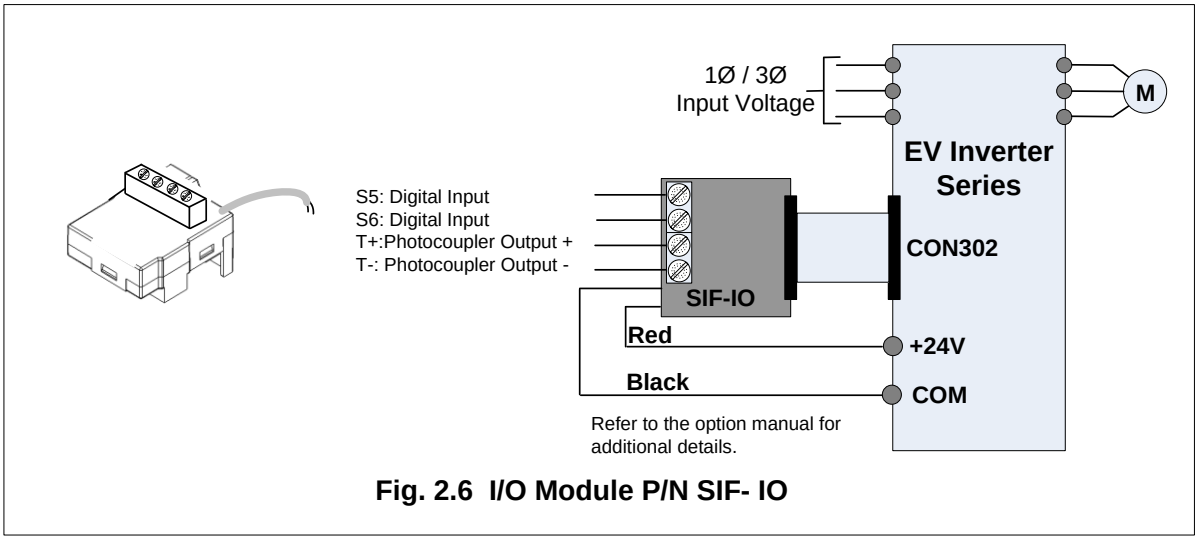


Fig. 2.6 I/O Module P/N SIF- IO

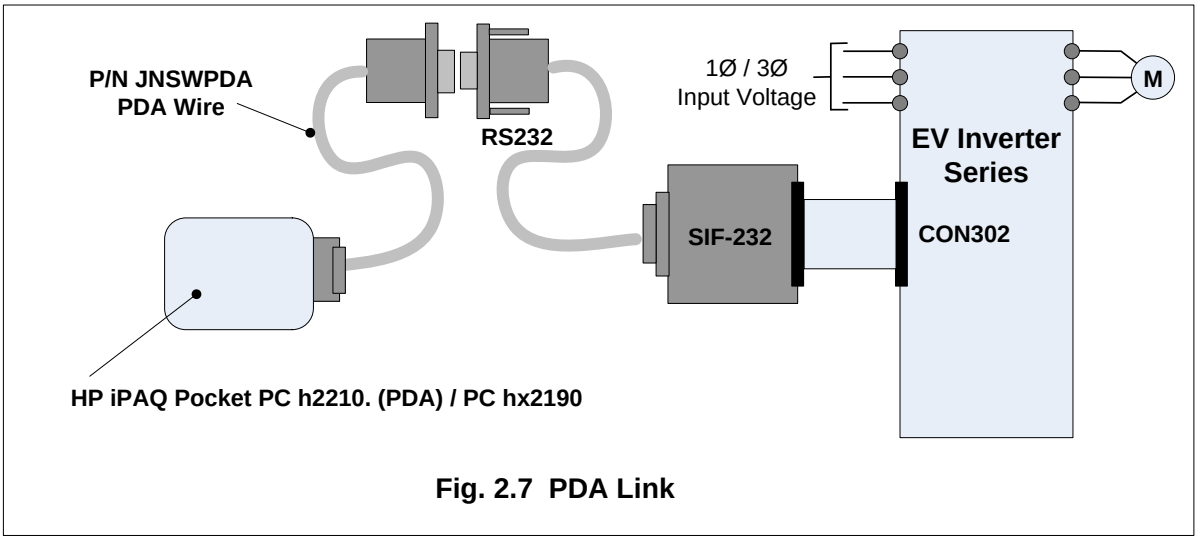


Fig. 2.7 PDA Link

Section 3 - *Control Signal Terminal Block Description*

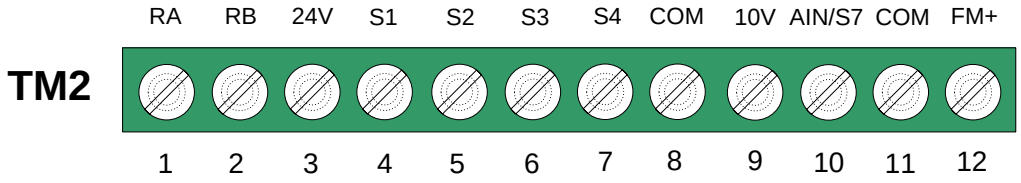


Fig. 3.1 Control Terminals Designations

Terminal No.	Terminal Designation	Description
1	**RA**	**Multi – function digital output** NO contact rated 250V @ 10A Refer to parameter ***F21 (000 – 015)*** for selecting output functions
2	**RB**	
3	**24V**	**24VDC @ 20mA Max.** - Provides the common point for the multi – function digital inputs ***S1 – S4*** when ***SW1*** is set to PNP (***Source Mode***). - Provides ***input power*** for the various option cards when required.
4	**S1**	**Multi – function digital input terminals** Refer to parameters ***F11 – F14 (000 – 016 ,019)*** for selecting input functions
5	**S2**	
6	**S3**	
7	**S4**	
8	**COM**	**Output common** - Provides a common for both the ***10V (terminal 9)*** and ***24V (terminal 3)*** sources - Provides the common point for the multi – function digital inputs ***S1 – S4*** when ***SW1*** is set to ***NPN*** (***Sink Mode***). - Provides a common for various option cards
9	**10V**	**10VDC @ 20mA Max**. - Reference voltage supply for an external speed control potentiometer.
10	**AIN / S7**	**Analog or digital** - ***AIN*** Analog***:*** When terminal **10** is used as an analog input refer to parameters ***F15 (017 & 018), F16 (000-001), F17, F18, F19 (000-001) and F20 (000-001).*** - ***S7*** Digital***:*** When terminal **10** is used as a digital input, parameters described for multi – function digital input terminals **S1 – S4** apply. ***NOTE*** : Logic level high; ***=> +8V**** logic level low level; ***=< 2V*** ***Caution! Do not exceed 10V maximum.**
11	**COM**	**Output common** - Same as terminal **8**
12	**FM+**	**Multi – function analog output** ***0 – +10VDC***, Refer to parameter ***F26 (000-005)*** for output functions.

Section 4 - *Input Power Terminal Block Description*

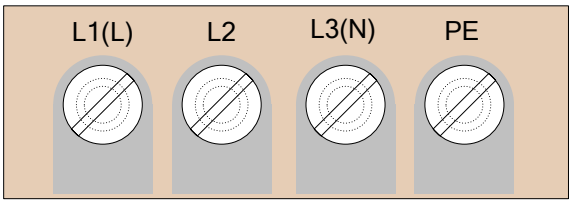


Fig. 4.1 Power Input Terminal Designations

Terminal Designation	Description
L1(L)	**Main power input :** (Single Phase) (L) – (N) *(100 – 120VAC ***or*** 200 – 240VAC) (Three Phase) L1 – L2 – L3 *(200 – 240VAC ***or*** 380 – 480VAC)
L2	
L3(N)	
PE	Earth Ground

Caution - ***Refer to the inverter nameplate for input voltage specifications***

Section 5 - *Output Power (Motor and Brake) Terminal Block Description*

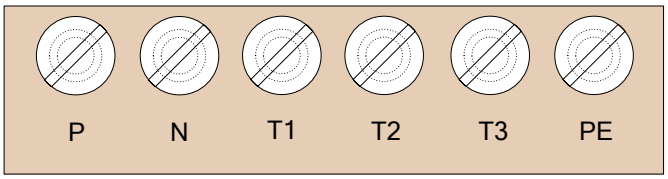


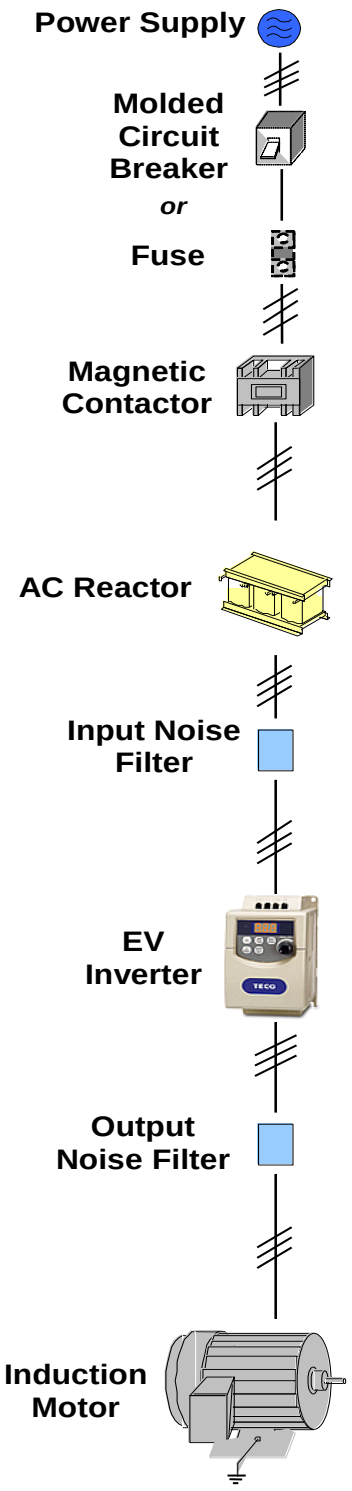
Fig. 5.1 Power Output Terminal Designations

Terminal Designation	Description
P	**DC Power and braking unit**
N	
T1	**Inverter power output (*Motor connections*)** *3Ø (Three Phase) 0 – 200Hz Max.
T2	
T3	
PE	Earth ground

Caution - ***Refer to the inverter nameplate for output voltage specifications***

Section 6 - *Peripheral Power Devices*

The following describes some of the precautions that should be followed when selecting peripheral power devices.



Power supply:

- ⚠ Make sure the correct voltage is applied to avoid damaging the inverter.

Molded-case circuit breaker (MCCB) or fused disconnect

- A molded-case circuit breaker or fused disconnect must be installed between the AC source and the inverter that conforms to the rated voltage and current of the inverter to control the power and protect the inverter. (See section 7 for fuse ratings)
- ⚠ Do not use the circuit breaker as the run/stop switch for the inverter.
- A suitable fuse should be installed with inverter rated voltage and current when a MCCB is not being used. (Please refer to Sec.7 for recommended current ratings)

Ground fault detector / breaker:

- ⚠ Install a ground fault breaker to prevent problems caused by current leakage and to protect personnel. Select current range up to 200mA, and action time up to 0.1 second to prevent high frequency failure.

Magnetic contactor:

- Normal operations do not need a magnetic contactor. When performing functions such as external control and auto restart after power failure, or when using a brake controller, install a magnetic contactor.
- ⚠ Do not use the magnetic contactor as the run/stop switch for the inverter.

AC line reactor for power quality:

- When inverters are supplied by a high capacity (above 600KVA) power source, an AC reactor can be connected to improve the power factor.

Input and output noise filter:

- A filter must be installed when there are inductive loads affecting the inverter.

Inverter:

- Output terminals T1, T2, and T3 are connected to U, V, and W terminals of the motor. If the motor runs in reverse while the inverter is set to run forward, swap any two terminals connections for T1, T2, and T3.
- ⚠ To avoid damaging the inverter, do not connect the input terminals T1, T2, and T3 to AC input power.
- ⚠ Connect the ground terminal properly.(230V series: Rg <100Ω; 460V series: Rg <10Ω.)

Section 7 - *Fuse Types and Ratings*

Inverter input fuses are provided for safely disconnecting the inverter from the input power in the event of a failure in the inverter's power circuitry. The inverter's electronic protection circuitry is designed to clear inverter output short circuits and ground faults without blowing the inverter input fuses. The table below shows the EV input fuse ratings; To protect the inverter most effectively, use fuses with current-limiting capabilities.

RK5 and CC/T type fuse ratings for the EV AC Drive series

115V class (1Ø)

JNEV-	HP	KW	KVA	100% CONT Output AMPS	Max.RK5 FUSE Rating(A)	Max.CC or T FUSE Rating(A)
1P2-H1	0.25	0.2	0.53	1.7	10	20
1P5-H1	0.5	0.4	0.88	3.1	15	30
101-H1	1	0.75	1.6	4.2	20	40

230V class (1Ø)

JNEV-	HP	KW	KVA	100% CONT Output AMPS	Max.RK5 FUSE Rating(A)	Max.CC or T FUSE Rating(A)
2P2-H1	0.25	0.2	0.53	1.7	8	15
2P5-H1	0.5	0.4	0.88	3.1	10	20
201-H1	1	0.75	1.6	4.2	15	30
202-H1	2	1.5	2.9	7.5	20	40
203-H1	3	2.2	4.0	10.5	25	50

230V class (3Ø)

JNEV-	HP	KW	KVA	100% CONT Output AMPS (A)	Max.RK5 FUSE Rating(A)	Max.CC or T FUSE Rating(A)
2P2-H3	0.25	0.2	0.53	1.7	5	8
2P5-H3	0.5	0.4	0.88	3.1	8	10
201-H3	1	0.75	1.6	4.2	12	15
202-H3	2	1.5	2.9	7.5	15	20
203-H3	3	2.2	4.0	10.5	20	30

460V class (3Ø)

JNEV-	HP	KW	KVA	100% CONT Output AMPS (A)	Max.RK5 FUSE Rating(A)	Max.CC or T FUSE Rating(A)
401-H3	1	0.75	1.7	2.3	6	10
402-H3	2	1.5	2.9	3.8	10	15
403-H3	3	2.2	4.0	5.2	10	20

Note: Fuse ratings are based upon 300V fuses for 120V inverters, 300V fuses for 230V inverters, and 500V for 460V inverters.

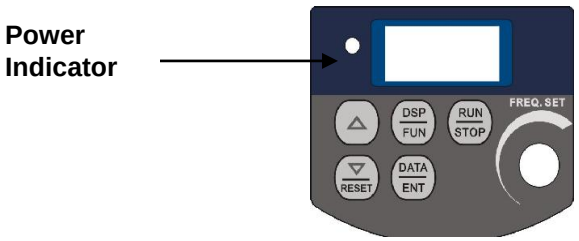
Section 8 - *Quick Start Guide*

This guide is a step by step procedure to assist in installing and operating the inverter with a motor to verify that they work properly. Starting, stopping, and motor speed will be initially controlled from the keypad. After the initial check has been completed, the inverter may then be configured for a particular application that may require external control or special systems programming.

Step 1: Before starting the inverter

Safety First! **Please refer to Section 1 *Safety precautions*, before proceeding.**

- Check inverter and motor nameplate to determine that they have the same HP and voltage ratings. (*Ensure that full load amps of the motor does not exceed that of the inverter*.)
- With power *OFF*, wire and verify that AC power is connected to L1(L), L2, and L3(N).
  CAUTION - *For single phase power, apply only to terminals L1(L) and L3(N)*
- Wire and verify that the motor leads are connected to T1, T2, and T3.
- When using a braking module, connect the terminal voltage of the braking unit to (P+ and N–) terminals on the inverter.



Step 2: Apply power to the inverter

Apply the appropriate AC power to the inverter and observe the keypad display. The 3 digit 7-segment display should show the input power voltage for 3- 5 seconds and then show the frequency command value of 05.0 (factory default). At this point the display will be blinking. The Power *ON* Indicator LED should also be *ON.*

Step 3: Check motor rotations *without* load

- On the keypad, press the *RUN* key. The display will be on steady and indicate 00.0 to 05.0, which is the value of the inverter output frequency applied to the motor.
- Verify the operation and direction of the motor. If the direction of the motor is incorrect, press the *STOP* Key, and turn *OFF* the AC power. Before proceeding any further verify that the Power Indicator LED on the inverter keypad is ***COMPLETELY OFF*****.**
- Swap the leads connected to the inverter T1 and T2 terminals. Go to Steps 2 and 3 and recheck the motor direction.
- Press the *STOP* key.

Step 4: Check motor full speeds at 50Hz/60Hz

- On the keypad, change the inverter output frequency with the ⋏,⋎ arrows, and then press the *DATA/ENT* key to store the new value. In this case set it to 60Hz.
- Press the *RUN /STOP* key, and observe the motor operation as it accelerates to full speed.
- Press the *RUN/STOP* key, and observe the motor operation as it decelerates to 0 speed.

After satisfying the above, you can proceed with setting the application specific parameters and permanent installation.

Section 9 - *Keypad Key Functions and Navigation*

The EV keypad, Fig. 9.1, provides all the necessary functions to allow full control of the EV inverter. The keypad has membrane type keys and a 7-segment 3-digit LED display. Also located on the keypad is a potentiometer that can be used to control inverter output frequency when selected as the control source. There is also an LED indicator which serves to show both power on as well as a DC bus charge indicator when power is removed. A ***remote*** keypad is available as an ***option***, and is covered more in detail in the **Option Modules (**See section 2).

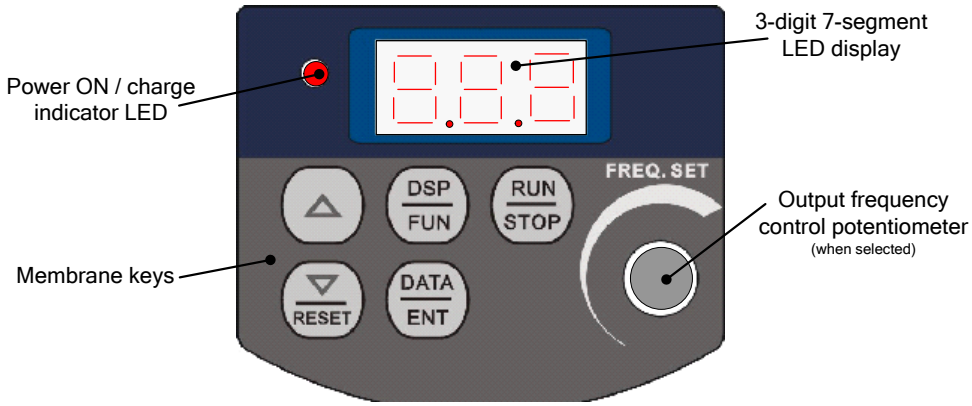
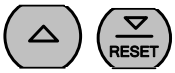


Fig. 9.1 EV Keypad

9.1 Key Functions

The keys are multifunctional, providing for both control of the inverter ***when keypad mode is selected (Default)*** and access in setting various parameters. The key functions are as follows.



UP / DOWN(Reset)

- Sets the inverter output frequency in increments of ***0.1Hz*** when using the keypad mode.
- Scrolls through the **F** and **C** parameters.
- **Reset:** Resets the inverter after a ***Fault*** has been cleared.

RUN / STOP

- Controls the output of the inverter when selected in the keypad mode. It is an ***on / off*** toggle function.

DISPLAY / FUNCTION

- Toggles the display between the inverter output selected values (Hz etc.) and the **F** and **C** parameter list.

DATA / ENTER

- In conjunction with the ***DSP / FUN*** key allows selection of the ***function*** or ***value*** of the various parameters with the ***UP / DOWN*** keys and to ***save*** updated parameter settings.
- Used in conjunction with the **DOWN / RESET** key to toggle between ***Local*** and ***Remote*** operation.

9.2 Keypad Navigation

When attempting to control and set various parameters for the inverter it would be useful for the user to become familiar with keypad navigation and to go through a few function changes before making the final settings.

