

INVERTER

L510



INSTRUCTION MANUAL

115V Class 1~

Open Chassis

0.2 - 0.75 kW

0.25 - 1 HP

230V Class 1~ / 3~

Open Chassis

0.2 - 2.2 kW

0.25 - 3 HP

460V Class 3~

Open Chassis

0.75 - 2.2 kW

1 - 3 HP

- Read all operating instructions before installing, connecting (wiring), operating, servicing, or inspecting the inverter.
- Ensure that this manual is made available to the end user of the inverter.
- Store this manual in a safe, convenient location.
- The manual is subject to change without prior notice.

****** STATEMENT ******

Si Desea descargar el manual en español diríjase a este Link: www.tecowestinghouse.com

Table of Contents

Preface	0-1
1 Safety Precautions (English).....	1-1
1.1 Before Supplying Power to the Inverter.....	1-1
1.2 Wiring.....	1-2
1.3 Before Operation.....	1-3
1.4 Parameters Setting	1-3
1.5 Operation	1-4
1.6 Maintenance, Inspection and Replacement	1-5
1.7 Disposal of the Inverter	1-5
1 Consignes de sécurité (Français).....	1-6
1.1 Avant d'alimenter le disque dur	1-6
1.2 Câblage.....	1-6
1.3 Avant l'opération.....	1-7
1.4 Configuration Paramètre	1-7
1.5 Opération	1-8
1.6 Entretien, Inspection et remplacement.....	1-8
1.7 Mise au rebut du variateur.....	1-9
2 Model Description	2-1
2.1 Inverter Models – Motor Power Rating	2-2
3 Environment and Installation	3-1
3.1 Environment.....	3-1
3.2 Installation	3-2
3.3 Mounting on a flat surface	3-4
3.4 Inverter Exterior.....	3-6
3.5 Wire Gauges and Tightening Torque	3-6
3.6 Wiring Peripheral Power Devices.....	3-7
3.7 General Wiring Diagram.....	3-9
3.8 User Terminals.....	3-10
3.9 Power Terminals	3-11
3.10 Inverter Wiring.....	3-12
3.11 Input Power and Motor Cable Length.....	3-13
3.12 Cable Length vs, Carrier Frequency	3-13
3.13 Control Circuit Wiring	3-13
3.14 Inverter Specifications.....	3-14
3.15 General Specifications	3-16
3.16 Inverter De-rating Based on Carrier Frequency	3-17
3.17 Inverter Dimensions	3-18

4. Keypad and Programming Functions	4-1
4.1 LED Keypad	4-1
4.1.1 Keypad Display and Keys	4-1
4.1.2 Keypad Menu Structure	4-3
4.2 Parameters.....	4-8
4.3 Description of Parameters.....	4-21
5. Check Motor Rotation and Direction	5-1
6. Speed Reference Command Configuration	6-1
6.1 Reference from the Keypad	6-1
6.2 Reference from an Analog Signal (0-10V / 4-20mA) / Speed Pot	6-2
6.3 Reference from Serial Communication RS485.....	6-4
6.4 Change Frequency Unit from Hz to rpm.....	6-5
7. Operation Method Configuration (Run / Stop).....	7-1
7.1 Run / Stop from the Keypad	7-1
7.2 Run / Stop from External Switch / Contact or Pushbutton.....	7-2
7.3 Run / Stop from Serial Communication RS485	7-4
8. Motor and Application Specific Settings	8-1
8.1 Set Motor Nameplate Data.....	8-1
8.2 Acceleration and Deceleration Time	8-2
8.3 Volt/Hz Curve Modification (Torque Boost)	8-3
8.4 Rapid Stop	8-4
8.5 Forward and Reverse Jog	8-5
8.6 Analog Output Setup.....	8-6
9. Using PID Control for Constant Flow / Pressure Applications	9-1
9.1 What is PID Control.....	9-1
9.2 Connect Transducer Feedback Signal	9-3
9.3 Engineering Units	9-4
9.4 Sleep / Wakeup Function	9-5
10 Troubleshooting and Fault Diagnostics.....	10-1
10.1 General	10-1
10.2 Fault Detection Function	10-1
11 Inverter Options and AC Line Reactors	11-1
11.1 Options.....	11-1
11.2 AC Line Reactors	11-2
11.3 Communication Options.....	11-3
Appendix: UL Instructions	A1

Preface

The L510 product is an inverter designed to control a three-phase induction motor. Please read this manual carefully to ensure correct operation and safety aspects to become familiar with the inverter functions.

The L510 inverter is an electrical / electronic product and must be installed and handled by qualified service personnel.

Improper handling may result in incorrect operation, shorter life cycle, or failure of this product as well as the motor.

All L510 documentation is subject to change without notice. Be sure to obtain the latest editions for use or visit our website at www.tecowestinghouse.com , for documentation in Spanish visit www.tecowestinghouse.com.mx

Read this instruction manual thoroughly before proceeding with installation, connections (wiring), operation, or maintenance and inspection.

Ensure you have thorough knowledge of the inverter and familiarize yourself with all safety information and precautions before proceeding to operate the inverter. Read this instruction manual for detailed descriptions on parameters.

Please pay close attention to the safety precautions indicated by the warning  and caution  symbol.

 Warning	Ignoring the information indicated by the warning symbol may result in death or serious injury.
 Caution	Ignoring the information indicated by the caution symbol may result in minor or moderate injury and/or substantial property damage.

1. Safety Precautions (English)

1.1 Before Supplying Power to the Inverter



Warning

The main circuit must be correctly wired. For single phase supply use input terminals (R/L1, T/L3) and for three phase supply use input terminals (R/L1, S/L2, T/L3). Terminals U/T1, V/T2, W/T3 must only be used to connect the motor. Connecting the input supply to any of the U/T1, V/T2 or W/T3 terminals will cause damage to the inverter.



Caution

- To avoid the front cover from disengaging or other physical damage, do not carry the inverter by its cover. Support the unit by its heat sink when transporting. Improper handling can damage the inverter or injure personnel, and should be avoided.
- To avoid the risk of fire, do not install the inverter on or near flammable objects. Install on nonflammable objects such as metal surfaces.
- If several inverters are placed inside the same control enclosure, provide adequate ventilation to maintain the temperature below 40°C/104°F (50°C/122°F without a dust cover) to avoid overheating or fire.
- When removing or installing the digital operator, turn off the power first, and then follow the instructions in this manual to avoid operator error or loss of display caused by faulty connections.



Warning

This product is sold subject to IEC 61800-3. In a domestic environment this product may cause radio interference in which case the user may need to apply corrective measures.

1.2 Wiring



Warning

- Always turn OFF the power supply before attempting inverter installation and wiring of the user terminals.
- Wiring must be performed by a qualified personnel / certified electrician.
- Make sure the inverter is properly grounded. (230V Class: Grounding impedance shall be less than 100Ω. 460V Class: Grounding impedance shall be less than 10Ω.)
- Please check and test emergency stop circuits after wiring. (Installer is responsible for the correct wiring.)
- Never touch any of the input or output power lines directly or allow any input or output power lines to come in contact with the inverter case.
- Do not perform a dielectric voltage withstand test (megger) on the inverter this will result in inverter damage to the semiconductor components.



Caution

- The line voltage applied must comply with the inverter's specified input voltage. (See product nameplate section 2.1)
- Connect braking resistor and braking unit to the designated terminals. (See section 3.10)
- Do not connect a braking resistor directly to the DC terminals P(+) and N(-), otherwise fire may result.
- Use wire gauge recommendations and torque specifications. (See Wire Gauge and Torque Specification section 3.6)
- Never connect input power to the inverter output terminals U/T1, V/T2, W/T3.
- Do not connect a contactor or switch in series with the inverter and the motor.
- Do not connect a power factor correction capacitor or surge suppressor to the inverter output.
- Ensure the interference generated by the inverter and motor does not affect peripheral devices.

1.3 Before Operation



Warning

- Make sure the inverter capacity matches the parameters 13-00.
- Reduce the carrier frequency (parameter 11-01) if the cable from the inverter to the motor is greater than 80 ft (25m), refer to table 3.14.1. A high-frequency current can be generated by stray capacitance between the cables and result in an overcurrent trip of the inverter, an increase in leakage current, or an inaccurate current readout.
- Be sure to install all covers before turning on power. Do not remove any of the covers while power to the inverter is on, otherwise electric shock may occur.
- Do not operate switches with wet hands, otherwise electric shock may result.
- Do not touch inverter terminals when energized even if inverter has stopped, otherwise electric shock may result.

1.4 Parameter Setting



Caution

- Do not connect a load to the motor while performing a rotational auto-tune.
- Make sure the motor can freely run and there is sufficient space around the motor when performing a rotational auto-tune.

1.5 Operation



Warning

- Be sure to install all covers before turning on power. Do not remove any of the covers while power to the inverter is on, otherwise electric shock may occur.
- Do not connect or disconnect the motor during operation. This will cause the inverter to trip and may cause damage to the inverter.
- Operations may start suddenly if an alarm or fault is reset with a run command active. Confirm that no run command is active upon resetting the alarm or fault, otherwise accidents may occur.
- Do not operate switches with wet hands, otherwise electric shock may result.
- All L510 inverters have an independent external hardware emergency switch, which immediately shuts down the inverter output in the case of danger.
- If automatic restart after power recovery (parameter 07-00) is enabled, the inverter will start automatically after power is restored.
- Make sure it is safe to operate the inverter and motor before performing a rotational auto-tune.
- Do not touch inverter terminals when energized even if inverter has stopped, otherwise electric shock may result.
- Do not check signals on circuit boards while the inverter is running.
- After the power is turned off, the cooling fan may continue to run for some time.



Caution

- Do not touch heat-generating components such as heat sinks and braking resistors.
- Carefully check the performance of motor or machine before operating at high speed, otherwise injury may result.
- Note the parameter settings related to the braking unit when applicable.
- Do not use the inverter braking function for mechanical holding, otherwise injury may result.
- Do not check signals on circuit boards while the inverter is running.

1.6 Maintenance, Inspection and Replacement



Warning

- Wait a minimum of five minutes after power has been turned OFF before starting an inspection. Also confirm that the charge light is OFF and that the DC bus voltage has dropped below 25Vdc.
- Never touch high voltage terminals in the inverter.
- Make sure power to the inverter is disconnected before disassembling the inverter.
- Only authorized personnel should perform maintenance, inspection, and replacement operations. (Remove any metal jewelry such as watches and rings and use insulated tools.)



Caution

- The inverter can be used in an environment with a temperature range from 14° -104°F (-10-40°C) and relative humidity of 95% non-condensing.
- The inverter must be operated in a dust, gas, mist and moisture free environment.

1.7 Disposal of the Inverter



Caution

- Please dispose of this unit with care as an industrial waste and according to your local regulations.
- The capacitors of inverter main circuit and printed circuit board are considered as hazardous waste and must not be burned.
- The plastic enclosure and parts of the inverter such as the top cover board will release harmful gases if burned.

1. Consignes de sécurité (Français)

1.1 Avant d'alimenter le disque dur



Avertissement

- Le circuit principal doit être correctement câblée. Pour les terminaux monophasés d'approvisionnement de l'utilisation des intrants (R/L1, T/L3) et de trois bornes d'entrée de l'utilisation de l'offre de phase (R/L1, S/L2, T/L3). U/T1, V/T2, W/T3 ne doivent être utilisés pour connecter le moteur. Raccordement de l'alimentation d'entrée à l'un des U/T1, V/T2 W/T3 ou bornes risque d'endommager le lecteur.



Attention

- Pour éviter que le couvercle ne se désengage ou de tout autre dommage physique, ne portez pas le lecteur par son couverture. Soutenir le groupe par son dissipateur de chaleur lors du transport. Une mauvaise manipulation peut endommager le lecteur ou blesser le personnel, et doit être évitée.
- Pour éviter que les risques d'incendie, ne pas installer le lecteur sur ou à proximité d'objets inflammables. Installer sur des objets ininflammables comme les surfaces métalliques.
- Si plusieurs disques sont placés dans le même panneau de contrôle, fournir une ventilation adéquate pour maintenir la température en dessous de 40°C /104°F (50°C/ 122 °F sans housse de protection) pour éviter la surchauffe ou incendie.
- Lors d'un retrait ou d'installation de l'opérateur numérique, éteignez-le d'abord, puis de suivre les instructions de ce manuel pour éviter les erreurs de l'opérateur ou de la perte de l'affichage causé par des connexions défectueuses.



Avertissement

- Lors d'un retrait ou d'installation de l'opérateur numérique, éteignez-le d'abord, puis de suivre les instructions de ce manuel pour éviter les erreurs de l'opérateur ou de la perte de l'affichage causé par des connexions défectueuses....

1.2 Câblage



Avertissement

- Coupez toujours l'alimentation électrique avant de procéder à l'installation d'entraînement et le câblage des terminaux utilisateurs.
- Le câblage doit être effectué par un personnel qualifié / électricien certifié.
- Assurez-vous que le lecteur est correctement mis à la terre. (220V Classe: impédance de mise à la terre doit être inférieure à 100Ω Classe 460V: Impédance de mise à la terre doit être inférieure à 10Ω.)
- vérifier et tester mes circuits d'arrêt d'urgence après le câblage. (L'Installateur est responsable du câblage.)
- Ne touchez jamais de l'entrée ou de lignes électriques de sortie permettant directement ou toute entrée ou de lignes de puissance de sortie à venir en contact avec le boîtier d'entraînement.
- Ne pas effectuer un test de tenue en tension diélectrique (mégohmmètre) sur le disque dur ou cela va entraîner des dommages de lecture pour les composants semi-conducteurs.



Attention

- La tension d'alimentation appliquée doit se conformer à la tension d'entrée spécifiée par le lecteur. (Voir la section signalétique du produit)
- Raccorder la résistance de freinage et de l'unité de freinage sur les bornes assignées.
- Ne pas brancher une résistance de freinage directement sur les bornes CC P (+) et N (-), sinon risque d'incendie.
- Utilisez des recommandations de la jauge de fil et les spécifications de couple. (Voir Wire Gauge et la section de spécification de couple) °
- Ne jamais brancher l'alimentation d'entrée aux bornes onduleur de sortie U/T1, V/T2, W/T3.
- Ne pas brancher un contacteur ou interrupteur en série avec le variateur et le moteur.
- Ne branchez pas un facteur condensateur de correction de puissance ou supprimeur de tension à la sortie du variateur °
- S'assurer que l'interférence générée par l'entraînement et le moteur n'a pas d'incidence sur les périphériques.

1.3 Avant l'opération



Avertissement

- Assurez-vous que la capacité du disque correspond aux paramètres de notation avant d'alimenter.
- Réduire le paramètre de la fréquence porteuse si le câble du variateur au moteur est supérieure à 80 pi (25 m). Un courant de haute fréquence peut être générée par la capacité parasite entre les câbles et entraîner un déclenchement de surintensité du variateur, une augmentation du courant ou d'une lecture actuelle inexactes.
- Veillez à installer tous les couvercles avant de l'allumer. Ne retirez pas les capots pendant que l'alimentation du lecteur est allumé, un choc électrique peut se produire autrement.
- Ne pas actionner d'interrupteurs avec les mains mouillées, un choc électrique pourrait survenir autrement.
- Ne touchez pas les bornes d'entraînement lorsqu'il est alimenté, même si le lecteur est arrêté, un choc électrique pourrait survenir autrement.

1.4 Configuration Paramètre



Attention

- Ne branchez pas une charge pour le moteur tout en effectuant un auto-tune.
- Assurez-vous que le moteur peut fonctionner librement et il y a suffisamment d'espace autour du moteur lors de l'exécution d'un auto-tune rotation.

1.5 Opération



Avertissement

- Veillez à installer tous les couvercles avant de l'allumer. Ne retirez pas les capots pendant que l'alimentation du lecteur est allumé, un choc électrique peut se produire autrement.
- Ne pas brancher ou débrancher le moteur pendant le fonctionnement. Le variateur pourrait se déclencher et ainsi endommager le lecteur.
- Les opérations peuvent commencer soudainement si une alarme ou un défaut est réarmé avec un ordre de marche active. Assurez-vous qu'un ordre de marche est actif lors de la réinitialisation de l'alarme ou de défaut, autrement des accidents peuvent se produire.
- Ne pas actionner d'interrupteurs avec les mains mouillées, un choc électrique pourrait survenir.
- Un interrupteur d'urgence externe indépendant est fourni, qui s'arrête en urgence vers le bas la sortie de l'onduleur en cas de danger.
- Si le redémarrage automatique après une récupération d'énergie est activée, le variateur démarrera automatiquement après le rétablissement du courant.
- Assurez-vous qu'il est sûr de faire fonctionner le variateur et le moteur avant d'effectuer un auto-tune rotation.
- Ne touchez pas les bornes d'entraînement lorsqu'il est alimenté même si l'onduleur s'est arrêté, un choc électrique pourrait survenir.
- Ne pas contrôler les signaux sur les circuits pendant que le lecteur est en marche.
- Après la mise hors tension, le ventilateur de refroidissement peut continuer à fonctionner pendant un certain temps.



Attention

- Ne touchez pas les composants générant de la chaleur tels que radiateurs et des résistances de freinage. 
- Vérifiez soigneusement la performance du moteur ou de la machine avant d'utiliser à grande vitesse, sous peine de blessure.
- Notez les réglages des paramètres liés à l'unité de freinage lorsque applicable.
- Ne pas utiliser la fonction de freinage d'entraînement pour un maintien mécanique, sous peine de blessure.
- Ne pas contrôler les signaux sur les circuits pendant que le lecteur est en marche.

1.6 Entretien, Inspection et remplacement



Avertissement

- Attendre un minimum de 5 minutes après que l'alimentation a été débranchée avant de commencer une inspection. Vérifiez également que le voyant de charge est éteint et que la tension du bus cc a chuté au-dessous de 25Vdc.
- Ne jamais toucher les bornes à haute tension dans le lecteur.
- Assurez-vous que l'alimentation du lecteur est débranché avant de démonter le lecteur.
- Seul le personnel autorisé peuvent faire l'entretien, l'inspection et les opérations de remplacement. (Enlevez les bijoux en métal tels que les montres et les bagues et utiliser des outils isolés.)



Attention

- Le variateur peut être utilisé dans un environnement avec une gamme de température allant de 14° -104°F (10-40°C) et l'humidité relative de 95% sans condensation.
- Le variateur doit être utilisé dans un environnement sans poussière, gaz, vapeur et humidité.

1.7 Mise au rebut du variateur



Attention

- jeter cet appareil avec soin comme un déchet industriel et selon les réglementations locales nécessaires.
- Les condensateurs du circuit principal d'entraînement et circuits imprimés sont considérés comme des déchets dangereux et ne doivent pas être brûlés.
- The Plastic enclosure and parts of the drive such as the top cover board will release harmful gases if burned.

2. Model Description

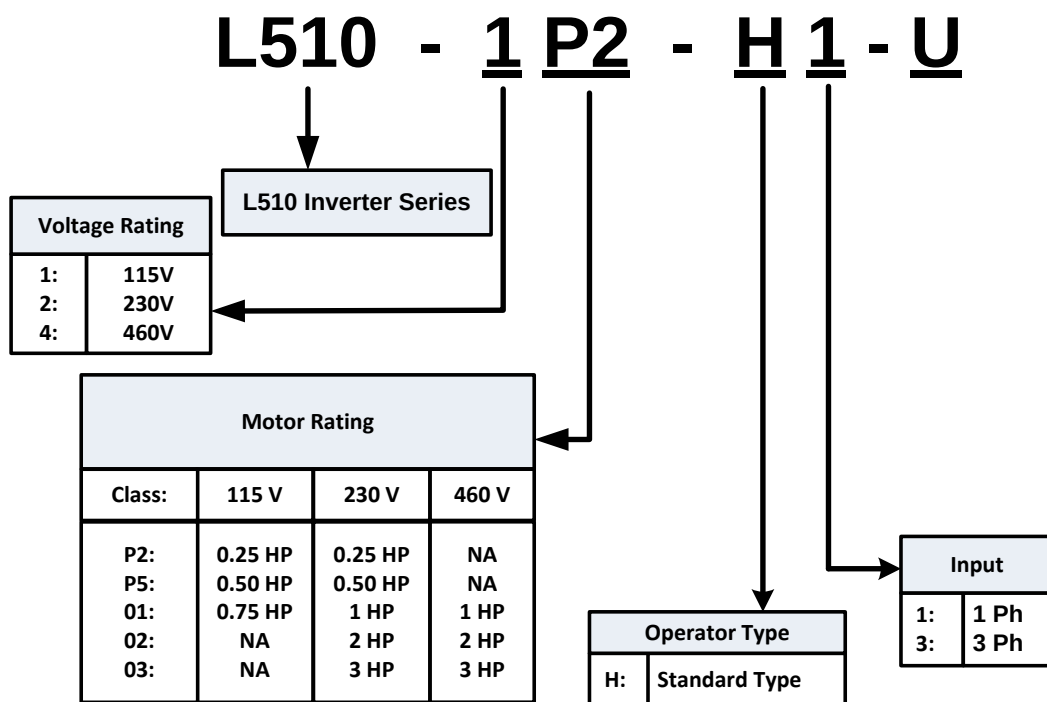
2.1 Nameplate Data

It is essential to verify the L510 inverter nameplate and make sure that the L510 inverter has the correct rating so it can be applied with the proper sized AC motor.

Unpack the L510 inverter and check the following:

- (1) The L510 inverter and instruction manual (this document) are contained in the package.
- (2) The L510 inverter has not been damaged during transportation there should be no dents or parts missing.
- (3) The L510 inverter is the correct ratings as ordered. Check the type and specifications on the main nameplate.
- (4) Check that the input voltage range meets the input power requirements.
- (5) Ensure that the motor full load amp rating matches the output rating of the inverter.

Model Identification



2.2 Inverter Models – Motor Power Rating (Constant Torque)

115V Class

Voltage (Vac) & Frequency (Hz)	L510 Model	Motor Power (HP)	Applied Motor (kW)
1ph 100~120V +10%/-15% 50/60Hz	L510-1P2-H1-U	0.25	0.2
	L510-1P5-H1-U	0.5	0.4
	L510-101-H1-U	1	0.75

230V Class

Voltage (Vac) & Frequency (Hz)	L510 Model	Motor Power (HP)	Applied Motor (kW)
1ph 200~240V +10%/-15% 50/60Hz 1ph	L510-2P2-H1-U	0.25	0.2
	L510-2P5-H1-U	0.5	0.4
	L510-201-H1-U	1	0.75
	L510-202-H1-U	2	1.5
	L510-203-H1-U	3	2.2
3ph 200~240V +10%/-15% 50/60Hz	L510-2P2-H3-U	0.25	0.2
	L510-2P5-H3-U	0.5	0.4
	L510-201-H3-U	1	0.75
	L510-202-H3-U	2	1.5
	L510-203-H3-U	3	2.2

460V Class

Voltage (Vac) & Frequency (Hz)	L510 Model	Motor Power (HP)	Applied Motor (kW)
3ph 380~480V +10%/-15% 50/60Hz	L510-401-H3-U	1	0.75
	L510-402-H3-U	2	1.5
	L510-403-H3-U	3	2.2

3. Environment and Installation

3.1 Environment

The environment will directly affect the proper operation and the life span of the inverter. To ensure that the inverter will give maximum service life, please comply with the following environmental conditions:

Protection	
Protection Class	IP20, NEMA/UL Open Type
Operating Temperature	Ambient Temperature: -10°C - +40°C (14 -104 °F) With fan: -10°C - +50°C (14-122 °F) If several inverters are placed in the same control panel, provide a heat removal means to maintain ambient temperatures below 40°C
Storage Temperature	-20°C - +60°C (-4 -140 °F)
Humidity:	95% non-condensing Relative humidity 5% to 95%, free of moisture. (Follow IEC60068-2-78 standard)
Altitude:	< 1000m (3,281 ft.)
Installation Site:	Avoid exposure to rain or moisture.
	Avoid direct sunlight.
	Avoid oil mist and salinity.
	Avoid corrosive liquid and gas.
	Avoid dust, lint fibers, and small metal filings.
	Keep away from radioactive and flammable materials.
	Avoid electromagnetic interference (soldering machines, power machines).
	Avoid vibration (stamping, punching machines etc.). Add a vibration-proof pad if the situation cannot be avoided.
Shock	1G (9.8m/s ²), for 20 Hz and below 0.6 G (5.88m/s ²), for 20 Hz to 50Hz

3.2 Installation

When installing the inverter, ensure that inverter is installed in upright position (vertical direction) and there is adequate space around the unit to allow normal heat dissipation as per the following Fig. 3.2.1

Frame: 1 & 2

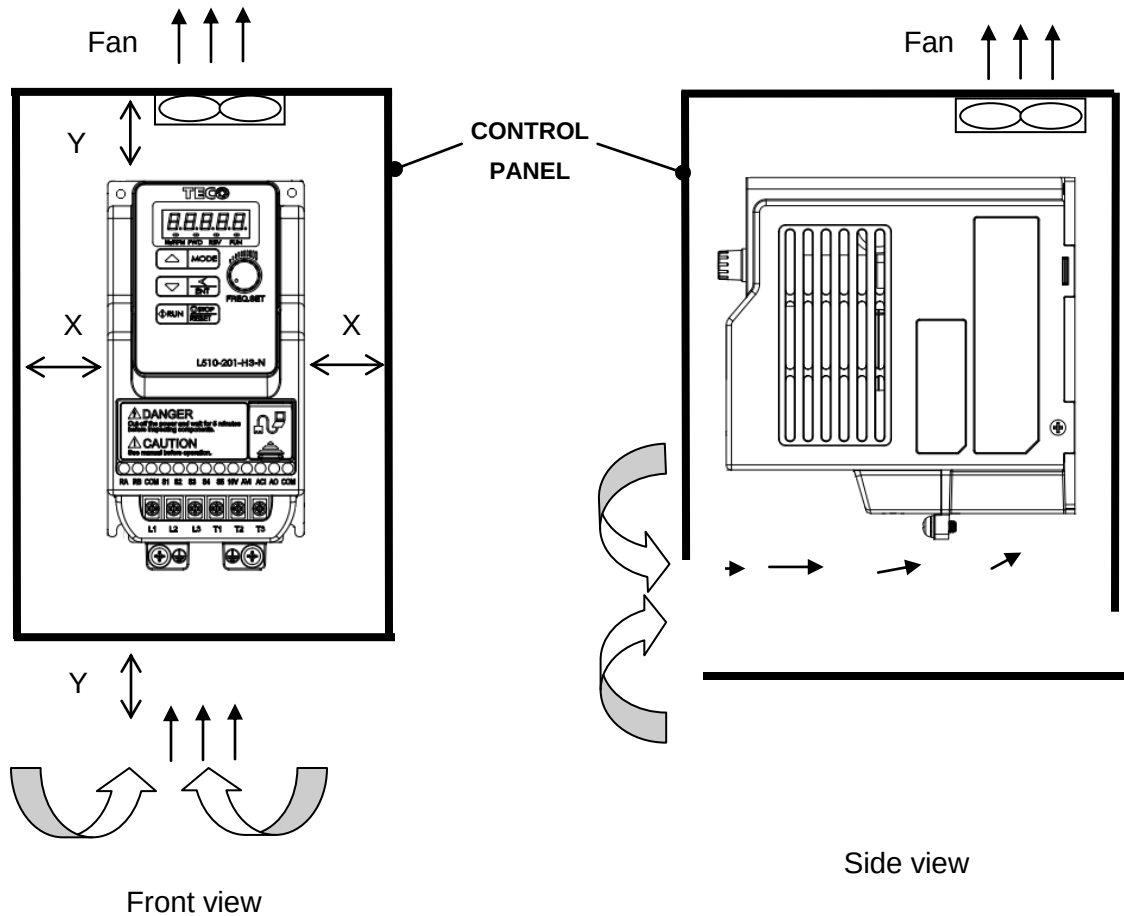


Fig 3.2.1: L510 Installation space

X = 1.97" (50mm)

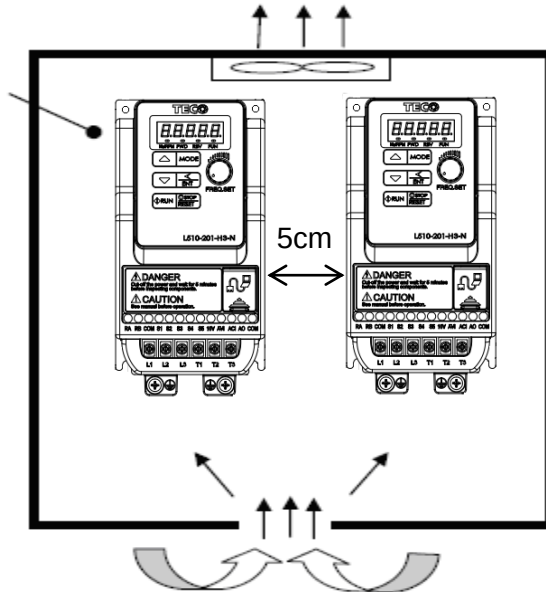
Y = 4.72" (120mm)

Important Note: The inverter heatsink temperature can reach up to 194°F / 90°C during operation; make sure to use insulation material rated for this temperature.