9.2.1 Basic Keypad Control (*Factory Default*, *F04=000 & F05=000*) **Fig. 9.2.1**

In its basic form as received from the factory, the inverter output is controlled from the keypad. Please refer to the **F** and **C** parameter list (Sec. 10) to view the factory default settings for the various parameters. When the inverter is powered up, the display will be flashing and momentarily show the inverter ***input voltage***. The display will then switch to a minimum output frequency of ***05.0Hz***. By pressing the **RUN / STOP** key the output is active (**RUN**) and the display is on solid. Using the **UP / DOWN** keys, the output frequency may be set in increments of ***00.1Hz*** from ***00.0 to 50.0/60.0Hz***. This can be done when the inverter is in the **RUN** or **STOP** mode. When the
RUN / STOP key is toggled to **STOP**, the set frequency is displayed and the display is again flashing. The **Down** key also functions to initiate a **RESET** ***after a Fault is cleared***.

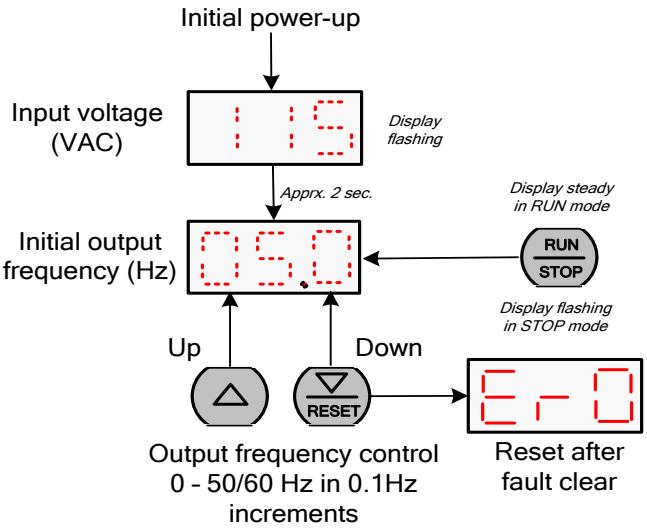


Fig. 9.2.1 Basic Keypad Control

9.3 Local / Remote Function

In **Local** mode:

- The RUN command is controlled by the RUN / STOP key.
- Frequency command
  -If C41= 000: The UP / DOWN keys control the output frequency.
  -If C41= 001: The front panel potentiometer controls the output frequency.

In **Remote** mode:

- The RUN command is controlled via the function set by (***F04***)
- The frequency command is set by the function set by (***F05***)

To toggle between **Local / Remote** press the DATA ENT and RESET keys ***simultaneously***.

9.4 Setting Parameters F(Basic) and C(Advanced) Fig. 9.4.1

The basic parameters **F** can be accessed in two ways; via the keypad or through the MODBUS protocol using an ***optional*** communications module. Here we will describe keypad access. Before proceeding, refer to the **F** and **C** parameter lists (**Sec. 10**) and note that some parameters must be changed with the inverter in the **STOP** mode while others can be changed in either the **RUN or STOP** mode. Also, changing certain parameters may affect other functions and should be carefully considered before making those changes.

To enter the **F** parameters, press the **DSP / FUN** key; the display should show ***F00***. Using the **Λ / V** keys, select the parameter to set and then press the **DATA / ENT** key. The display should be showing the existing ***code*** or ***function*** for that parameter. Using the **Λ / V** keys, select the desired ***code*** or ***function*** and then press the **DATA / ENT** key to save; the display should momentarily flash ***End*** and return to the **F** menu. To enter the **C** (advanced) parameters select **F51** and then Code = **001**; **C00** will be displayed. Using the same procedure in setting the **F** parameters scroll to the desired **C** parameter and select the **code** or **function** to be set and then press the **DATA / ENT** key to save. To return to the **F** parameter list press the **DSP / FUN** key **twice** and set **F51** to Code = **000.** After all parameter changes have been made, press the **DSP / FUN** key to return the display show the output frequency.

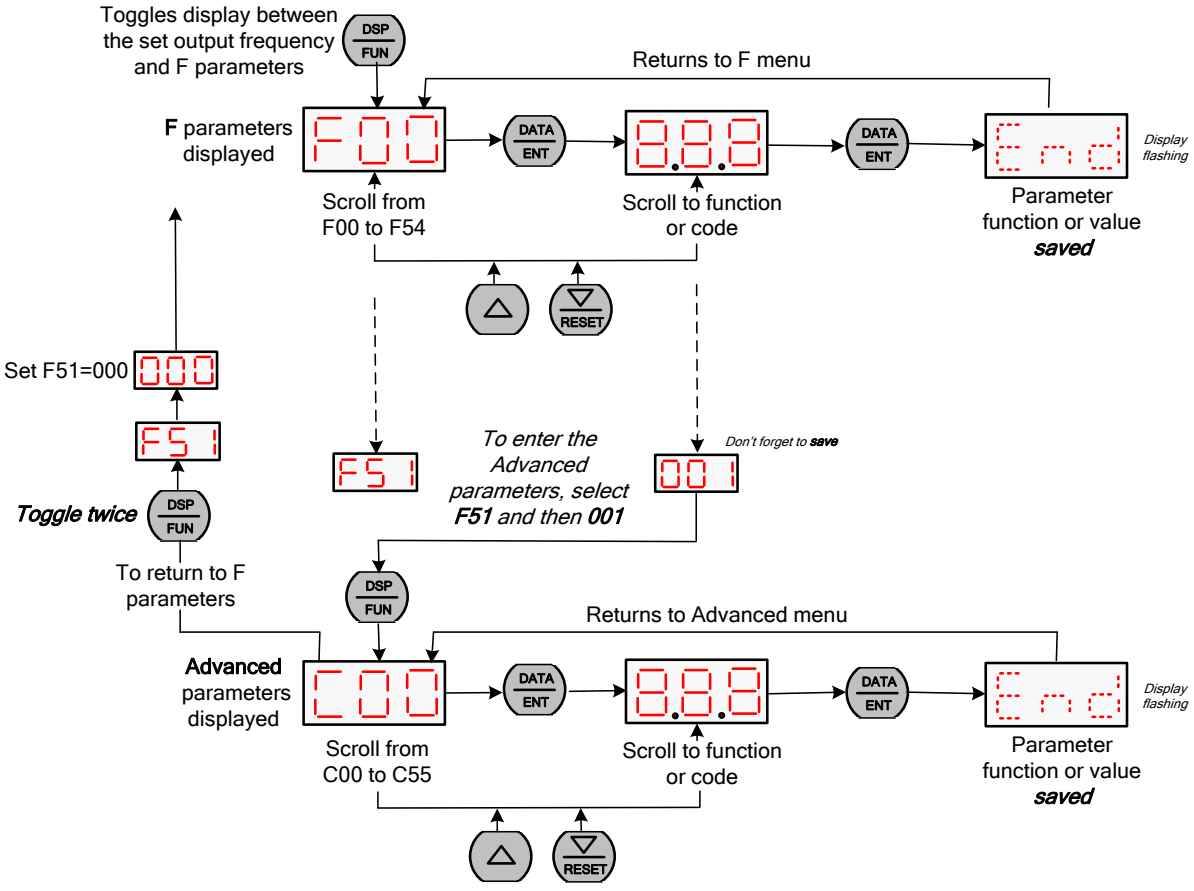


Fig. 9.4.1 Set F (Basic) and C (Advanced) Parameters

Section 10 - *Parameters F (Basic) and C (Advanced) Function Tables*

Overview – The **EV** Inverter Series is program capable to allow for a variety of application requirements. The parameters are split into two categories, **F** and **C.** The **F** parameters set the ***Basic*** functions of the inverter while the **C** parameters control the more ***Advanced*** functions.

The parameters can be accessed and changed through the keypad. (Refer to Sec.9 for keypad functions and navigation). They may also be accessed and changed though ***MODBUS*** protocol in conjunction with an optional communications module (Refer to **Sec. 2** for available communication options).

When the inverter is shipped from the factory each parameter is set at a **Factory Default** value and is so specified in the Tables. Most parameters ***may not*** be changed when the inverter is in the ***RUN*** mode. Those parameters that can be are so noted (note 1) in the **Remarks** column.

Table 10.1 F (Basic) Parameters

F	Parameter	Code	Range/ Function	Factory Default	Remarks
F00	Inverter horsepower capacity code	-			*Note 5*
F01	Acceleration time 1 (***sec.***)	-	00.1 – 999	05.0	*Note 1 & 2*
F02	Deceleration time 1 (***sec.***)	-	00.1 – 999	05.0	*Note 1 & 2*
F03	Motor rotation direction	000	Forward	000	*Note 1*
		001	Reverse		
F04	Run command source	000	Keypad	000	
		001	External terminal		
		002	Communication control		
F05	Frequency command source	000	UP/Down key on keypad	000	
		001	Potentiometer on keypad		
		002	AIN (input signal from TM2)		
		003	Multi-function input terminal UP/DOWN function		
		004	RS-485 Communication frequency setting		
F06	External control operation mode	000	Forward / Stop - Reverse / Stop	000	
		001	Run / Stop- Forward / Reverse		
		002	3-wire—Run / Stop		
F07	Frequency upper limit (***Hz***)	-	01.0 - 200	50.0 / 60.0	*Note 2 & 7*
F08	Frequency lower limit (***Hz***)	-	00.0 - 200	00.0	*Note 2*

F09	Stopping method	000	Decelerate to stop	000	
		001	Coast to stop		
F10	Status display parameters	000	Disable	000	*Note 1*
		001	Enable		
F11 F12 F13 F14 F15	Terminal S1 function Terminal S2 function Terminal S3 function Terminal S4 function AIN – ***Can be set as an analog input (017 Factory default or 018) or as a digital input and becomes S7*** ***Note:*** Digital inputs S1 – S4, *S5 and S6 and S7 can be programmed with Codes 000 – 016 and 019 only. Codes 017 and 018 are reserved for when AIN is used as an analog input *Digital Inputs ***S5 & S6*** are provided by an optional I/O Module SIF-IO. (see Sec., Fig. 2.6)	000	Forward	S1 = 000 S2 = 001 S3 = 005 S4 = 006 AIN = 017	
		001	Reverse		
		002	Preset speed command 1		
		003	Preset speed command 2		
		004	Preset speed command 3		
		005	Jog frequency command		
		006	Emergency stop (E.S.)		
		007	Base block (b.b.)		
		008	Select 2nd acceleration / deceleration time		
		009	Reset		
		010	Up command		
		011	Down command		
		012	Control signal switch		
		013	Communication control signal switch		
		014	Acceleration / deceleration prohibit		
		015	Master / Auxiliary speed source select		
		016	PID function disable		
		017	Analog signal input (terminal ***AIN***)		
		018	PID feedback signal (terminal ***AIN***)		
		019	DC Injection brake signal		
*F16	AIN signal select	000	0-10V (0-20mA)	000	
		001	2-10V(4-20mA)		
*F17	AIN gain (%)	-	000 – 200	100	*Note 1*
*F18	AIN bias (%)	-	000 – 100	000	
*F19	AIN bias	000	Positive	000	
		001	Negative		
*F20	AIN slope direction	000	Positive	000	
		001	Negative		

**** Parameters F16 – F20 are used when F15 is selected as an analog input 017 or 018***

F21	Multi-function output RY1	000	Run	000	
		001	Frequency reached (Set frequency ± ***F23***)		
		002	Frequency is within the range set by (***F22±F23***)		
		003	Frequency detection (***>F22***)		
		004	Frequency detection (***<F22***)		
		005	Fault terminal		
		006	Auto reset and restart		
		007	Momentary power loss		
		008	Emergency stop (E.S.)		
		009	Base block (b.b.)		
		010	Motor overload protection		
		011	Inverter overload protection		
		012	**Not used**		
		013	Power on		
		014	Communication error		
		015	Output current detection(***>F24***)		
F22	Preset output frequency target (***Hz***)	-	00.0 – 200	00.0	*Note 1*
F23	Target frequency detection range (±***Hz***)	-	00.0 - 30.0	00.0	*Note 1*
F24	Output current target value ***(%)***	-	000 – 100	000	
F25	Output current detection time(***sec.***)	-	00.0 – 25.5	00.0	
F26	Multi-function analog output type selection (***0 - 10VDC***)	000	Output frequency	000	*Note 1*
		001	Set frequency		
		002	Output voltage		
		003	DC voltage		
		004	Output current		
		005	PID feedback signal		
F27	Multi-function analog output gain (***%***)	-	000 – 200	100	*Note 1*
F28	Preset frequency 1 (Main frequency setting) (***Hz***)	-	00.0 - 200	05.0	*Note 1&2*
F29	Preset frequency 2 (***Hz***)	-	00.0 - 200	05.0	*Note 1&2*
F30	Preset frequency 3 (***Hz***)	-	00.0 - 200	10.0	*Note 1&2*
F31	Preset frequency 4 (***Hz***)	-	00.0 - 200	20.0	*Note 1&2*
F32	Preset frequency 5 (***Hz***)	-	00.0 - 200	30.0	*Note 1&2*
F33	Preset frequency 6 (***Hz***)	-	00.0 - 200	40.0	*Note 1&2*
F34	Preset frequency 7 (***Hz***)	-	00.0 - 200	50.0	*Note 1&2*
F35	Preset frequency 8 (***Hz***)	-	00.0 – 200	60.0	*Note 1&2*
F36	Jog frequency setting (***Hz***)	-	00.0 – 200	05.0	*Note 1&2*

F37	DC braking time (***sec.***)	-	00.0 – 25.5	00.5	
F38	DC braking start frequency (***Hz***)	-	01.0 – 10.0	01.5	
F39	DC braking level (voltage ***%***)	-	000 – 020	005	
F40	Carrier frequency (***kHz***)	-	004 – 016	010	
F41	Auto restart after power-loss	000	Enable	001	*Note 6*
		001	Disable		
F42	Auto-restart attempts	-	000 – 005	000	
F43	Motor rated current	-			*Note 4*
F44	Motor rated voltage	-			*Note 4*
F45	Motor rated frequency	-			*Note 4*
F46	Motor rated power	-			*Note 4*
F47	Motor rated speed	-	0 - 120 (*100RPM) *7		*Note 4*
F48	Torque boost gain (Vector mode)	-	001 – 450		
F49	Slip compensation gain (Vector mode)	-	001 – 450		
F50	Low frequency voltage compensation	-	000 – 40		
F51	Advanced (***C***)parameter function display	000	Disable	000	*Note 1*
		001	Enable		
F52	Factory default	010	Reset to factory default (***50Hz***)	000	
		020	Reset to factory default (***60Hz***)		
F53	Software version	-	CPU version		*Notes 3 & 4*
F54	Latest 3 fault records	-			*Notes 3 & 4*

F Parameter Notes:

1 - Can be changed during RUN mode.

2 - Frequency resolution is 1Hz for settings above 100Hz.

3 - Cannot be modified via RS485 communication.

4 - Remains unchanged after reset to factory default.
F52 factory setting is 020(60HZ) and motor parameter value is 7.0.

F52 factory setting is 010(50HZ) and motor parameter value is 4.0.

5 - Please consult factory before making any parameter adjustments

6 - Changed in Software version 1.5 or later

7 – Default setting for North American units is to the right of the /; setting for all other units are to the left.

Table 10.2 C (Advanced) Parameters (Set F51=001 to access)

C	Function Description	Code	Range / Function	Factory default	Remarks
C00	Reverse run	000	Reverse enable	000	
		001	Reverse disable		
C01	Acceleration stall-prevention	000	Acceleration stall prevention enable	000	
		001	Acceleration stall prevention disable		
C02	Acceleration stall-prevention level ***(%)***	-	050 – 200	200	
C03	Deceleration stall-prevention	000	Deceleration stall prevention enable	000	
		001	Deceleration stall prevention disable		
C04	Deceleration stall-prevention level (***%***)	-	050 – 200	200	
C05	Run stall-prevention	000	Run stall prevention enable	000	
		001	Run stall prevention disable		
C06	Run stall-prevention level (***%***)	-	050 – 200	200	
C07	Stall prevention foldback time during run	000	Follow the deceleration time set in ***F02***	000	
		001	Follow the deceleration time set in ***C08***		
C08	Stall prevention deceleration time set (***sec.***)	-	00.1 – 999	03.0	*Note 2*
C09	Direct start on power up	000	Direct start enabled	001	
		001	Direct start disabled		
C10	Reset mode	000	***RUN*** instruction must be ***OFF*** before the reset command is available	000	
		001	Whether ***RUN*** instruction is ***OFF*** or ***ON***, the reset command is always available		
C11	Acceleration time 2 (***sec.***)	-	00.1 – 999	05.0	*Notes 1&2*
C12	Deceleration time 2 (***sec.***)	-	00.1 – 999	05.0	*Notes 1&2*

C13	Fan control	000	Auto-run at or above set temperature	001	This function only available for enclosure type ***IP20***, For enclosure type ***IP65,*** fan will run while power is on.
		001	Run whenever the inverter runs		
		002	Always running		
		003	Always stopped		
C14	Control mode	000	Vector control	000	*Note 4*
		001	V/f control		
C15	V/f Pattern setting	-	001 – 007	001/004	*Note 6 &7*
C16	V/f Base output voltage setting (***VAC***)	-	198~265V / 380~530V	220/440	*Note 7*
C17	Max output frequency (***Hz***)	-	00.2 – 200	50.0/60.0	*Note 7*
C18	Output voltage ratio at max frequency (***%***)	-	00.0 – 100	100	
C19	Mid frequency(***Hz***)	-	00.1 – 200	25.0/30.0	*Note 7*
C20	Output voltage ratio at mid frequency (***%***)	-	00.0 – 100	50.0	
C21	Min output frequency (***Hz***)	-	00.1 – 200	00.5/00.6	*Note 7*
C22	Output voltage ratio at Min frequency (***%***)	-	00.0 – 100	01.0	
C23	Torque boost gain (V/f) (***%***)	-	00.0 - 30.0	00.0	*Note 1*
C24	Slip compensation gain (V/f) (***%***)	-	00.0 - 100	00.0	*Note 1*
C25	Motor no load current (***A***)	-			Varies with motor rating *Note 4*
C26	Electronic thermal relay protection for motor (***OL1***)	000	Enable motor protection	000	*Note 8*
		001	Disable motor protection		
C27	Skip frequency 1(***Hz***)	-	00.0 - 200	00.0	*Note 1&2*
C28	Skip frequency 2(***Hz***)	-	00.0 - 200	00.0	*Note 1&2*
C29	Skip frequency range (±***Hz***)	-	00.0 - 30.0	00.0	*Note 1*

C30	PID operation mode	000	PID Function disabled	000	
		001	PID Control, bias D control		
		002	PID Control, feedback D control		
		003	PID Control, bias D reverse characteristics control.		
		004	PID Control, feedback D reverse characteristics control.		
C31	PID Error gain	-	0.00 – 10.0	1.00	*Note 1*
C32	P: Proportional gain	-	0.00 – 10.0	01.0	*Note 1*
C33	I: Integral time (***sec.***)	-	00.0 – 100	10.0	*Note 1*
C34	D: Differential time (***sec***.)	-	0.00 – 10.0	0.00	*Note 1*
C35	PID Offset	000	Positive direction	000	*Note 1*
		001	Negative direction		
C36	PID Offset adjust (***%***)	-	000 – 109	000	*Note 1*
C37	PID Update time (***sec.***)	-	00.0 - 02.5	00.0	*Note 1*
C38	PID Sleep mode threshold (***Hz***)	-	00.0 - 200	00.0	
C39	PID Sleep delay time (***sec.***)	-	00.0 - 25.5	00.0	
C40	Frequency Up/Down control using MFIT	000	UP/Down command is available. Set frequency is ***held*** when inverter stops.	000	
		001	UP/Down command is available. Set frequency resets to ***0Hz*** when inverter stops.		
		002	UP/Down command is available. ***Set*** frequency is held when inverter stops. ***Up/Down is available when stopped.***		

C41	Local/Remote frequency control select (Run command by the Run/Stop key)	000	UP/Down key on keypad sets frequency	000	
		001	Potentiometer on the keypad set frequency		
C42 C43	Terminal S5 function Terminal S6 function ***Note: Terminals S5 and S6 are provided by an SIF-IO option card.***	000	Forward	007 009	
		001	Reverse		
		002	Preset speed command 1		
		003	Preset speed command 2		
		004	Preset speed command 3		
		005	Jog frequency command		
		006	Emergency stop (E.S.)		
		007	Base block (b.b.)		
		008	Select 2nd acceleration / deceleration time		
		009	Reset		
		010	Up command		
		011	Down command		
		012	Control signal switch		
		013	Communication control signal switch		
		014	Acceleration / deceleration prohibit		
		015	Master / Auxiliary speed source select		
		016	PID Function disable		
		017	Analog signal input (terminal ***AIN***)		***Not used with S5 and S6***
		018	PID Feedback signal (terminal ***AIN***)		
		019	DC Injection brake signal		
C44	Multi-function input terminals ***S1-S6*** signal scan time (***mSec ×8***)	-	001 - 100	010	
C45	AIN signal scan time (***mSec x 8***)	-	001 - 100	050	

C46	Multi-function output T+, T- (Photocoupler) ***Note: This function is provided by an SIF-IO option card***	000	Run	005	
		001	Frequency reached (Set frequency ± ***F23***)		
		002	Frequency is within the range set by (***F22±F23***)		
		003	Frequency detection (***>F22***)		
		004	Frequency detection (***<F22***)		
		005	Fault terminal		
		006	Auto reset and restart		
		007	Momentary power loss		
		008	Emergency stop(E.S.)		
		009	Base block (b.b.)		
		010	Motor overload protection		
		011	Inverter overload protection		
		012	**Not used**		
		013	Power on		
		014	Communication error		
		015	Output current detection ***(>F24***)		
C47	Remote keypad control selection ***Note: The remote keypad is an option***	000	Disable (no signal loss detection)	000	*Note 4* ***Stop inverter then connect remote keypad for proper operation***
		001	Enable. On signal loss stop according to ***F09***		
		002	Enable. Runs at the last set frequency. On signal loss stop according to ***F04*** setting or Stop key on keypad.		
C48	Copy module ***Note: This function is provided by the Copy Module option card***	000	Copy module disable	000	*Note 3*
		001	Copy to module from inverter		
		002	Copy to inverter from module		
		003	Read / Write check		
C49	Inverter communication address ***Note: SIF-232 or SIF-485 required***	-	001 - 254	001	*Notes 3&4*
C50	Baud rate (***bps***) ***Note: SIF-232 or SIF-485 required***	000	4800	003	*Notes 3&4*
		001	9600		
		002	19200		
		003	38400		
C51	Stop bit ***Note: SIF-232 or SIF-485 required***	000	1 Stop bit	000	*Notes 3&4*
		001	2 Stop bits		
C52	Parity bit ***Note: SIF-232 or SIF-485 required***	000	No parity	000	*Notes 3&4*
		001	Even parity		
		002	Odd parity		

C53	Data bits ***Note: SIF-232 or SIF-485 required***	000	8 Bits data	000	*Notes 3&4*
		001	7 Bits data (Only for MODBUS ASCII Mode)		
C54	Communication error detection time (***sec.***) ***Note: SIF-232 or SIF-485 required***	-	00.0 - 25.5	00.0	*Notes 3&5*
C55	Communication error operation selection ***Note: SIF-232 or SIF-485 required***	000	Deceleration to stop. (Deceleration time = ***F02***).	000	*Notes 3&5*
		001	Coast to stop.		
		002	Deceleration to stop. Deceleration time = ***C12***)		
		003	Continue operating.		

C Parameter Notes:

1 - Can be changed during RUN mode.

2 - Frequency resolution is 1Hz for settings above 100Hz.

3 - Cannot be modified via RS-485 communication.

4 - Does not change after reset to factory default.
F52 factory setting is 020(60HZ) and motor parameter value is 7.0.

F52 factory setting is 010(50HZ) and motor parameter value is 4.0.

5 - Available in Software version 1.2 or later.

6 - Changed in Software version 1.7 or later

7 - Default setting for North American units is to the right of the /; setting for all other units are to the left.

8 - Please consult factory before making any parameter adjustments

Section 11 - *Parameters F (Basic) and C (Advanced) Function Descriptions*

F (Basic) Parameter Function Descriptions

F00 Inverter horsepower capacity

F00	Inverter model	
1P2	JNEV	1P2
1P5		1P5
101		101
2P2		2P2
2P5		2P5
201		201
202		202

F00	Inverter model	
203	JNEV	203
401		401
402		402
403		403

F01 Acceleration time 1 (sec) : 00.1 – 999
F02 Deceleration time 1 (sec) : 00.1 – 999

Formula for acceleration/deceleration time: Denominator is based on the setting of C14
a) Motor rated frequency (Sensorless vector control C14=000)
b) Max output frequency (V/f mode C14=001)

a) **Vector**

$$\text{Accel time} = F01 \times \frac{\text{Set frequency}}{F45\ (\text{rated frequency})} \qquad \text{Decel time} = F02 \times \frac{\text{Set frequency}}{F45\ (\text{rated frequency})}$$

b) **V/F**

$$\text{Accel time} = F01 \times \frac{\text{Set frequency}}{C17\ (\text{Max. output freq.})} \qquad \text{Decel time} = F02 \times \frac{\text{Set frequency}}{C17\ (\text{Max. output freq.})}$$

F03 Motor rotation direction	**000: Forward** **001: Reverse**

Parameter F04 must be set to 000 for this function to be effective.

F04 Run signal source	**000: Keypad** **001: External terminal** **002: Communication control**

1.) F04=000: inverter is controlled by the keypad.
2.) F04=001: inverter is controlled by external signals via the I/O terminal, TM2.
3.) F04=002: inverter is controlled by serial communications.

F05 Frequency signal source	**000: UP/Down key on keypad** **001: Potentiometer on keypad** **002:TM2 input signal (Terminal AIN)** **003: Multi-function input terminal UP/DOWN function** **004: Frequency set by communication method** ***(NOTE: When C47=1, the remote keypad has priority)***

1.) F5=001: When any parameter F11- F15 is set to 015 and the multi-function input terminal is OFF, the frequency is set by the potentiometer on the keypad. If the multi-function input terminal is ON, the frequency is set by the analog signal (AIN) from TM2.
2.) F5=002: When any parameter F11 - F15 is set to 015 and the multi-function input terminal is OFF, the frequency is set by the analog signal (AIN) from TM2. If the multi-function input terminal ON, the frequency is set by the potentiometer on the keypad.
3.) F5=003: Up / Down terminal: Refer to the description of parameters F11- F15 (multi-function input terminal).
4.) Priority of frequency command; Jog> preset frequency > (keypad▲▼ or TM2 Up / down or communication)

F06 External control operation mode	**000: Forward / Stop – Reverse / Stop** **001: Run / Stop - Forward / Reverse** **002: 3-wire—Run / Stop**

1.) F06 is only available when F04 = 001 (TM2 terminal).
2.) When both forward and reverse commands are ON, this will result in a stopped mode.

Parameter F06 = 000, control method works as follows:

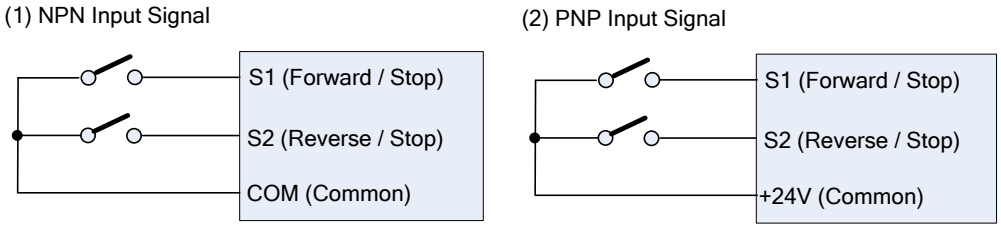


Fig. 11.1a Forward / Stop - Reverse / Stop

Parameter F06 = 001, control method works as follows:

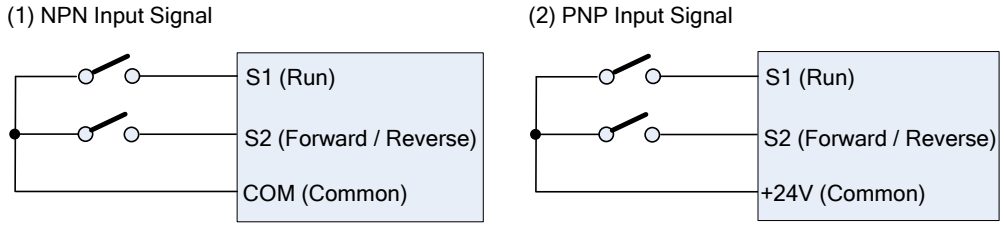


Fig. 11.1b Run / Stop - Forward / Reverse

Parameter F06 = 002, control method works as follows:

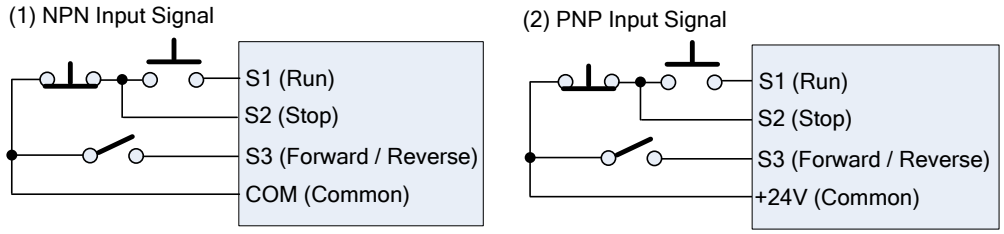


Fig. 11.1c 3- Wire Run / Stop

NOTE: In 3 wire control mode, terminals S1-S3 are dedicated, therefore parameters F11 - F13 are ineffective.

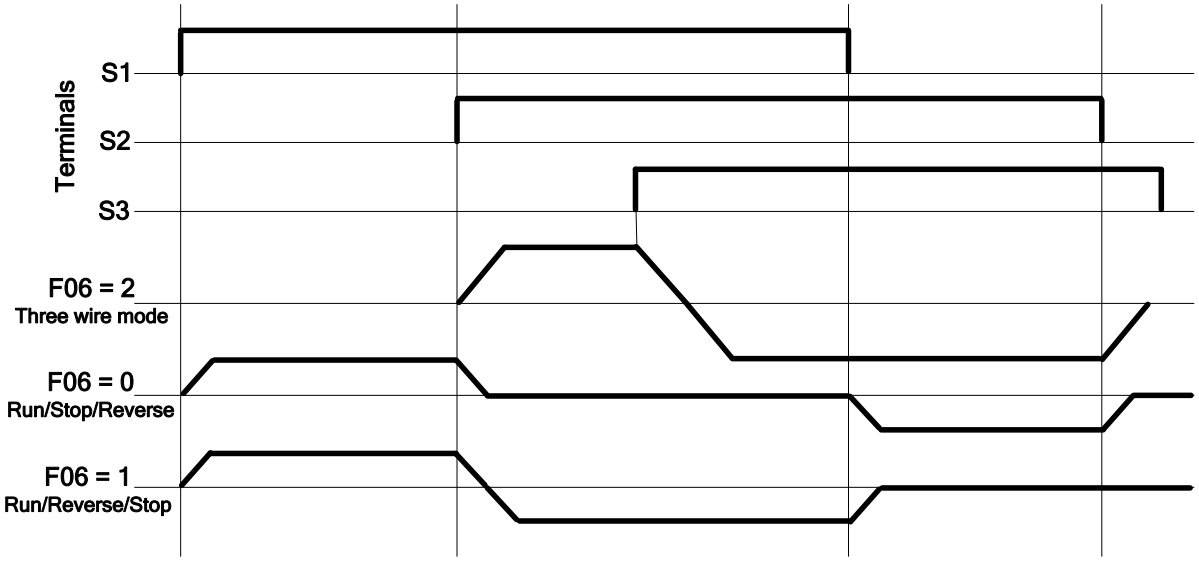


Fig. 11.1d Control Method Sequences

NOTE: If C00=001, the reverse command is disabled.

F07 Frequency upper limit (Hz) : 01.0 - 200
F08 Frequency lower limit (Hz) : 00.0 - 200

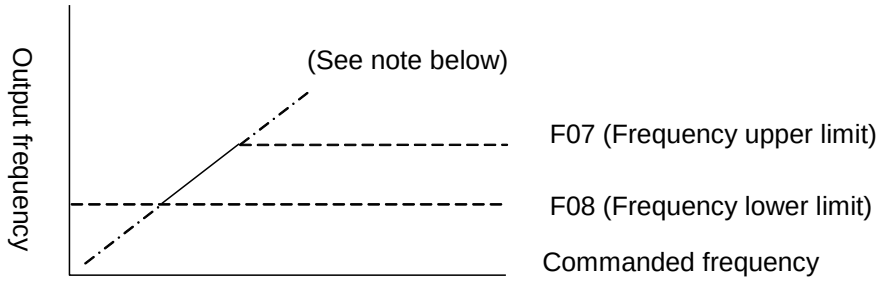


Fig. 11.2 Frequency Limits

NOTE: If F07 = 0Hz and frequency command = 0Hz, the inverter will zero-speed stop.
If F08 > 0Hz and frequency command <F08, the inverter will run at the F08 set value.

F09 Stopping method	**000: Decelerate to stop** **001: Free run (Coast) to stop**

1.) F09 = 000: after receiving a stop command, the motor will decelerate to stop at the rate set in F02, deceleration time 1.

2.) F09 = 001: after receiving a stop command, the motor will free-run (Coast) to stop.

F10 Status monitoring display	**000: Disable** **001: Enable**

F10 = 001: Display motor current, voltage, DC bus voltage, and PID feedback along with frequency. F10 = 000: Display frequency only.

F11 - 15	**Selectable Functions for input terminals (S1-S4& AIN)** **000: Forward run** **001: Reverse run** **002: Preset speed command 1** **003: Preset speed command 2** **004: Preset speed command 3** **005: Jog frequency command** **006: External emergency stop (E.S.)** **007: Base block (b.b.)** **008: Switch to 2nd acceleration / deceleration time** **009: Reset** **010: Up command** **011: Down command** **012: Control signal switch** **013: Communication mode. Disable / Enable.** **014: Acceleration / deceleration prohibit** **015: Master / Auxiliary speed switch** **016: PID function disable** **017: Analog frequency signal input (terminal AIN)** **018: PID feedback signal (terminal AIN)** **019: DC Brake signal**

1.) S1 - AIN on TM2 are the multi-function input terminals which can be set to the above 19 functions.
2.) F11 - F15 function descriptions:

F11 - F15=000 / 001: Forward/ Reverse

When the Forward command is ON, the inverter runs forward; when OFF the inverter stops. F11 is the factory default Forward command. When the Reverse command is ON, the inverter runs in reverse; when OFF the inverter stops. F12 is the factory default Reverse command.
NOTE: If both forward and reverse command are ON at the same time the inverter will activate Stop mode.

F11 - F15=002 - 004: Preset speed commands 1 - 3
When the run signal is applied and any of the selected external multi-function input terminals are ON, the inverter will run at one of 8 preset speeds depending on the combined state of all the multi-function input terminals. The corresponding speeds are programmed by parameters F28 to F36 as shown in the table on the next page.

F11 - F15=005: Jog frequency command
When a run signal is applied and the selected external multi-function input terminal is configured for **Jog** speed and is active (On), the inverter will run at the frequency programmed in the F36 setting. (See table on next page)

NOTE: Priority of the frequencies: Jog > Preset Speed

Preset Speed Command 3 Set value=004	Preset Speed Command 2 Set value=003	Preset Speed Command 1 Set value=002	Jog Frequency Command Set value=005	Output frequency set value
X	X	X	1	F36
0	0	0	0	F28
0	0	1	0	F29
0	1	0	0	F30
0	1	1	0	F31
1	0	0	0	F32
1	0	1	0	F33
1	1	0	0	F34
1	1	1	0	F35

X = 1 or 0

F11 - F15=006: External Emergency Stop (E.S.)

Upon receiving an external Emergency Stop signal the inverter will decelerate to a stop by the value set by C12, the 2nd deceleration time setting regardless of the F09 deceleration setting and the display will flash **"E.S".** The inverter will restart only when the Emergency Stop signal is removed and the start signal is removed and re-asserted (remote mode), or the Run key is pushed (keypad mode). Removing the Emergency Stop signal before the inverter has fully stopped will not cancel the Emergency Stop operation. The output relay can be set to Emergency Stop fault by setting F21=008.

F11 - F15=007: Base Block (b.b.)

The inverter will stop immediately (coast to stop) upon receiving the Base Block signal regardless of the setting of F09 and the display will flash **"b.b".** The inverter will auto restart in a speed search mode when the Base Block signal is removed.

F11 - F15=008: Switching to 2nd acceleration / deceleration time

When the external terminal is ON the 2nd acceleration / deceleration time are in effect. (Refer to parameters C11, C12 for the time settings)

F11=009: Reset command

When the reset command is ON, the inverter will be disabled and all re-settable table faults will be cleared. ***NOTE: Do not use a maintained device on the Reset input.***

F11 - F15=010 / 011: Up / Down functions (*Controlled by acceleration / deceleration times)*

Set F05=003 to enable the Up / Down function.

Set C40=000, When the Up / Down terminal is ON, the inverter begins accelerating / decelerating to the set frequency and stops when the UP / DOWN signal is removed. The inverter continues to run at that frequency. Setting **C40=002** will operate identically as C40 = 000 except that the reference frequency can now be modified with the Up / Down terminals when the inverter is stopped.

The inverter will decelerate to stop or coast to stop when the Run command is OFF depending on the deceleration setting of F09. The frequency at which the inverter will re-start is stored in F28. ***NOTE: The Up / Down keys on the keypad are disabled for changing the frequency when F05=003, but the frequency can be modified by setting Parameter F28.***

Set C40=001, The inverter will accelerate from 0Hz (stop) upon receiving a run command. The Up / Down action is similar to the description above. When the run command is removed, the inverter will decelerate to a stop or coast to a stop depending on the deceleration setting of F09. The inverter will accelerate from 0Hz each time a run command is given.

NOTE: The Up / Down commands are disabled if both Up and Down terminals are ON at the same time.

F11 - F15=012: Control signal switch

External control terminal OFF: The operation and frequency signals are controlled by parameter settings in F04 / F05.

External control terminal ON: The operation and frequency signals are controlled by the keypad.

F11 - F15=013: Communication mode select.

External control terminal OFF: The inverter is controlled by the master (Host Computer or PLC) for run / frequency signals and allows parameter modifications. ***The Keypad and TM2 run / frequency signals are disabled***. The keypad is only available to display voltage / current / frequency and read parameters but cannot modify them. It is also available for emergency stop.

External control terminal ON: The Host Computer or PLC can read and modify parameters, ***but the inverter can only be controlled from the keypad***. (Not affected by settings of F04 & F05).

F11 - F15=014: Acceleration / deceleration prohibit

When the external control terminal is ON, the inverter will stop acceleration/ deceleration until the signal is removed. The operation is as follows:

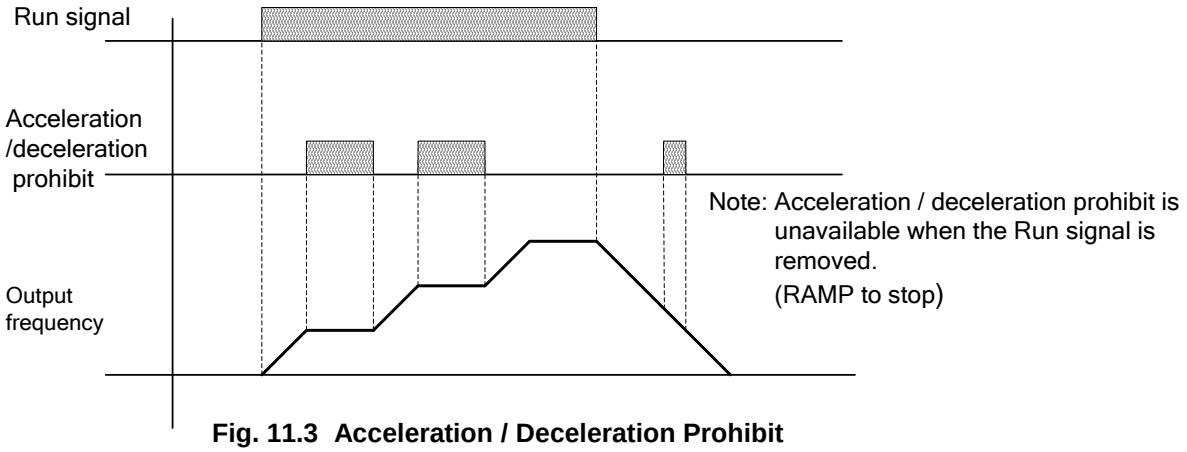


Fig. 11.3 Acceleration / Deceleration Prohibit

F11 - F15=015: Master / Auxiliary speed switch

1) F05=001, when one of the parameters F11 - F15 is set to 015, and the multi-function input terminal is OFF and the frequency is set by the potentiometer on the Keypad (Master speed). When the multi-function input terminal is ON, the frequency is set by the analog signal at terminal AIN.