Side by side Installation

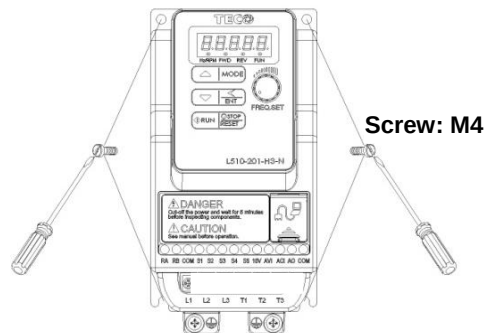
Provide the necessary physical space and cooling based on the ambient temperature and the heat loss in the panel

CONTROL
PANEL



3.3 Mounting on a flat surface

Frame1: Mounting on a flat surface.



Din rail type installation:

Din rail kit includes a plastic and a metal adaptor plate.

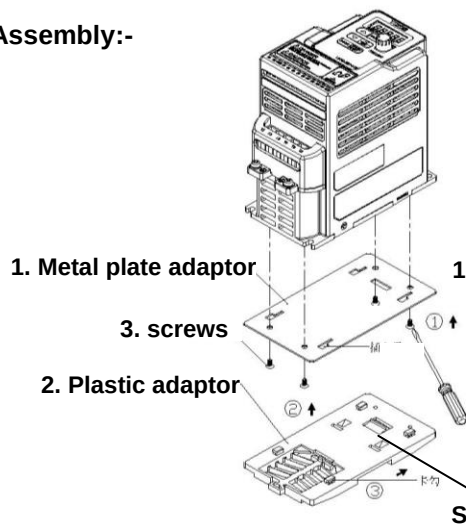
Assembly Steps:

- 1) Attach the metal adaptor plate to the inverter base with the screws provided.
- 2) Attach the plastic Din rail adaptor to the metal adaptor plate.
- 3) Push the plastic adaptor forward to lock into position.

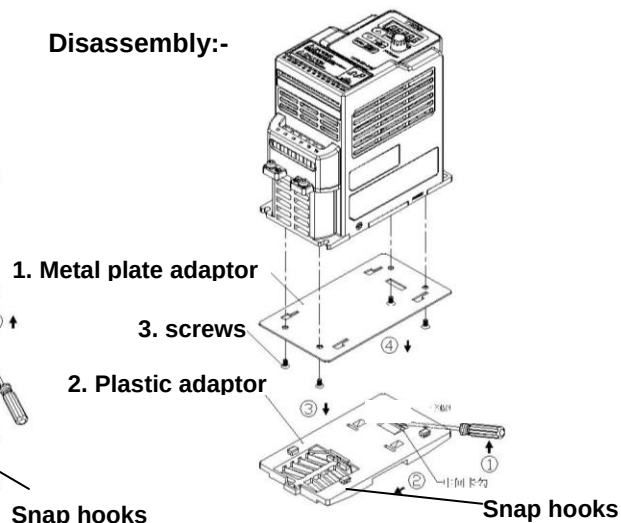
Disassembly Steps:

- 1) Unlock by pushing the snap hooks
- 2) Retract and remove the plastic Din rail adaptor.
- 3) Unscrew the metal plate & Remove

Assembly:-

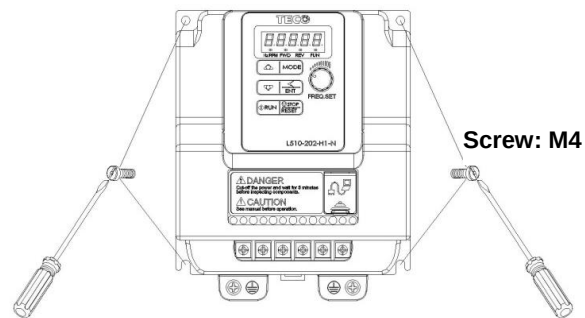


Disassembly:-



Note: JN5-DIN-L01 (Frame 1 Din rail kit part number), including the following parts
Metal plate adaptor, Plastic adaptor, Screw: M3 X 6

Frame 2: Mounting on a flat surface.

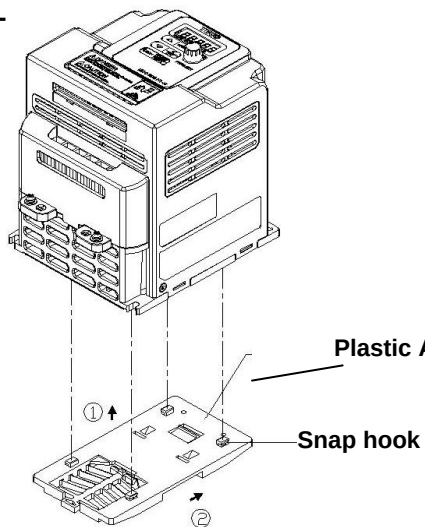


Din rail type installation:

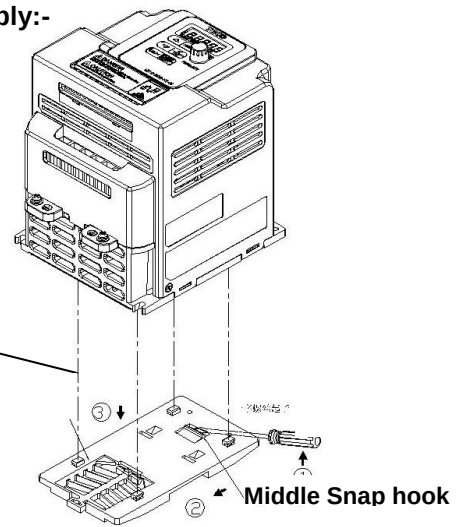
Din rail kit includes a plastic adaptor plate as an attachment for the inverter base.

Refer to Diagram below:

Assembly:-

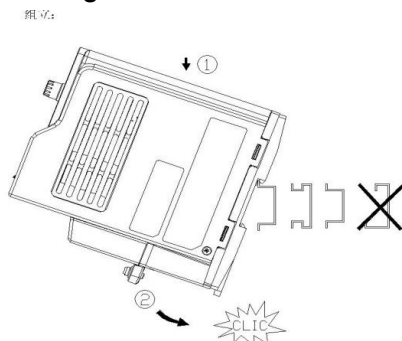


Disassembly:-

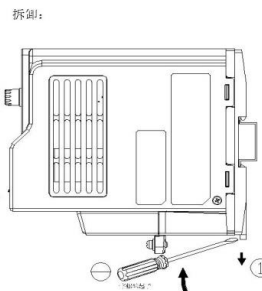


Din Rail Mounting & Dismounting as shown in the diagram below:-Use a 35mm Din Rail.

Mounting

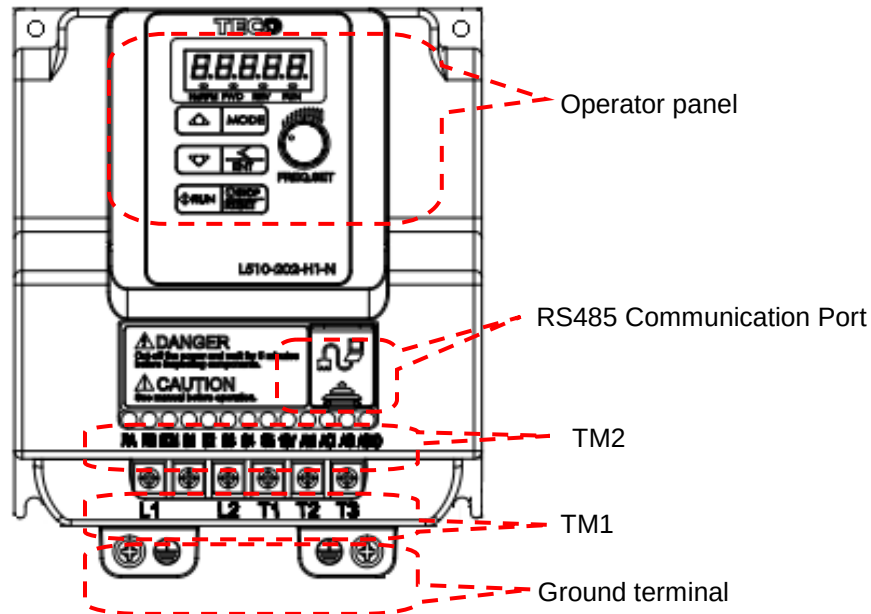


Dismounting



Plastic adaptor plate: JNDINE2-201 (Frame 2 Din rail kit part number)

3.4 Inverter Exterior



3.5 Wire Gauges and Tightening Torque

To comply with UL standards, use UL approved copper wires (rated 75° C) and round crimp terminals (UL Listed products) as shown in table below when connecting to the main circuit terminals. TECO recommends using crimp terminals manufactured by NICHIFU Terminal Industry Co., Ltd and the terminal crimping tool recommended by the manufacturer for crimping terminals and the insulating sleeve.

Model	TM1					TM2				
	Cable Size		Tightening torque			Cable Size		Tightening torque		
	AWG	mm ²	kgf.cm	lbf.in	Nm	AWG	mm ²	kgf.cm	lbf.in	Nm
Frame1	22~10	0.34~6	14	12.15	1.37	24~12	0.25~4	4.08	3.54	0.4
Frame2			12.24	10.62	1.2					

3.6 Wiring Peripheral Power Devices



Caution

- After power is shut off to the inverter the capacitors will slowly discharge. Do NOT touch any of the inverter circuitry or replace any components until the “CHARGE” indicator is off.
- Do NOT wire or connect/disconnect internal connectors of the inverter when the inverter is powered up or when powered off and the “CHARGE” indicator is on.
- Do NOT connect inverter output U, V and W to the supply power. This will result in damage to the inverter.
- The inverter must be properly grounded. Use terminal E to connect earth ground and comply with local standards.
- Do NOT perform a dielectric voltage withstand test (Megger) on the inverter this will result in inverter damage to the semiconductor components.
- Do NOT touch any of the components on the inverter control board to prevent damage to the inverter by static electricity.



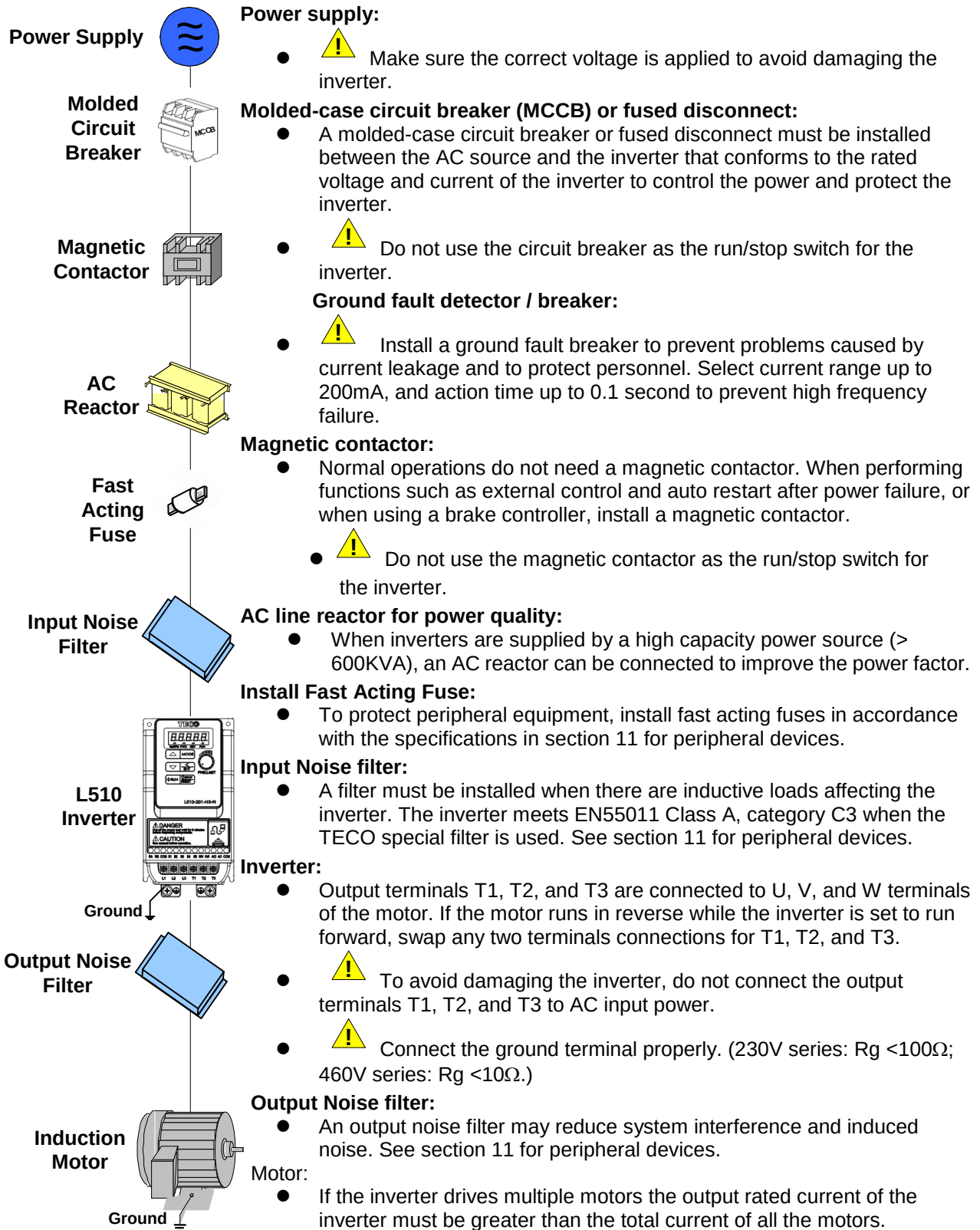
Caution

- Refer to the recommended wire size table for the appropriate wire to use. The voltage between the power supply and the input of the inverter may not exceed 2%.

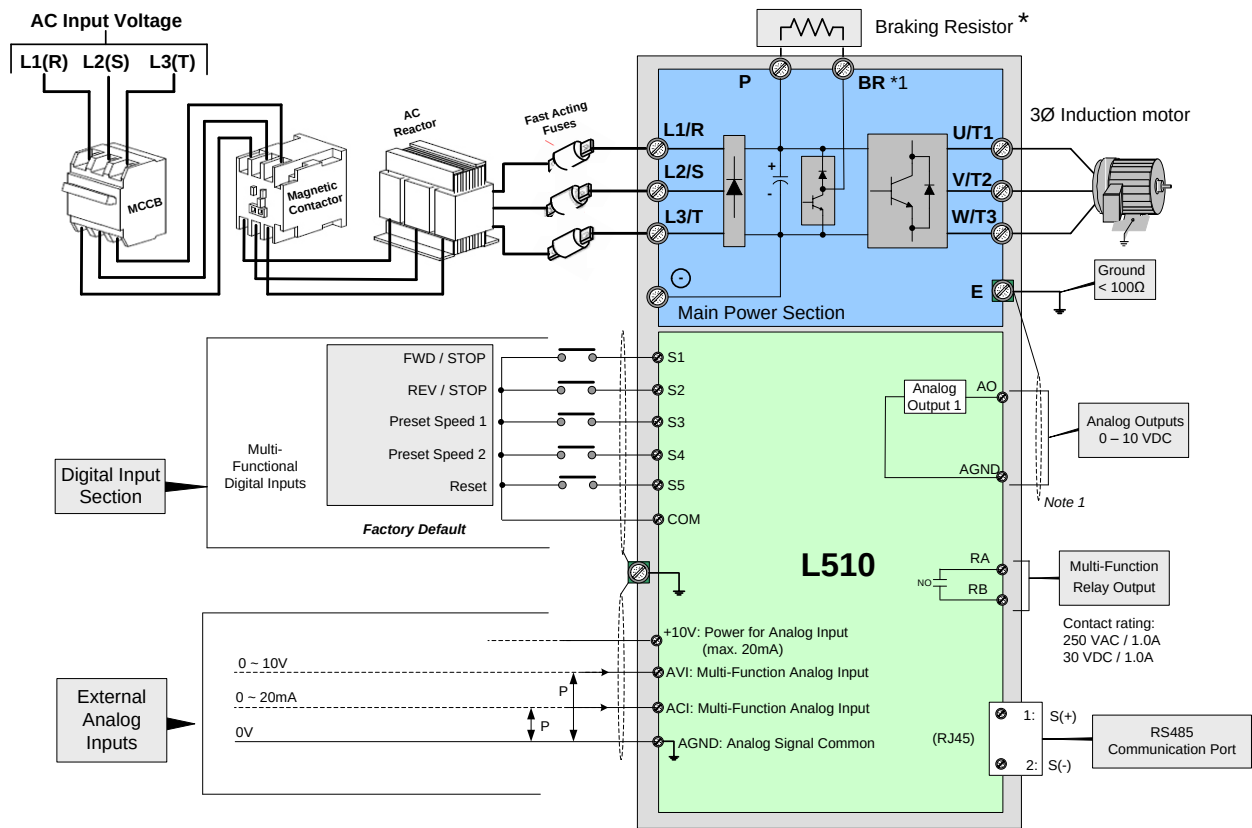
$$\text{Phase-to-phase voltage drop (V)} = \sqrt{3} \times \text{resistance of wire } (\Omega/\text{km}) \times \text{length of line (m)} \times \text{current} \times 10^{-3}.$$

(km=3280 x feet) / (m=3.28 x feet)

- Reduce the carrier frequency (parameter 11-01) if the cable from the inverter to the motor is greater than 25m (82ft). A high-frequency current can be generated by stray capacitance between the cables and result in an overcurrent trip of the inverter, an increase in leakage current, or an inaccurate current readout.
- To protect peripheral equipment, install fast acting fuses on the input side of the inverter. Refer to section 11.6 for additional information.



3.7 General Wiring Diagram



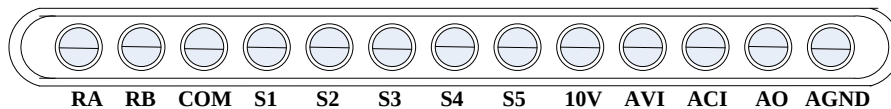
Notes:

*1: Models 460V 1 ~ 3 HP ratings have a built-in braking transistor. To use this braking transistor a braking resistor can be connected between P and BR.

3.8 User Terminals (Control Circuit Terminals)

Terminal symbols	TM1 Function Description
RA	Relay output terminal, Specification: 250VAC/1A(30VDC/1A)
RB	
COM	S1~S5 (COMMON) 【NPN】
S1	Multi-function input terminals(refer to group3)
S2	
S3	
S4	
S5	
10V	Built in power for an external speed potentiometer
AVI	Analog voltage input, Specification : 0~10VDC/ 2-10V
ACI	Analog current input, Specification : 0/4~20mA
AO	Multi-function analog output terminal. Maximum output 10VDC/1mA
AGND	Analog ground terminal

NPN:



Notes:

*1:Multi-function digital input can be referred to in this manual.

- Group 03: External Terminals Digital Input / Output Function Group.

*2:Multi-function analog input can be referred to in this manual..

- Group 04 - External Terminal Analog Signal Input (Output) Function Group.

*3:Multi-function analog output can be referred to in this manual.

- Group 04 - External Terminal Analog Signal Input (Output) Function Group.



Caution

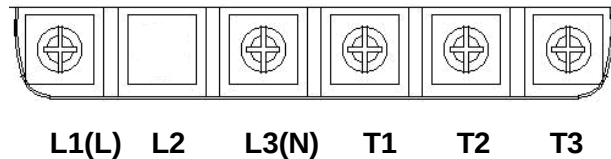
- Maximum output current capacity for terminal 12V is 20mA.
- Multi-function analog output AO is used for an analog output meter. Do not use this output for feedback control.
- Control board's 12V/24V are to be used for internal control only. Do not use the internal power supply to power external devices.

3.9 Power Terminals

Terminal symbols	TM1 Function Description
L1(L)	Main power input, L1(L)/L2/L3(N)
L2	
L3(N)	
P*	Externally connected braking resistor
BR*	
T1	Inverter output, connect to U, V, W terminals of motor
T2	
T3	
	Ground terminal

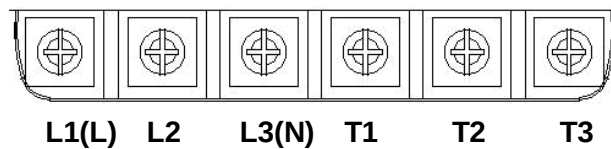
*P, BR for 460V series

Single phase

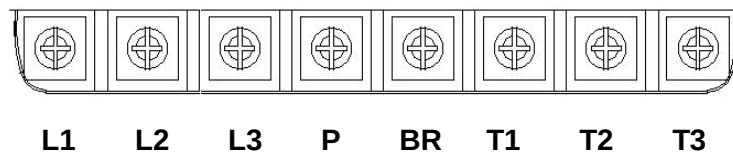


Note: Screw for terminal L2 is removed for the single phase models.

Three phase (230V series)



Three phase (460V series)



Notes: For wire gauges and screw torques, please refer to the table in section 3.6.

Electrical ratings power terminals

Horsepower	Power Specification	Voltage (Volt)	Current(A)
0.25/0.5/1	220~240V	300	30
1	100~120V		20
2/3	220~240V		30
1/2/3	380~480V	600	28

3.10 Inverter Wiring

Wiring Precautions



- Do **NOT** remove any protective covers or attempt any wiring while input power is applied. Connect all wiring before applying input power. When making wiring changes after power up, remove input power and wait a minimum of five minutes after power has been turned off before starting.
- Only authorized personnel should work on the equipment. (Take off metal jewelry such as watches and rings and use insulated tools.), otherwise **electric shock or injury may result.**

(A) Power input terminals

1. The input power supply voltage can be connected in any phase sequence to power input terminals R/L1, S/L2, or T/L3 on the terminal block.
2. DO NOT connect the AC input power source to the output terminals U/T1, V/T2, or W/T3.
3. Connect the output terminals U/T1, V/T2, W/T3 to motor lead wires U/T1, V/T2, and W/T3 respectively.
4. Check that the motor rotates forward with the forward run source. If it does not, swap any 2 of the output cables to change motor direction.
5. DO NOT connect phase correcting capacitors or LC/RC noise filter to the output circuit.

(B) Grounding

1. Connect the ground terminal (E) to ground having a resistance of less than 100Ω.
2. Do not share the ground wire with other devices, such as welding machines or power tools.
3. Always use a ground wire that complies with the local codes and standards for electrical equipment and minimize the length of ground wire.
4. When using more than one inverter, be careful not to loop the ground wire, as shown below in Fig. 3.10.1.

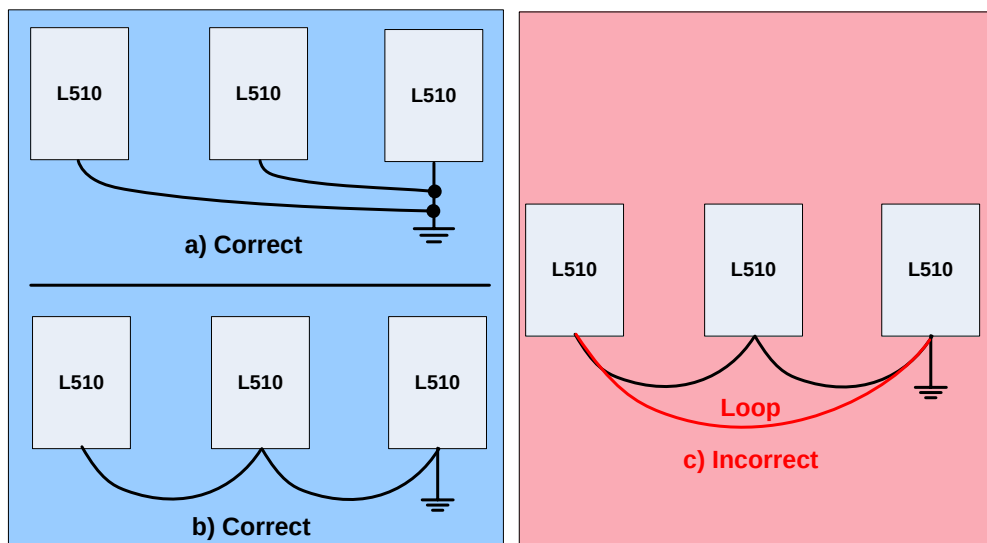


Fig. 3.10.1 Inverter Grounding

3.11 Input Power and Motor Cable Length

The length of the cables between the input power source and /or the motor and inverter can cause a significant phase to phase voltage reduction due to the voltage drop across the cables. The wire size shown in Tables 3.16.1 is based on a maximum voltage drop of 2%. If this value is exceeded, a wire size having larger diameter may be needed. To calculate phase to phase voltage drop, apply the following formula:

$$\text{Phase-to-phase voltage drop (V)} = \sqrt{3} \times \text{resistance of wire } (\Omega/\text{km}) \times \text{length of line (m)} \times \text{current} \times 10^{-3}.$$

(km=3280 x feet)

(m=3.28 x feet)

3.12 Cable Length vs. Carrier Frequency

The allowable setting of the PWM carrier frequency is also determined by motor cable length and is specified in the following Table 3.14.1.

Table 3.13.1 Cable Length vs. Carrier Frequency

Cable length between the inverter and Motor in m (ft.).	< 30m (100)	30 – 50 (100 – 165)	50 – 100 (166 - 328)	≥ 100 (329)
Recommended carrier frequency allowed Parameter 11-01	16kHz (max)	10 kHz (max)	5 kHz (max)	2 kHz (max)

3.13 Control Circuit Wiring

- (1) Separate the wiring for control circuit terminals from main circuit wiring for terminals (R/L1, S/L2, T/L3, U/T1, V/T2, W/T3).
- (2) Separate the wiring for control circuit terminals RA-RB (Relay output) from wiring for terminals S1 – S5, AVI, ACI and AGND wiring.
- (3) Use shielded twisted-pair cables (#24 - #14 AWG / 0.5 -2 mm²) shown in Fig. 3.13.1 for control circuits to minimize noise problems. The maximum wiring distance should not exceed 50m (165 ft).