2.) F05=002, when one of the parameters F11 - F15 is set to 015, and multi-function input terminal is OFF, the frequency is set by the analog AIN. When the multi-function input terminal is ON, the frequency is set by the potentiometer on the Keypad (Auxiliary speed).

F11 - F15=016: PID function disable

When the input terminal is ON, PID operation and functions set by C30 - C39 are disabled.
When the input terminal is OFF, PID operation and functions set by C30 - C39 are enabled.

F15=017: Analog frequency signal input (Terminal AIN)

A 0-10VDC or 4-20mA signal can be used as a frequency reference at terminal AIN as set by F16 and switch SW2 (select between 0-10Vdc or 0/4-20mA).

F15=018: PID Feedback signal input (Terminal AIN)

The PID feedback signal can be connected to the analog input terminal AIN 0-10VDC / 0 - 20mA or 2 - 10VDC / 4 - 20mA as set by F16 and switch, SW2 (select between 0-10VDC or 0/4-20mA).

F11 - F15=019: DC Injection brake signal

The DC injection braking function time and start frequencies are set by parameters F37 and F38. When the TM2 DC injection brake signal is OFF, and the internal brake timer (set by F37) has not expired, the brake timer is reset to the value of F37.

When the TM2 DC injection brake signal is ON, and the internal brake time F37 has not expired, DC injection braking is activated.

F16 AIN Signal select	**000: 0 - 10V / 0 - 20mA (Set SW2 to the correct signal : V / I)** **001: 2 - 10V / 4 - 20mA (Set SW2 to the correct signal : V / I)**

F17 AIN gain	**000 - 200 (%)**
F18 AIN bias	**000 - 100 (%)**

F19 AIN bias	**000: Positive** **001: Negative**
F20 AIN signal slope direction	**000: Positive** **001: Negative**
C45 AIN signal scan time confirmation	**(mSec × 8): 001 – 100**

The AC drive processor reads A/D values every C45 x 8mS. The user can set the scan interval time to suppress any noise levels caused by the operating environment. Extend C45 to increase the filter time if noise is a problem, however the analog signal response will be slower.

F19= 000: 0VDC (4mA) corresponds to lower frequency limit, 10VDC (20mA) corresponds to upper frequency limit.

F19= 001: 10VDC (20mA) corresponds to lower frequency limit, 0VDC (4mA) corresponds to upper frequency limit.

NOTE: Refer to the example tables and figures below for additional information

Fig 11.4a setting:

	F17	F18	F19	F20
A	100%	050%	000	000
B	100%	000%	000	000

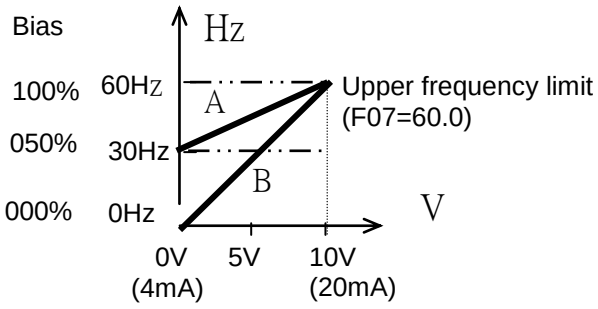


Fig 11.4a

Fig 11.4b setting:

	F17	F18	F19	F20
C	100%	050%	000	001
D	100%	000%	000	001

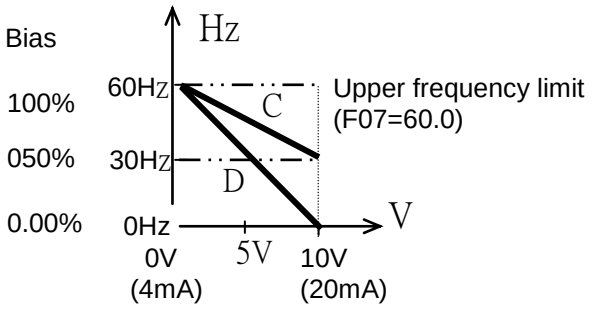


Fig 11.4b

Fig 11.4c setting:

	F17	F18	F19	F20
E	100%	020%	001	000

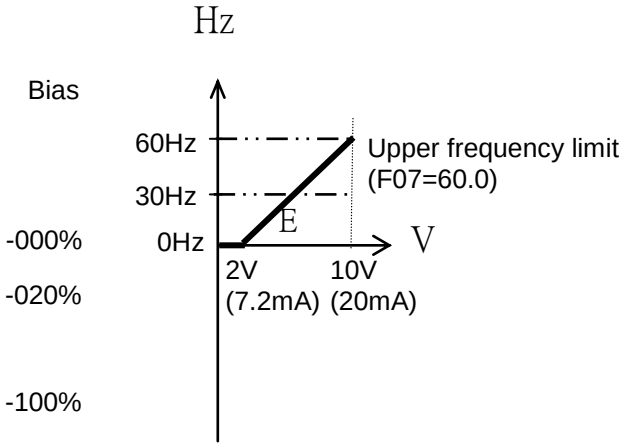


Fig 11.4c

Fig 11.4d setting:

	F17	F18	F19	F20
F	100%	050%	001	001

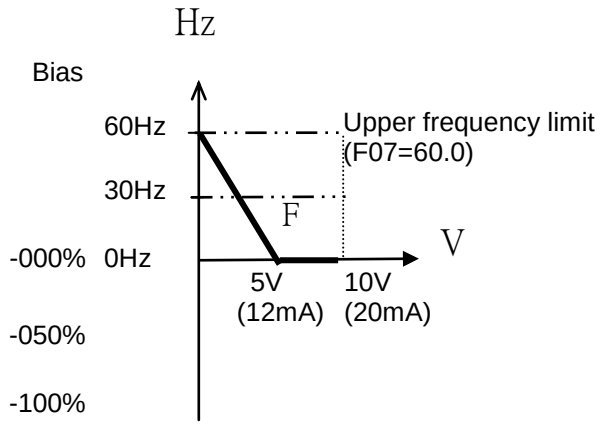


Fig 11.4d

F21 Multi function output RY1	**000: Run** **001: Frequency reached (Preset target frequency ± F23)** **002: Frequency reached (Preset output frequency level (F22) ±F23)** **003: Frequency detection (>F22)** **004: Frequency detection (<F22)** **005: Fault output** **006: Auto restart** **007: Momentary power loss** **008: Emergency stop (E.S.)** **009: Base block(b.b.)** **010: Motor overload protection** **011: Inverter overload protection** **012: Not used** **013: Power on** **014: Communication error** **015: Output current detection (>F24)**
F22 Preset output frequency target	**00.0 - 200Hz**
F23 Target frequency detection range	**00.0 - 30Hz**

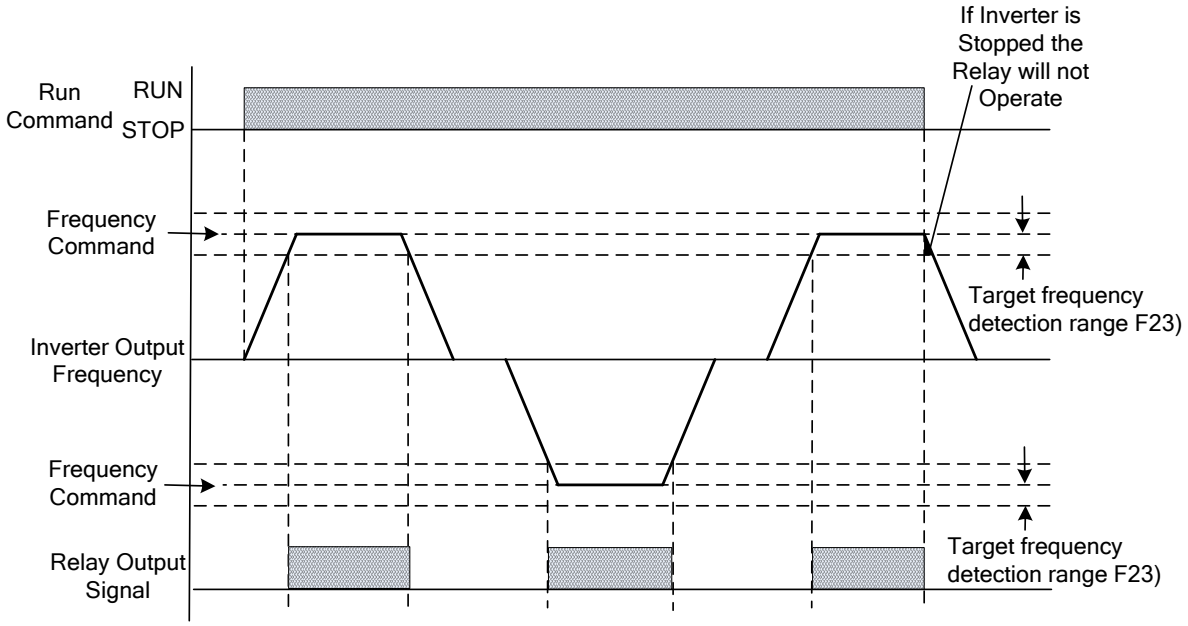


Fig. 11.5a Multifunction Output F21 / C46 = 1
Frequency Reached (Setting Frequency +/- F23)

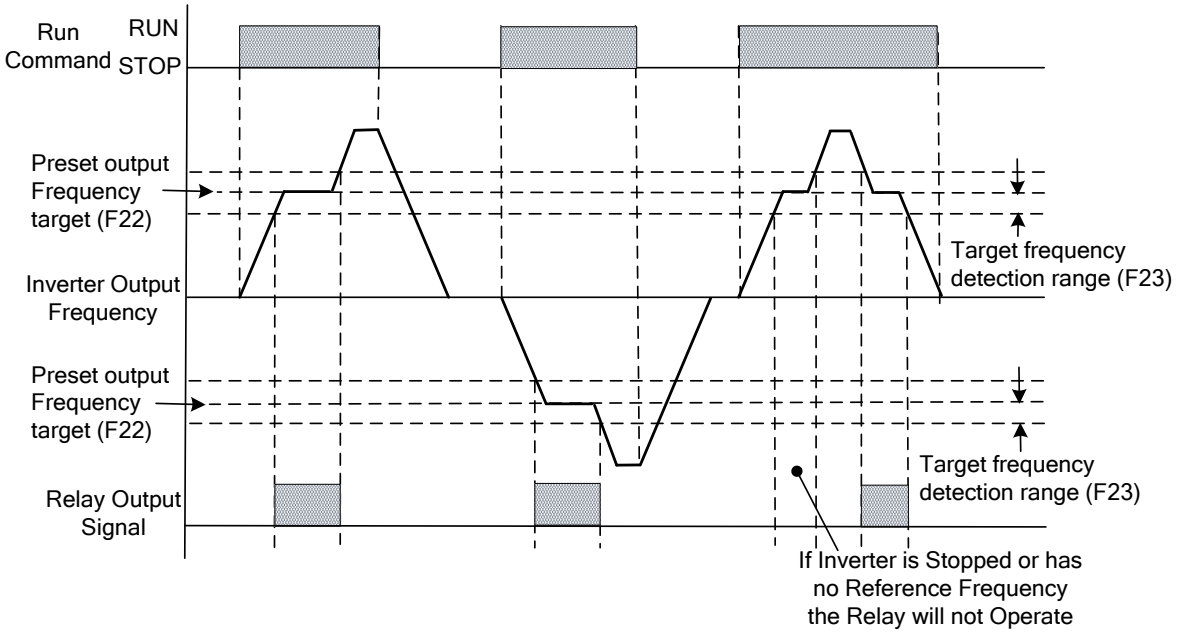


Fig. 11.5b Multi-function Output (F21 / C46 = 002) Preset output frequency (F22 ± F23) Reached.

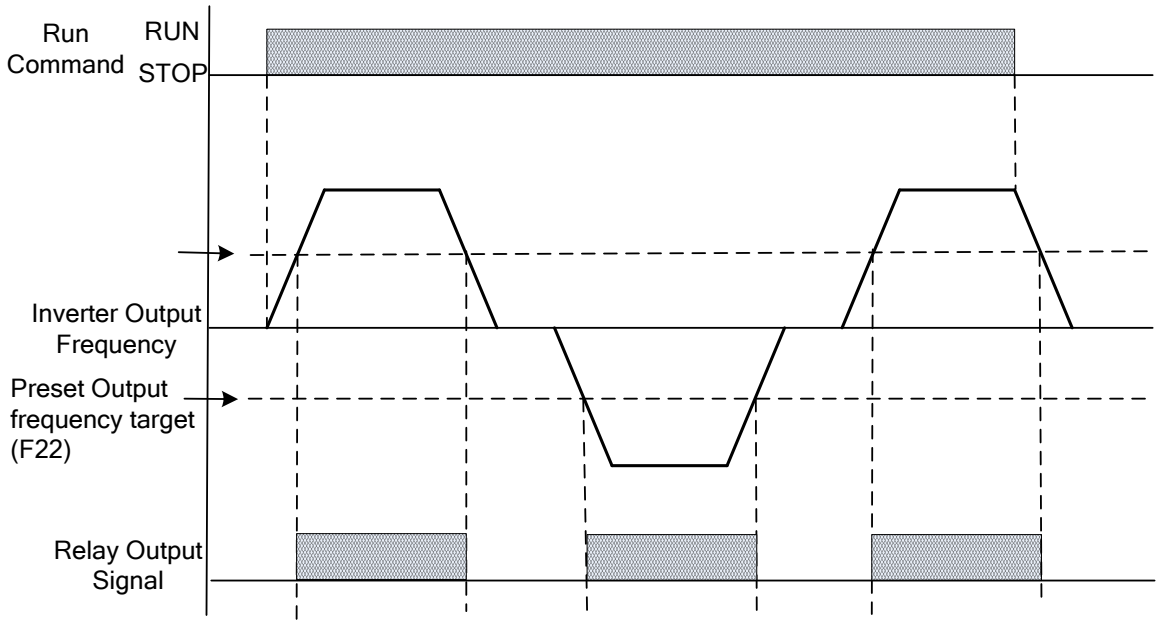


Fig. 11.5c (F21/C46=003) Frequency detection Fout>F22

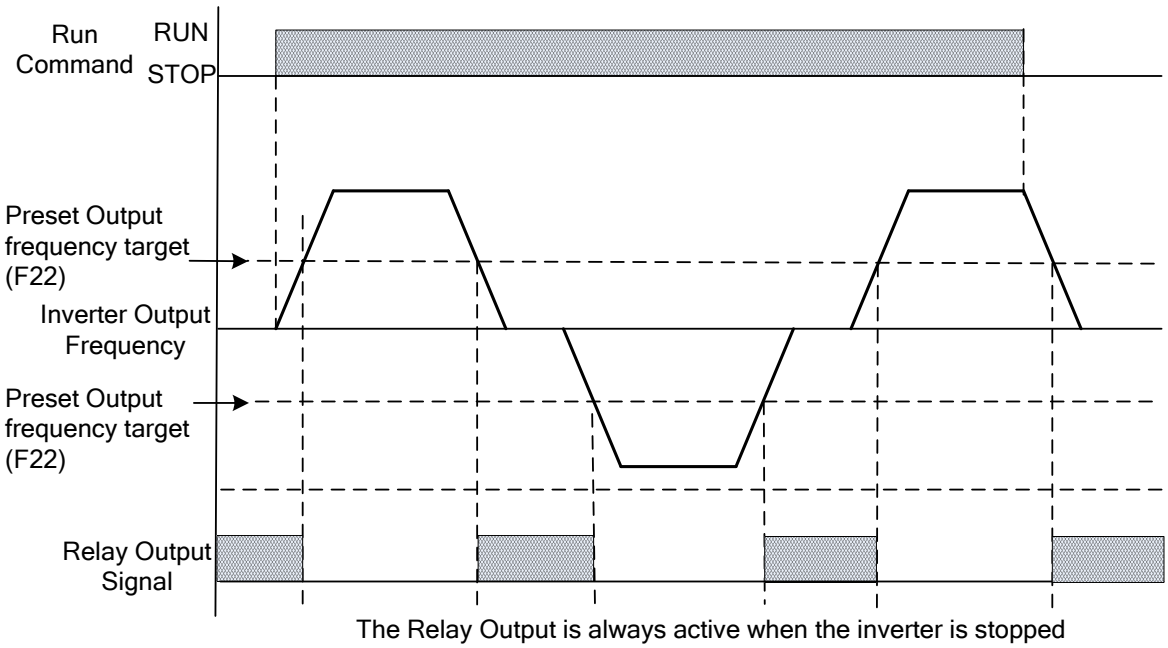


Fig. 11.5d (F21/C46=004) Frequency detection Fout<F22

F24 Output current target value

F25 Output current detection time

F21: Output current detection value >F24 }
C46*: Output current detection value >F24 } When set value is = 015
F24: (000 - 100%) set by motor rated current (F43)
F25: (00.0 - 25.5) unit: sec

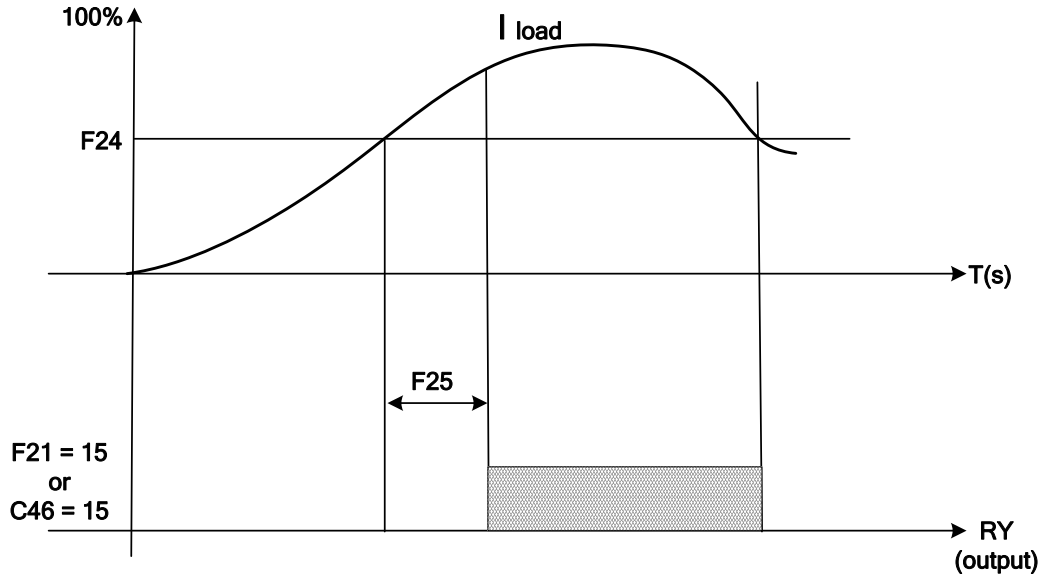


Fig. 11.6 Output current detection

*C46=Output relay 2 on SIF-I/O option card.

Multi-function analog output: **F26 Multi-function analog output type selection**	**001: Set frequency** **002: Output frequency** **003: DC voltage** **004: Output current** **005: PID feedback signal**
F27 Multi-function analog output gain	**000 - 200%**

The analog output can be set to any of the above selections and will provide a 0-10 VDC output to the FM+ multi-function analog output terminal. F27 is used to scale the analog output signal.