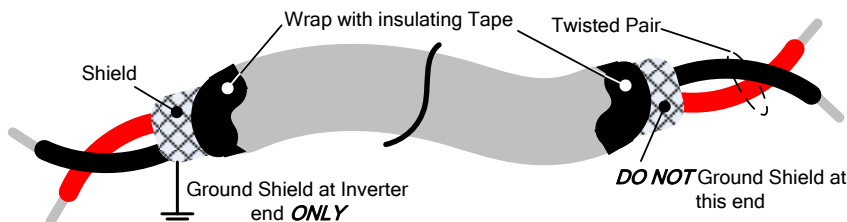


Fig. 3.13.1 Shielded Twisted-Pair

3.14 Inverter Specification

Basic Specifications 110V class (Single Phase)

Model : L510-□□□-H1-U	1P2	1P5	101
Horse power (HP)	0.25	0.5	1
Suitable motor capacity (KW)	0.2	0.4	0.75
Rated output current (A)	1.8	2.6	4.3
Rated capacity (KVA)	0.68	1.00	1.65
Input voltage range(V)	Single Phase : 100~120V,50/60Hz		
Allowable voltage fluctuation	+10%-15%		
Output voltage range(V)	Three phase 0~240V		
Input current (A)*	9.5	13	19
Allowable momentary power loss time (S)	1.0	1.0	1.0
Enclosure	IP20		

Basic Specifications 230V class (Single Phase)

Model : L510-□□□-H1-U	2P2	2P5	201	202	203
Horse power (HP)	0.25	0.5	1	2	3
Suitable motor capacity (KW)	0.2	0.4	0.75	1.5	2.2
Rated output current (A)	1.8	2.6	4.3	7.5	10.5
Rated capacity (KVA)	0.68	1.00	1.65	2.90	4.00
Input voltage range(V)	Single Phase : 200~240V,50/60Hz				
Allowable voltage fluctuation	+10%-15%				
Output voltage range(V)	Three phase 0~240V				
Input current (A)	4.9	7.2	11	15.5	21
Allowable momentary power loss time (S)	1.0	1.0	1.0	2.0	2.0
Enclosure	IP20				

Basic Specifications 230V class (Three Phase)

Model L510-□□□-H3-U	2P2	2P5	201	202	203
Horse power (HP)	0.25	0.5	1	2	3
Suitable motor capacity (KW)	0.2	0.4	0.75	1.5	2.2
Rated output current (A)	1.8	2.6	4.3	7.5	10.5
Rated capacity (KVA)	0.68	1.00	1.65	2.90	4.00
Input voltage range(V)*	Three phase : 200~240V,50/60Hz				
Allowable voltage fluctuation	+10%-15%				
Output voltage range(V)	Three phase 0~240V				
Input current (A)	3.0	4.0	6.4	9.4	12.2
Allowable momentary power loss time(S)	1.0	1.0	1.0	2.0	2.0
Enclosure	IP20				

Basic Specifications 460V class

Model : L510-□□□-H3-U	401	402	403
Horse power (HP)	1	2	3
Suitable motor capacity (KW)	0.75	1.5	2.2
Rated output current (A)	2.3	3.8	5.2
Rated capacity (KVA)	1.7	2.9	4.0
Input voltage range(V)	Three Phase : 380~480V,50/60Hz		
Allowable voltage fluctuation	+10%-15%		
Output voltage range(V)	Three phase 0~480V		
Input current (A)	4.2	5.6	7.3
Allowable momentary power loss time (S)	2.0	2.0	2.0
Enclosure	IP20		

*The input current is calculated value at full rated output current.

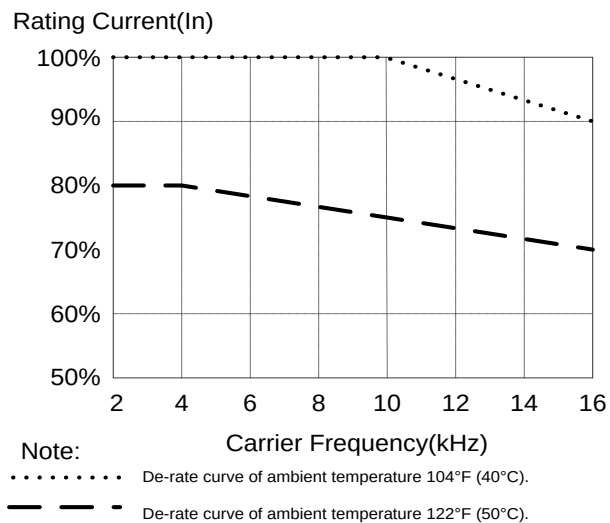
3.15 General Specification

Item		L510
Control Mode		V/F Control + SLV Control
Frequency	Range	0.01~599.00Hz
	Setting resolution	Digital input : 0.01Hz
		Analog input : 0.06Hz/60Hz
	Setting	Keypad : Set directly with ▲ ▼ keys or use VR (Potentiometer) on the keypad
		External Input Terminals: AVI(0/2~10V), ACI(0/4~20mA)input Multifunction input up/down function(Group3)
		Setting frequency by Communication method.
Run	Operation set	Lower and upper frequency limits 3 -skip frequency settings.
		Keypad run, stop button
		External terminals: Multi- operation-mode 2 / 3 wire selection Jog operation
		Run signal by communication method.
Main Controls	V / F curve setting	6 fixed curve and one customized curve
	Carrier frequency	1~16KHz(default 5KHz)
	Acceleration and deceleration control	2 Acc / dec time parameters. 4 S curve parameters.
	Multifunction input	19 functions (refer to description in group 3)
	Multifunction output	14 functions (refer to description in group 3)
	Multifunction analog output	5 functions (refer to description in group 4) 1 Output (0-10V)
	Main features	Overload Detection, 8 preset speeds, Auto-run, Acc/Dec Switch (2 Stages), Main/Alt run Command select, Main/Alt Frequency Command select, PID control, torque boost, V/F start Frequency ,Fault reset.
Display	LED	Display: parameter/parameter value/frequency/line speed/DC voltage/output voltage/output current/PID feedback/input and output terminal status/Heat sink temperature/Program Version/Fault Log.
	LED Status Indicator	For run/stop/forward and reverse.

Protective Functions	Overload Protection	Integrated motor and Inverter overload protection.
	Over voltage	115V/230V : Over 410V, 460V : Over 820V
	Under voltage	115V/230V: Under 190V, 460V : Under 380V
	Momentary Power Loss Restart	Inverter auto-restart after a momentary power loss.
	Stall Prevention	Stall prevention for Acceleration/ Deceleration/ and continuous Run.
	Short-circuit output terminal	Electronic Circuit Protection
	Grounding Fault	Electronic Circuit Protection
	Additional protective functions	Heatsink over temperature protection, auto carrier frequency reduction with temperature rise, fault output, reverse prohibit, number of auto restart attempts, parameter lock, over voltage protection (OVP), motor PTC over temperature protection.
International Certification		CE/UL/cUL/RCM
Communication		RS485 (Modbus * BACnet) built in
Environment	Operating temperature	-10~50°C
	Storage temperature	-20~60°C
	Humidity	Under 95%RH (no condensation)
	Shock	Under 20Hz, 1G(9.8m/s ²); 20~50Hz 0.6G(5.88m/s ²)
	EMC Compliance	EN61800-3, First Environment
	LVD Compliance	EN50178
	Electrical Safety	UL508C
	Protection level	IP20

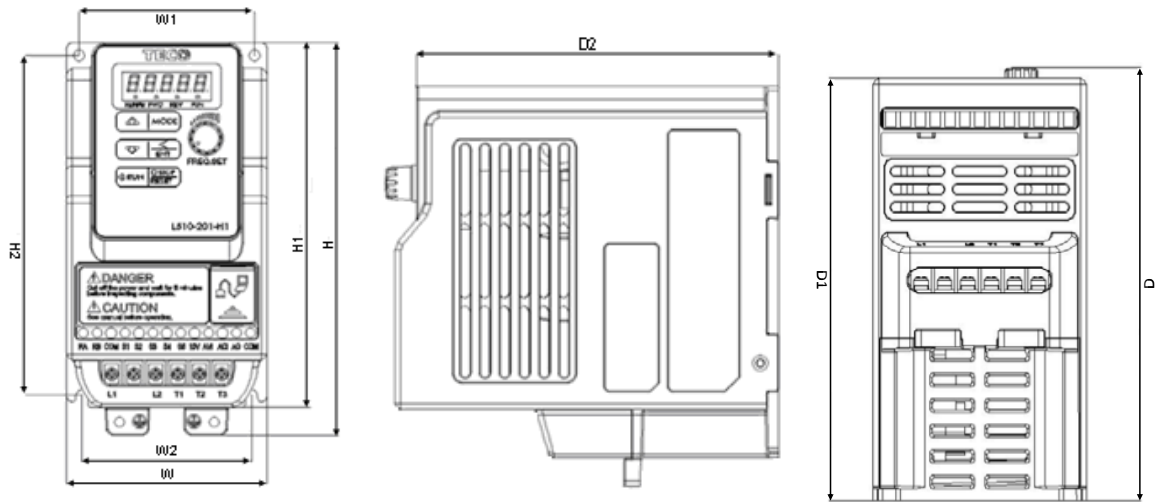
3.16 De-rating curve

Curves below show the applicable output current de-rate due to setting of carrier frequency and the ambient operating temperatures of 104°F (40°C) and 122°F (50°C).



3.17 Inverter Dimensions

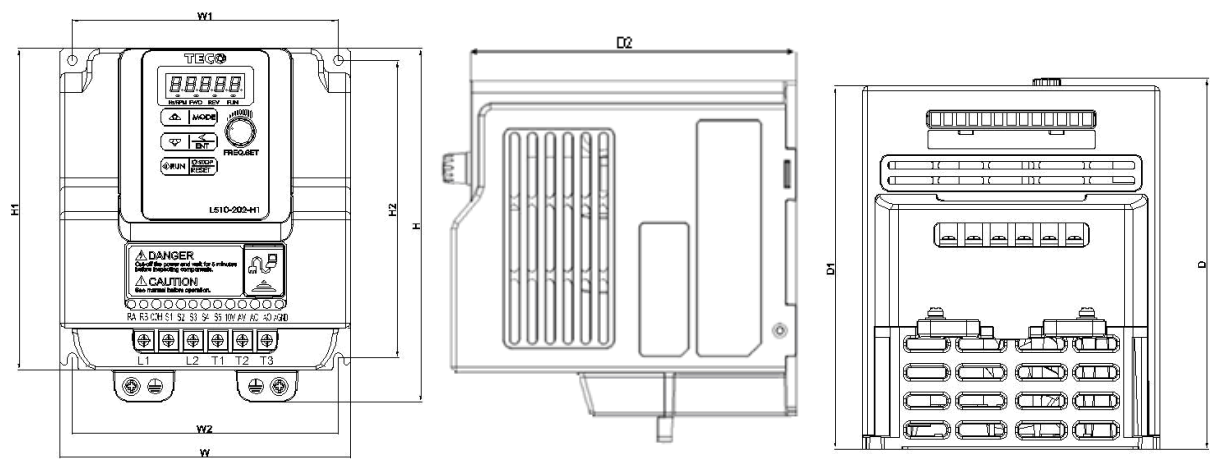
Frame 1:



Unit : Inch (mm)

Model	W	W1	W2	H	H1	H2	D	D1	Weight
L510-1P2-H1-U	2.83 (72)	2.48 (63)	2.40 (61)	5.55 (141)	5.16 (131)	(4.80) 122	(5.57) 141	(5.35) 136	1.98 lbs. (0.9kg)
L510-1P5-H1-U									
L510-2P2-H1-U									
L510-2P5-H1-U									
L510-201-H1-U									
L510-2P2-H3-U									
L510-2P5-H3-U									
L510-201-H3-U									

Frame 2:



Unit : Inch (mm)

Model	W	W1	W2	H	H1	H2	D	D1	Weight
L510-101-H1-U	4.65 (118)	4.25 (108)	4.25 (108)	5.67 (144)	5.16 (131)	4.76 (121)	5.92 (150)	5.68 (144)	3.53 Lbs. (1.6kg)
L510-202-H1-U									
L510-203-H1-U									
L510-202-H3-U									
L510-203-H3-U									
L510-401-H3-U									
L510-402-H3-U									
L510-403-H3-U									

4. Keypad and Programming Functions

4.1 LED Keypad

4.1.1 Keypad Display and Keys

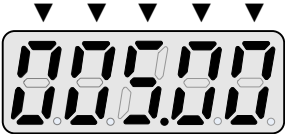


DISPLAY	Description
5 Digit LED Display	Monitor inverter signals, view / edit parameters, fault / alarm display.
LED INDICATORS	
Hz/RPM	LED ON when frequency or line speed is displayed.
FWD	LED ON when inverter is running in forward direction, flashing when stopping.
REV	On when inverter is running in reverse direction, flashing when stopping.
FUN	LED ON when parameters are displayed.

KEYS (6)	Description
RUN	RUN Inverter in Local Mode
STOP / RESET	STOP Inverter RESET alarms and faults
▲	Parameter navigation up, increase parameter or reference value
▼	Parameter navigation down, decrease parameter or reference value
MODE	Switch between available displays
</ENTER	"<" Left Shift: Used to change parameters or values ENTER: Used to display the preset value of parameters and to save changes

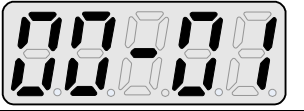
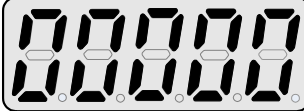
4.1.2 Digital Display Description

Actual	LED Display	Actual	LED Display	Actual	LED Display	Actual	LED Display
0	0	A	A	L	L	Y	Y
1	1	B	b	n	n	-	-
2	2	C	C	o	0	°	□
3	3	D	d	P	P	—	-
4	4	E	E	q	q	.	
5	5	F	F	r	r		
6	6	G	G	S	5		
7	7	H	H	t	t		
8	8	I	l	u	u		
9	9	J	J	V	U		

Display output frequency	Frequency Reference	Set Frequency Reference
LED lights on	LED flashes	Flashing digit
		

At power-up the display will show the frequency reference setting, all LEDs are flashing. Press the ▲UP or ▼DOWN key to enter the frequency reference edit mode, use the ◀/ENT key to select which digit to edit (flashing). Use the ▲UP or ▼DOWN key to modify the value. During run operation the display will show the output frequency.

LED display examples

Seven Segment display	Description
	1. Displays the frequency reference at power-up 2. Display the actual output frequency in operation status.
	Display parameter code
	Display the setting value of parameter
	Display input voltage
	Display inverter current.
	Display DC Bus Voltage
	Display temperature
	Display PID feedback value. The displayed digit is set by 12-01.
	Error display, refer to Chapter 5 Troubleshooting and maintenance
	Display AI1 / AI2 input (0 - 100%)

4.1.3 LED Status description

Hz/ RPM LED

State	Description	Hz/RPM LED
Off	Display doesn't show frequency or line speed	
Illuminated	Display shows frequency or line speed	

Forward LED

State	Description	FWD LED
Off	Inverter in reverse direction	
Illuminated	Inverter is running in forward direction	
Flashing	Forward direction active, no run command	

Reverse LED

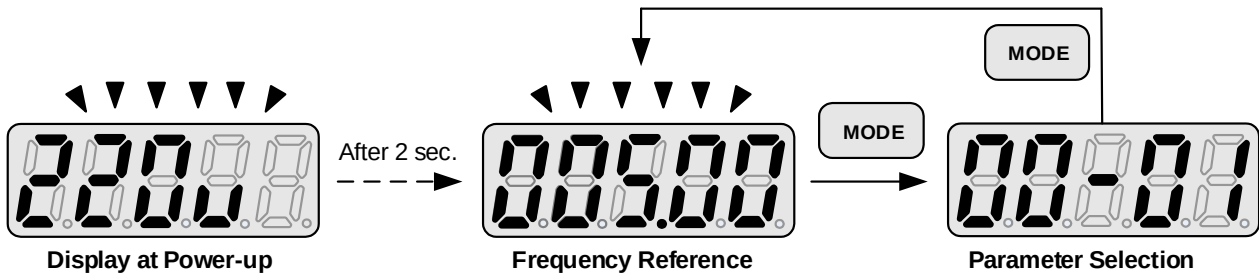
State	Description	REV LED
Off	Inverter in forward direction	
Illuminated	Inverter is running in reverse direction	
Flashing	Reverse direction active, no run command	

FUN LED

State	Description	FUN LED
Off	Display doesn't show parameter	
Illuminated	Display shows parameter	

4.1.4 Power-Up Monitor

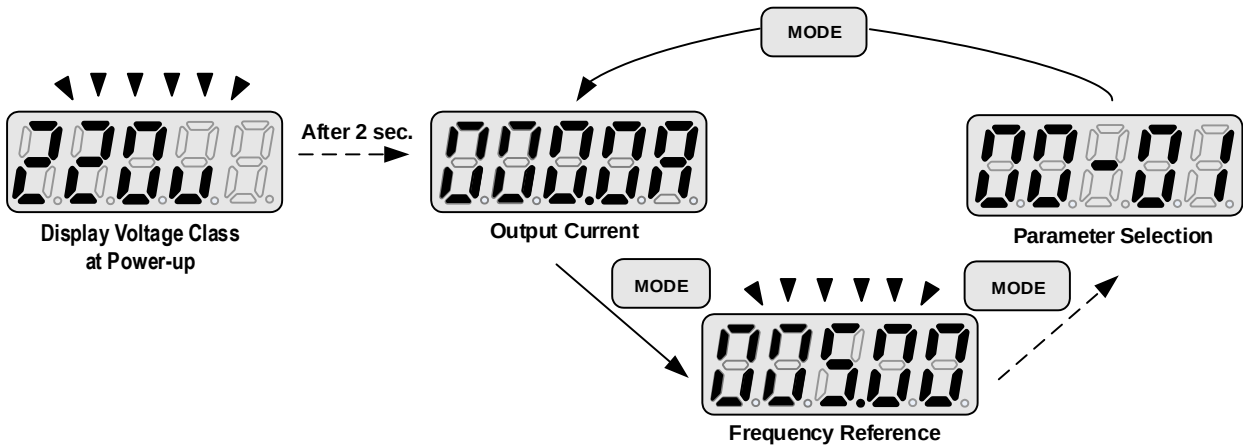
Power Up:



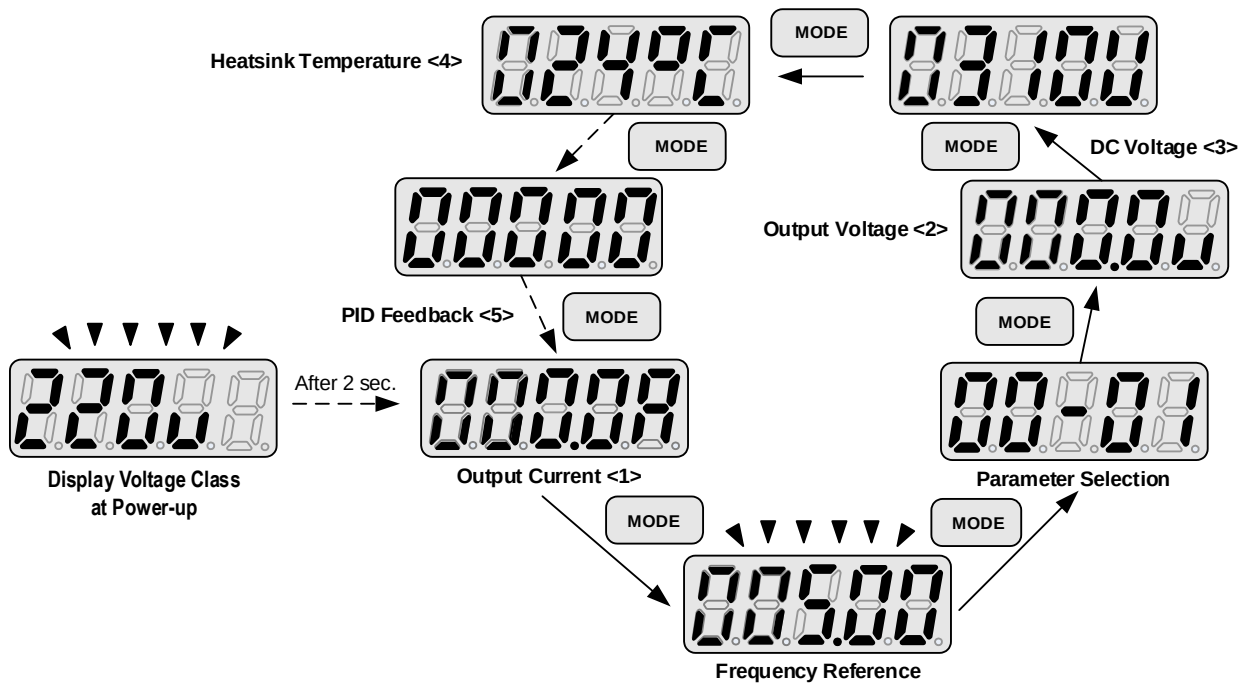
Change Monitor at Power-Up

12-00	Display selection								
Range	Highest bit -> 0 0 0 0 0 <- Lowest bit The setting range for each bit is 0 ~ 7 from the highest bit to the lowest bit. <table><tr><td>0: No display</td><td>4: Temperature</td></tr><tr><td>1: Output current</td><td>5: PID feedback</td></tr><tr><td>2: Output voltage</td><td>6: AVI value</td></tr><tr><td>3: DC voltage</td><td>7: ACI value</td></tr></table>	0: No display	4: Temperature	1: Output current	5: PID feedback	2: Output voltage	6: AVI value	3: DC voltage	7: ACI value
0: No display	4: Temperature								
1: Output current	5: PID feedback								
2: Output voltage	6: AVI value								
3: DC voltage	7: ACI value								

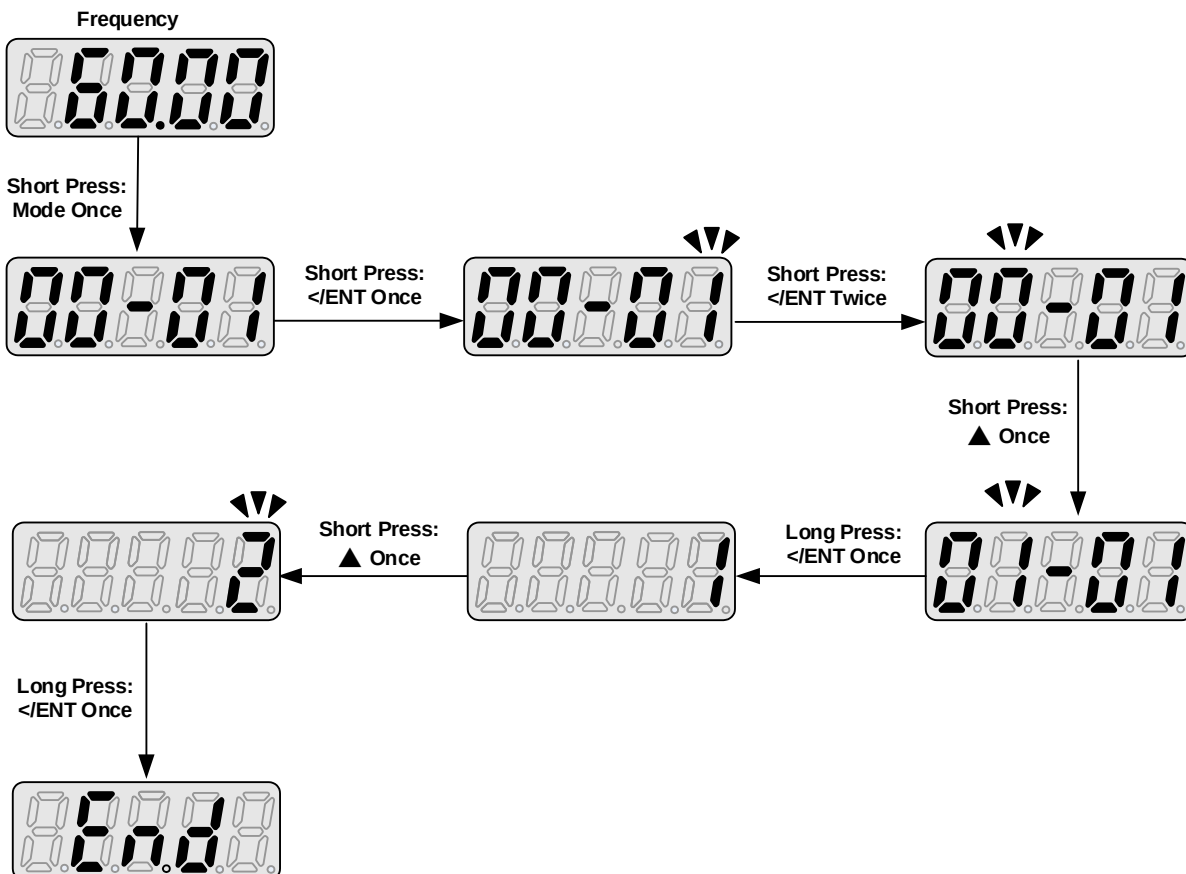
Example: 12-00 = 10000



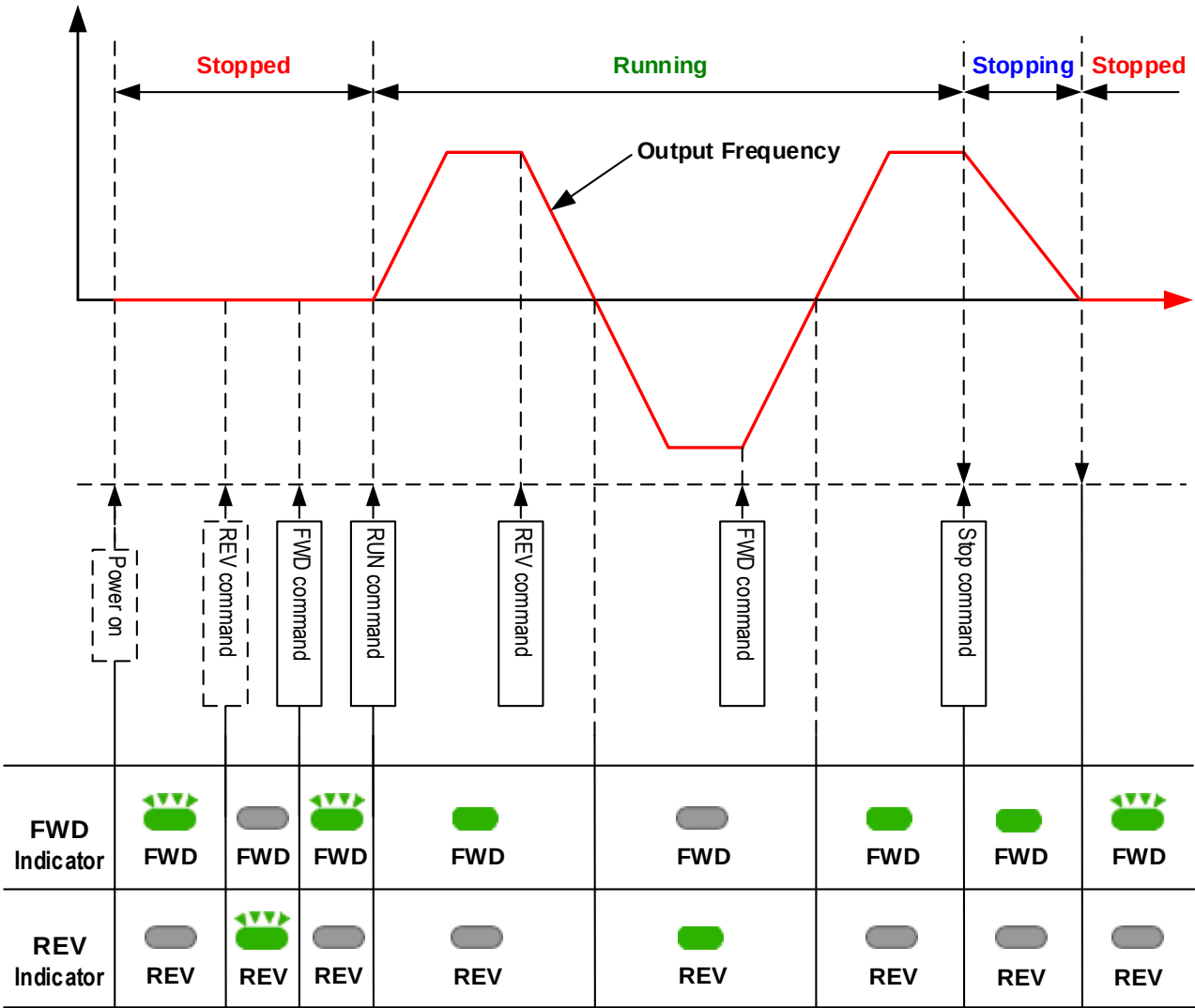
Example: 12-00 = 12345



4.1.5 Modifying Parameters / Set Frequency Reference



4.1.6 Operation Control



4.2 Parameters

Parameter Groups	
Group Number	Description
00	Basic Parameters
01	V/F Patterns
02	Motor Parameters
03	Digital Inputs & Outputs
04	Analog Inputs & Outputs
05	Preset Frequencies
06	Auto Run (Auto Sequencer)
07	Start / Stop Command Setup
08	Drive and Motor Protection
09	Communication
10	PID Controller
11	Performance Control
12	Display & Monitoring
13	Inspection & Maintenance
14	Pump Functions