When F26=005 (PID Feedback), the analog input at terminal AIN (0-10VDC or 0/4-20mA) will be sent to terminal FM+ as 0-10VDC.
NOTE: Due to hardware limits, the maximum output voltage from the FM+ terminal will be limited to 10VDC.

F28 – F36 Keypad, jog, and preset frequency settings (MFIT):
Note1: Frequency selection will be made based on the settings of terminals S1-S4 & AIN and corresponding settings of parameters F11 – F15 as required.

Note2: Selected preset frequency values should be programmed in parameters F28- F36 as required. Refer to the table on the next page.

1) F11 - F15=002-004: Preset frequency Command 1 - 3

When the run signal is applied and any of the selected multi-function input terminals are ON, the inverter will run at the preset frequency per the table on the next page.

2) F11 - F15=005: Jog Frequency Command

The external input terminal set to Jog operation. When turned ON, the inverter will run at the Jog frequency, F36.

Parameter	Description	Frequency range	Factory default
F28	Preset frequency 1 (Hz)	00.0 - 200	05.0
F29	Preset frequency 2 (Hz)	00.0 - 200	05.0
F30	Preset frequency 3 (Hz)	00.0 - 200	10.0
F31	Preset frequency 4 (Hz)	00.0 - 200	20.0
F32	Preset frequency 5 (Hz)	00.0 - 200	30.0
F33	Preset frequency 6 (Hz)	00.0 - 200	40.0
F34	Preset frequency 7 (Hz)	00.0 - 200	50.0
F35	Preset frequency 8 (Hz)	00.0 - 200	60.0
F36	Jog frequency (Hz)	00.0 - 200	05.0

Set frequency priority: Jog→ Preset frequency →External analog frequency signal

Preset Frequency Command 3 Set value =004	Preset Frequency Command 2 Set value =003	Preset Frequency Command 1 Set value =002	Jog frequency Command Set value =005	Output frequency
0	0	0	0	F28
0	0	1	0	F29
0	1	0	0	F30
0	1	1	0	F31
1	0	0	0	F32
1	0	1	0	F33
1	1	0	0	F34
1	1	1	0	F35
X	X	X	1	F36

X = 1 or 0

F37 DC braking time (s) : 00.0 - 25.5
F38 DC braking start frequency (Hz) : 01.0 - 10.0
F39 DC braking level (%) : 00.0 - 20.0% (Level 100% based on Motor Rate Voltage F44)

NOTE: DC braking is enabled / disabled by multifunction input setting as described on page 33

F37 / F38: DC braking time and start frequency, per the following figure:

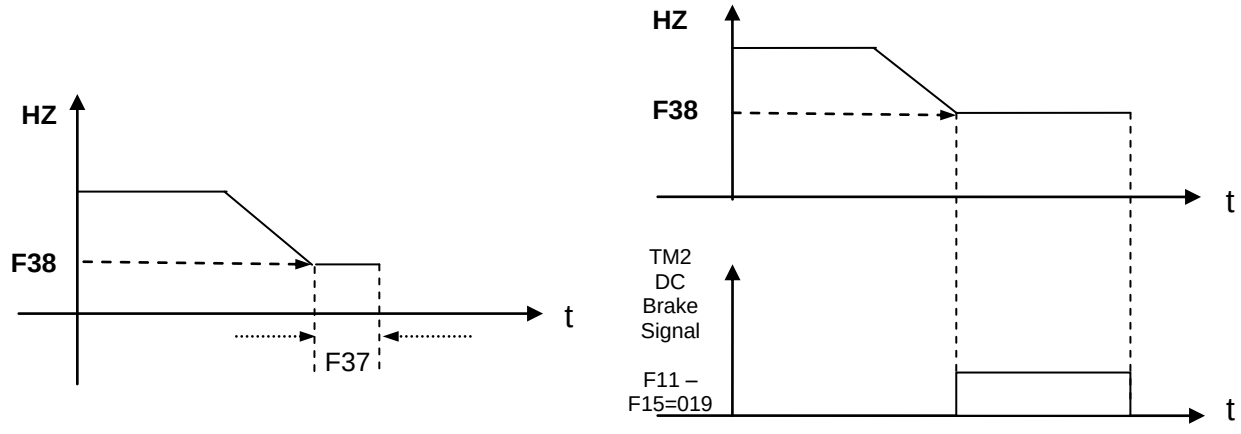


Fig. 11.7 DC Injection Braking

F40 Carrier frequency (kHz): 004-016
Set this parameter to a level from 4-16kHz as required. (Default is 10kHz).

F40	Carrier frequency	F40	Carrier frequency	F40	Carrier frequency	F40	Carrier frequency
004	4kHz	008	8kHz	012	12kHz	016	16kHz
005	5kHz	009	9kHz	013	13kHz		
006	6kHz	010	10kHz	014	14kHz		
007	7kHz	011	11kHz	015	15kHz		

NOTE: In situations where there is excessive audible noise from the motor or unwanted electrical noise from the inverter caused by excessive cable length, the carrier frequency can be adjusted:

- To reduce noise due to excessive cable length, *decrease* the carrier frequency.
- To reduce motor audible noise, *increase* carrier frequency. However the output current from the inverter will be de-rated according to the table below.
- When the output current is higher than the full load current rating of inverter, the carrier frequency will be *decreased* automatically.

Current de-rating vs carrier frequency

Model / Carrier frequency	EV-1P2/2P2 H1/H1F/H3	EV-1P5/2P5 H1/H1F/H3	EV-101/201 H1/H1F/H3	EV-202 H1/H1F/H3	EV-203 H1/H1F/ H3	EV-401 H3/H3F	EV-402 H3/H3F	EV-403 H3/H3F
4-10kHz	1.7A	3.1A	4.2A	7.5A	10.5A	2.3A	3.8A	5.2A
12kHz	1.7A	3.1A	4.2A	7.5A	10.5A	2.2A	2.2A	3.7A
14kHz	1.6A	3.0A	4.0A	7.0A	10.0A	2.2A	2.2A	3.6A
16kHz	1.5A	2.8A	3.8A	6.8A	8.7A	2.1A	2.1A	3.5A

F41 Auto restart on momentary power loss	**000:** Enable **001:** Disable

F41=000: Auto restart after a momentary power loss is enabled. Upon recovery of power with a run command, as set by parameter F4, the inverter will perform an auto speed search. Once the motor rotation speed is found, it will accelerate to the reference speed setting.

F41=001: Auto restart disabled.

F42 Auto restart times : 000 - 005

1.) F42=000: The inverter will not auto-restart on a fault trip.
2.) F42>000: The Inverter will carry out an auto speed search 0.5 sec after a fault trip, while the inverter output is disabled and the motor is coasting to a stop. Once the rotational speed is determined, the inverter will accelerate or decelerate to its speed reference.
3.) Auto restart is not available for OL1, OL2, OH, and bb faults.

NOTE: Auto restart will not function when DC injection braking or deceleration to stop are performed.

F43 Motor rated current : (A)
F44 Motor rated voltage : (VAC)

F45 Motor rated frequency : (Hz)
F46 Motor rated power : (kW)
F47 Motor rated speed : (RPM) : F47 X 10= Motor rated speed

F48 Torque boost gain (Vector mode), C14=000 (Control mode setting)

Performance: If the motor load is determined to be excessive, increase the output torque.

The inverter will output the value of B and C voltage points according the C15 V/F pattern setting.
'B' = Parameter C20 Value and 'C' = Parameter C22 Value. The starting torque will be raised as shown.

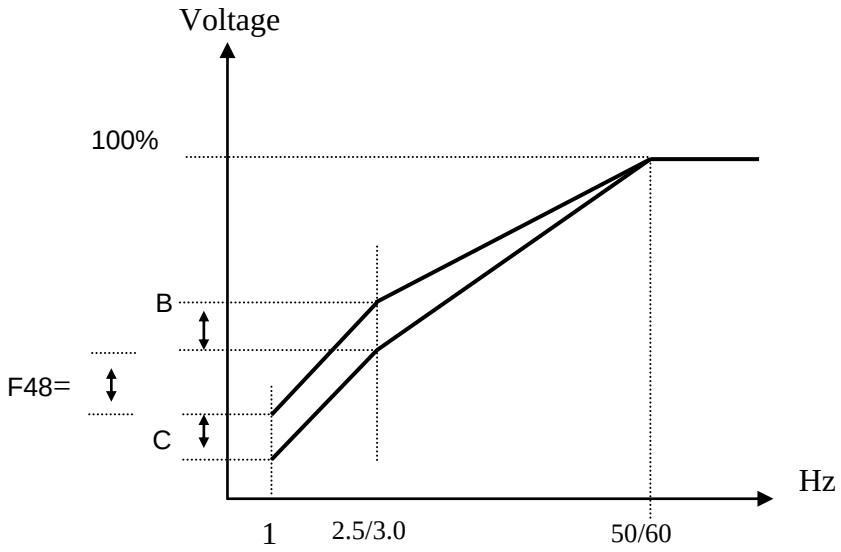


Fig. 11.8 V / f curve with torque boost

- Operating frequency range: 0 - Motor rated frequency
- When the motor output torque is not sufficient, increase the value of F48.
- When the motor is erratic or vibrates, decrease the value of F48.
- The maximum output torque limit of the inverter is the current rating.
- If increasing the value of F48 results in excessive output current, then increase the value of F49 at the same time. (See Fig. 11.9)

F49 Slip compensation gain (vector mode), C14=000 (Control mode setting)

Performance: If the motor load is excessive, *increase* the slip compensation.

$$\Delta F_{slip} \fallingdotseq I \times Gain$$

(Load current) (Compensation gain)

F50 Low frequency voltage compensation (Vector mode), C14=000 (Control mode setting)

Performance during low frequency:

Increase the value of F50 to increase the output voltage and low frequency torque.
Decrease the value of F50 to decrease the output voltage and low frequency torque.

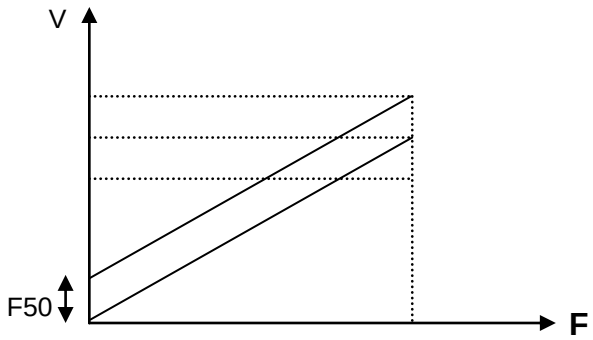


Fig. 11.10 Low Frequency Voltage Compensation

- Operating frequency range: 0 - 12Hz / 60Hz
  0 - 10Hz / 50Hz

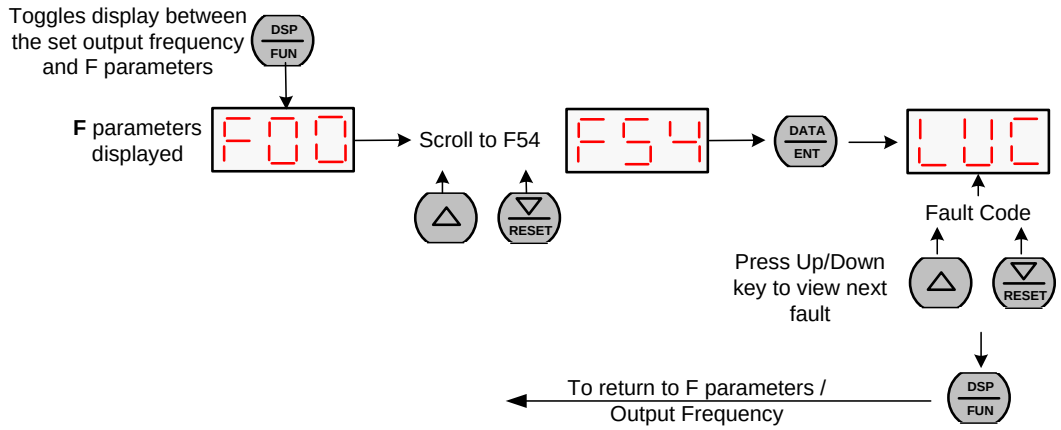
- During low frequency operation:
  When the motor output torque is insufficient, increase the value of F50.
  When the motor is vibrating excessively, decrease the value of F50.

F51 Advanced (C) parameter function display	**000: Disable access to advanced parameters (Group C)** **001: Enable access to advanced parameters (Group C)**

F52 Factory default	**010: Reset parameters to factory default (50Hz)** **020: Reset parameters to factory default (60Hz)**

F53 Software version (Read only)

F54 Fault records (Last 3 Faults)



Refer to section 13 for an explanation on the Error/Fault Codes

C (Advanced) Parameter Function Descriptions

C00 Reverse run	**000: Reverse enable** **001: Reverse disable**

When F04=000 (Run signal source) and C00=001, F03 (motor direction) is disabled and the inverter is set to run forward.
When F04=001 or 002 (Run signal source) and C00=001, the reverse command is disabled.

C01 Acceleration stall-prevention mode	**000: Enable stall prevention during acceleration** **001: Disable stall prevention during acceleration**
C02 Acceleration stall-prevention mode level (%)	**050% - 200%**
C03 Deceleration stall-prevention mode	**000: Enable stall prevention during deceleration** **001: Disable stall prevention during deceleration**
C04 Deceleration stall-prevention mode level (%)	**050% - 200%**
C05 Run stall-prevention mode	**000: Enable stall prevention in run mode** **001: Disable stall prevention in run mode**
C06 Run stall-prevention mode level (%)	**050% - 200%**
C07 Stall prevention time during run mode	**000: Set by parameter F02 (Deceleration 1)** **001: Set by parameter C08**
C08 Stall prevention deceleration time (sec.)	**00.1 - 999s**

1.) When the acceleration time is set too low, the inverter may trip on Overcurrent (OC).
If the acceleration time can not be increased, then stall prevention can be used. The stall prevention level C02 must be programmed. When the inverter detects this level it stops the acceleration until the output current is below this set level, and then continues with acceleration.

2.) When the deceleration time is set too low the inverter could trip on Overvoltage (OV).
If the deceleration time can not be increased, then stall prevention can be used. The stall prevention level C04 must be programmed. When the inverter detects this level it holds the deceleration until the DC bus voltage is below this set level, and then continues with deceleration.

3.) The Inverter could trip (Stall) at set frequency due to an impact load or sudden change of the load. Stall prevention in run mode will detect a programmed stall level (C06) for a period of time (C07). If the level exceeds C06, then the inverter reduces its frequency to provide the required additional torque to overcome the stall. Once this level is below the programmed stall level, the inverter ramps up to its normal running speed.

C09 Direct start on power up	**000: Enable direct start on power up** **001: Disable direct start on power up**

1.) When C09=000 and external run mode (F04=001) is enabled, the inverter will auto start when the power is supplied to the inverter and the run switch is ON.

Danger

This feature should only be considered when all safety implications of its use have been investigated. (Risk assessment for maintenance, use of warning labels etc.)

We recommend this mode to be disabled.

2.) When C09=001 and external run mode (F04=001) is enabled, the inverter will not auto start when power is supplied and the RUN switch is ON. The inverter display will blink "SP1" error message. It can only restart after the RUN input has been cycled.

C10 Reset mode	**000: Reset is enabled when the RUN input is OFF** **001: Reset is enabled when the RUN input is OFF or ON**

C10=000. When the RUN switch is in the ON position (F4=001), the fault can not be reset and therefore the inverter can not start.

C11 Acceleration time 2 (s): 00.1 – 999 **C12 Deceleration time 2 (s): 00.1 – 999 (Always used *for emergency Stop reference)***

C13 Fan control	**000: Auto-run at or above temperature** **001: Run whenever the inverter runs** **002: Always running** **003: Always stopped**

1.) C13=000: The fan will auto run at or above a set certain temperature.
2.) C13=001: The fan runs whenever the inverter is running.
3.) C13=002: The fan runs whenever the power is supplied.
4.) C13=003: The fan does not run at any time.

C14 Control mode	**Vector control(000)** **V/f control (001)**
C17 Max. output frequency (Hz)	**50.0 –200Hz**
C18 Output voltage ratio at max. frequency (%)	**00.0 – 100%**
C19 Mid frequency (Hz)	**00.1 – 200Hz**
C20 Output voltage ratio at mid. frequency (%)	**00.0 – 100%**
C21 Min. output frequency (Hz)	**00.1 – 200Hz**
C22 Output voltage ratio at min. frequency (%)	**00.0 – 100%**

Please refer to C15 description for discussion of parameters C17 - C22

C15 Preset V / f patterns = 1 – 7

C15 = 007. Select user-set V / f pattern by setting parameters C17 - C22. See the fig. below. Care should be taken when this feature is used as improper setting of these parameters can have an adverse effect on motor performance.

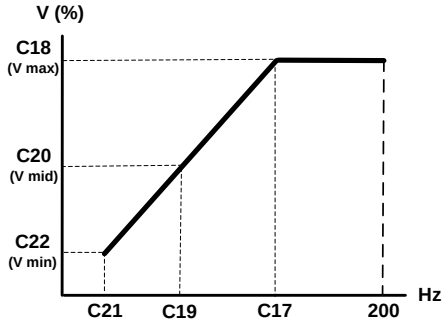


Fig. 11.11a User configured V / f pattern

C15 = 001– 006 fixed V / f patterns (see below).

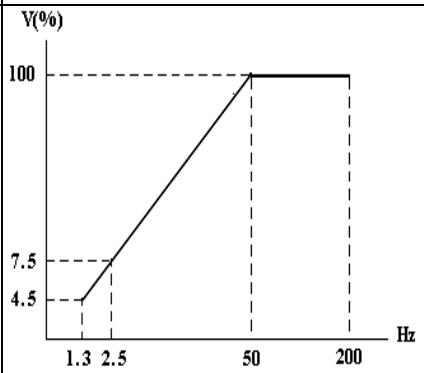
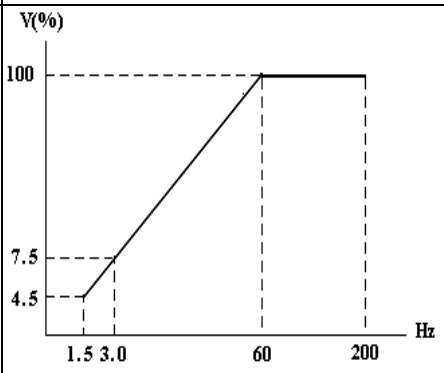
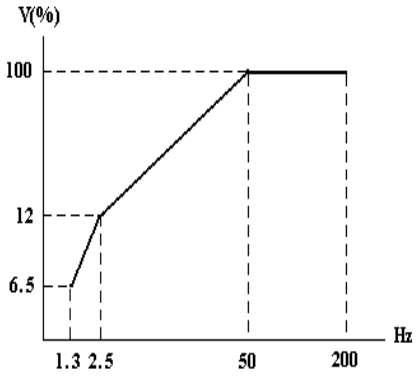
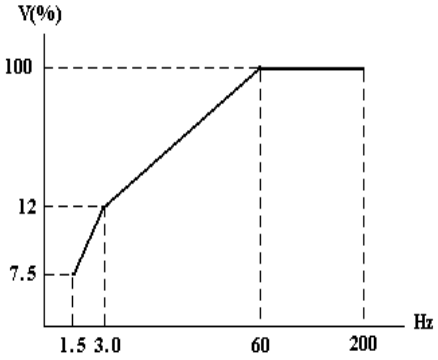
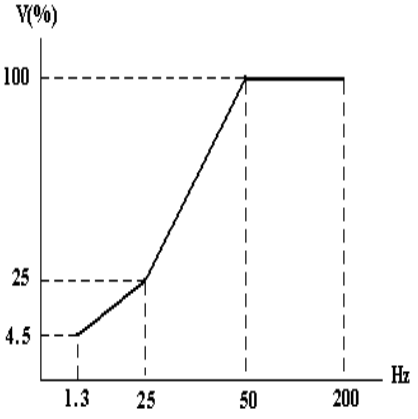
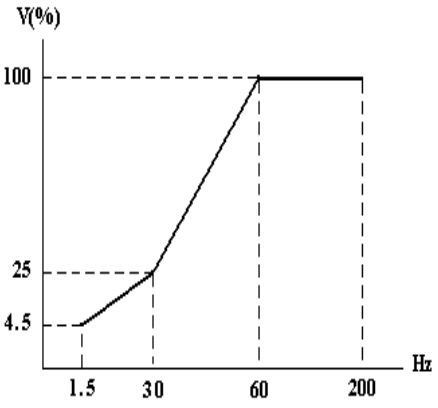
	Purpose	C15	V / f Pattern		Purpose	C15	V / f Pattern
50 Hz Systems	General	001		60 Hz Systems	General	004	
	High starting torque	002			High starting torque	005	
	Variable torque	003			Variable torque	006	

Fig. 11.11b Pre-configured V / f patterns

C16 V / f base output voltage setting

When C17=60HZ, and C18=100%

For 200-240VAC, patterns based an output voltage are shown below. (For corresponding settings at 400-480 VAC input: multiply by 2)

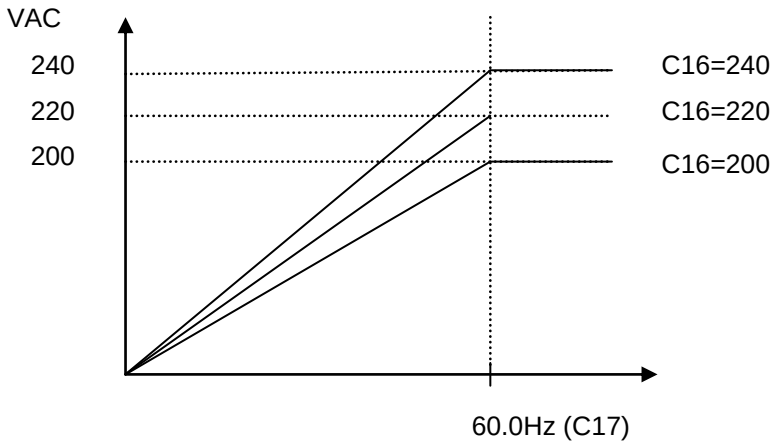


Fig. 11.12 V / Hz curves with varying base voltages

When the output voltage is set higher than the input voltage, the max output voltage is limited to the max input voltage.

C23 Torque boost gain : (V / f) (%) 00.0 – 30.0%

C24 Slip compensation gain : (V / f) (%) 00.0 – 100%

C24 value= (Motor synchronization speed – Rated speed) / Motor synchronization speed

Where:
Rated speed = The RPM Marked on the motor nameplate

Motor synchronization speed (RPM)= $\frac{120}{\text{Motor Poles}}$ × Motor rated frequency (50Hz or 60Hz)

Example: 4 Poles,60Hz induction motor synchronization speed = $\frac{120}{4}$ × 60 =1800 RPM

Motor synchronization speed 1725 RPM, F49 =(1800 – 1725) / 1800 = 4.2%

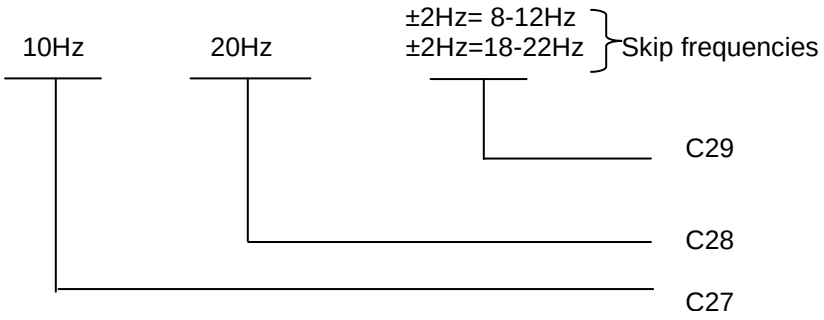
C25 Motor no load current : (A)

Motor no load current varies with inverter capacity F00. Adjust according the actual conditions.

C26 Electronic thermistor protection for motor (OL1)	**000: Protection Enabled** **001: Protection Disabled**

C27 Skip frequency 1 (Hz) : 00.0 –200
C28 Skip frequency 2 (Hz) : 00.0 –200
C29 Skip frequency range (± Hz) : 00.0 –30.0

Example: C27=10.0Hz / C28=20.0Hz / C29=02.0Hz



C30 PID operation mode (See Fig. 11.13)	**000: PID Function disabled** **001: PID Control, Deviation is derivative controlled** **002: PID Control, Feedback is derivative controlled** **003: Same as 001 but (reverse characteristics control)** **004: Same as 002 but (reverse characteristics control)**

C30 =1: D is the deviation of PID error in the unit time (C34).

=2: D is the deviation of feedback value in the unit time (C34).

=3: D is the deviation of PID error in the unit time (C34). When the deviation is positive, the output frequency decreases, and vice versa.

=4: D is the deviation of feedback value in unit time (C34).When the deviation is positive, the output frequency decreases, and vice versa.

C31 PID Error gain : 0.00 - 10.0

C31 is PID error gain, and the feedback value = feedback value × C31.

C32 P: Proportional gain : 0.00 - 10.0

C32: Proportional gain for PID control.

C33 I: Integral time (s) : 00.0 – 100

C33: Integral time for I control (***NOTE:*** *To* ***increase*** *integral action,* ***decrease*** *the integral time setting.)*

C34 D: Differential time (s) : 0.00 - 10.0

C34: Differential time for D control.

C35 PID offset	**000: Positive direction** **001: Negative direction**
C36 PID offset adjust (%)	**000 - 109%**

PID offset percentage can be adjusted by C36 (C35 affects the polarity of C36).

C37 PID update time (s): 00.0 - 02.5

C37 is the refresh time for the PID output command.

NOTE: The PID function is used for applications such as automatic flow control, external fan volume control, air pressure control, and temperature control. See flow control diagram below.

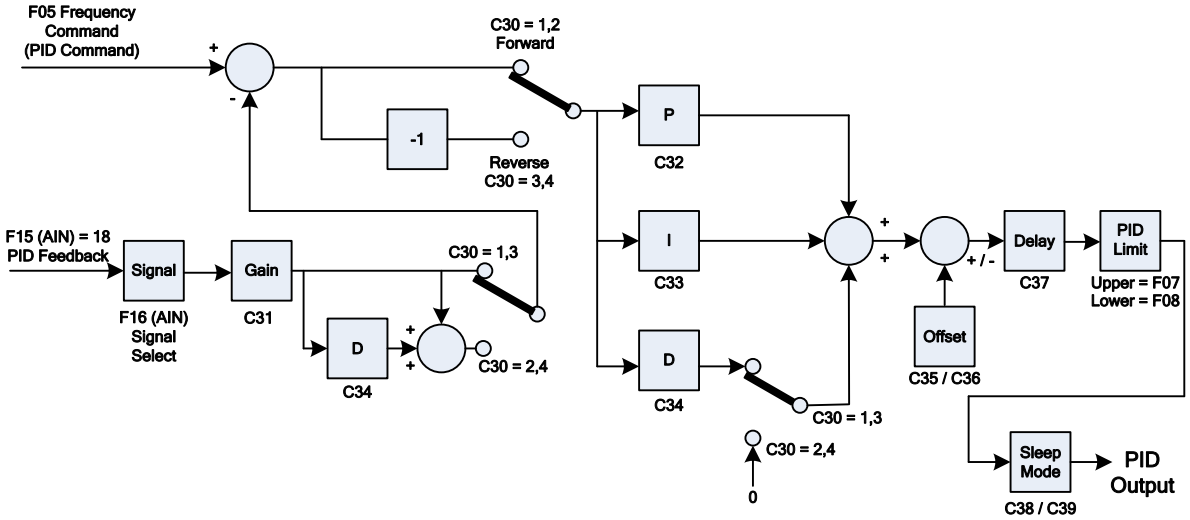


Fig. 11.13 PID flow control diagram

1.) In PID mode select, AIN on TM2 is the PID feedback signal (Set F15=018.)

2.) The PID command (set point) is selected by parameter F05 = (000, 001 or 004).
This value is stored in F28.

C38 PID Sleep start frequency	**00.0 - 200Hz**
C39 PID Sleep delay time (sec)	**00.0 - 25.5sec**

PID sleep mode requires setting all functions below:
C30=001 – 004 (PID Enable)
F15=018 (AIN is the PID feedback signal)
F28=PID preset frequency
C38 sleep start frequency: (Hz)
C39 PID sleep delay time: (Sec)

When the PID output frequency gets lower than the PID sleep start frequency (C38) for longer than the time set by (C39), the inverter output will decelerate to zero speed (Sleep mode). When the PID output frequency becomes higher than the sleep start frequency (C38), the inverter output accelerates to PID output frequency (Wake mode). Refer to Fig. 11.14 on the next page.

Timing diagram is as follows:

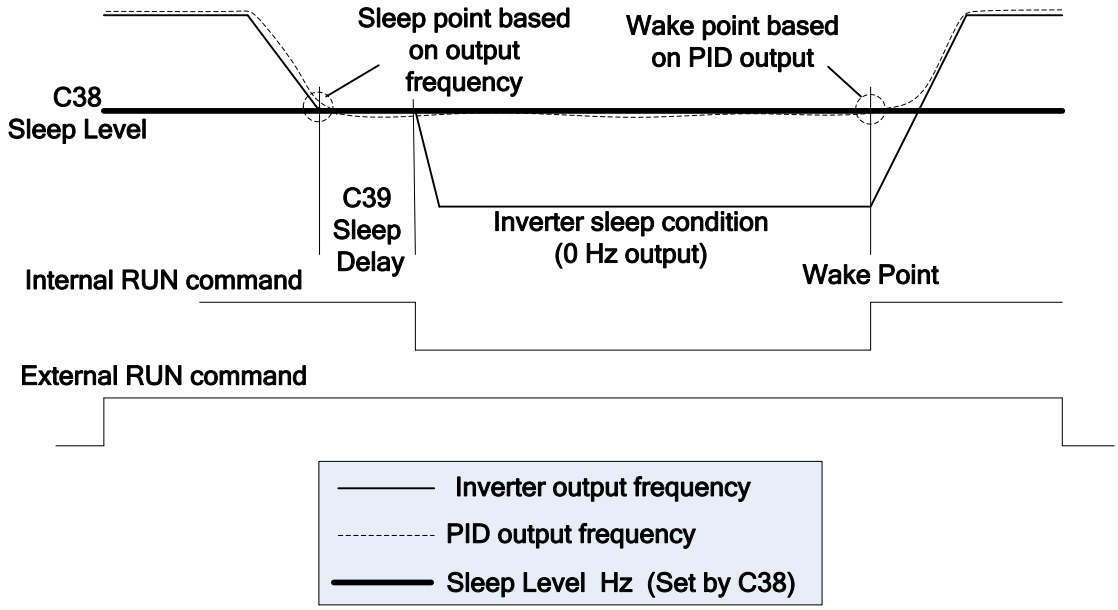


Fig. 11.14 Sleep / Wake Mode

C40 Frequency Up / Down Control modes using MFIT	**000: When using the Up / Down command, the set frequency will be stored after the inverter stops.** ***The Up / Down function is not available in stop mode.*** **001: When using the Up / Down command, the set frequency will be reset to 0Hz after the inverter stops.** **002: When using the Up / Down command, the set frequency will be stored after the inverter stops.** ***The Up / Down function is available in stop mode.***

1) C40=000: When the RUN signal is ON, the inverter will accelerate to the value set by F28 then continue to run at the set commanded speed. When Up / Down terminal is activated, the inverter begins to accelerate/decelerate until the Up / Down command is removed. The inverter then runs at that set speed.

   When the RUN signal is OFF, the inverter decelerates to STOP (or coasts to stop) according to the setting of (F09) and the last output frequency, will be stored in (F28).

   The Up / Down Key is *unavailable* in stop mode. The stored frequency can not be changed by at The Up / Down terminal, but can be changed by the content of F28 via the keypad.

2) C40=001: The inverter will run from 0Hz when the run signal is applied. The Up / Down operation is same as C40=000, except when restarted, the inverter always ramps up from 0Hz.

3) C40=002: Same as for C40=001 except the Up / Down is available while in stop mode to adjust the set frequency.

C41 Local /Remote control select description

• **Local mode**

Run command:

The Run / Stop button on the keypad controls drive operation. Parameter F04 setting has no effect on control.

Frequency command:

When C41=000, the Up / Down key on the keypad controls the inverter and the F05 setting has no effect.

When C41=001, the potentiometer on the keypad controls frequency, and the F05 setting has no effect.

• **Remote mode**

Run command:

The Run command is set by the value of F04.

Frequency command:

The frequency command is set by the value of F05.

• **The control mode is changed by simultaneously pressing V/RESET and DATA/ENT keys.**
NOTE: ***The Inverter must be in STOP mode***

C42/43 (SIF-IO option card)	**S5 / S6 terminal on MFIT Setting** **000: Forward** **001: Reverse** **002: Preset speed command 1** **003: Preset speed command 2** **004: Preset speed command 3** **005: Jog frequency command** **006: Emergency stop (E.S.)** **007: Base block (b.b.)** **008: Switch to 2nd acceleration/ deceleration time.** **009: Reset** **010: Up command** **011: Down command** **012: Control signal switch** **013: Communication control signal switch** **014: Acceleration / deceleration disable** **015: Master / Auxiliary speed switch** **016: PID Function disable** **019: DC Injection brake signal**

Refer to Parameters F11 - F14 for a detailed explanation

C44: Multi-function input terminal S1-S6 signal scan time (N msec ×8), N = (1 - 100 times)

C45: AIN signal scan time (N msec ×8), N = (1 - 100 times)

1.) As an example, if the C44 scan time is set to 80 ms (i.e N=10), then any digital input signals applied for less than 80 msec will be ignored.

2.) If the scanned signal is seen for N times (scan times), the inverter responds to it as a signal change.
If it is seen for less than N times, it is considered noise. Minimum Scan time = 8ms.

3.) The user can set scan interval times according to the noise in the operating environment. Extend the values of C44/C45 if noise is a problem, however this will reduce the signal response time.

C46 (SIF-IO Option card) Multi-function output T+, T-	**000: Run** **001: Frequency reached [Preset target frequency ± F23]** **002: Frequency reached [Preset output frequency level (F22) ±F23]** **003: Frequency detection (>F22)** **004: Frequency detection (<F22)** **005: Fault.** **006: Auto-restart** **007: Momentary power loss** **008: Emergency stop (E.S.)** **009: Base block (b.b.)** **010: Motor overload protection** **011: Inverter overload protection** **012: Not used** **013: Power on** **014: Communication error** **015: Output current detection (>F24)**

Refer to Parameter F21 for a detailed explanation.

C47 Remote keypad control selection	**000: Disable** **001: Enable. Operation determined by parameter F09 on signal loss** **002: Enable. Operation at the last set frequency on signal loss (Stop mode by Inverter keypad or F04 parameter as configured)**

1.) Before installing the remote keypad, set C47 to 001 or 002 via the main keypad, then POWER DOWN the inverter and install the remote keypad.

2.) When C47=001, parameters C49 - C53 will be auto set as follows:
Inverter communication address: No. 1
Data bytes: 8 bit
Baud rate: 38400 (bps)
Parity: no parity
Stop bits: 1

3.) Set C47 = 000 via the main keypad after the remote keypad is removed.

4.) C47 can't be changed by the remote keypad.

NOTES: 1. For safety reasons, install or remove remote keypad only when the power is OFF.
2. If the remote keypad is installed while the power is ON and in stop mode, the inverter will be controlled by the remote keypad.
3. If the remote keypad installed while the power is ON and in run mode, the Inverter will be controlled by the main keypad. The remote keypad control will not be effective until the inverter has stopped.

C48 Copy module	**000: Copy module disabled** **001: Copy to module from inverter (read)** **002: Copy to inverter from module (write)** **003: Read/ write check (compare the parameters)**

NOTE: Module copy function is applicable only to inverters with the same voltage and kW rating.

C49 Inverter communication address: 001 - 254

C49 sets the communication address, for the specific inverter when multi-inverters are controlled.

C50 Baud rate (bps)	**000: 4800** **001: 9600** **002: 19200** **003: 38400**

C51 Stop bit	**000: 1 Stop bit** **001: 2 Stop bit**

C52 Parity bit	**000: No parity** **001: Even parity** **002: Odd parity**

C53 Data bits	**000: 8 Bits data** **001: 7 Bits data**

1.) RS-485 communication: (requires RS485 option SIF-485)
1 to 1 control: A PC or PLC controls one inverter (C49 communication address to 001 - 254).
1 to multiple inverters control: A PC or PLC controls several inverters (up to 254) inverters use parameter C49 to set the communication address (001 - 254). When the communication address =000, the inverter is controlled by serial communication regardless of the C49 setting.

2.) RS-232communication: (requires RS232 option SIF-232)
1 to 1 control: A PC or PLC controls one inverter (C49 communication address to 001 - 254).

NOTES: ***a*** *.The BAUD RATE (C50) and communication format (C51/C52/C53) of the Host Computer or PLC and inverter must be the same.*

b*. The inverter will validate the modified parameters after the parameters are modified by the Host Computer or PLC.*

c*. Communication protocol: refer to the EV MODBUS communication protocol manual*

d*. Parameters C49 - C53 cannot be changed via the communication module*

C54/ C55 Communication error detection time / Communication error operation selection

1.) Time out detection time: 00.0 - 25.5sec; setting 00.0 sec, disables the time out function.

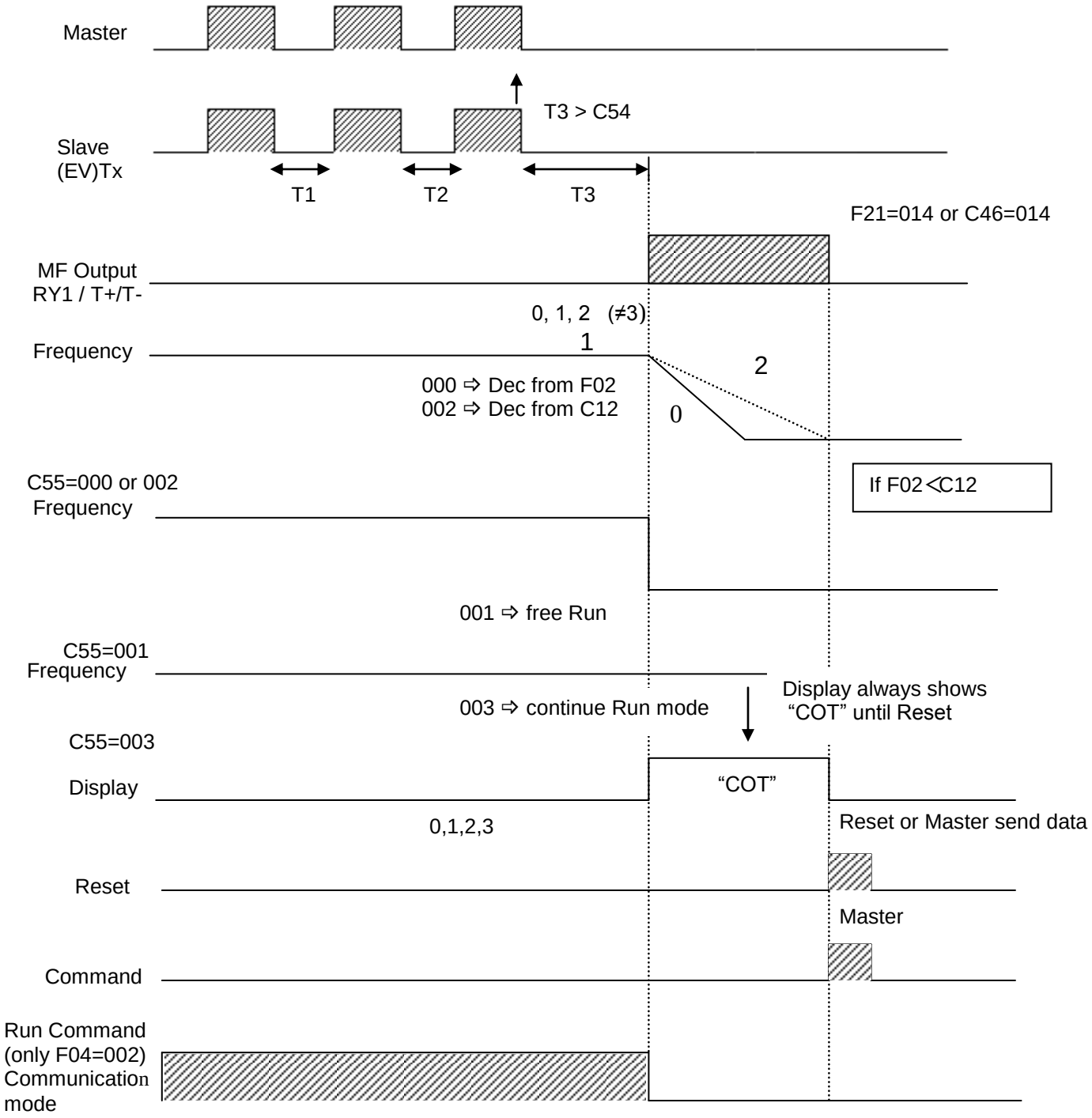
Default: 00.0sec ****Cannot be modified when in serial communication mode***.