Parameter Notes	
*1	Parameter can be adjusted during running mode
*2	Cannot be modified in communication mode
*3	Does not change with factory reset
*4	Read only
^x.xx	This parameter or its settings are applicable on this firmware version or higher

Group 00: Basic Parameters					
Code	Name	Setting Range	Default	Unit	Note
00-00	Control Method	0: V/F 1: SLV	0	-	*1
00-01	Motor Rotation	0: Forward 1: Reverse	0	-	*1
00-02	Run Source	0: Keypad 1: External Run/Stop 2: Communication	0	-	^v1.06
00-03	Alternative Run Source	0: Keypad 1: External Run/Stop 2: Communication	0	-	
00-04	External Terminal Mode	0: Forward/Stop-Reverse/Stop 1: Run/Stop-Reverse/Forward 2: 3-Wire Control Mode-Run/Stop	0	-	
00-05	Frequency Source	0: Keypad 1: Potentiometer on Keypad 2: Analog Input AVI 3: Analog Input ACI 4: Up/Down Frequency Control 5: Communication 6: PID	0	-	^v1.10
00-06	Alternative Frequency Source	0: Keypad 1: Potentiometer on Keypad 2: Analog Input AVI 3: Analog Input ACI 4: Up/Down Frequency Control 5: Communication 6: PID	4	-	
00-07	Alternative Frequency Command Mode	0: Main -or- Alternative Frequency 1: Main + Alternative Frequency	0	-	
00-08	Communication Frequency Command	0.00~599.00	-	Hz	^v0.3 *4
00-09	Communication Frequency Save Mode	0: Save Frequency Before Power Down 1: Save Communication Frequency	0	-	^v0.3
00-10	Initial Keypad Frequency Mode	0: Set by Current Frequency Command 1: Set by 0 Frequency Command 2: Set by 00-11	0	-	^v0.3
00-11	Initial Keypad Frequency	0.00~599.00	50.00/60.00	Hz	^v0.3
00-12	Frequency Upper Limit	0.01~599.00	50.00/60.00	Hz	
00-13	Frequency Lower Limit	0.00~598.99	0.00	Hz	
00-14	Acceleration Time 1	0.1~3600.0	10.0	s	*1
00-15	Deceleration Time 1	0.1~3600.0	10.0	s	*1
00-16	Acceleration Time 2	0.1~3600.0	10.0	s	*1
00-17	Deceleration Time 2	0.1~3600.0	10.0	s	*1
00-18	Jog Frequency	1.00~25.00	2.00	Hz	^v1.16 *1
00-19	Jog Acceleration Time	0.1~25.5	0.5	s	*1
00-20	Jog Deceleration Time	0.1~25.5	0.5	s	*1
00-21	Application	0: General 1: Xinzhan Pump	0	-	^v1.10

Group 01: V/F Patterns					
Code	Name	Setting Range	Default	Unit	Note
01-00	Pattern	1~7	1/4	-	
01-01	Max Voltage	200V: 170.0~264.0 400V: 323.0~528.0	Based on 13-08	VAC	
01-02	Max Frequency	0.2 ~ 599.00	50.00/60.00	Hz	^v1.04
01-03	Max Frequency Voltage Ratio	0.0 ~ 100.0	100.0	%	
01-04	Mid Frequency 2	0.1 ~ 599.00	2.50/3.00	Hz	^v1.04
01-05	Mid Frequency Voltage Ratio 2	0.0 ~ 100.0	10.0/6.8	%	
01-06	Mid Frequency 1	0.1 ~ 599.00	2.50/3.00	Hz	^v1.04
01-07	Mid Frequency Voltage Ratio 1	0.0 ~ 100.0	10.0/6.8	%	
01-08	Min Frequency	0.1 ~ 599.00	1.30/1.50	Hz	^v1.04
01-09	Min Frequency Voltage Ratio	0.0 ~ 100.0	8.0/3.4	%	
01-10	Curve Modification (Torque Boost)	0 ~ 10.0	0.0	%	*1
01-11	Start Frequency	0.00~10.00	0.00	Hz	
01-12	No-load Oscillation Suppression Gain	0.0~200.0	0	-	
01-13	Hunting Prevention Coefficient	1~8192	800	-	
01-14	Hunting Prevention Gain	0~100	Frame 1/2 100V/200V: 7 Others: 0	%	
01-15	Hunting Prevention Limit	0~100.0	5.0	%	
01-16	Auto-Torque Compensation Filter Coefficient	0.1~1000.0	0.1	ms	
01-17	Auto-Torque Compensation Gain	0~100	0	%	
01-18	Auto-Torque Compensation Frequency	1.30~5.00	2	Hz	

Group 02: Motor Parameters					
Code	Name	Setting Range	Default	Unit	Note
02-00	No Load Current	-	by model	A	*4
02-01	Rated Current	-	by model	A	*4
02-02	V/F Slip Compensation	0.0 ~ 100.0	0.0	%	*1
02-03	Rated Speed	-	by model	RPM	*4
02-04	Rated Voltage	-	by model	VAC	*4
02-05	Rated Power	0~22.0	by model	kW	
02-06	Rated Frequency	0~599.0	by model	Hz	
02-07	Auto Tuning	0: Disable 1: Static auto tuning	0	-	
02-08	Stator Resistor Gain	0~600	by model	-	
02-09	Rotor Resistor Gain	0~600	by model	-	
02-10 ~ 02-12	Reserved				
02-13	SLV Slip Compensation Gain	0~200	by model	%	
02-14	SLV Torque Compensation Gain	0~200	100	%	
02-15	Low Frequency Torque Gain	0~100	50	%	
02-16	SLV Without Load Slip Compensation Gain	0~200	by model	%	
02-17	SLV With Load Slip Compensation Gain	0~200	150	%	
02-18	SLV With Load Torque Compensation Gain	0~200	100	%	
02-19	SLV Slip Compensation Select	0: Slip compensation 1 2: Slip compensation 2	0	-	

Group 03: Digital Inputs & Outputs					
Code	Name	Setting Range	Default	Unit	Note
03-00	Multifunction Input Term. S1	0: Forward/Stop Command	0	-	^v1.10
03-01	Multifunction Input Term. S2	1: Reverse/Stop Command	1	-	^v1.10
03-02	Multifunction Input Term. S3	2: Preset Speed 1 (5-02) 3: Preset Speed 2 (5-03)	2	-	^v1.10
03-03	Multifunction Input Term. S4	4: Preset Speed 4 (5-05) 6: Jog Forward Command	3	-	^v1.10
03-04	Multifunction Input Term. S5	7: Jog Reverse Command 8: Up Command 9: Down Command 10: Acc/Dec 2 11: Acc/Dec Disabled 12: Main/Alternative Run Command 13: Main/Alternative Frequency Command 14: Rapid Stop (Decelerate to stop) 15: Base Block 16: Disable PID Function 17: Reset 18: Auto Run Mode enable 19: Forced Frequency Run(pump model only) 20: Switch to Constant Pressure 2(pump model only)	17	-	^v1.10
03-05	Reserved				
03-06	Up/Down Frequency Band	0.00~5.00	0.00	Hz	
03-07	Up/Down Frequency Modes	0: Preset frequency is held as the inverter stops, and up/down function is disabled. 1: Preset frequency is reset to 0 Hz as the inverter stops. 2: Preset frequency is held as the inverter stops, and the up/down is available.	0	-	
03-08	S1~S5 Scan Confirmation	1~200. Number of scan cycles	10	2ms	
03-09	S1~ S5 Switch Type	xxxx0:S1 NO xxx1:S1 NC xxx0x:S2 NO xxx1x:S2 NC xx0xx:S3 NO xx1xx:S3 NC x0xxx:S4 NO x1xxx:S4 NC 0xxxx:S5 NO 1xxxx:S5 NC	00000	-	
03-10	Reserved				
03-11	Output Relay(RY1)	0: Run 1: Fault 2: Setting Frequency Reached 3: Frequency Reached (3-13±3-14) 4: Output Frequency Detection1(> 3-13) 5: Output Frequency Detection2(< 3-13) 6: Auto-Restart 7: Momentary AC Power Loss 8: Rapid Stop 9: Base Block 10: Motor Overload Protection(OL1) 11: Drive Overload Protection(OL2) 12: Reserved 13: Output Current Reached 14: Brake Control 15: PID feedback disconnection detection 16: High Pressure Detection 17: Low Pressure Detection 18: Pressure Loss Detection 19: S1 Status 20: S2 Status 21: S3 Status 22: S4 Status 23: S5 Status	0	-	^v1.11 *1
03-12	Reserved				
03-13	Output Frequency Detection Level (Hz)	0.00~599.00	0.00	Hz	*1
03-14	Frequency Detection Band	0.00~30.00	2.00	Hz	*1
03-15	Output Current Detection Level	0.1~15.0	0.1	A	^v1.06
03-16	Output Current Detection Period	0.1~10.0	0.1	s	
03-17	External Brake Release Level	0.00~20.00	0.00	Hz	^v0.3
03-18	External Brake Engage Level	0.00~20.00	0.00	Hz	^v0.3
03-19	Relay Output Function Type	0:A (Normally open) 1:B (Normally close)	0	-	^v0.3
03-20	Braking Transistor On Level	240.0~800.0V	115V: 380V 230V: 380V 460V: 780V	VDC	
03-21	Brake Transistor Off Level	240.0~800.0V	115V: 360V 230V: 360V 460V: 760V	VDC	

Group 04: Analog Inputs & Outputs					
Code	Name	Setting Range	Default	Unit	Note
04-00	AVI/ACI Analog Input Signal Type Select	ACI AVI 0: 0~10V 0~20mA 1: 0~10V 4~20mA 2: 2~10V 0~20mA 3: 2~10V 4~20mA	0	-	
04-01	AVI Signal Verification Scan Rate	1~200	50x2ms	2ms	
04-02	AVI Gain	0~1000	100	%	*1
04-03	AVI Bias	0~100	0	%	*1
04-04	AVI Bias Selection	0: Positive 1: Negative	0	-	*1
04-05	AVI Slope	0: Positive 1: Negative	0	-	*1
04-06	ACI Signal Verification Scan Rate	1~200	50x2ms	2ms	
04-07	ACI Gain	0~1000	100	%	*1
04-08	ACI Bias	0~100	0	%	*1
04-09	ACI Bias Selection	0: Positive 1: Negative	0	-	*1
04-10	ACI Slope	0: Positive 1: Negative	0	-	*1
04-11	Analog Output Mode	0: Output Frequency 1: Frequency Command 2: Output Voltage 3: DC Bus Voltage 4: Motor Current	0	-	*1
04-12	Analog Output Gain	0~1000	100	%	*1
04-13	Analog Output Bias	0~100	0	%	*1
04-14	Analog Output Bias Selection	0: Positive 1: Negative	0	-	*1
04-15	Analog Output Slope	0: Positive 1: Negative	0	-	*1
04-16	Keypad Potentiometer Gain	0~1000	100	%	^v1.06 *1
04-17	Keypad Potentiometer Bias	0~100	0	%	^v1.06 *1
04-18	Keypad Potentiometer Bias Selection	0: Positive 1: Negative	0	-	^v1.06 *1
04-19	Keypad Potentiometer Slope	0: Positive 1: Negative	0	-	^v1.06 *1

Group 05: Preset Frequencies					
Code	Name	Setting Range	Default	Unit	Note
05-00	Preset Speed Control Mode	0: Common Accel/Decel Accel/Decel 1 or 2 apply to all speeds 1: Individual Accel/Decel Accel/ Decel 0-7 apply to the selected preset speeds (Acc0/Dec0~ Acc7/Dec7)	0	-	
05-01	Speed 0 (Keypad Frequency)	0.00 ~ 599.00	5.00	Hz	*1
05-02	Speed 1	0.00 ~ 599.00	5.00	Hz	*1
05-03	Speed 2	0.00 ~ 599.00	10.00	Hz	*1
05-04	Speed 3	0.00 ~ 599.00	20.00	Hz	*1
05-05	Speed 4	0.00 ~ 599.00	30.00	Hz	*1
05-06	Speed 5	0.00 ~ 599.00	40.00	Hz	*1
05-07	Speed 6	0.00 ~ 599.00	50.00	Hz	*1
05-08	Speed 7	0.00 ~ 599.00	50.00	Hz	*1
05-09 ~ 05-16	Reserved				
05-17	Speed 0 Acceleration Time	0.1 ~ 3600.0	10.0	s	*1
05-18	Speed 0 Deceleration Time	0.1 ~ 3600.0	10.0	s	*1
05-19	Speed 1 Acceleration Time	0.1 ~ 3600.0	10.0	s	*1
05-20	Speed 1 Deceleration Time	0.1 ~ 3600.0	10.0	s	*1
05-21	Speed 2 Acceleration Time	0.1 ~ 3600.0	10.0	s	*1
05-22	Speed 2 Deceleration Time	0.1 ~ 3600.0	10.0	s	*1
05-23	Speed 3 Acceleration Time	0.1 ~ 3600.0	10.0	s	*1
05-24	Speed 3 Deceleration Time	0.1 ~ 3600.0	10.0	s	*1
05-25	Speed 4 Acceleration Time	0.1 ~ 3600.0	10.0	s	*1
05-26	Speed 4 Deceleration Time	0.1 ~ 3600.0	10.0	s	*1
05-27	Speed 5 Acceleration Time	0.1 ~ 3600.0	10.0	s	*1
05-28	Speed 5 Deceleration Time	0.1 ~ 3600.0	10.0	s	*1
05-29	Speed 6 Acceleration Time	0.1 ~ 3600.0	10.0	s	*1
05-30	Speed 6 Deceleration Time	0.1 ~ 3600.0	10.0	s	*1
05-31	Speed 7 Acceleration Time	0.1 ~ 3600.0	10.0	s	*1
05-32	Speed 7 Deceleration Time	0.1 ~ 3600.0	10.0	s	*1

Group 06: Auto Sequencer					
Code	Name	Setting Range	Default	Unit	Note
06-00	Auto Run Mode	0: Disabled 1: Single cycle (Continues to run from the unfinished step if re-started) 2: Periodic cycle (Continues to run from the unfinished step if restarted) 3: Single cycle, then holds the speed of final step to run (Continues to run from the unfinished step if restarted) 4: Single cycle (Starts a new cycle if restarted) 5: Periodic cycle (Starts a new cycle if restarted) 6: Single cycle, then hold the speed of final step to run (Starts a new cycle if restarted)	0	-	
06-01	Frequency Command 1	0.00~599.00	0.00	Hz	*1
06-02	Frequency Command 2	0.00~599.00	0.00	Hz	*1
06-03	Frequency Command 3	0.00~599.00	0.00	Hz	*1
06-04	Frequency Command 4	0.00~599.00	0.00	Hz	*1
06-05	Frequency Command 5	0.00~599.00	0.00	Hz	*1
06-06	Frequency Command 6	0.00~599.00	0.00	Hz	*1
06-07	Frequency Command 7	0.00~599.00	0.00	Hz	*1
06-08 ~ 06-15	Reserved				
06-16	Running Time 0	0.0 ~ 3600.0	0.0	s	*1
06-17	Running Time 1	0.0 ~ 3600.0	0.0	s	*1
06-18	Running Time 2	0.0 ~ 3600.0	0.0	s	*1
06-19	Running Time 3	0.0 ~ 3600.0	0.0	s	*1
06-20	Running Time 4	0.0 ~ 3600.0	0.0	s	*1
06-21	Running Time 5	0.0 ~ 3600.0	0.0	s	*1
06-22	Running Time 6	0.0 ~ 3600.0	0.0	s	*1
06-23	Running Time 7	0.0 ~ 3600.0	0.0	s	*1
06-24 ~ 06-31	Reserved				
06-32	Running Direction 0	0: Stop 1: Forward 2: Reverse	0	-	
06-33	Running Direction 1	0: Stop 1: Forward 2: Reverse	0	-	
06-34	Running Direction 2	0: Stop 1: Forward 2: Reverse	0	-	
06-35	Running Direction 3	0: Stop 1: Forward 2: Reverse	0	-	
06-36	Running Direction 4	0: Stop 1: Forward 2: Reverse	0	-	
06-37	Running Direction 5	0: Stop 1: Forward 2: Reverse	0	-	
06-38	Running Direction 6	0: Stop 1: Forward 2: Reverse	0	-	
06-39	Running Direction 7	0: Stop 1: Forward 2: Reverse	0	-	

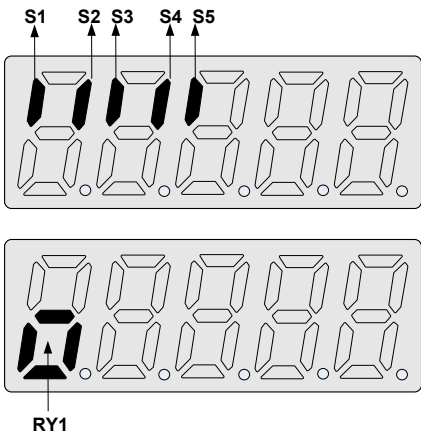
Group 07: Start & Stop Commands					
Code	Name	Setting Range	Default	Unit	Note
07-00	Momentary Power Loss and Restart	0: Momentary power loss and restart disable 1: Momentary power loss and restart enable	0	s	^v1.10
07-01	Auto Restart Delay Time	0.0~800.0	0.0	s	
07-02	Number of Auto Restart Attempts	0~10	0	-	
07-03	Reset Mode Setting	0: Enable reset only when run command is off 1: Enable reset when run command is on or off	0	-	
07-04	Direct Running After Power Up	0: Enable direct run on power up 1: Disable direct run on power up	1	-	
07-05	Delay-ON Timer	1.0~300.0	1.0	s	
07-06	DC Injection Brake Start Frequency (Hz) In Stop mode	0.10 ~ 10.00	1.5	Hz	
07-07	DC Injection Brake Level (%) In Stop Mode	0 ~ 20 (Frame1/2). based on the 20% of maximum output voltage 0 ~ 100 (Frame3/4) based on the rated current	50	%	
07-08	DC Injection Brake Time (Seconds) In Stop Mode	0.0 ~ 25.5	0.5	s	
07-09	Stopping Method	0: Deceleration to stop 1: Coast to stop	0	-	
07-10	DC Braking Level at Start	0~100	0	%	^v1.04
07-11	DC Braking Time at Start	0.0~25.5	0.0	s	^v1.04
07-12	Run Command Retention	0: Retention during power-loss 1: No retention during power-loss	1	-	^v1.11

Group 08: Drive & Motor Protection					
Code	Name	Setting Range	Default	Unit	Note
08-00	Trip Prevention Selection	xxxx0: Enable trip prevention during acceleration xxxx1: Disable trip prevention during acceleration xxx0x: Enable trip prevention during deceleration xxx1x: Disable trip prevention during deceleration xx0xx: Enable trip prevention in run mode xx1xx: Disable trip prevention in run mode x0xxx: Enable over voltage prevention in run mode x1xxx: Disable over voltage prevention in run mode	00000	-	
08-01	Trip Prevention Level During Acceleration	50 ~ 200	by model	%	
08-08	Trip Prevention Level During Deceleration	50 ~ 200	by model	%	
08-03	Trip Prevention Level In Run Mode	50 ~ 200	by model	%	
08-04	Over Voltage Prevention Level in Run Mode	200V: 350.0~390.0 400V: 700.0~780.0	380.0/760.0	V	
08-05	Motor Overload Protection Operation Mode	xxxx0: Disable electronic motor overload protection xxxx1: Enable electronic motor overload protection xxx0x: Motor overload cold start xxx1x: Motor overload hot start xx0xx: Standard motor xx1xx: Inverter duty motor	00001	-	^v1.06
08-06	Operation After Overload is Activated	0: Coast-to-stop after overload protection is activated 1: Drive will not trip when overload protection is activated (OL1)	0	-	
08-07	Overheat Protection (Cooling Fan Control)	0: Auto (Depends on temp.) 1: Operate while in RUN mode 2: Always Run 3: Disabled	1	-	
08-08	Auto Voltage Regulation Function	0: AVR function enable 1: AVR function disabled 2: AVR function disabled for stop 3: AVR function disabled for deceleration 4: AVR function disabled for stop and deceleration 5: When VDC>(360V/740V), AVR function disable for stop and deceleration	4	-	
08-09	Input Phase Lost Protection	0: Disabled 1: Enabled	0	-	^0.3
08-10	PTC Overheat Function	0: Disabled 1: Decelerate to stop 2: Coast to stop 3: Continue running when warning level is reached. Coast to stop, when protection level is reached	0	-	
08-11	PTC Signal Smoothing Time	0.01~10.00	0.2	s	
08-12	PTC Detection Time Delay	1~300	60	s	
08-13	PTC Protection Level	0.1~10.0	0.7	V	
08-14	PTC Detection Level Reset	0.1~10.0	0.3	V	
08-15	PTC Warning Level	0.1~10.0	0.5	V	
08-16	Fan Control Temperature Level	10.0~50.0	50.0	°C	
08-17	Over Current Protection Level	0.0 ~ 60.0	0.0	A	^v1.04
08-18	Over Current Protection Time	0.0 ~ 1500.0	1.0	s	^v1.04
08-19	Motor Overload Protection Level	0: Motor Overload Protection Level 0 1: Motor Overload Protection Level 1 2: Motor Overload Protection Level 2	0	-	^v1.06

Group 09: Communication					
Code	Name	Setting Range	Default	Unit	Note
09-00	Station Address	1 ~ 32	1	-	*2*3
09-01	Communication Mode	0: Modbus RTU code 1: Modbus ASCII code 2: BACnet (Pump application built-in without this function)	0	-	*1*2*3
09-02	Baud Rate	0: 4800 1: 9600 2: 19200 3: 38400	2	bps	^v1.12 *2*3
09-03	Stop Bits	0: 1 Stop bit 1: 2 Stop bits	0	-	*2*3
09-04	Parity	0: Without parity 1: With even parity 2: With odd parity	0	-	*2*3
09-05	Data Format	0: 8-Bits 1: 7-Bits	0	-	*2*3
09-06	Time-Out Detection Time	0.0 ~ 25.5	0.0	s	
09-07	Time-Out Operation	0: Decelerate to stop (set by 00-15) 1: Coast to stop 2: Decelerate stop (set by 00-17) 3: Continue operating	0	-	
09-08	Comm Failed Verification Time	0 ~ 20	3	-	^v1.04
09-09	Transmit Delay Time	5 ~ 65	5	ms	
09-10	BACnet stations	1~254	1	-	*1*2*3

Group 10: PID Controller					
Code	Name	Setting Range	Default	Unit	Note
10-00	PID Setpoint Source	0: Potentiometer on Keypad 1: Analog Signal Input (AVI) 2: Analog Signal Input (ACI) 3: Freq. set by Communication 4: Keypad Freq. Parameter 10-02	1	-	^v1.04 *1
10-01	PID Feedback Source	0: Potentiometer on Keypad 1: Analog Signal Input (AVI) 2: Analog Signal Input (ACI) 3: Freq. set by Communication	2	-	^v0.3 *1
10-02	PID Target (keypad input)	0.0 ~ 100.0	50.0	%	^v0.3 *1
10-03	PID Mode Selection	0: Disabled 1: Deviation D Control. FWD Characteristic 2: Feedback D Control. FWD Characteristic 3: Deviation D Control. Reverse Characteristic 4: Feedback D Control. Reverse Characteristic 5: Frequency Command + Deviation D Control FWD Characteristic 6: Frequency Command + Feedback D Control FWD Characteristic 7: Frequency Command + Deviation D Control Reverse Characteristic 8: Frequency Command + Feedback D Control Reverse Characteristic	0	-	
10-04	Feedback Gain Coefficient	0.00 ~ 10.00	1.00	%	*1
10-05	Proportional Gain	0.0 ~ 10.0	1.0	%	*1
10-06	Integral Time	0.0 ~ 100.0	10.0	s	*1
10-07	Derivative Time	0.00 ~ 10.00	0.00	s	*1
10-08	PID Offset	0: Positive 1: Negative	0	-	*1
10-09	PID Offset Adjust	0 ~ 109	0	%	*1
10-10	PID Output Lag Filter Time	0.0 ~ 2.5	0.0	s	*1
10-11	Feedback Loss Detection Mode	0: Disabled 1: Drive keeps running after feedback loss 2: Drive stops after feedback loss	0	-	
10-12	Feedback Loss Detection Level	0 ~ 100	0	%	
10-13	Feedback Loss Detection Delay Time	0.0 ~ 25.5	1.0	s	
10-14	Integration Limit Value	0 ~ 109	100	%	*1
10-15	Integral Value Resets to Zero When Feedback Signal Equals Setpoint	0: Disabled 1: 1 Second 30: 30 Seconds (0 ~ 30)	0	-	
10-16	Allowable Integration Error. Margin (units) (1unit = 1/8192)	0 ~ 100	0	-	
10-17	PID Sleep Frequency Level	0.00~599.00	0.00	Hz	
10-18	PID Sleep Function Delay Time	0.0 ~ 25.5	0.0	s	
10-19	PID Wake Up Frequency Level	0.00 ~ 599.00	0.00	Hz	
10-20	PID Wake Up Delay Time	0.0 ~ 25.5	0.0	s	
10-21	Max PID Feedback	0 ~ 999	100	-	*1
10-22	Min PID Feedback	0 ~ 999	0	-	*1