2.) Time out operation selection:

000: Deceleration to stop (F02: Deceleration time 1).
001: Free run (coast) to stop.
002: Deceleration to stop (C12: Deceleration time 2).
003: Continue operating.

Default=000 ****Cannot be modified when in serial communication mode***.

C54/C55 Communication error parameter timing pattern



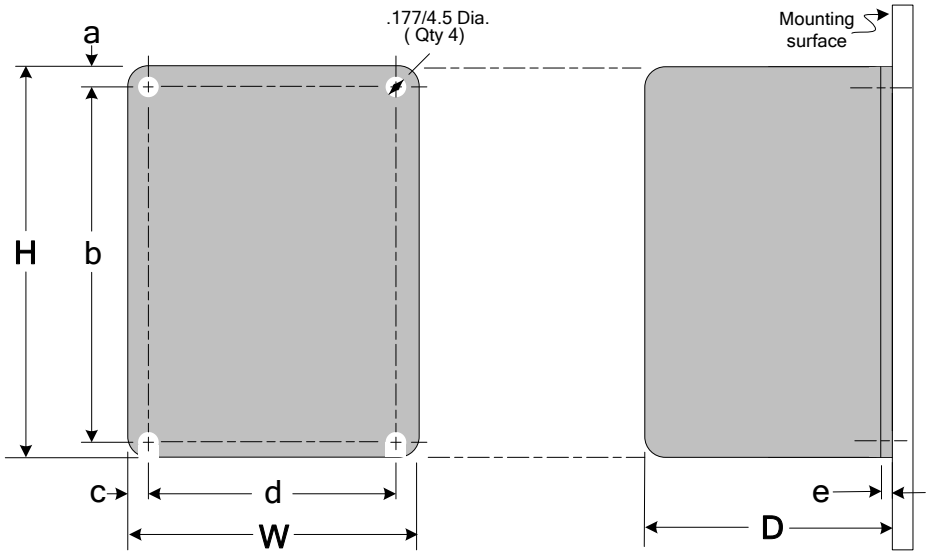
NOTE : COT = communication time out fault

Fig. 11.15 Communication error timing pattern

Section 12 - *Envelope & Dimensional Tables*

Select the Model No. from the table below and then select the corresponding frame size. Refer to the dimensional table for envelope size and mounting dimensions.

Frame Size	Model No.	Input Voltage VAC	Phase Ø		HP CT	Approx. Wt. Lbs.
			IN	OUT		
1	JNEV – 1P2 – H1	115	1	3	.25	1
	JNEV – 1P5 – H1	115	1	3	.50	2
	JNEV – 101 – H1	115	1	3	1	2
	JNEV – 2P2 – H1	230	1	3	.25	1
	JNEV – 2P5 – H1	230	1	3	.50	1
	JNEV – 201 – H1	230	1	3	1	1
	JNEV – 2P5 – H3	230	3	3	0.5	1
	JNEV – 201 – H3	230	3	3	1	1
2	JNEV – 202 – H1	230	1	3	2	2
	JNEV – 203 – H1	230	1	3	3	2
	JNEV – 202 – H3	230	3	3	2	2
	JNEV – 203 – H3	230	3	3	3	2
	JNEV – 401 – H3	460	3	3	1	3
	JNEV – 402 – H3	460	3	3	2	3
	JNEV – 403 – H3	460	3	3	3	3



Frame Size	Dimensions Inches / mm							
	H	W	D	a	b	c	d	e
1	5.2/132	3.03/77	5.13/130.5	0.17/4.3	4.86/123.5	0.20/5	2.64/67	0.315/8
2	5.2/132	4.65/118	5.83/148	0.17/4.3	4.86/123.5	0.20/5	4.25/108	0.315/8

Section 13 - *Error Codes and Troubleshooting*

The following *Tables 13.1 - 13.5* describe the error codes that are displayed under fault conditions. They are broken down into five categories:

- Unresettable / Unrecoverable errors
- Errors recoverable both manually and automatically
- Manually recoverable errors Only *(no auto-restart)*
- Set-up configuration and interface errors
- Keypad errors

Some of the faults can be reset manually via the ***Reset*** key, or by an ***external reset*** command. Certain faults can also be reset by setting parameter *F41=000* (Enable Auto Restart). Other faults are ***not resettable***. In this case, the inverter may need a total replacement or a ***part*** replaced.

SAFETY FIRST! **Use extreme caution when trouble shooting.**

Table 13.1 Unresettable / Unrecoverable Errors

Display	Error	Cause	Remedy
EPR	EEPROM problem	EEPROM problem	*Replace EEPROM*
***OV**	Overvoltage during stop	Voltage detection circuit malfunction	*Repair or replace unit*
***LV**	Undervoltage during stop	1. Input voltage too low 2. Power resistor or fuse burned out. 3. Detection circuit malfunctions	*1. Check that the input voltage is correct.* *2. Replace the power resistor or the fuse* *3. Repair or replace inverter*
***OH**	The inverter is overheating during stop	1. Thermal detection circuit malfunction 2. Ambient temperature too high or poor ventilation	*1. Repair or replace unit* *2. Improve ventilation conditions or relocate inverter*
CTR	Current transducer detection error	Current transducer or circuit error.	*Repair or replace unit*

**** The Fault relay contact does not operate with these error indications.***

Table 13.2 Automatically and Manually Recoverable Errors

Display	Error	Cause	Remedy
OCS	Overcurrent at start	1. Motor winding and frame short circuit 2. Motor and ground short circuit 3. Power module is damaged	*1. Check the motor* *2. Check the wiring* *3. Replace the power module*
OCD	Overcurrent at deceleration	The preset deceleration time is set too short	*Set a longer deceleration time (Parameter F02)*
OCA	Overcurrent at acceleration	1. Acceleration time is set too short 2. The capacity of the motor exceeds the capacity of the inverter 3. Short circuit between the motor winding and frame. 4. Short circuit between motor wiring and earth 5. IGBT module is damaged	*1. Set a longer acceleration time (Parameter F01)* *2. Replace the inverter with the same or greater capacity as that of the motor* *3. Check the motor* *4. Check the wiring* *5. Replace the IGBT module*
OCC	Overcurrent during run	1. Transient load change 2. Transient power change	*Increase inverter capacity*
OVC	Overvoltage during operation/ deceleration	1. Deceleration time is set too low or excessive load inertia 2. Input voltage varies widely	*1. Set a longer deceleration time (Parameter F02)* *2. Add a braking resistor or braking unit* ***3. Add a reactor to the input line side*** *4. Increase inverter capacity*
OHC	Excessive heat sink temperature during operation	1. Excessive motor load 2. Ambient temperature too high or poor ventilation	*1. Check if there are any problems with the motor load* *2. Increase inverter capacity* *3. Improve ventilation conditions* *4. Check the setting value of parameter C13*

Table 13.3 Manually Recoverable Errors Only (no auto-restart)

Display	Error	Cause	Remedy
OC	Overcurrent during stop	1. OC Detection circuit malfunction 2. Bad connection for CT signal cable	*Send the inverter back for repair*
OL1	Motor overload	1. Motor under-sized 2. Improper settings of parameter F43	*1. Increase motor capacity* *2. Set Parameter F43 based on the motor nameplate current.*
OL2	Inverter overload	Excessively loaded	*Increase inverter capacity*
LVC	Undervoltage during operation	1. Input voltage too low 2. Input voltage varies widely	*1. Improve input voltage quality.* *2. Set a longer acceleration time (Parameter F01)* *3. Add a line reactor to the input side* *4. Contact technical support*

Table 13.4 Set-up Configuration and Interface Errors

Display	Error	Description
SP0	Zero speed stop	*Set frequency is <0.1Hz. Increase set frequency*
SP1	Fail to direct start on power-up	*1. If the inverter is set to external control mode (F04=001), and direct start on power-up is disabled (C09=001), the inverter cannot be started and will flash SP1 when the run switch is ON and power is applied. (refer to C09 for selections).* *2. Set C09=000 for direct start.*
SP2	Keypad emergency stop	*1. If the inverter is set to external control mode (F04=001) and the Stop key is pressed, the inverter will stop based on the setting of F9 and SP2 will flash. Turn the run switch to OFF and then ON again to restart the inverter.* *2. If the inverter is in communication mode and Stop key is pressed, the inverter will stop based on the setting of (F9) and SP2 will flash. The PLC or PC must send a Stop command then a Run command to the inverter for it to be restarted.*
E.S.	External emergency stop	*The inverter will decelerate to stop and flashes E.S. when there is an external emergency stop signal via the Control input terminals (see parameters F11-F14).*

b.b.	External base block	*The inverter stops immediately and then flashes b.b. when external base block is input through the multi-functional input terminal (see descriptions of F11-F14).*
PID	PID feedback signal loss	*PID feedback signal circuit error detection*
———	Remote keypad cable broken	*1. When REMOTE KEYPAD does not communicate with the inverter, this signal will be displayed on the Main keypad.* *2. When REMOTE KEYPAD connects improperly with inverter, this signal will be displayed on the main keypad.* *3. When both REMOTE KEYPAD and main KEYPAD display this signal, communication errors result.*

Table 13.5 Keypad Errors

Display	Error	Cause	Remedy
Er1	Key operation error	1. Attempt to Press▲ or ▼ keys when F05 ≠ 000 or in speed operation. 2. Attempt to modify parameters, which can not be modified during Run (see parameter list).	*1. ▲ or ▼ keys can be used to control output frequency only when F05=000.* *2. Modify parameters only in stop mode.*
Er2	Parameter setting error	The setting of parameter F07 is within ranges of Parameters C27 ± C29 or C28 ± C29 F07<F08 or F07=F08	*1. Modify Parameters C27- C29* *2. F07>F08*
Er5	Modification of parameter is not allowed during communication	1. Enable command disabled during communication 2. Modifying parameters C49-C53 during communication.	*1. Issue an enable command before/while communicating.* *2. Set up parameters before communicating.*
Er6	Communication failure	1. Faulty/Incorrect wiring. 2. Incorrect settings of communication parameters. 3. Check-sum error. 4. Incorrect communication verification.	*1. Check hardware and wiring.* *2. Check parameters C49-C53*
Er7	Incorrect parameter settings	1. Attempt to change F00 2. Voltage and current detection circuits are malfunctioning.	*Reset inverter or contact technical support*
EP1	Parameter set error, Copy unit failure	1. Can not connect with Copy unit. 2. Copy unit failure. 3. The voltage and inverter rating on Copy unit & the inverter are different.	*1. Modify Parameter C48* *2. Change Copy unit* *3. Copy from keypad to inverter with only matched HP ratings.*
EP2	Parameters do not match	Copy the parameter to inverter to verify the parameter not matched.	*1. Change Copy unit* *2. The voltage and HP rating of Copy unit is different than the inverter.*

Appendix A - *Inverter Specifications*

Inverter Basic Specifications

Model	EV- xxx- H1			EV-xxx-H1(F)					EV-xxx-H3				
	120VAC			240VAC									
				1Ø					3Ø				
	1P2	1P5	101	2P2	2P5	201	202	203	2P2	2P5	201	202	203
Horsepower (HP)	0.25	0.5	1	0.25	0.5	1	2	3	0.25	0.5	1	2	3
Max. applicable motor output. HP *(kW)	0.25 (0.2)	0.5 (0.4)	1 (0.75)	0.25 (0.2)	0.5 (0.4)	1 (0.75)	2 (1.5)	3 (2.2)	0.5 (0.2)	0.5 (0.4)	1 (0.75)	2 (1.50)	3 (2.2)
Rated output current (A)	1.7	3.1	4.2	1.7	3.1	4.2	7.5	10.5	1.7	3.1	4.2	7.5	10.5
Rated capacity (kVA)	0.53	0.88	1.60	0.53	0.88	1.60	2.90	4.00	0.53	0.88	1.60	2.90	4.00
Input voltage range (VAC)	**1Ø** 100 -120VAC +10%, -15% (50/60Hz)			**1Ø** 200 - 240VAC +10%,-15% (50/60Hz)					**3Ø** 200 - 240VAC +10%,-15% (50/60Hz)				
Output voltage range (VAC)	3Ø 0 - 240VAC												
Input current (A)	7.1	12.2	17.9	4.3	5.4	10.4	15.5	21	3.0	4.0	6.4	9.4	12.2
Inverter weight lb (kg) Inverter with filter weight lb (kg)	1.37 (0.62)	1.50 (0.68)	1.59 (0.72)	1.43 (0.65) 1.57 (0.71)	1.48 (0.67) 1.71 (0.73)	1.48 (0.67) 1.71 (0.73)	2.20 (1.0) 2.76 (1.25)	2.31 (1.05) 2.87 (1.3)	1.34 (0.61)	1.34 (0.61)	1.46 (0.66)	2.09 (0.95)	2.20 (1.0)
Maximum momentary power loss time (sec.)	1.0	1.0	1.0	1.0	1.0	1.0	2.0	2.0	1.0	1.0	1.0	2.0	2.0
Enclosure	IP20												

Model	EV-xxx-H3(F)		
	460VAC		
	401	402	403
Horse power (HP)	1	2	3
Max. applicable motor Output HP * (kW)	1.0 (0.75)	2.0 (1.50)	3.0 (2.2)
Rated output current (A)	2.3	3.8	5.2
Rated capacity (kVA)	1.7	2.9	4.0
Input voltage range(VAC)	3Ø 380 - 480VAC +10%,-15% (50/60Hz)		
Output voltage range(VAC)	3Ø 0 - 480VAC		
Input current (A)	3	4.8	6.6
Inverter weight lb (kg) Inverter with filter weight lb (kg)	3.31 (1.26) 3.70 (1.37)	3.35 (1.29) 3.75 (1.4)	3.42 (1.34) 3.82 (1.45)
Maximum momentary power loss time (sec.)	1.0	1.0	2.0
Enclosure	IP20		

**** Based on a 4-Pole Motor***

Inverter General Specifications

Frequency control	Range	0 - 200Hz
	Initial Drive Torque Rating	100% / 3Hz (Vector mode)
	Speed Control Range	20 :1 (Vector mode)
	Speed Control Precision	±0.5% (Vector mode)
	Setting resolution ***(Note1)***	Digital: 0.1Hz (0 - 99.9Hz) / 1Hz (100 - 200Hz); Analog: 0.06Hz / 60Hz
	Keypad setting	Set directly with▲▼ keys *or* the potentiometer on the keypad
	Display	3-digit, 7-segment. displays; frequency / DC voltage / output voltage / Current / inverter parameters / fault log / program version / PID feedback control potentiometer.
	External signal setting	•External: 0(2)-10V / 0(4)-20mA •Performs up/down controls with multi-function contacts on the terminal strip.
	Frequency limit function	Upper / lower frequency limits, and two skip frequencies.
Genera control	Carrier frequency	4 - 16KHz (default 10KHz, above 10KHz with De-rating)
	V/F pattern	6 fixed patterns 50Hz / 60Hz, 1 programmable
	Acc/dec control	Two-stage acc / dec time (0.1 - 999s)
	Multi-functional analog output	6 functions (refer to F26 description)
	Multi-functional input	19 functions (refer to F11 - F14 description)
	Multi-functional output	16 functions (refer to F21 description)
	DI (digital input)	NPN / PNP alternative : 4 points standard, 2 points optional (S1 - S4 standard, S5 & S6 optional)
	DO (digital output)	Relay output : Form A contact ---- set to multi-function output. External multi-function output option 1 point (open collector transistor 24V, 600mA)
	AI(analog input)	Set speed command and PID feedback signal (4 - 20mA / 0 -10V)
	Other functions	Instantaneous power loss on restart, speed search, fault restart, DC injection braking, torque boost, 2 / 3 wire control & PID function
	Communication control	•RS485 Option card: Modbus RTU / ASCII mode, 4800 - 38400 bps, max. 254 stations •PC / PDA software
Environmental	Ambient temperature	(IP20)14 - 122 F° (-10 - 50 C°), (IP65)14 - 104 F° (-10 - 40 C°)
	Storage temperature	- 4 - 140 F° (- 20 - 60 C°)
	Humidity	0 – 95% RH (non condensing)
	Altitude	1000m or below
	Vibration	1G (9.8m/s^2)
	EMI / EMS Compatibility	Built-in class B / external: class A, accordance with EN61800-3 first non limit / limit environment
	LVD	Accordance with EN50178
	Enclosure	IP20
	Safety Class	UL508C

Inverter General Specifications Con't

Protective Functions	Over load protection	Inverter rated current 150%/1min
	International conformity	UL / CE
	Over voltage	230V Class: DC voltage >400V 460V Class: DC voltage >800V
	Under voltage	230V Class: DC voltage <190V 460V Class: DC voltage <380V
	Instantaneous power loss restart	Set to enable or disable
	Stall prevention	ACC / DEC / Operation stall prevention and stall prevention level.
	Output terminal short circuit	Electronic circuit protection
	Other faults	Electronic circuit protection
	Other functions	Over current, over voltage, under voltage, over load, instantaneous power loss restart, ACC / DEC / Operation stall prevention, output terminal short circuit, grounding error, reverse limit, directly start on power up and fault reset limit.

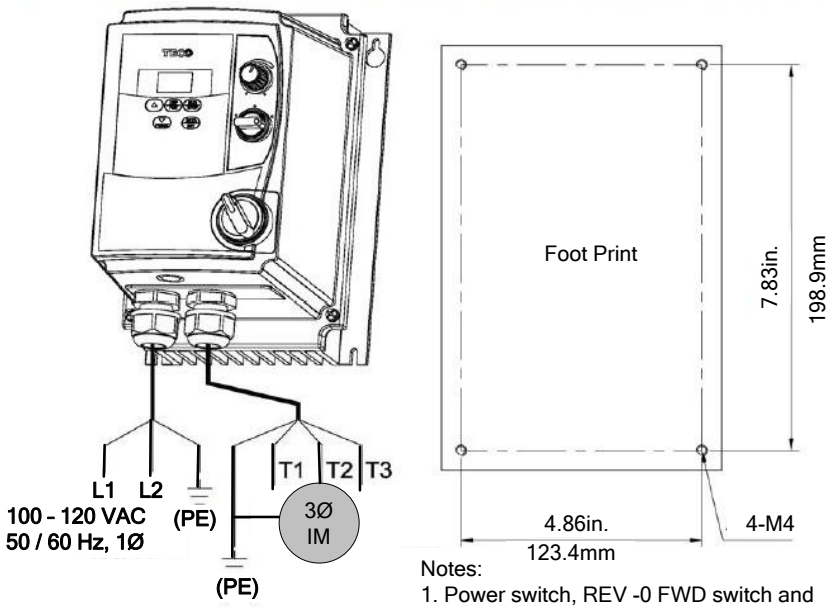
Note1: The setting resolution above 100Hz is 1Hz when controlled by keypad, and 0.01Hz when controlled using a computer (PC) or programmable controller (PLC).