Group 11: Performance Control					
Code	Name	Setting Range	Default	Unit	Note
11-00	Reverse Operation Control	0: Reverse command is valid 1: Reverse command is invalid	0	-	
11-01	Carrier Frequency (kHz)	1~16	5	KHz	
11-02	Carrier Mode Selection	0: Mode0, 3phase PWM modulation 1: Mode1, 2phase PWM modulation 2: Mode2, random PWM modulation	1	-	
11-03	Carrier Frequency Reduction by Temperature Rise	0: Disabled 1: Enabled	0	-	
11-04	S-Curve Acc 1	0.0 ~ 4.0	0.00	s	
11-05	S-Curve Acc 2	0.0 ~ 4.0	0.00	s	
11-06	S-Curve Dec 3	0.0 ~ 4.0	0.00	s	
11-07	S-Curve Dec 4	0.0 ~ 4.0	0.00	s	
11-08	Skip Frequency 1	0.00 ~ 599.00	0.00	Hz	*1
11-09	Skip Frequency 2	0.00 ~ 599.00	0.00	Hz	*1
11-10	Skip Frequency 3	0.00 ~ 599.00	0.00	Hz	*1
11-11	Skip Frequency Bandwidth (±)	0.00 ~ 30.00	0.00	Hz	*1
11-12	Reserved				
11-13	Regeneration Prevention Function	0: Disable 1: Enable 2: Enable (during constant speed only)	0	-	
11-14	Regeneration Prevention Voltage Level	200v: 300.0~400.0 400v: 600.0~800.0	380/760	V	
11-15	Regeneration Prevention Frequency Limit	0.00-15.00	3.00	Hz	
11-16	Regeneration Prevention Voltage Gain	0~200	100	%	
11-17	Regeneration Prevention Frequency Gain	0~200	100	%	
11-18	Speed Loop Proportion Gain	0~65535	10000	-	
11-19	Speed Loop Integration Gain	0~65535	800	-	
11-20	Speed Loop Differential Gain	0~65535	0	-	
11-21	Stop Key Selection	0: Enable Stop Key when Run Command not from Keypad 1: Disable Stop Key when Run Command not from Keypad	0	-	^v1.06

Group 12: Display & Monitoring					
Code	Name	Setting Range	Default	Unit	Note
12-00	Extended Display Mode	00000 ~77777. Each digit can be set to 0 to 7 0: Default display(frequency & parameters) 1:Output Current 2:Output Voltage 3:DC Voltage 4:Temperature of Heat Sink 5:PID Feedback 6:Analog Signal Input (AVI) 7:Analog Signal Input (ACI)	00321	-	^v0.3 *1
12-01	PID Feedback Display Format	0: Integer (xxx) 1: One decimal place (xx.x) 2: Two decimal places (x.xx)	0	-	*1
12-02	PID Feedback Display Unit Setting	0: xxx-- 1: xxxpb (pressure) 2: xxxfl (flow)	0	-	*1
12-03	Custom Units (Line Speed) Value	0~65535	1500/1800	RPM	*1
12-04	Custom Units (Line Speed) Display Mode	0:Drive Output Frequency is Displayed 1:Line Speed. Integer.(xxxxx) 2:Line Speed One Decimal Place (xxxx.x) 3:Line Speed Two Decimal Places (xxx.xx) 4:Line Speed Three Decimal Places (xx.xxx)	0	-	*1
12-05	Inputs and Output Logic Status Display (S1 to S5) & RY1		-	-	^v0.3 *4
12-06	Output Power	-----	0.0	kW	^v1.06
12-07	Motor Current Percentage	-----	0	%	^v1.06

Group 13: Inspection & Maintenance					
Code	Name	Setting Range	Default	Unit	Note
13-00	Drive Horsepower Code	----	-	-	*3
13-01	Software Version	----	-	-	*3*4
13-02	Fault Log (Last 3 Faults)	----	-	-	*3*4
13-03	Accumulated Operation Time 1	0~23	-	-	*3
13-04	Accumulated Operation Time 2	0~65535	-	hour	*3
13-05	Accumulated Operation Time Mode	0: Time Under Power 1: Run Mode Time Only	0	day	*3
13-06	Parameter Lock	0: Enable all functions 1: Preset speeds 05-01~05-08 cannot be changed 2: All Functions cannot be changed except for preset speeds 05-01~05-08 3: Disable all functions	0	-	^v1.13
13-07	Parameter Lock Code	00000~65535	00000	-	
13-08	Restore Factory Settings	1150: Initialization (50Hz,220V/380V) 1160: Initialization (60Hz,220V/380V) 1250: Initialization (50Hz,230V/400V) 1260: Initialization (60Hz,230V/460V) 1350: Initialization (50Hz,220V/415V) 1360: Initialization (60Hz,230V/400V)	1250/1360	-	

Group 14: Pump Functions					
Code	Name	Setting Range	Default	Unit	Note
14-00	Function Selection	0: Disable 1: Enable	0	-	^1.13
14-01	Pump Mode	0: Single Pump 1: Multiple pumps-Master 2: Multiple pumps-Slave 1 3: Multiple pumps-Slave 2 4: Multiple pumps-Slave 3	0	-	
14-02	Operation Pressure Setting	0.10 – (14-03 setpoint)	4.00	PSI	
14-03	Transmitter Maximum Pressure	0.10 – 650.00	10.00	PSI	
14-04	Pump Pressure Command Source	0: Parameter 14-02 is set 1: Set by AI	0	-	
14-05	Display Mode	0 : Target pressure and feedback pressure are displayed at the same time (14-03 must be less than or equal to 99) 1 : Only the target pressure is displayed 2 : Only the feedback pressure is displayed	0	-	
14-06	Proportion Gain (P)	0.00 ~ 10.00	3.00	-	
14-07	Integral Time (I)	0.0 ~ 100.0	0.5	s	
14-08	Differential Time (D)	0.00 ~ 10.00	0.00	s	
14-09	Tolerance Range of Constant Pressure	When 14-20=0 : 0.01 ~ 650.00 PSI When 14-20=1 : 1~100%	5	PSI/%	
14-10	Sleep Frequency of Constant Pressure	0.00 ~ 599.00	30.00	Hz	
14-11	Sleep Time of Constant Pressure	0.0 – 255.5	0.0	s	
14-12	Maximum Pressure Limit	When 14-20=0 : 0.00 ~ 650.00 PSI When 14-20=1 : 0~100%	50	PSI/%	
14-13	Warning Time of High Pressure	0.0 – 600.0	10.0	s	
14-14	Stop Time of High Pressure	0.0 – 600.0	20.0	s	
14-15	Minimum Pressure Limit	When 14-20=0, range is 0.00~650.00 PSI When 14-20=1, range is 0~100 %	5	PSI/%	
14-16	Warning Time of Low Pressure	0.0 – 600.0	0.0	s	
14-17	Fault Stop Time of Low Pressure	0.0 – 600.0	0.0	s	
14-18	Detection Time of Loss Pressure	0.0 - 600.0	0.0	s	
14-19	Proportion of Loss Pressure Detection	0 - 100	0	%	
14-20	Percentage/Pressure Selection	0: Pressure 1: Percentage	1	-	
14-21	Reserved				
14-22	Slave Trip Frequency	0 – 599.00	45.00	Hz	
14-23	Direction of Water Pressure Detection	0: Water use detection upward 1: Water use detection downward	1	-	
14-24	Range of Water Pressure Detection	When 14-20=0 : 0.00 ~ 650.00 PSI When 14-20=1 : 0~100%	1	PSI/%	
14-25	Period of Water Pressure Detection	0.0 – 200.0	30.0	s	
14-26	Acceleration Time of Water Pressure	0.1 – 3600.0	12.0	s	
14-27	Deceleration Time of Water Pressure	0.1 – 3600.0	35.0	s	
14-28	Forced Run Command	0.00 - (the value of 00-12)	0.00	Hz	
14-29	Switching Time of Multiple Pumps in Parallel	0 – 240	3	Hours	
14-30	Det. Time of Multiple Pumps in Parallel at Start	0 – 30.0	0.0	s	
14-31	Synchronous Selection of Parallel Pumps	0 : Closed 1 : Pressure setting and Run/Stop synchronization 2 : Pressure setting synchronization 3 : Run/Stop synchronization	1	-	
14-32 ~ 14-33	Reserved				
14-34	Tolerance Range of Constant Pressure 2	When 14-20=0 : 0.01 ~ 650.00 When 14-20=1 : 1~100	5	PSI/%	
14-35	Selection of Multiple Pumps Shift Operation	0: No function is performed 1: Timer alternate selection 2: Hibernation stops alternate selection 3: The timer is alternately selected from the sleep stop 4: Multiple parallel test mode	1	-	
14-36	Reserved				
14-37	Leakage Detection Time	0.0 – 100.0	0.0	s	

Note: When 14-00 is set to 1, 07-12 will be set to 0 at the same time

Group 14: Pump Functions					
Code	Name	Setting Range	Default	Unit	Note
14-38	Pressure Variation of Leakage Detection	When 14-20=0 : 0.01 ~ 65.00 When 14-20=1 : 1~10	1	PSI/%	
14-39	Pressure Tolerance Range of Leakage Detection Restart	When 14-20=0 : 0.01 ~ 650.00 When 14-20=1 : 1~100	5	PSI/%	
14-40 ~ 14-70	Reserved				
14-71	Maximum Pressure	0.10~650.00	10.00	PSI	
14-72	Switching Time of Alternation in Parallel	0: Hours 1: Minute	0	-	
14-73	Slave Wake-up Selection	0: Disable 1: Enable	0	-	
14-74	Proportion Gain 2 (P)	0.00 ~ 10.00	3.00	-	
14-75	Integral Time 2 (I)	0.0 ~ 100.0	0.5	-	
14-76	Differential Time 2 (D)	0.00 ~ 10.00	0.00	-	
14-77	Water Pressure Detection Level	0 ~ 100	1	-	
14-78	Maximum Current Limit	0.1~6553.5	6.1	A	
14-79	Minimum Current Limit	0.1~6553.5	6.1	A	
14-80	Current Limit cumulative time	0~600.0	0.0	s	

4.3 Parameter Function Description

00-Basic parameter group

00-00	Control mode
Range	【0】 : V/F mode 【1】 : SLV mode

Select control mode in parameter 00-00 best suitable for the application.

Default control mode is V/F.

- **V/F mode** can be used for most applications.

V/f patterns can be selected with parameter 01-00. Select the appropriate V/f pattern based on the application load type and the motor base frequency 50 or 60 Hz.

Refer to description of parameter 01-00

- **SLV (Sensorless Vector)** is used for general purpose applications that require higher precision speed control and torque response.

00-01	Motor Direction Control
Range	【0】 : Forward 【1】 : Reverse

- 00-01 valid only in keypad mode.

Note: "LOC" is displayed on the keypad when parameter 11-00=1 and parameter 00-01=1.

00-02	Main Run Command Source selection
00-03	Alternative Run Command Source selection
Range	【0】 : Keypad 【1】 : External Run/Stop Control 【2】 : Communication

- Parameter 00-02/00-03 sets the inverter operation command source. For switching between 00-02 and 00-03, use any of the external inputs S1 to S5 and set the relevant parameters (03-00~03-04) to [12]. Refer to parameter group3.

00-04	Operation modes for external terminals
Range	【0】 : Forward/stop-reverse/stop 【1】 : Run/stop-forward/reverse 【2】 : 3-wire control mode -run/stop

- 00-04 is valid when Run command source is set to External Run/Stop Control parameter 00-02/00-03=1.

2-wire operation mode:

Set 00-04 to **【0/1】** first, before setting (03-00, 03-04) to [0] or [1]

00-04= **【0】** Set external terminals (03-00 to 03-04) function to 0 for FWD/Stop or set to 1 for REV/Stop control.

00-04= **【1】** Set external terminals (03-00 to 03-04) function to 0 for Run/Stop or Set to 1 for FWD/REV control.

3-wire operation mode:

00-04 = **【2】** Terminals S1, S2, S3 are reserved for 3 wire run/stop control.

In this mode parameter 03-00, 03-01 and 03-02 are not active. (Refer to Group 03)

00-05	Main Frequency Command Source Selection
00-06	Alternative Frequency Command Source Selection
Range	【0】 :UP/DOWN of Keypad 【1】 :Potentiometer on Keypad 【2】 :External AVI Analog Signal Input 【3】 :External ACI Analog Signal Input 【4】 :External Up/Down Frequency Control 【5】 :Communication setting Frequency 【6】 :PID Output frequency

- When 00-06 = **【6】**, frequency reference source is the PID output.

00-07	Main and Alternative Frequency Command Modes
Range	【0】 :Main or Alternative Frequency. 【1】 :Main frequency + Alternative Frequency

- When 00-07 = **【0】** , the frequency reference source is set by the **Main frequency** parameter 00-05 (Default) or by the **Alternative frequency** parameter 00-06.

Use any of the external terminals S1 to S5 and set the relevant parameter 03-00 to 03-04 =**【13】**to switch between **Main** and **Alternative** source.

- When 00-07 = **【1】** the frequency reference becomes the sum of the main reference frequency (00-05) and alternative frequency (00-06).

00-08	Communication Frequency Command – Read Only
Range	【0.00~599.00】 Hz

- Displays the frequency reference when 00-05 or 00-06 is set to communication control (5).

00-09	Frequency Command save on power down (Communication mode)
Range	【0】 :Disable 【1】 :Enable

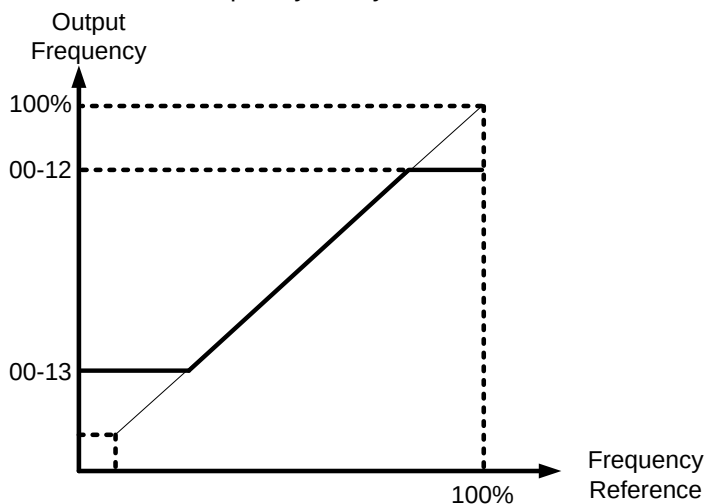
- 00-09 = **【0】** Keypad frequency is saved at power down
- 00-09 = **【1】** Frequency set via communication is saved at power down.

00-10	Initial Frequency Selection
Range	【0】 :By Current Freq Command 【1】 :By Zero Freq Command 【2】 :By 00-11
00-11	Initial Frequency Setpoint
Range	【0.00~599.00】 Hz

- This parameter is only active in keypad mode
- When 00-10 = **【0】** , frequency reference at power-up is last known frequency.
- When 00-10 = **【1】** , frequency reference at power-up is 0.
- When 00-10 = **【2】** , frequency reference at power-up is set by parameter 00-11.
-

00-12	Frequency Upper limit
Range	【0.01~599.00】 Hz
00-13	Frequency Lower limit
Range	【0.00~649.99】 Hz

- "Stpo" is displayed on the keypad when RUN is pressed and parameter 00-13 and the command frequency are both set to 0.00.
- When frequency command is greater than 00-13 the inverter output will ramp up from 0.00 to the command frequency.
- When 00-13 is greater than 0, and the frequency command value is smaller or equal to 00-13, the inverter output will ramp up to the lower limit frequency set by 00-13.



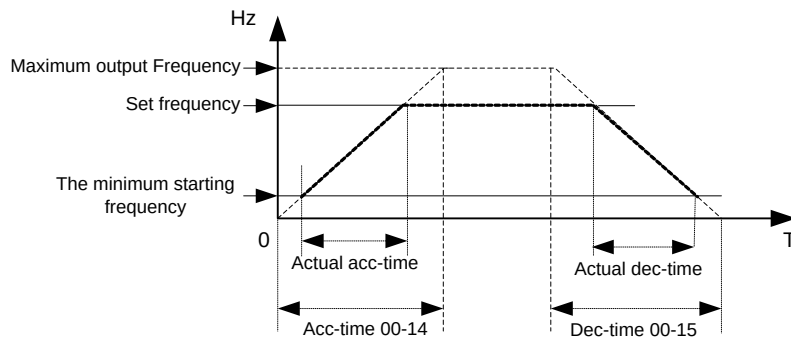
00-14	Acceleration time 1
Range	【0.1~3600.0】 s
00-15	Deceleration time 1
Range	【0.1~3600.0】 s
00-16	Acceleration time 2
Range	【0.1~3600.0】 s
00-17	Deceleration time 2
Range	【0.1~3600.0】 s

- Acceleration time is the time required to accelerate from 0 to 100% of maximum output frequency.
- Deceleration time is the time required to decelerate from 100 to 0% of maximum output frequency.
- Preset acceleration and deceleration times by above parameters are the time taken for the output frequency to ramp up or ramp down between the upper and the lower frequency limits.

- Actual acceleration and deceleration time is calculated as follows:

$$\text{Actual acceleration time} = \frac{(00-14) \times (\text{set frequency} - \text{the minimum starting frequency})}{\text{Maximum output frequency}}$$

$$\text{Actual deceleration time} = \frac{(00-15) \times (\text{set frequency} - \text{the minimum starting frequency})}{\text{Maximum output frequency}}$$



Note:

Maximum output frequency fixed when VF curve (01-00) is set to a value of 1 to 6.

Maximum output frequency parameter 01-02 can be adjusted when VF curve (01-00) is set to 7.

00-18	Jog Frequency
Range	【1.00~25.00】 Hz
00-19	Jog Acceleration Time
Range	【0.1~3600.0】 s
00-20	Jog Deceleration Time
Range	【0.1~3600.0】 s

- The JOG function is active when any of the multi-function input terminals S1 to S5 parameters 03-00~03-04 is set to **【6】 JOG FWD** or **【7】 JOG REV**. Refer to parameter group 3.

01-V/F command group	
01-00	Volts/Hz Patterns (V/F)
Range	【1~7】

- Set 01-00 to one of the following preset V/f selections 【1~6】 based on the application.
- Parameters 01-02~01-09 are automatically set (read-only) when 01-00 is set to a value from 1 to 6.
- Six fixed V/f patterns are shown below. 【1~3】 for 50 Hz motor and 【4~6】 for 60 Hz motors.

TYPE	50Hz		60Hz	
Function	01-00	V/F pattern	01-00	V/F pattern
General Use	= 【1】		= 【4】	
High start torque	= 【2】		= 【5】	
Decreasing torque	= 【3】		= 【6】	

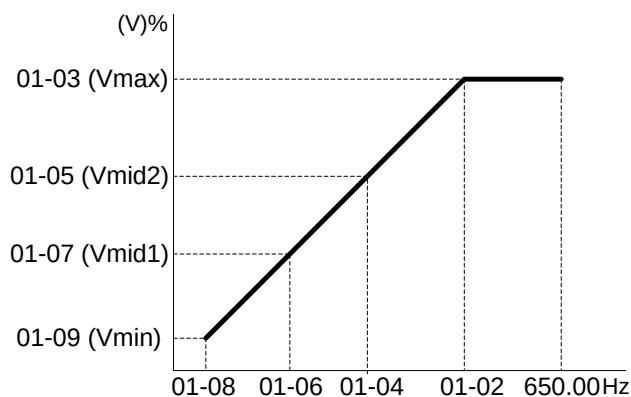
- (V) 100% is the maximum output voltage. Point B and C are defined as a % of the maximum voltage see table below:

01-00	Frame1/2	
	B(Xb)	C(Xc)
1/4	10%	8%
2/5	12%	9.5%
3/6	25%	7.7%

- To set a custom V/F curve set 01-00 = [7]. Parameters (01-02~01-09) can now be modified.

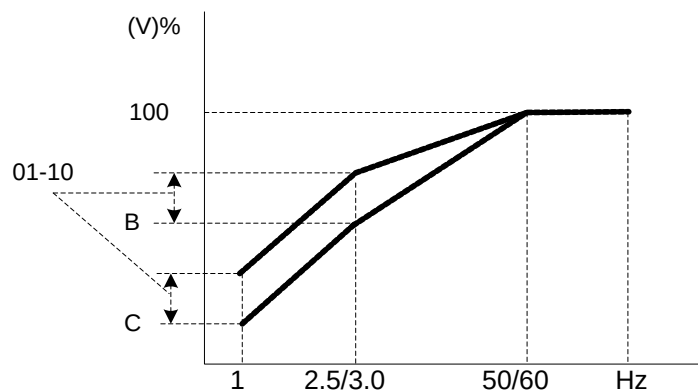
01-01	v/f Maximum voltage
Range	230: 【170.0~264.0】 V 460: 【323.0~528.0】 V
01-02	Maximum Frequency (base frequency)
Range	【1.40~ 599.00】 Hz
01-03	Maximum Frequency Voltage Ratio
Range	【0.0 ~ 100.0】 %
01-04	Medium Frequency 2
Range	【1.30~599.00】 Hz
01-05	Medium Frequency Voltage Ratio 2
Range	【0.0 ~ 100.0】 %
01-06	Medium Frequency 1
Range	【1.30~599.00】 Hz
01-07	Medium Frequency Voltage Ratio 1
Range	【0.0 ~ 100.0】 %
01-08	Minimum Frequency
Range	【1.30~599.00】 Hz
01-09	Minimum Frequency Voltage Ratio
Range	【0.0 ~ 100.0】 %

- Maximum output frequency is set by parameter 01-02 when 01-00= 【7】 (Custom V/F)
- For 01-00 ≠ 【7】 , the maximum output frequency is limited by parameter 00-12, frequency upper limit.



01-10	Volts/Hz Curve Modification (Torque Boost)
Range	【0 ~ 10.0】 %

- Inverter output V/F curve settings for points B, C can be adjusted by parameter 01-10 to adjust the output torque.
- Calculation of B, C point voltage: B point voltage = $X_b \times \text{maximum output voltage}$, C point voltage = $X_c \times \text{maximum output voltage}$ (X_b , X_c see Page 4-26). When 01-10 = 0, torque boost is disabled.



01-11	V/F start Frequency
Range	【0.00 ~10.00】 Hz

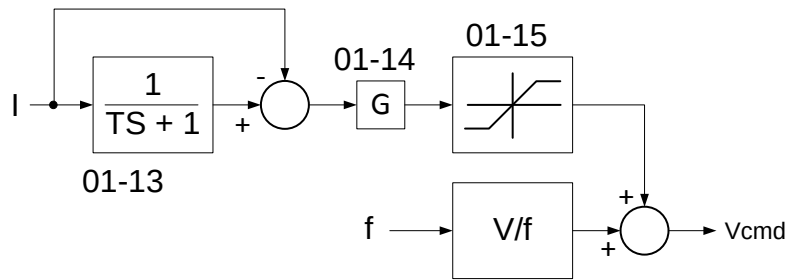
V/F Start Frequency can be used in application where the initial start frequency needs to be greater than 0.

01-12	No-load oscillation suppression gain
Range	【0.0~200.0】 %

- During power fluctuations under a no-load condition the inverter might experience output current oscillations. Adjusting 01-12 accordingly to suppress oscillation. Compensation is based on the percentage of the load current relative to the motor rated current. Adjust 01-12 in steps of 5 to 10% up or down.

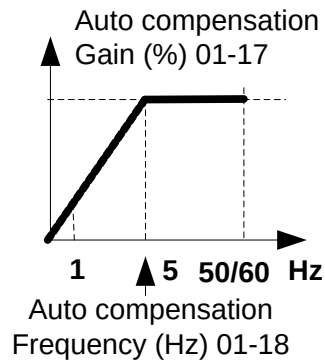
01-13	Motor Hunting Prevention Coefficient
Range	【1~8192】
01-14	Motor Hunting Prevention Gain
Range	【0~100】 %
01-15	Motor Hunting Prevention Limit
Range	【0.0~100.0】 %

- During power fluctuations under a no-load condition the inverter might experience output current oscillations. Adjusting 01-12 accordingly to suppress oscillation by compensating V/F voltage command. Compensation is based on filtering the load current by using a high-pass filter multiplied by the gain and clamped by a limiter. The result is added to the V/F output voltage. Adjust 01-14 in steps of 5 to 10% up or down.
- Parameter 01-13 is a filter coefficient. Filter time in ms is 2048 divided by 01-13. Example: 01-13 = 800, then filter time = $2048 \div 800 = 2.56$ ms.
- 100% of the output limiter parameter 01-15 corresponds to 150V (100, 200V series) and 300V (400V series).



01-16	Auto-Torque Compensation Filter Coefficient
Range	【0.1 ~ 1000.0】 ms
01-17	Auto-torque Compensation Gain
Range	【0~ 100】 %
01-18	Auto-torque Compensation Frequency
Range	【1.30 ~ 5.00】 Hz

- Auto-torque Compensation function is set in SLV mode during auto-tuning to determine the stator resistance. To disable Auto-Torque Compensation set parameter 01-17 to 0. Auto-torque compensation is based the maximum output voltage and load current in V/F mode. Adjust 01-17 in steps of 5 to 10% up or down if needed.
- Parameter 01-16~01-18 active in V/F mode only. In SLV mode there is no need to adjust these parameter as they are automatically set during auto-tuning.



02-Motor Parameter Group

02-00	Motor no load current. (For slip compensation calculation)
Range	----
02-01	Motor Rated Current
Range	----
02-02	Slip Compensation Gain. (V/f mode only)
Range	【0.0 ~ 100.0】 (%)
02-03	Motor Rated Speed
Range	----
02-04	Motor Rated Voltage
Range	----
02-05	Motor Rated Power
Range	【0~100.0】 kW
02-06	Motor Rated Frequency
Range	【0~599.0】 Hz

- When motor load causes the actual motor speed to fall below the inverter output frequency (Slip), parameter 02-02 Slip compensation can be used to adjust the actual motor speed.

Slip compensation calculation in V/F mode:

$$\text{Slip compensation boost} = \frac{\text{Output Current} - (02-00)}{(02-01) - (02-00)} \times (02-02) \times \text{Rate motor slip}$$

$$\text{Motor slip} = \text{Motor synchronous speed} - \text{Motor Rated Speed}$$

$$(02-02) \text{ approximate Value} = \frac{\text{Motor synchronization speed} - \text{Rated speed}}{\text{Motor synchronization speed}}$$

Example:

$$4 \text{ poles, } 60\text{Hz induction motor synchronization speed} = \frac{120}{4} \times 60 = 1800(\text{RPM})$$

Note:

- Default value for parameter 02-00 / 02-01 depend on the inverter model/size (13-00).
- Adjust based on the application.

02-07	Motor Auto Tuning
Range	【0】 : Disable 【1】 : Static auto tuning
02-08	Stator Resistor Gain
Range	----
02-09	Rotor Resistor Gain
Range	----

To start auto tuning procedure in SLV mode:

- Set motor parameters 02-01 and 02-03~02-06, next set 02-07 to **【1】** to start the auto tune procedure.
- During the Auto tune the display will show AT and show END briefly when auto tune is completed then the display will return back to show frequency.
- After a successful auto tune the motor test data is stored in parameters 02-08 and 02-09 and parameter 02-07 is set back to 0.

Notes:

- Perform an auto tune whenever the motor is replaced.
- Auto tuning is not possible for applications with multiple motors connected to one inverter.
- Auto tune can be used on motors of similar size to the inverter or one size smaller. Make sure to set the correct motor parameters.
- Parameters 02-00 ~ 02-06 are available both for V/F & SLV mode (Except parameter 02-02 V/f only).

02-13	SLV Slip Compensation Gain
Range	【0~150】 %
02-14	SLV Torque Compensation Gain
Range	【0~100】 %

SLV Slip compensation

- When the load causes the actual motor speed to fall below the set speed due to the slip of the motor, parameter 02-13 (SLV only) can be used to compensate and correct the speed.

SLV Torque compensation

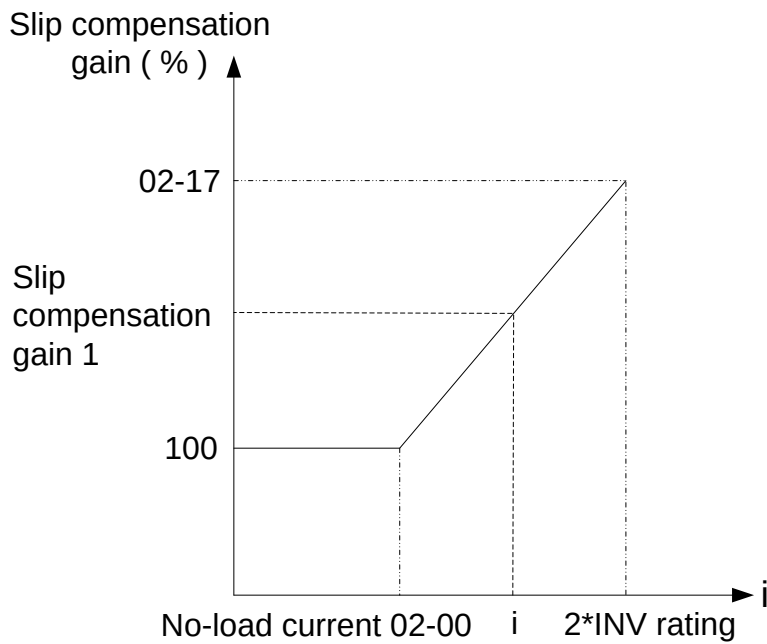
- When torque is reduced due to load conditions, parameter 02-14 can be used to correct the torque producing current and compensate for the reduced torque.
- Both 02-13 and 02-14 compensation are based on the load current. Parameter 02-13 is based on rated slip frequency and 02-14 is based on the difference in rated torque.
- Adjust 02-14 in steps of 5 to 10% up or down if needed.

02-15	Low Frequency Torque Gain
Range	【0~100】 %

- When operating at low output frequency (IGBT dead zone) results in a lower output torque of the system and therefor resulting in lower motor efficiency. Setting 02-15 can increase output torque at low frequency. Default setting is 50% voltage compensation. 100% of 02-15 is based on the output voltage of the dead zone.

02-16	SLV Without Load Slip Compensation Gain
Range	【0~200】 %
02-17	SLV With Load Slip Compensation Gain
Range	【0~200】 %

- 1. When output current $\leq$ 02-00 (Motor without load)
 Slip compensation gain:
 $= [\text{SLV slip compensation gain (02-13)}] * [\text{light load slip compensation gain (02-16)}]$
- 2. When output current $>$ 02-00 (Motor with load)
 Slip compensation gain:
 $= [\text{SLV slip compensation gain (02-13)}] * \text{Slip compensation gain (see figure below.)}$



03-External digital inputs & Relay Output Parameters

03-00	Multifunction Input Term. S1	
03-01	Multifunction Input Term. S2	
03-02	Multifunction Input Term. S3	
03-03	Multifunction Input Term. S4	
03-04	Multifunction Input Term. S5	
Range	【0】 :Forward/Stop Command	(Parameters 00-02/03=1 & 00-04)
	【1】 :Reverse/Stop Command	(Parameters 00-02/03=1 & 00-04)
	【2】 :Preset Speed 1 (5- 02)	(Parameter Group5)
	【3】 :Preset Speed 2 (5- 03)	(Parameter Group5)
	【4】 :Preset Speed 4 (5- 05)	(Parameter Group5)
	【6】 :JOG Forward Command	(Parameters 00-18~00-20)
	【7】 :JOG Reverse Command	(Parameters 00-18~00-20)
	【8】 :Up Command	(Parameters 00-05/06=4 & 03-06/07)
	【9】 :Down Command	(Parameters 00-05/06=4 & 03-06/07)
	【10】 : 2 nd Acc/Dec times	
	【11】 : Disable Acc/Dec	
	【12】 : Main/ Alternative run source Select	(Parameters 00-02/00-03)
	【13】 : Main/Alternative Frequency Command Select	(Parameters 00-05/00-06)
	【14】 : Rapid Stop (controlled deceleration stop)	
	【15】 : Base Block (Coast to stop)	
	【16】 : Disable PID Function	(Parameter Goup10)
	【17】 : Reset	
	【18】 : Enable Auto Run Mode	(Parameter Group 6)

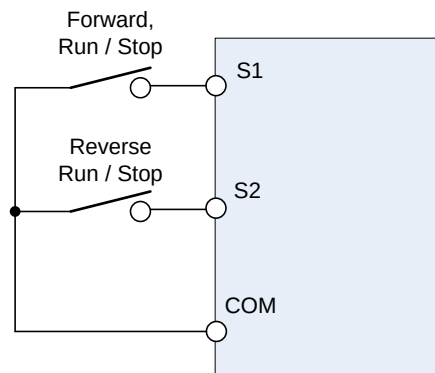
See examples and function explanation in the following pages.

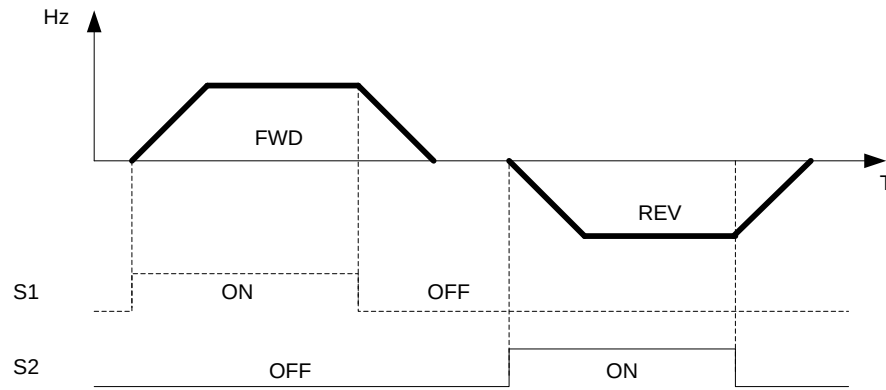
1): For setting parameters 03-00~03-04 set to **【0, 1】** External Run/Stop Control, refer to parameter 00-04.

2-wire control method. Mode 1.

Example: FWD/STOP and REV/STOP from two inputs (S1&S2)

Set 00-04 = **【0】** , S1: 03-00= **【0】** (FWD/STOP) , S2: 03-01= **【1】** (REV/STOP)



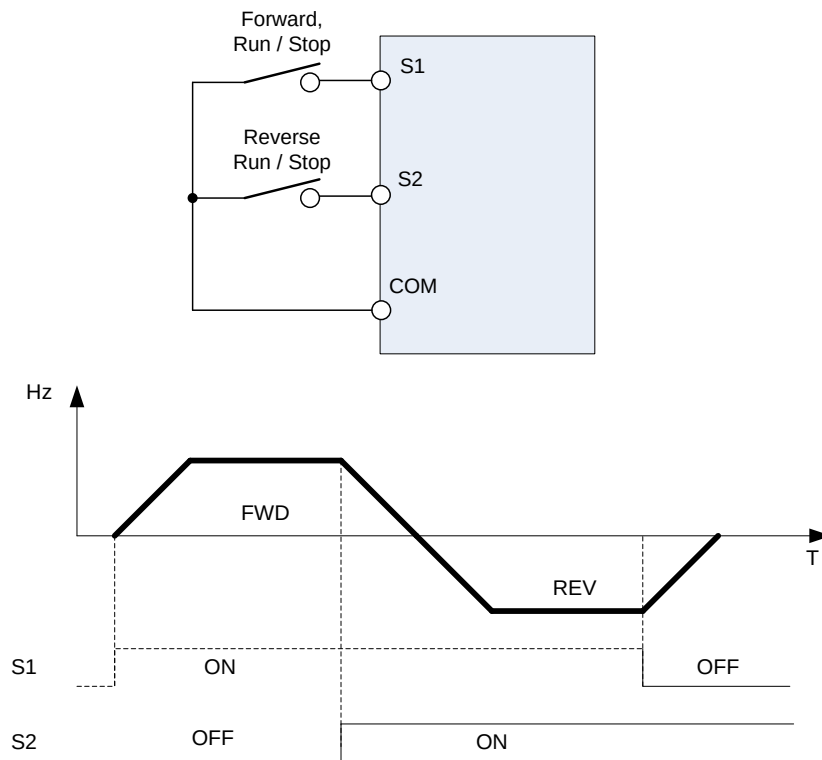


Note: If both forward and reverse commands are active the inverter will treat this as a STOP condition.

2-wire control method. Mode 2.

Example: RUN/STOP and REV/FWD from two inputs (S1&S2)

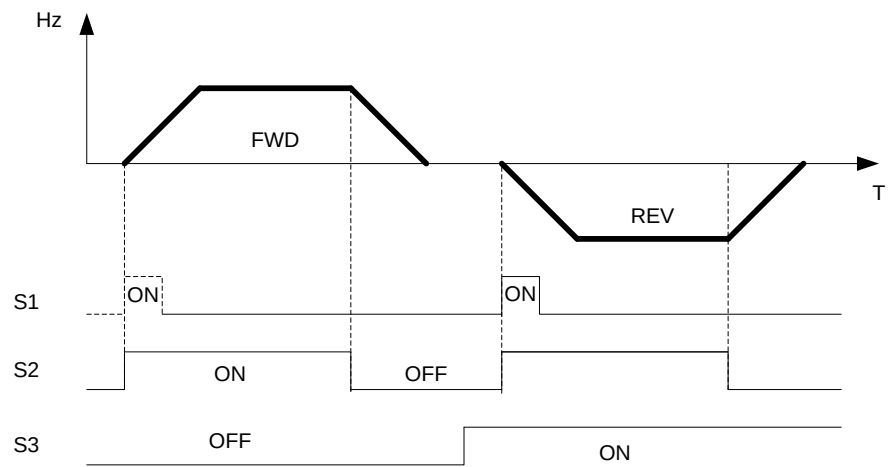
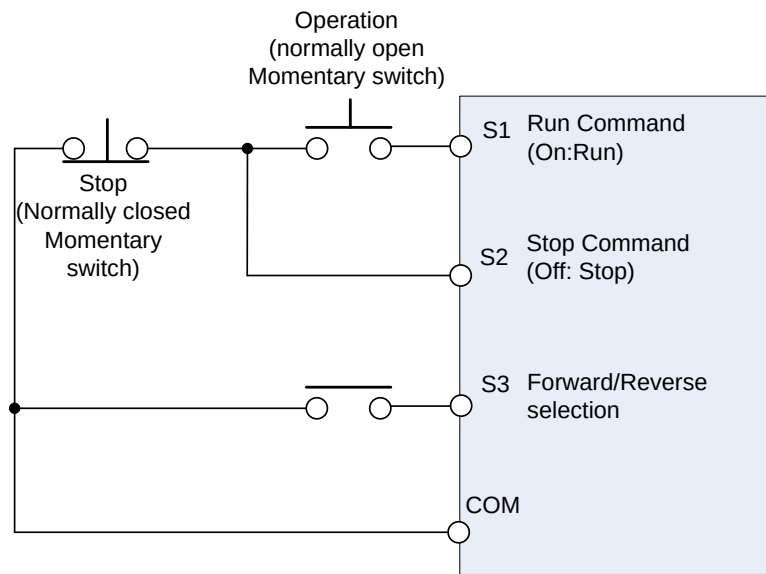
Set 00-04 = **【1】** ; S1: 03-00= **【0】** (RUN/STOP), S2: 03-01= **【1】** (REV/FWD)



3-wire control method.

Example: Two separate push buttons for RUN & STOP and a two position switch for FWD/REV

Set 00-04 to 2 (3 wire control mode), terminals S1, S2 and S3 are now dedicated for use in 3-wire control and parameter 03-00, 03-01 and 03-02 do not have any effect on the inverter operation.



2) 03-00 ~ 03-04 = 【4, 3, 2】 Preset speed selections.

A combination of any three terminals (S1~ S5) can be used to select preset speeds 0 to 7 according to the table below. Preset speed 0-7 and the related acceleration/decelerating times can be set in parameter group 5. See timing diagram example in Group 5 description.

Preset speed	Function setting and state of any three (A,B,C) of terminal S1~S5			Frequency	Acc-time	Dec-time
	terminal A=4	terminal B =3	terminal C =2			
speed 0	OFF	OFF	OFF	05-01	05-17	05-18
speed 1	OFF	OFF	ON	05-02	05-19	05-20
speed 2	OFF	ON	OFF	05-03	05-21	05-22
speed 3	OFF	ON	ON	05-04	05-23	05-24
speed 4	ON	OFF	OFF	05-05	05-25	05-26
speed 5	ON	OFF	ON	05-06	05-27	05-28
speed 6	ON	ON	OFF	05-07	05-29	05-30
speed 7	ON	ON	ON	05-08	05-31	05-32

3) 03-00~03-04 = 【6, 7】 Forward/ Reverse JOG

When any of the input terminal is set to function 【6】 and is turned on, inverter operates in jog forward mode.

When any of the input terminal is set to function 【7】 and is turned on, inverter operates in jog reverse mode.

Note: The inverter will stop if jog forward and jog reverse function are active at the same time.

4) 03-00~03-04 = 【8, 9】 UP/DOWN

When any of the input terminal is set to function 【8】 and is turned on, the frequency command is increased according to the UP/DOWN increment/decrement step size set in parameter 03-06.

If the input is active continuously, the frequency command increases accordingly until the upper frequency limit is reached.

When any of the input terminal is set to function 【9】 and is turned on, the frequency command decreases according to the UP/DOWN increment/decrement step size set in parameter 03-06.

If the input is active continuously, the frequency command decreases accordingly based on the settings of parameter 03-06 and 3-07 until zero speed is reached.

Refer to group 3 for description of the parameters.

5) 03-00~03-04 = 【10】 2nd Acc/Dec time

When any of the input terminals is set to function 【10】 and turned on, acceleration and deceleration time used will be based on the 2nd Accel/Decel set in parameters 00-16 and 00-17.

if the input is turned off, the acceleration and deceleration time will revert back to the acceleration and deceleration time set in parameters 00-14 & 00-15.

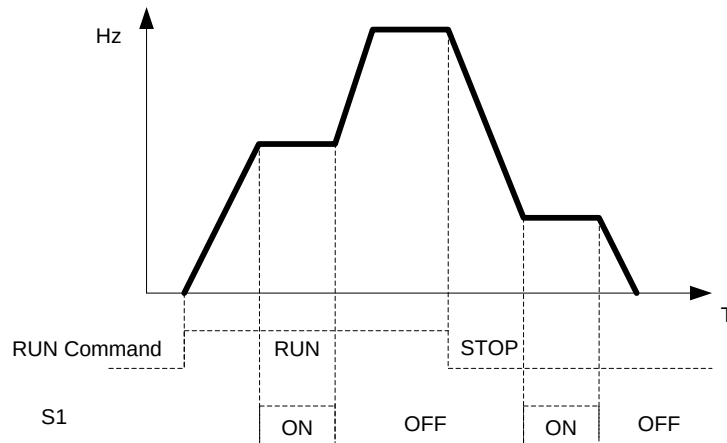
6) 03-00~03-04 = 【11】 Disable Acc/Dec function

When any of the input terminals is set to function 【11】 and turned on, acceleration and deceleration ramp will be disabled and the output frequency at that moment is maintained (output frequency hold).

If the input is turned off, acceleration and deceleration function continues.

See example in the following diagram.

Accel/Decel & Enable/Disable timing diagram using terminal S1 and parameter 03-00 = 11.



7) 03-00~03-04 = 【12】 Main/ Alternative run source select.

When any of the input terminal is set to function 【12】 and is turned on, the run command source is based on parameter 00-03 (Alternative Run source). If the Input is off run command source will revert back to the setting in parameter 00-02 (Main run source).

8) 03-00~03-04 = 【13】 Main/ Alternative Frequency source Select

When any of the input terminal is set to function 【13】 and is turned on, the frequency source is set based on parameter 00-06 (Alternative Frequency source). If the Input is off frequency source will revert back to the setting in parameter 00-05 (Main Frequency source).

9) 03-00~03-04 = 【14】 Rapid Stop (controlled deceleration stop)

When any of the input terminal is set to function 【14】 and is turned on, the inverter decelerates to a stop.

10) 03-00~03-04 = 【15】 Base Block (Coast to stop)

When any of the input terminal is set to function 【15】 and is turned on, the inverter output is turned off.

11) 03-00~03-04 = 【16】 Disable PID Function.

When any of the input terminal is set to function 【16】 and is turned on, the PID function is disabled. If the input is turned off, PID function is enabled again.

12) 03-00~03-04 = 【17】 Reset

When any of the input terminal is set to function 【17】 and is turned on, the existing fault is reset when no run command is present. (Same function as the Reset button on keypad).

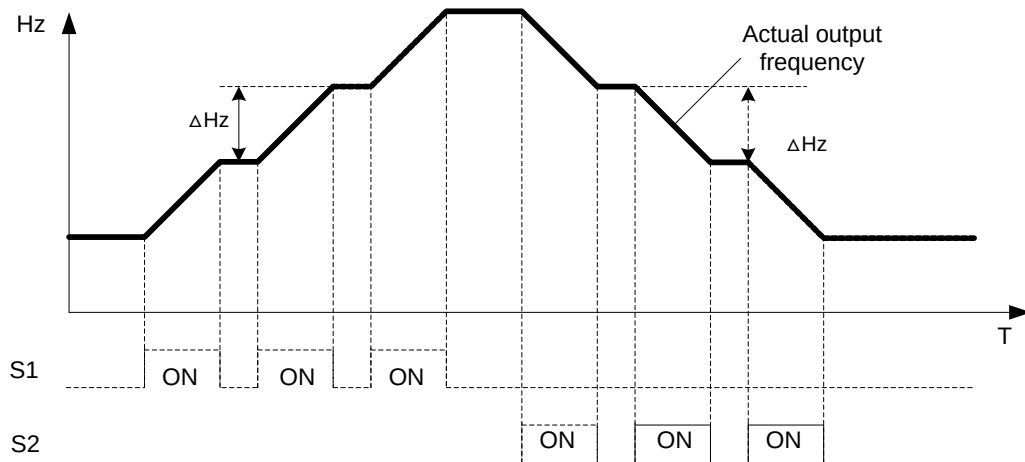
13) 03-00~03-04 = 【18】 Auto _ Run Mode

When any of the input terminal is set to function 【18】 and is turned on, the programmable auto- sequencer function is enabled, Refer to description in parameter group 6.

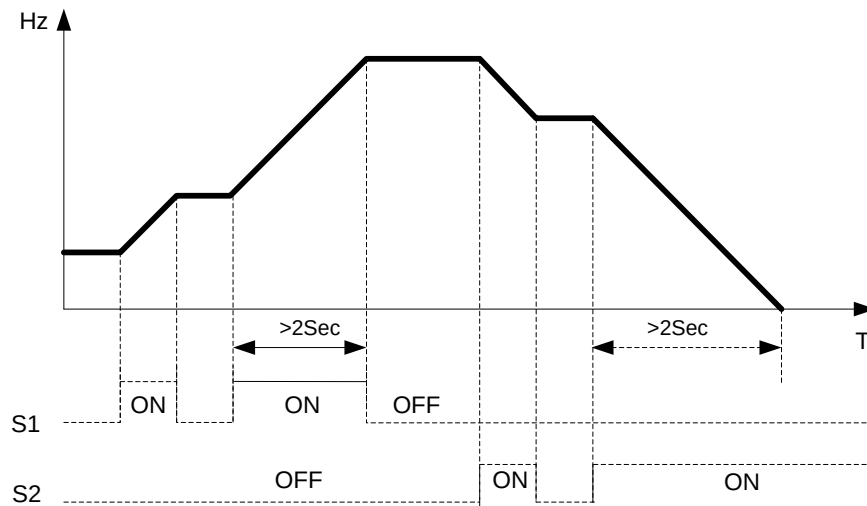
03-06	Up/Down frequency step
Range	【0.00~5.00】 Hz

Example: S1: 03-00= 【8】 Up frequency command, S2: 03-01= 【9】 Down frequency command,
03-06= 【Δ】 Hz

Mode1: If UP or DOWN input terminal is turned on for less than 2 seconds, operation frequency changes by Δ Hz.



Mode 2: If UP or DOWN input terminals are turned on for more than 2 seconds, UP/DOWN is repeated and the output frequency Ramps up or down as long as the input is kept ON.



03-07	Up/Down keep Frequency status after a stop command
Range	【0】 : After a stop command in Up/Down mode, the preset frequency is retained when the inverter stops, and the UP/Down function is disabled. 【1】 : After a stop command in Up/Down mode, the preset frequency is reset to 0 Hz when the inverter stops. 【2】 : After a stop command in Up/Down mode, the preset frequency is retained when the inverter stops and the UP/Down function remains enabled.

- 03-07 = **【0】** , **【2】** When run signal is removed (Stop Command), the output frequency is stored in parameter 05-01 (Keypad Frequency).
- 03-07 = **【0】** while the inverter is stopped Up/Down mode is disabled and the keypad can be used to change the frequency (parameter 05-01).
- 03-07 = **【1】** When in Up/down frequency mode the inverter will ramp up from 0 Hz on a Run command and Ramp down to 0 Hz on a stop command.

03-08	Multifunction terminals S1~S5 scan time
Range	【1~200】 1ms

- Sets the digital input CPU scan time. The digital input needs to be present for the minimum scan time to qualify as a valid command.
- Scan period unit in milliseconds.
- Use this parameter in noisy environments, note longer scan time results in slower response time for inputs.

03-09	S1~S5 Input type selection NO & NC
Range	【xxxx0】 :S1 NO 【xxxx1】 :S1 NC 【xxx0x】 :S2 NO 【xxx1x】 :S2 NC 【xx0xx】 :S3 NO 【xx1xx】 :S3 NC 【x0xxx】 :S4 NO 【x1xxx】 :S4 NC 【0xxxx】 :S5 NO 【1xxxx】 :S5 NC

- (NO) Normally open, (NC) normally closed. Select as required by the application.
- Select Normally Open (NO) or Normally Closed (NC) by setting the corresponding digit in parameter 03-09 to 0 or 1.
- Set Parameter 03-09 first before setting parameters 00-02/00-03=1 (Run mode from terminals).

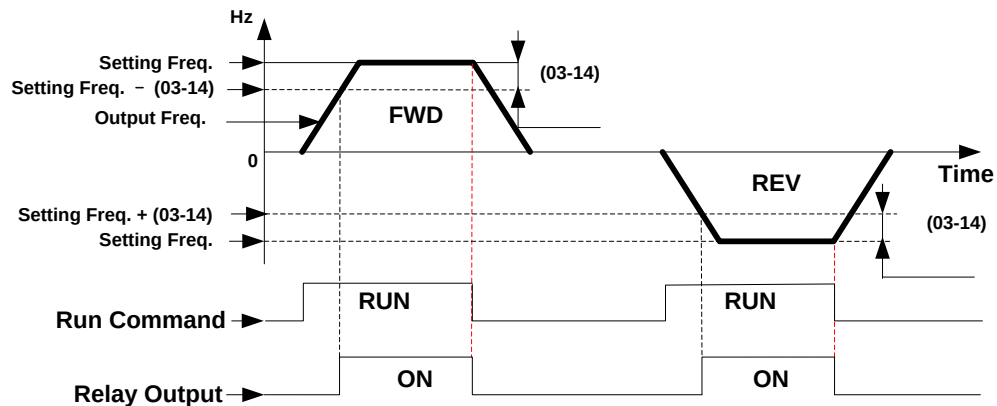
03-11	Multifunction Output Relay RY1 functions. (Terminals RA, RB)
Range	【0】 :Run 【1】 :Fault 【2】 :Setting Frequency Reached (Refer to 03-14) 【3】 :Frequency Reached (3-13±3-14) (Refer to 03-13/03-14) 【4】 :Output Frequency Detection 1 (> 03-13) (Refer to 03-13) 【5】 :Output Frequency Detection 2 (< 03-13) (Refer to 03-13) 【6】 :Auto-Restart 【7】 :Momentary AC Power Loss (Refer to 07-00) 【8】 :Rapid Stop (Decelerate to Stop) 【9】 :Base Block

	【10】 :Motor Overload Protection (OL1) 【11】 :Drive Overload Protection (OL2) 【12】 :Reserved 【13】 :Output Current Reached (refer to 03-15/03-16) 【14】 :Brake Control (refer to 03-17/03-18) 【15】 :PID Feedback Disconnection Detection (refer to 10-11/10-13)
03-13	Frequency Detection Level
Range	【0.00~599.00】 Hz
03-14	Frequency Detection Width
Range	【0.00~30.00】 Hz

Output relay RY1. Function descriptions:

- 1) **03-11 = 【0】** RY1 output is active during running.
- 2) **03-11 = 【1】** RY1 output is active during fault condition.
- 3) **03-11 = 【2】** RY1 output is active when the output frequency falls within the setting frequency minus the frequency detection width (03-14).

When Output Freq. = Setting Frequency - Frequency Detection Width (03-14),
Relay Output will be ON.