Note 2: EV-1P2 - 101-H1, 2P2 -201-H1/H3, and 401- 403-H3 type (Carrier frequency =10KHz) with option filter complies with EN61800-3 first environment restricted distribution.
EV-202- 203-H1/H3 type (Carrier frequency =10KHz) with option filter complies with EN61800-3 first environment unrestricted distribution.
EV-2P2-201-H1F type (Carrier frequency =10KHz) with *built-in* filter complies with EN61800-3 first environment unrestricted distribution.
(IP65) EV-2P2-403-H1(3)FN4(S) series & EV- 401- 403-H3F type (Carrier frequency=10KHz) With built-*in* filter & EV-202-203-H1F type (Carrier frequency =10KHz) complies with EN61800-3 first environment restricted distribution.

Appendix B – *NEMA 4 EV Installation and Wiring*

The following describes the installation and wiring for the ***EV*** inverter NEMA 4 enclosures.

Models: JNEV-1P2 / 1P5 / 101 / 2P2 / 2P5 / 201 – H1FN4S (IP65).



Notes:
1. Power switch, REV -0 FWD switch and Potentiometer are only for for the models JNEV – 1P2 to 201 – H1FN4S.
2. Power supply cable : #14 AWG (2.0m).
3. Motor cable: #16 AWG (1.25m)
4. Tightening torques:
   - Power / motor cable plug-in terminal block (TM1): 4.34 lb-in.
   - Control wiring terminal block (TM2): 3.47 lb-in.
   - Outer cover screws (M4): 5.20 lb-in.

Fig. B.1 JNEV NEMA4 Installation and Mounting

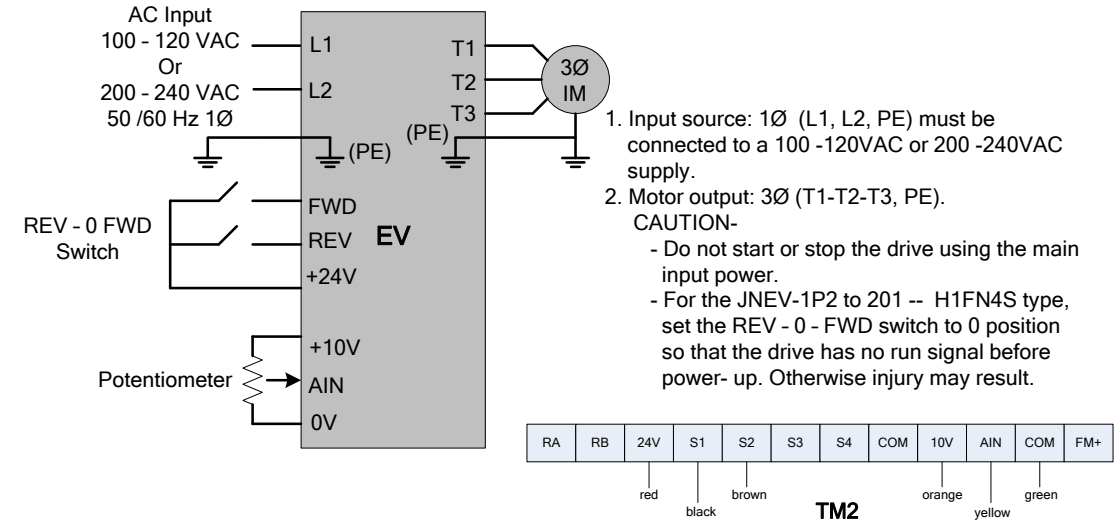
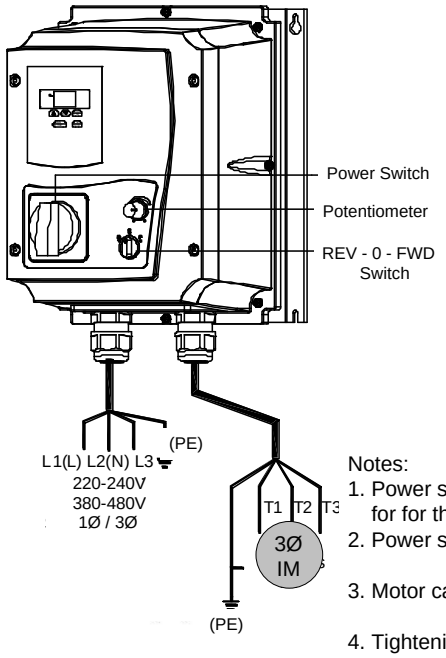
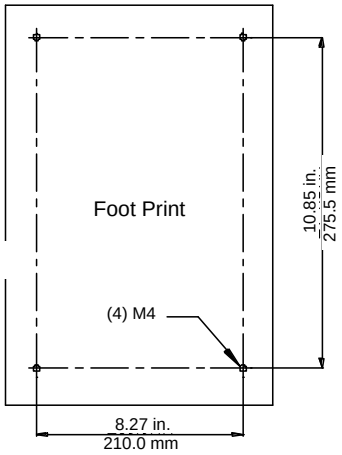


Fig. B.2 JNEV NEMA4 Wiring Diagram

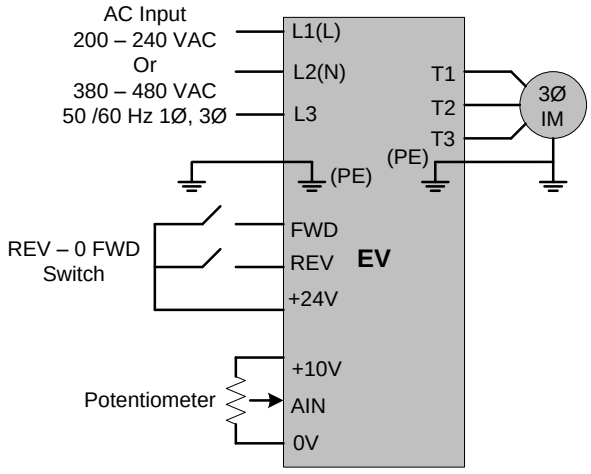
Models: JNEV – 202/203/401/402/403 – H3FN4S (IP65) Installation



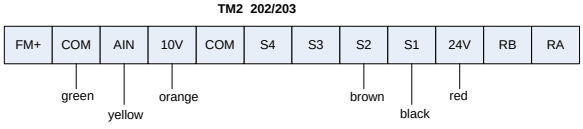


Notes:
1. Power switch, REV -0 FWD switch and Potentiometer are only for for the models JNEV – 202 - 403 – H3FN4S.
2. Power supply cable :JNEV-200 #12 AWG (3.5mm2).
   JNEV-200 #16 AWG (1.25mm2)
3. Motor cable: JNEV-200 #14 AWG (2.0m)
   JNEV-200 #16 AWG (1.25m)
4. Tightening torques:
   - Power / motor cable plug-in terminal block (TM1): 6.94 lb-in. (8 kgf-cm)
   - Control wiring terminal block (TM2): 3.47 lb-in. (4 kgf-cm)
   - Outer cover screws (M4): 6.94 lb-in. (8 kgf-cm)

Fig. B.3 JNEV NEMA4 Installation and Mounting



Notes:
1. Input source: 1Ø (L1(L), L2(N), PE) must be connected to a 200 -240VAC or 3Ø (L1(L), L2(N), L3, PE) must be connected to a 200 -240, 380-480 VAC supply.
2. Motor output: 3Ø (T1-T2-T3, PE).
   CAUTION-
   - Do not start or stop the drive using the main input power.
   - For the JNEV-202 to 403 – H3FN4S type, set the REV – 0 – FWD switch to 0 position so that the drive has no run signal before power- up. Otherwise injury may result.
   - For the JNEV-202 to 403 – H3FN4 type, set the RE or FW switch to the 0FF position so that the drive has no run signal before power- up. Otherwise injury may result.



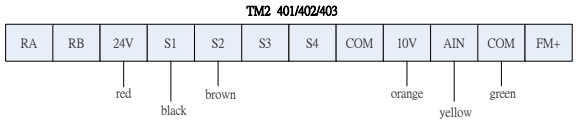
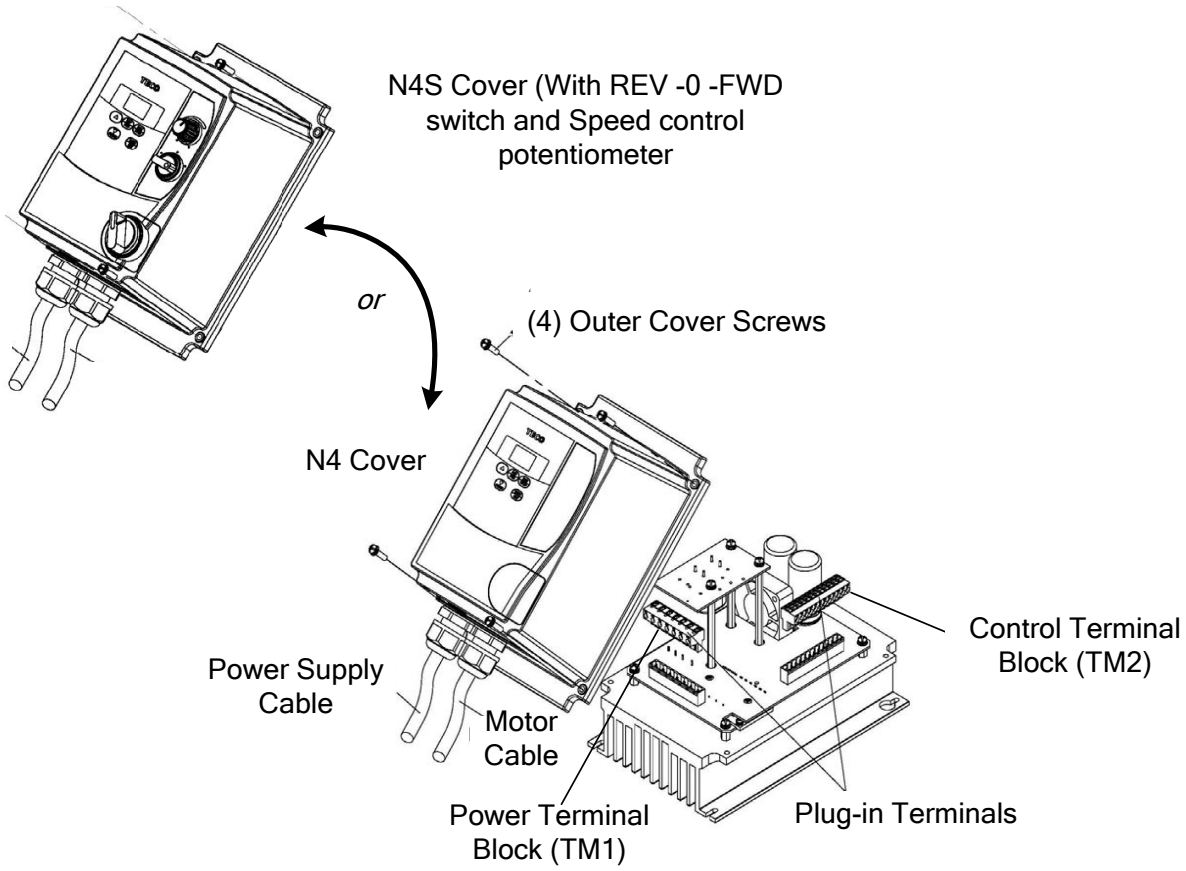


Fig. B.4 JNEV NEMA4 Wiring Diagram

JNEV NEMA4 Assembly and Terminal layout



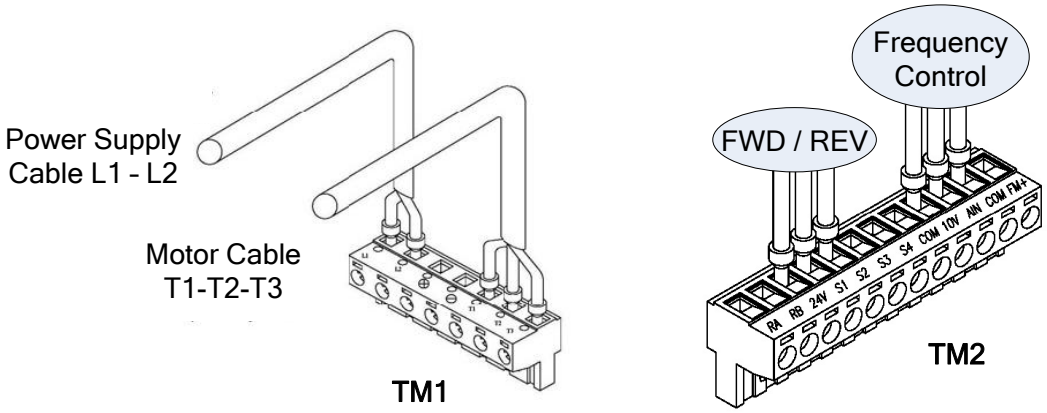


Fig. B.5 M/N JNEV – YYY – H1FN4 & H1FN4S (115VAC and 230VAC) Connection Diagram

JNEV NEMA4 Dimensions

IP65 Frame 1 (switch) JNEV-1P2/1P5/101/2P2/2P5/201 - H1FN4FS

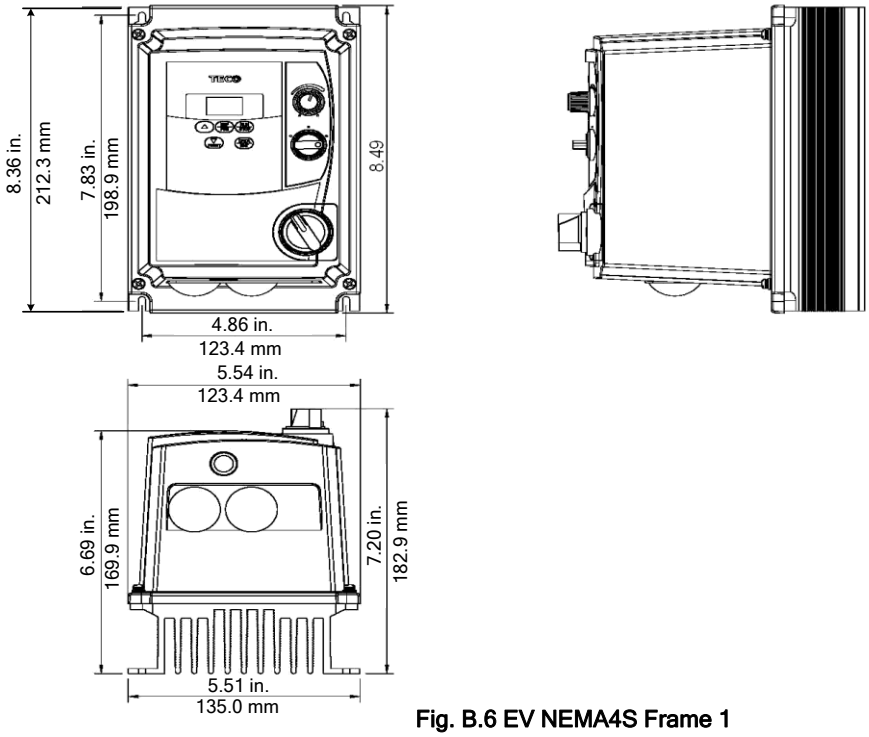


Fig. B.6 EV NEMA4S Frame 1

IP65 Frame 2 (*switch) JNEV-202/203/401/402/403 - H3FN4FS

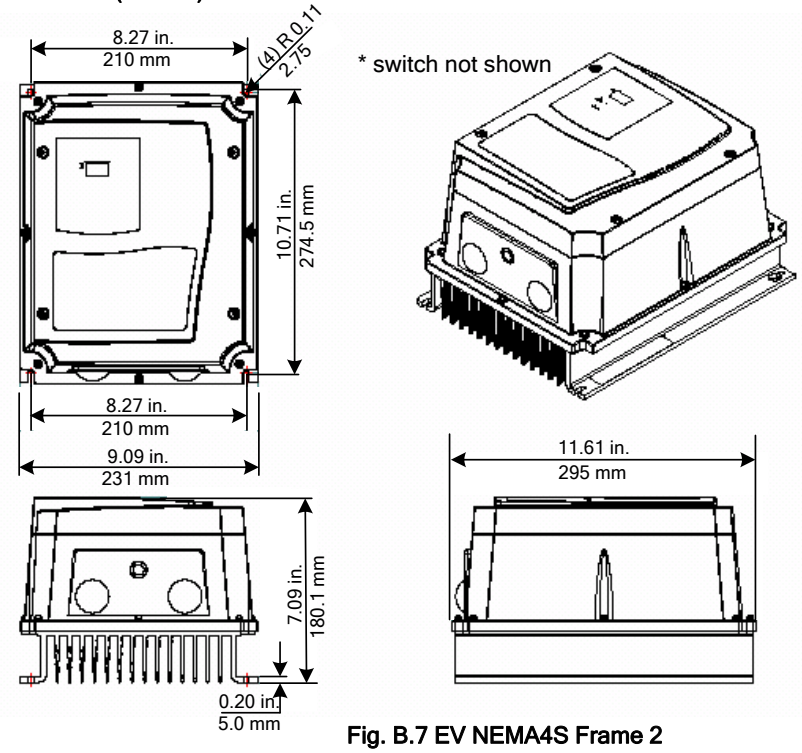


Fig. B.7 EV NEMA4S Frame 2

Appendix C – *EV Parameter Setting List*

Customer:	**EV Model No.**
Site:	
Equipment:	

F (Basic) Parameters				**C (Advanced) Parameters**			
Parameter	Setting	Parameter	Setting	Parameter	Setting	Parameter	Setting
F00		F28		C00		C28	
F01		F29		C01		C29	
F02		F30		C02		C30	
F03		F31		C03		C31	
F04		F32		C04		C32	
F05		F33		C05		C33	
F06		F34		C06		C34	
F07		F35		C07		C35	
F08		F36		C08		C36	
F09		F37		C09		C37	
F10		F38		C10		C38	
F11		F39		C11		C39	
F12		F40		C12		C40	
F13		F41		C13		C41	
F14		F42		C14		C42	
F15		F43		C15		C43	
F16		F44		C16		C44	
F17		F45		C17		C45	
F18		F46		C18		C46	
F19		F47		C19		C47	
F20		F48		C20		C48	
F21		F49		C21		C49	
F22		F50		C22		C50	
F23		F51		C23		C51	
F24		F52		C24		C52	
F25		F53		C25		C53	
F26		F54		C26		C54	
F27				C27		C55	

NOTES:

Warranty

All Low Voltage Motor Control Products, such as Solid State Starters and Inverters, ("products") sold by TECO-Westinghouse Motors Company ("TWMC"), are warranted to be free from defects in material and workmanship for a period of 24 months from the date of shipment. A warranty of 36 months from the date of manufacture is applicable when a TWMC Low Voltage Motor Control Product and a TWMC Inverter Duty motor (per NEMA MG1-31.4.2.2) are purchased together.

This warranty is conditioned upon the installation, operation, and maintenance of the products in accordance with TWMC's recommendations or standard industry practice, and that the products have at all times been operated or used under the normal operating conditions for which they were designed. This warranty will not be applicable to products that have been altered without prior written permission from TWMC.

TWMC shall, at its sole option and expense, repair or replace, F.O.B. warehouse or TWMC designated service center, any such products, which are defective within the warranty period. In the event of warranty claims, TWMC must be notified promptly following any product failure. The product shall be sent to a TWMC authorized service center for diagnosis of the cause of failure. TWMC will not be responsible for any repair that has been performed without prior written permission from TWMC.

The repair or replacement of defective material and workmanship shall constitute complete fulfillment of TWMC's warranty liability, whether the warranty claims are based on contract, tort (including negligence and strict liability), or otherwise. **THERE ARE NO OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND ALL WARRANTIES ARISING FROM COURSE OF DEALING AND USAGE OF TRADE. UNDER NO CIRCUMSTANCES, SHALL TWMC BE LIABLE FOR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING FREIGHT.**

Warranty Return Procedure

The Product must be returned prepaid to TECO-Westinghouse Motor Company factory. A completed Return Material Authorization (RMA) form with an assigned RMA number must be included in the shipment. Contact the nearest TECO-Westinghouse location or Factory directly for RMA forms.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