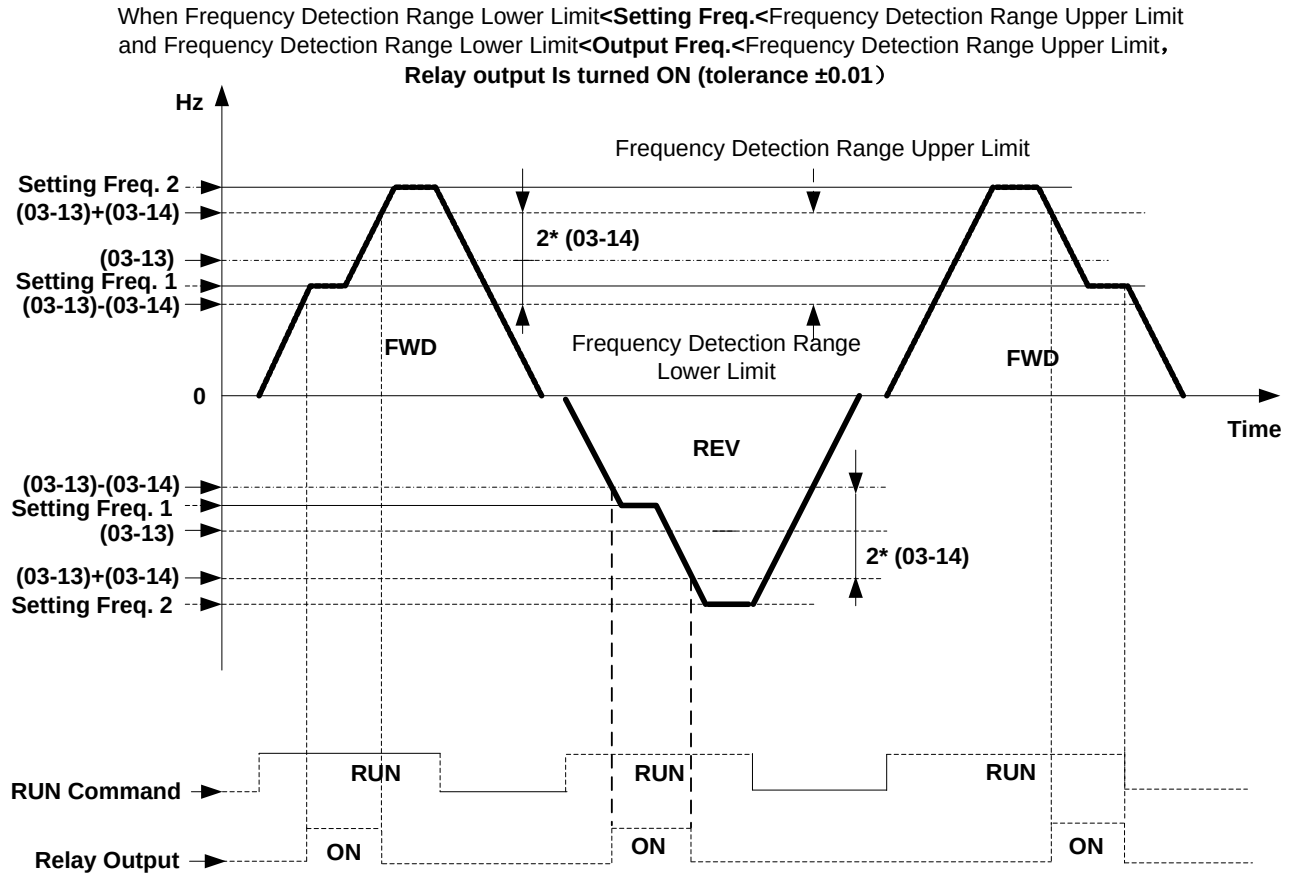


Example:

Setting Freq. set to 30 Hz, and Frequency Detection Width (03-14) set to 5 Hz.

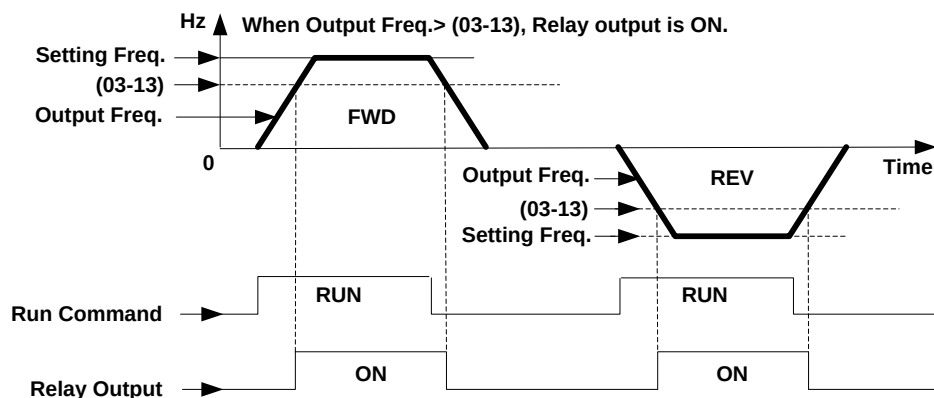
Relay is ON when the output frequency ≥ 25 Hz and ≤ 30 Hz and a Run Command is present (Allowable tolerance ± 0.01).

4) **03-11 = [3]** RY1 output is active when the output frequency falls within the frequency detection width (03-14) of the set frequency detection level (o3-13).

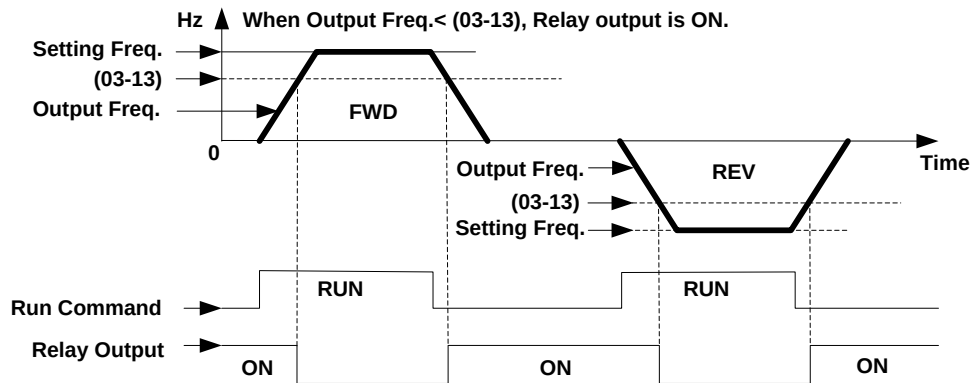


Example: Frequency Detection Level (03-13) set to 30Hz, and Frequency Detection Width (03-14) set to 5 Hz cause Frequency Detection Range upper limit to be 35 Hz and Frequency Detection Range lower limit to be 25 Hz. RY1 will turn on when Setting Freq. and Output Freq. both fall within these limits; and turn off when the Setting Freq. and Output Freq. fall outside these limits.

5) **03-11 = [4]** . RY1 output is active when the output frequency rises above the frequency detection level (03-13) and deactivates when the output frequency falls below frequency detection level (o3-13).

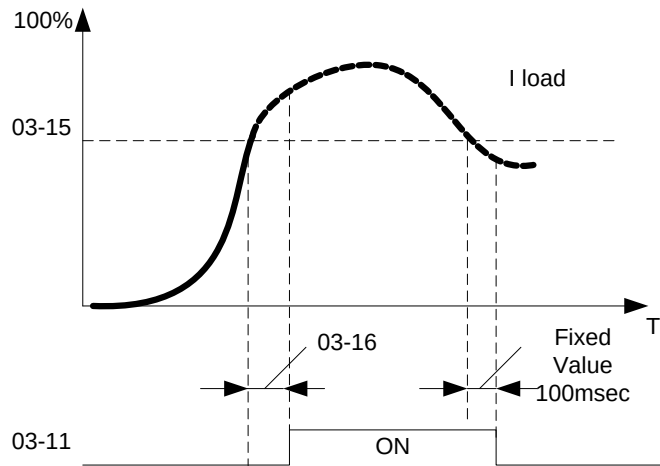


- 6) **03-11 = 【5】** . RY1 output is active when the output frequency is below the frequency detection level (03-13) and turns off when the output frequency falls below frequency detection level.



03-15	Output Current Detection Level
Range	【0.1~15.0】 A
03-16	Output Current Detection Period
Range	【0.1~10.0】 Sec

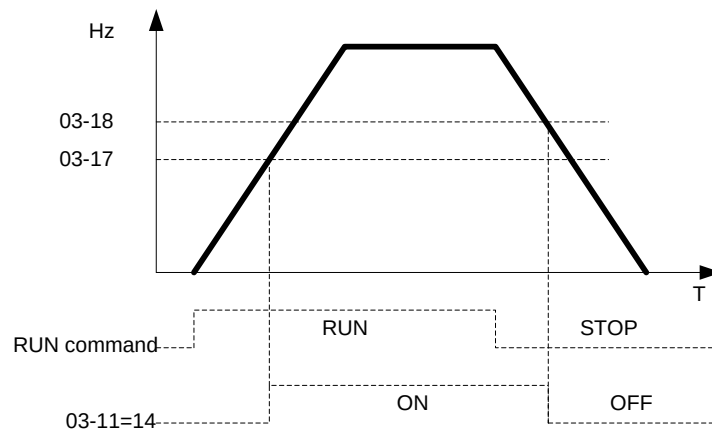
- **03-11 = 【13】** .RY1 output is active when the output current value is greater than the output current detection level (03-15).
- 03-15: Setting range (0.1~15.0 Amps) set based on motor rated current.
- 03-16: Setting range (0.1~10.0) unit: seconds.



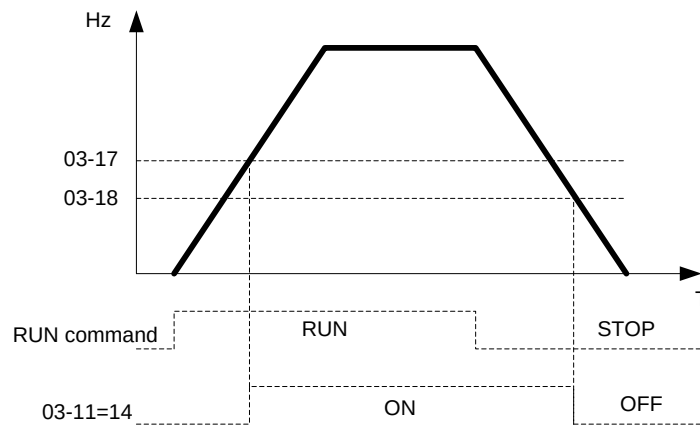
03-17	Brake Release Level
Range	【0.00~20.00】 Hz
03-18	Brake Engage Level
Range	【0.00~20.00】 Hz

- If 03-11 = **【14】**
- In accelerating mode. RY1 output is active when the output frequency reaches the external Brake release level set in parameter 03-17.
- In decelerating mode, RY1 output is turned OFF when the actual output frequency reaches the external Brake Engage level set in parameter 03-18.

Timing diagram for 03-17 < 03-18 is shown below:



Timing diagram for 03-17 > 03-18 is shown below:



03-19	Relay Output Status type
Range	【0】 :A (Normally open) 【1】 :B (Normally closed)

03-20	Brake Transistor ON Level
Range	【100.0~800.0】 VDC
03-21	Brake Transistor OFF Level
Range	【100.0~800.0】 VDC

When the DC bus voltage > 03-20 Braking transistor is on (braking resistor turned on if connected).
When the DC bus voltage ≤ 03-21 Braking transistor is off.

When 03-21 > 03-20 display will show Err2 parameter setting error.

04-External Analog Input / Output Parameter

04-00	Analog Voltage & Current input selections	
Range	AVI	ACI
	【0】 :0~10V	0~20mA
	【1】 :0~10V	4~20mA
	【2】 :2~10V	0~20mA
	【3】 :2~10V	4~20mA

➤ **Analog Input Scaling formulas:**

- AVI (0~10V), ACI (0~20mA)

$V \text{ (v)}$

$$\text{AVI (0 - 10V): F (Hz)} = \frac{\text{ } }{10 \text{ (v)}} \times (00-12)$$

$I \text{ (mA)}$

$$\text{ACI (0 - 20mA): F (Hz)} = \frac{\text{ } }{20 \text{ (mA)}} \times (00-12)$$

- AVI (2~10V), ACI (4~20mA)

$V - 2 \text{ (v)}$

$$\text{AVI (2 - 10V): F (Hz)} = \frac{\text{ } }{10 - 2 \text{ (v)}} \times (00-12) \text{ (V} \geq 2\text{)}$$

$I - 4 \text{ (mA)}$

$$\text{ACI (4 - 20mA): F (Hz)} = \frac{\text{ } }{20 - 4 \text{ (mA)}} \times (00-12) \text{ (I} \geq 4\text{)}$$

04-01	AVI signal verification Scan Time
Range	【1~200】 1m s
04-02	AVI Gain
Range	【0 ~ 1000】 %
04-03	AVI Bias
Range	【0~ 100】 %
04-04	AVI Bias Selection
Range	【0】 : Positive 【1】 : Negative
04-05	AVI Slope
Range	【0】 : Positive 【1】 : Negative
04-06	ACI signal verification Scan Time
Range	【1~200】 1m sec
04-07	ACIGain
Range	【0 ~ 1000】 %
04-08	ACI Bias
Range	【0 ~ 100】 %
04-09	ACI Bias Selection
Range	【0】 : Positive 【1】 : Negative
04-10	ACI Slope
Range	【0】 : Positive 【1】 : Negative

➤ Set 04-01 and 04-06 for Analog signal scan and filtering time.
 Inverter reads the average values of A/D signal once every 04-01/04-06 x 1ms.
 Set scan intervals based on the application environment for signal instability and/or signal interference caused by external sources. Note: Long scan times will result in slower response times.

AVI: Analog Voltage input scaling examples adjusting Gain, Bias & Slope parameters (04-02~04-05).

(1) Positive Bias type (04-04 = 0) showing the effects of modifying Bias parameter 04-03 and Slope type parameter 04-05 as shown in Fig 1 & 2.

Figure 1:

	04-02	04-03	04-04	04-05
A	100%	50%	0	0
B	100%	0%	0	0

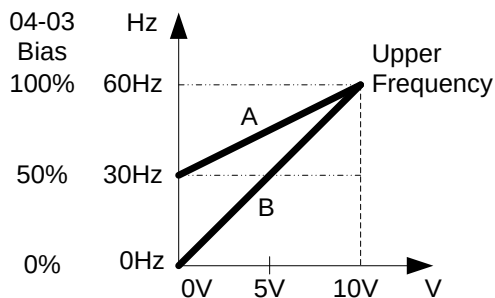
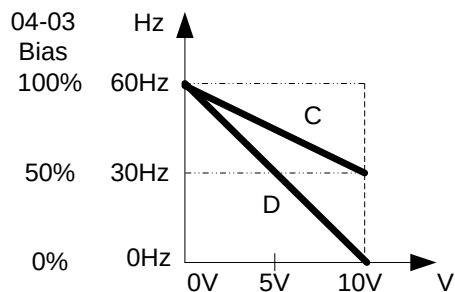


Figure 2:

	04-02	04-03	04-04	04-05
C	100%	50%	0	1
D	100%	0%	0	1



- (2) Negative Bias type (04-04 = 1) showing the effects of modifying Bias parameter 04-03 and Slope type parameter 04-05 as shown in Fig 3 & 4.

Figure 3:

	04-02	04-03	04-04	04-05
E	100%	20%	1	0

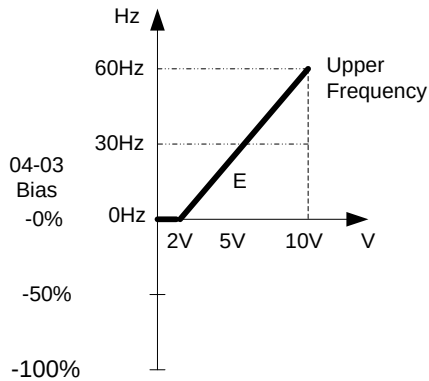
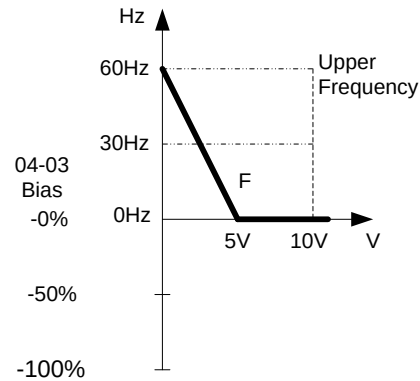


Figure 4:

	04-02	04-03	04-04	04-05
F	100%	50%	1	1



- (3) Offset bias set to 0% (04-03) showing the effect of modifying Analog Gain (04-02), Bias type (04-04) and slope type (04-05) as shown Fig 5 & 6.

Figure 5:

	04-02	04-03	04-04	04-05
A'	50%	0%	0/1	0
B'	200%	0%	0/1	0

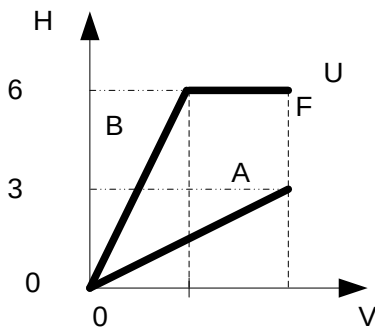
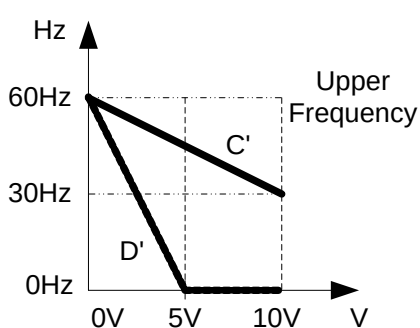


Figure 6:

	04-02	04-03	04-04	04-05
C'	50%	0%	0/1	1
D'	200%	0%	0/1	1



- (4) Various examples of analog input scaling and modification are shown in following figures 7, 8, 9 & 10.

Figure 7:

	04-02	04-03	04-04	04-05
a	50%	50%	0	0
b	200%	50%	0	0

Figure 8:

	04-02	04-03	04-04	04-05
c	50%	50%	0	1
d	200%	50%	0	1

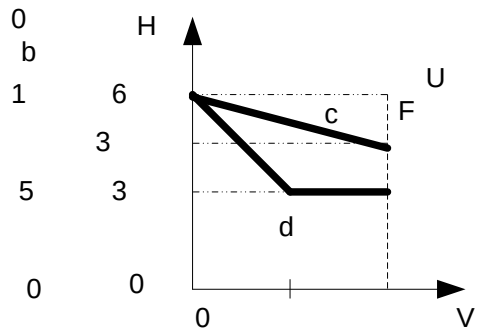
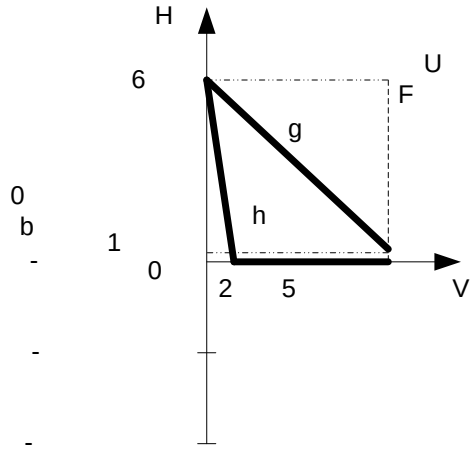


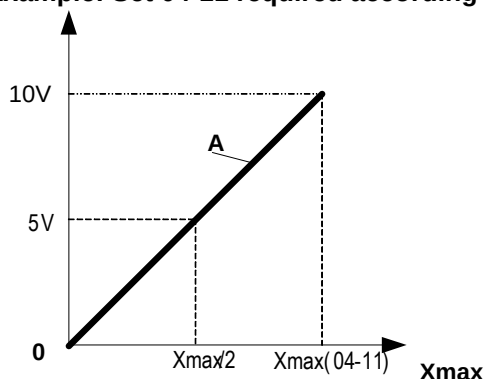
Figure 10:

	04-02	04-03	04-04	04-05
g	50%	50%	1	1
h	200%	0%	0	1



04-11	Analog Output (AO) function selection.
Range	【0】 :Output frequency 【1】 :Frequency Setting 【2】 :Output voltage 【3】 :DC Bus Voltage 【4】 :Output current

Example: Set 04-11 required according to the following table.



04-11	A	10V =xMax
【0】	Output frequency	Maximum output frequency
【1】	Frequency Setting	Maximum output frequency
【2】	Output voltage	Motor Rated Voltage
【3】	DC Bus Voltage	230V: 0 ~ 400Vdc 460V: 0 ~ 800Vdc
【4】	Output current	2 x inverter rated current

04-12	AO Gain	
Range	【0 ~ 1000】 %	
04-13	AO Bias	
Range	【0 ~ 100】 %	
04-14	AO Bias Selection	
Range	【0】 : Positive	【1】 : Negative
04-15	AO Slope	
Range	【0】 : Positive	【1】 : Negative

- Use parameter 04-11 to select the analog output signal for AO. Output range is 0-10Vdc.
- The output voltage level can be adjusted using parameters 04-12 to 04-15.
- For examples on gain and bias adjustment see Analog Voltage Input (AVI) parameters 4-02 to 4-05.

Note: The maximum output voltage of 10V is limited by the inverter hardware. Use external devices that can handle a maximum of 10Vdc signal.

05-Preset Speed Parameters

05-00	Preset Speed Control mode Selection
Range	【0】 : Common Accel / Decel. 【1】 : Individual Accel/Decel for each preset speed 0-7.

05-01	Preset Speed 0 (Keypad Frequency)
05-02	Preset Speed 1
05-03	Preset Speed 2
05-04	Preset Speed 3
05-05	Preset Speed 4
05-06	Preset Speed 5
05-07	Preset Speed 6
05-08	Preset Speed 7
Range	【0.00 ~ 599.00】 Hz
05-17	Preset Speed 0 Acceleration time
05-18	Preset Speed 0 Deceleration time
05-19	Preset Speed 1 Acceleration time
05-20	Preset Speed 1 Deceleration time
05-21	Preset Speed 2 Acceleration time
05-22	Preset Speed 2 Deceleration time
05-23	Preset Speed 3 Acceleration time
05-24	Preset Speed 3 Deceleration time
05-25	Preset Speed 4 Acceleration time
05-26	Preset Speed 4 Deceleration time
05-27	Preset Speed 5 Acceleration time
05-28	Preset Speed 5 Deceleration time
05-29	Preset Speed 6 Acceleration time
05-30	Preset Speed 6 Deceleration time
05-31	Preset Speed 7 Acceleration time
05-32	Preset Speed 7 Deceleration time
Range	【0.1 ~ 3600.0】 s

- When 05-00 = **【0】** Accel /Decel 1 or 2 set by parameters 00-14/00-15 or 00-16/00-17 applies to all preset speeds.
- When 05-00 = **【1】** Individual Accel/Decel applies to each preset speed 0-7, set by Parameter 05-17 to 05-32.
- Formula for calculating acceleration and deceleration time:

V/F mode:

$$\text{Actual Acc time} = \frac{\text{Time of Accel1 or 2 x Preset Frequency}}{\text{V/F Max Frequency}}$$

$$\text{Actual Dec time} = \frac{\text{Time of Accel1 or 2 x Preset Frequency}}{\text{V/F Max Frequency}}$$

SLV mode:

$$\text{Actual Acc time} = \frac{\text{Time of Accel1 or 2 x Preset Frequency}}{\text{Motor rated output frequency}}$$

$$\text{Actual Dec time} = \frac{\text{Time of Accel1 or 2 x Preset Frequency}}{\text{Motor rated output frequency}}$$

- V/F Maximum output frequency set by parameter 01-02 when custom V/F is selected by 01-00 = **【7】** .
- V/F Maximum output frequency = 50.00 Hz or 60.00 Hz when preset V/F patterns are selected. 01-00 = **【1 to 6】** .

Example : 01- 00≠ **【7】** , 01- 02= **【50】** Hz, 05- 02= **【10】** Hz (preset speed1),
05-19= **【5】** s(Accel time), 05-20= **【20】** s (Decel time)

$$\text{Preset speed 1 Actual Accel time} = \frac{(05-19) \times 10(\text{Hz})}{01-02} = 1(\text{s})$$

$$\text{Preset speed 1 Actual Deccel time} = \frac{(05-20) \times 10(\text{Hz})}{01-02} = 4(\text{s})$$

Multi speed run/stop cycles with Individual accel/decel times. 05-00= **【1】**

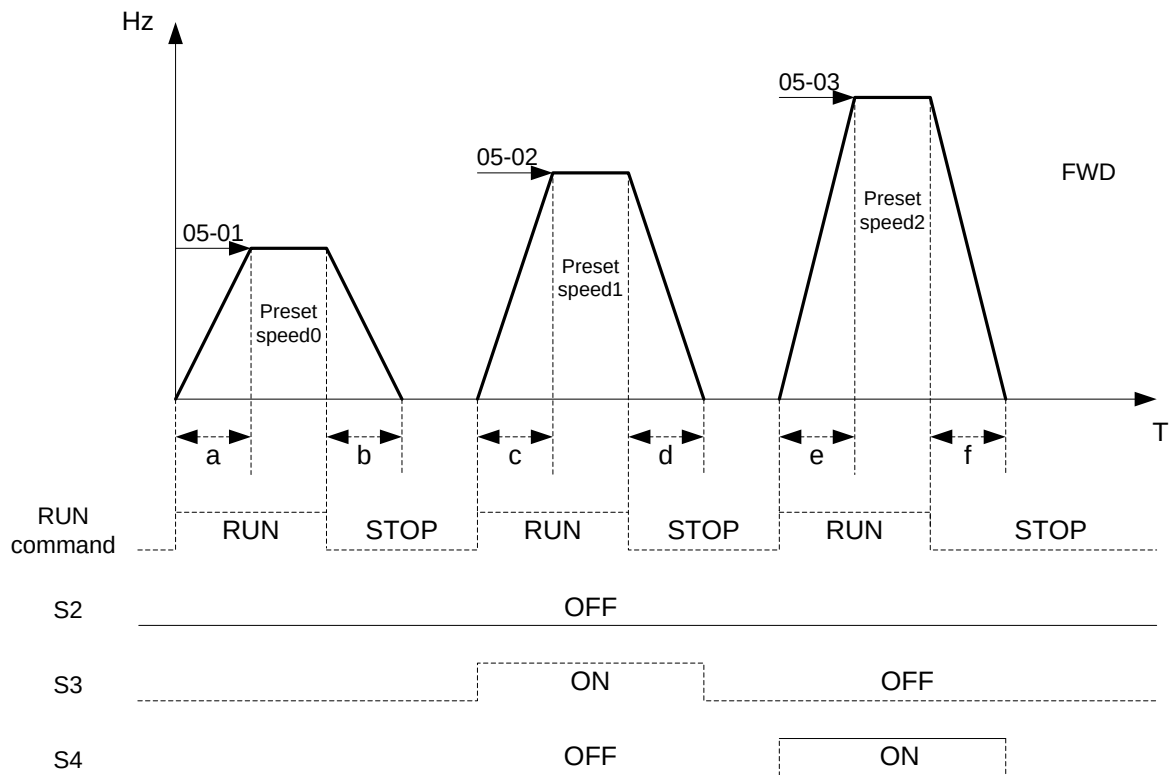
Two modes of operation:

- Mode1 = On/Off run command
- Mode2 = Continuous run command

Mode1 Example: 00-02= **【1】** (External Run/Stop Control).
00-04= **【1】** (Operation Mode: Run/stop-forward/reverse).
S1: 03-00= **【0】** (RUN/STOP);
S2: 03-01= **【1】** (Forward/Reverse);
S3: 03-02= **【2】** (Preset speed 1);
S4: 03-03= **【3】** (Preset speed 2);
S5: 03-04= **【4】** (Preset speed 4);

Acceleration / Deceleration Calculation Mode 1:

If the run command is cycled on and off, acceleration and deceleration time (a ~ f) is calculated based on the active speed command as follows:



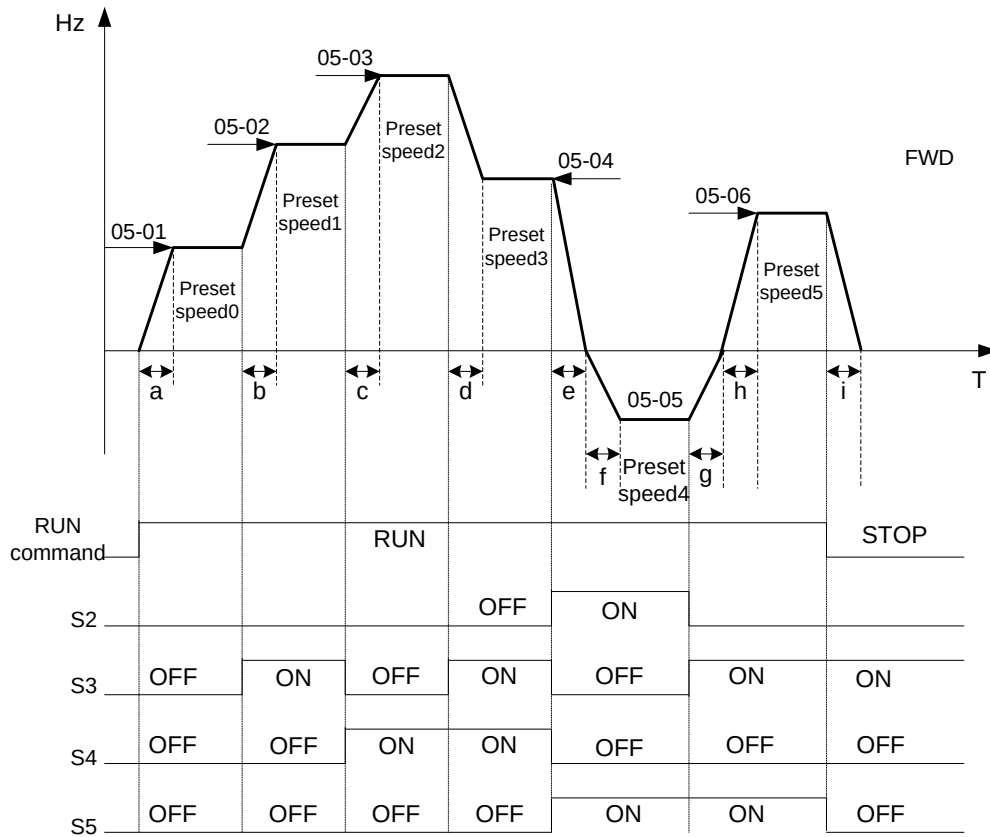
$$a = \frac{(05-17) \times (05-01)}{(01-02)} \quad b = \frac{(05-18) \times (05-01)}{(01-02)} \quad c = \frac{(05-19) \times (05-02)}{(01-02)} \quad \text{in sec.}$$

$$d = \frac{(05-20) \times (05-02)}{(01-02)} \quad e = \frac{(05-21) \times (05-03)}{(01-02)} \quad f = \frac{(05-22) \times (05-03)}{(01-02)} \quad \text{in sec.}$$

Mode2 Example:

- Set S1 for Continuous Run
- Set S2 For Forward /Reverse direction selection
- Set multi-function terminals S3,S4 & S5 to select three different preset speeds

Acceleration / Deceleration Calculation Mode 2:



If the run command remains on, acceleration and deceleration time (a ~ f) is calculated based on the active speed command as follows:

$$a = \frac{(05-17) \times (05-01)}{(01-02)} \quad b = \frac{(05-19) \times [(05-02) - (05-01)]}{(01-02)} \quad c = \frac{(05-21) \times [(05-03) - (05-02)]}{(01-02)} \text{ in sec.}$$

$$d = \frac{(05-24) \times [(05-03) - (05-04)]}{(01-02)} \quad e = \frac{(05-26) \times (05-05)}{(01-02)} \quad f = \frac{(05-28) \times (05-05)}{(01-02)} \text{ in sec.}$$

$$g = \frac{(05-27) \times (05-05)}{(01-02)} \quad h = \frac{(05-29) \times (05-05)}{(01-02)} \quad i = \frac{(05-32) \times (05-05)}{(01-02)} \text{ in sec.}$$

06-Auto Run (Auto Sequencer) function

06-00	Auto Run(sequencer) mode selection
Range	0: Disable 1, 4: Execute a single cycle operation. Restart speed is based on the previous stopped speed. 2, 5: Execute continuous cycle operation. Restart speed is based on the previous cycle stop speed. 3, 6: After completion of a single cycle, the on-going operation speed is based on the speed of the last stage. Restart speed is based on the previous stopped speed 1 to 3: After a stop the inverter will start with the incomplete step when the run command is re-applied. 4 to 6: After a stop the inverter will start with the first step of the cycle when the run command is re-applied.

Frequency step 0 is set by parameter 05-01 keypad Frequency.	
06-01	Auto Run Mode Frequency Command 1
06-02	Auto Run Mode Frequency Command 2
06-03	Auto Run Mode Frequency Command 3
06-04	Auto Run Mode Frequency Command 4
06-05	Auto Run Mode Frequency Command 5
06-06	Auto Run Mode Frequency Command 6
06-07	Auto Run Mode Frequency Command 7
Range	【0.00 ~ 599.00】 Hz

06-16	Auto_ Run Mode Running Time Setting 0
06-17	Auto_ Run Mode Running Time Setting 1
06-18	Auto_ Run Mode Running Time Setting 2
06-19	Auto_ Run Mode Running Time Setting 3
06-20	Auto_ Run Mode Running Time Setting 4
06-21	Auto_ Run Mode Running Time Setting 5
06-22	Auto_ Run Mode Running Time Setting 6
06-23	Auto_ Run Mode Running Time Setting 7
Range	【0.00 ~ 3600.0】 Sec

06-32	Auto_ Run Mode Running Direction 0
06-33	Auto_ Run Mode Running Direction 1
06-34	Auto_ Run Mode Running Direction 2
06-35	Auto_ Run Mode Running Direction 3
06-36	Auto_ Run Mode Running Direction 4
06-37	Auto_ Run Mode Running Direction 5
06-38	Auto_ Run Mode Running Direction 6
06-39	Auto_ Run Mode Running Direction 7
Range	【0】 : STOP 【1】 : Forward 【2】 : Reverse

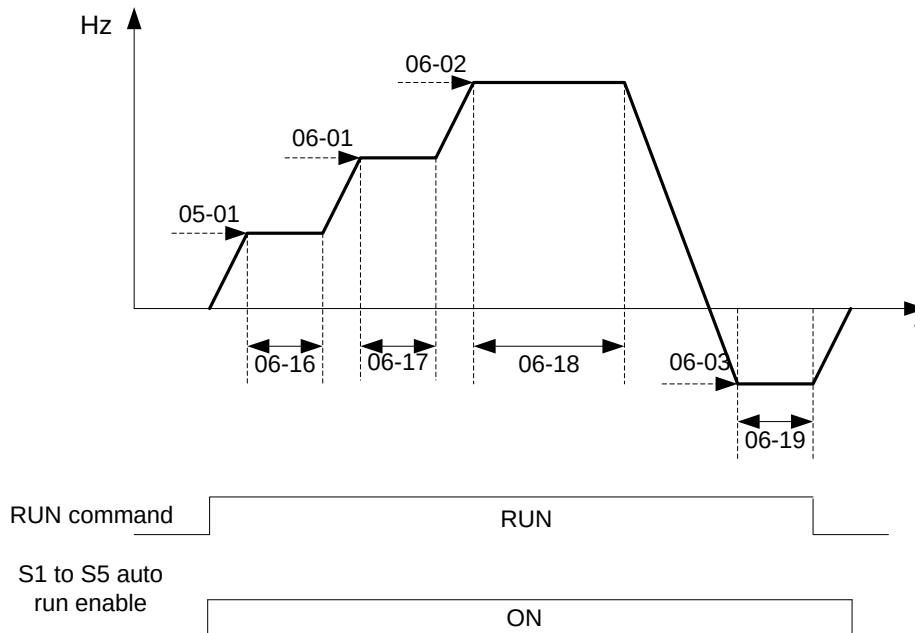
- Auto Run sequencer mode can be enabled by setting any of the multifunctional input parameter 03-00 to 03-04 for S1 to S5 to selection **【18】**.
- Various Auto Run (sequencer) modes can be selected with parameter (06-00).
- 7 Auto Run (sequencer) modes can be selected with parameters (06-01~06-39).
- Auto Run frequency commands 1 to 7 are set with Parameters (06-01 ~ 06-07).
- Sequence run times are set with parameters (06-17 ~ 06-23).
- FWD/REV Direction for each sequence can be set with parameters (06-33 ~ 06-39).
- Auto sequence 0 uses keypad frequency parameter 05-01; sequence run time and direction are set by parameters 06-16 and 06-32.

Auto RUN (Auto Sequencer) Examples:

Example 1: Automatic operation mode – Single cycle

The inverter will run for a single full cycle based on the specified number of sequences, then it will stop. In this example 4 sequences are set, three in forward direction and one in Reverse.

Auto Run Mode: 06-00 = **【1】** or **【4】** ,
 Frequency: 05-01 = **【15】** Hz, 06-01 = **【30】** Hz, 06-02 = **【50】** Hz, 06-03 = **【20】** Hz
 Sequence Run Time: 06-16 = **【20】** s, 06-17 = **【25】** s, 06-18 = **【30】** s, 06-19 = **【40】** s,
 Direction: 06-32 = **【1】** FWD, 06-33 = **【1】** FWD, 06-34 = **【1】** (FWD), 06-35 = **【2】** (REV)
 Unused Sequence Parameters: 06-04~06-07 = **【0】** Hz, 06-20~06-23 = **【0】** s, 06-36~06-39 = **【0】**

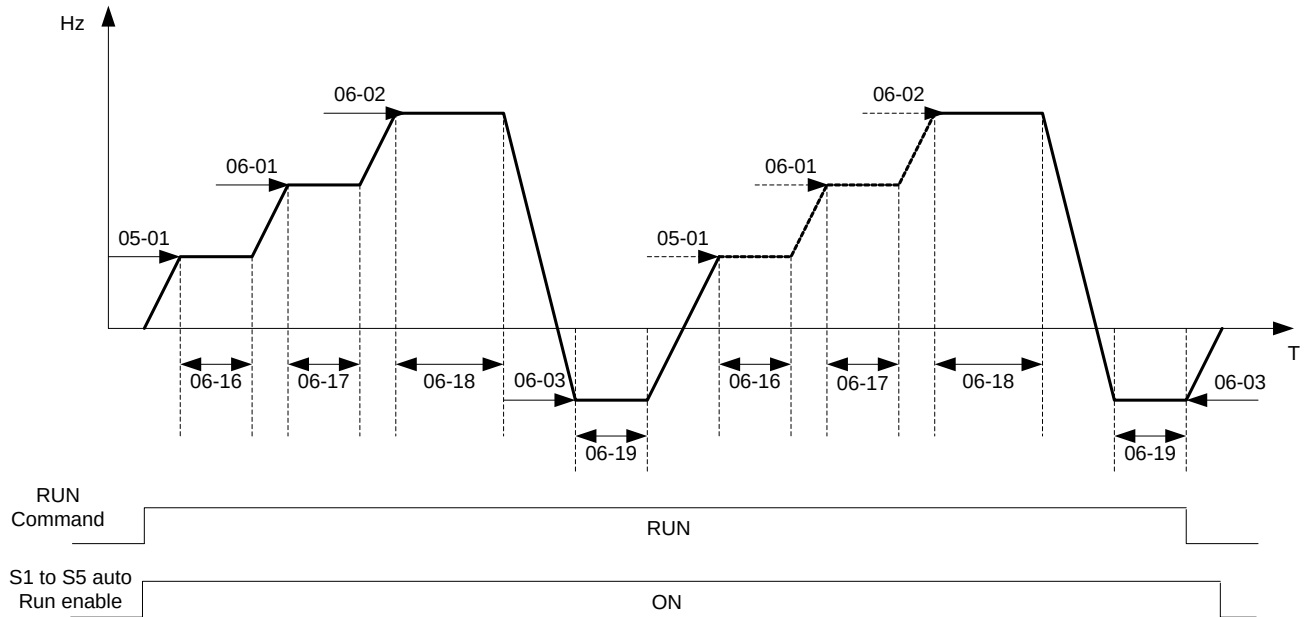


Example 2: Automatic operation mode – Continuous cycle

06-00= **【2】** or **【5】**

06-01~06-39 = Enter same setting as that of Example 1.

In this example the inverter repeats the same cycle.



Example 3: Automatic operation mode – Single cycle and continue running at last speed of the cycle

In this example the inverter executes a single cycle and continue running at last speed of the cycle.

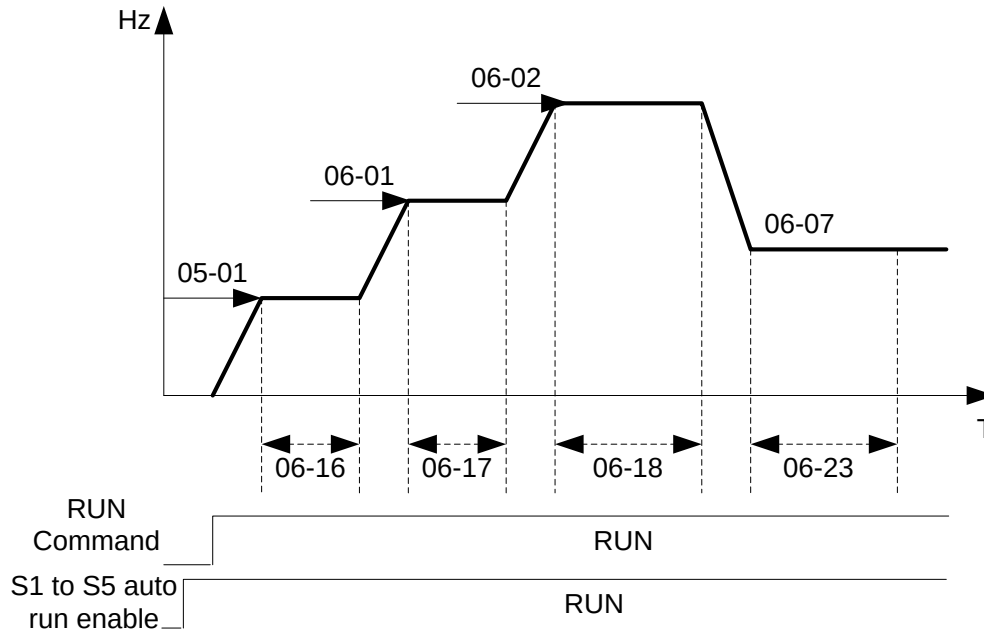
Auto Run Mode: 06-00 = **【3】** or **【6】**

Frequency: 05-01 = **【15】** Hz, 06-01 = **【30】** Hz, 06-02 = **【50】** Hz, 06-07 = **【20】** Hz,

Sequence Run Time: 06-16 = **【20】** s, 06-17 = **【25】** s, 06-18 = **【30】** s, 06-23 = **【40】** s,

Direction: 06-32 = **【1】** FWD, 06-33 = **【1】** , 06-34 = **【1】** , 06-39 = **【1】** ,

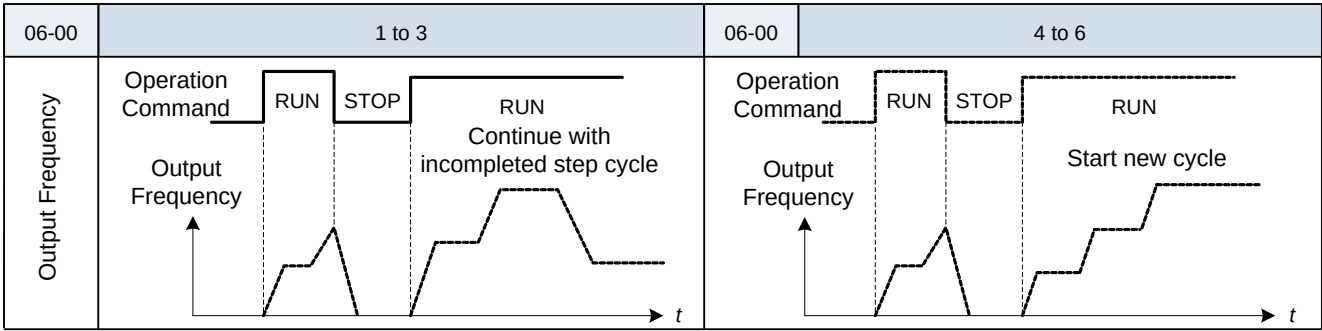
Unused Sequence Parameters 06-03~06-06 = **【0】** Hz, 06-19~06-22 = **【0】** s, 06-35~06-38 = **【0】**



Example 4 & 5:

Auto Run Mode 06-00 =【1~3】. After a stop the inverter will start with the incomplete step when the run command is re-applied.

Auto Run Mode 06-00 = 【4~6】 . After a stop the inverter will start with the first step of the cycle when the run command is re-applied.



- ACC/DEC time in Auto run mode used is based on parameter 00-14/00-15 or 00-16/00-17.
- For Auto sequence 0.Run frequency used is the keypad frequency set by parameter
- 05-01.Parameters 06-16 and 06-32 are used to set the sequence Run time and Run direction.

07-Start/Stop Command Parameters	
07-00	Momentary power loss and restart
Range	【0】 : Momentary Power Loss and Restart disable 【1】 : Momentary power loss and restart enable

- If the input power supply suddenly decreases resulting in the DC bus voltage to drop below the under voltage level, the inverter output is turned off.
- When 07-00 = **【0】** : On power loss, the inverter will not start.
- When 07-00 = **【1】** : Inverter resumes operation after a momentary power loss while running, independent of the number of restarts.
- On power loss, as long as the inverter CPU still has power, momentary power loss restart is enabled based on the setting of parameters 00-02 and 07-04 and status of external run command.

Caution: After any power loss if the Run mode is set to external run command parameter 00-02=1 and if direct start on power up is enabled parameter 07-04=0 the inverter will automatically start when power is re-applied.

To ensure safety of operators and to avoid any damages to the machinery, all necessary safety measure must be considered, including disconnecting power to the inverter.

07-01	Auto Restart Delay Time
Range	【0.0~800.0】 Sec
07-02	Number of Auto Restart Attempts
Range	【0~10】

- 07-02 = **【0】** : The inverter will not auto restart after trips due to fault.
- 07-02 > **【0】** , 07-01 = **【0】** .After a trip due to fault the inverter will run at the same frequency as before power loss, and automatically restarts after an internal delay of 0.5 seconds.
- 07-02 > **【0】** , 07-01 > **【0】** , After a fault trip the inverter will run with at the same frequency as before power loss, and restart after a delay set in parameter 07-01.
- **Note: Auto restart after a fault does not work while in DC injection braking or decelerating to a stop.**

07-03	Reset Mode Setting
Range	【0】 :Enable Reset Only when Run Command is Off 【1】 :Enable Reset when Run Command is On or Off

- 07-03=0 Inverter can only be reset when no run command is present.
- 07-03=1 Inverter can always be reset when a fault is active.

Caution: When parameter 07-03 is set to 1 the inverter will automatically start after a fault reset and run command is present (Run mode is set to external run command parameter 00-02=1).

07-04	Direct Running on Power Up
Range	【0】 :Enable Direct running after power up 【1】 :Disable Direct running after power up
07-05	Delay-ON Timer (Seconds)
Range	【1.0~300.0】 Sec

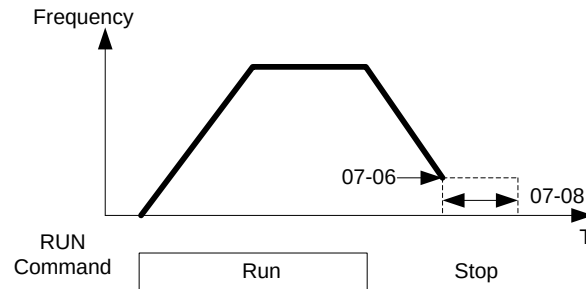
- When direct run on power up is active 07-04=0 and the inverter is set to external run (00-02/00-03=1), the inverter will automatically start after power is re-applied. It is recommend to turn off the power switch and run command switch to avoid injury to operators and damage to machinery when power is re-applied.

Note: If this mode is active all safety measures must be taken including warning labels.

- When direct run on power up is disabled 07-04=1 and the inverter is set to external run by (00-02/00-03=1), the inverter will not auto start when the power is re-applied and the run switch is turned ON. The display will flash with STP1. It will be necessary to cycle the run command switch to start the inverter.

07-06	DC Injection Brake Start Frequency (Hz)
Range	【0.10 ~ 10.00】 Hz
07-07	DC Injection Brake Level (%)
Range	【0~ 20】 % Based on the 20% of maximum output voltage
07-08	DC Injection Brake Time (Sec)
Range	【0.0 ~ 25.5】 Sec

- 07-08/07-06 set the DC injection brake duration and the brake start frequency as shown below.



07-09	Stopping Method
Range	【0】 :Deceleration to stop. 【1】 :Coast to stop.

- 07-09 = **【0】** : When a stop command is issued, the motor will decelerate to a stop using deceleration time specified in parameter 00-15.
- 07-09 = **【1】** : When a stop command is issued, the motor will coast to a stop. Stop time depends on motor load and friction of the system.

08-Protection Parameters	
08-00	Trip Prevention Selection
Range	【xxxx0】 :Enable Trip Prevention During Acceleration 【xxxx1】 :Disable Trip Prevention During Acceleration 【xxx0x】 :Enable Trip Prevention During Deceleration 【xxx1x】 :Disable Trip Prevention During Deceleration 【xx0xx】 :Enable Trip Prevention in Run Mode 【xx1xx】 :Disable Trip Prevention in Run Mode 【x0xxx】 :Enable over voltage Prevention in Run Mode 【x1xxx】 :Disable over voltage Prevention in Run Mode

08-01	Trip Prevention Level During Acceleration
Range	【50 ~ 200】 %

- Trip prevention adjustment level during acceleration to prevent over current (OC-A) trips.
- If trip prevention during acceleration is enabled and an over current condition occurs due to the load, acceleration ramp is put on hold until the inverter output current drops below the over current level set by parameter 08-01.

08-02	Trip Prevention Level During Deceleration
Range	【50 ~ 200】 %

- Trip prevention adjustment level during deceleration to prevent over Voltage (OV-C) trips.
- If trip prevention during deceleration is enabled and an over current condition occurs due to the load, deceleration ramp is put on hold until the inverter output current drops below the over current level set by parameter 08-02. The inverter will resume normal operation after the over current condition is no longer present.

08-03	Trip Prevention Level during continuous Run Mode
Range	【50 ~ 200】 %

- Trip prevention adjustment level during continuous Run to prevent over current (OC-C) trips.
- If trip prevention during running is enabled and an over current condition occurs due a load condition such as a sudden transient load, the output frequency is automatically reduced by decelerating to a lower speed until the output current drops below the over current level set by parameter 08-03. The inverter will resume normal operation after the over current condition is no longer present.

08-04	Over voltage Prevention Level during Run Mode
Range	230: 【350~390】 VDC 460: 【700~780】 VDC

- Over voltage prevention level is set by parameter 08-04 if needed.
When the DC bus voltage is higher than the level set in 08-04 an over voltage fault will occur.

08-05	Electronic Motor Overload Protection Operation Mod (OL1)
Range	xxxx0: Disable Electronic Motor Overload Protection xxxx1: Enable Electronic Motor Overload Protection xxx0x: Motor Overload Cold Start xxx1x: Motor Overload Hot Start xx0xx: Standard Motor xx1xx: Invertor Duty Motor (Force Vent)

The motor overload protection function estimates the motor overload level based on the output current, output frequency, motor characteristics and time. The motor overload trip time depends on the motor rated current when the output frequency is greater than 60Hz.

On inverter power-up the motor overload protection internal thermal accumulation register is automatically reset.

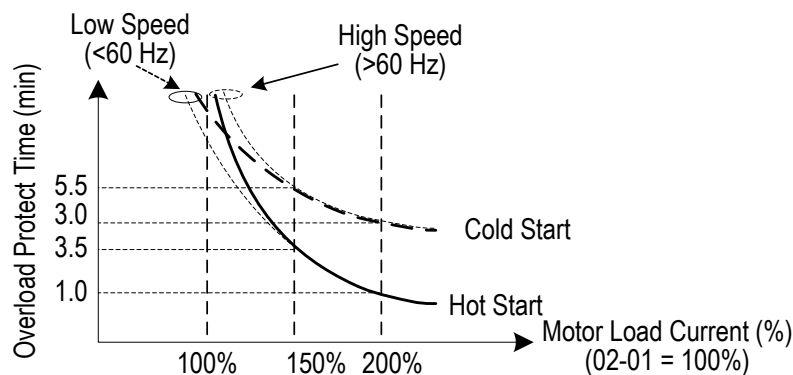
To use the built-in motor overload protection function parameter 02-01 (motor rated current) has to match the motor rated current on the motor nameplate.

Turn off the motor overload protection when using two or more motors connected to the inverter (set 08-05 = xxx0b), and provide external overload protection for each motor (e.g. thermal overload switch).

With cold start enabled (08-05 = xx0xb), motor overload protection occurs in 5 and a half minutes when operating the motor at 150% of the motor rated current at an output frequency greater than 60Hz.

With hot start enabled (08-05 = xx1xb), motor overload protection occurs in 3 and a half minutes when operating the motor at 150% of the motor rated current at an output frequency greater than 60Hz.

Example: Motor overload protection standard curve.



Motor overload protection curve (example: standard motor)

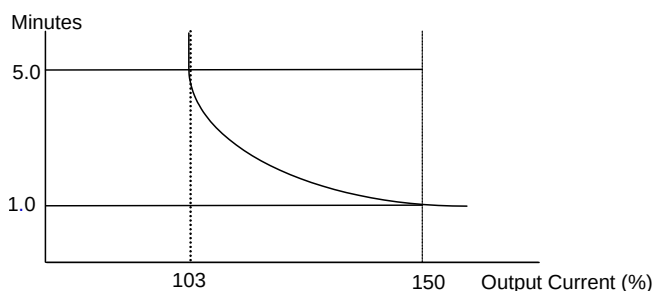
When using force cooled motors (Special inverter motor), thermal characteristics are independent of the motor speed, set 08-05 = x1xxb.

When 08-05 = x1xxb, overload protection function is based on motor rated current for output frequencies between 6 and 60Hz. If the output frequency is lower than 1Hz, the overload protection function uses 83% of the motor rated current to determine an overload condition.

When 08-05 = x0xxb, overload protection function is based on 70% of the motor rated current for an output frequency of 20Hz. If the output frequency is lower than 1Hz, the overload protection function uses 40% of the motor rated current to determine an overload condition.

08-06	Operation After Overload Protection is Activated
Range	【0】 :Coast-to-Stop in case of a motor overload condition 【1】 :Drive Will Not Trip in case of a motor overload condition (OL1)

- 08-06 = **【0】** : In case of a motor overload condition the inverter will coast to stop and the display will flash OL1. To reset Press the 'Reset' key or use an external reset clear the fault and continue to run.
- 08-06 = **【1】**: On overload condition the inverter continues to run, display flash with OL1, until the current falls below the overload level.



08-07	OH over heat Protection
Range	【0】 :Auto (Depends on heatsink temp.) 【1】 :Active while inverter is running 【2】 :Always Run 【3】 :Disabled

- 08-07= **【0】** : Cooling fan runs as the inverter detects temperature rise.
- 08-07= **【1】** : Cooling fan runs while the inverter is running.
- 08-07= **【2】** : Cooling fan runs continuously.
- 08-07= **【3】** : Cooling fan is disabled.

08-08	AVR function
Range	【0】 :AVR function enabled 【1】 :AVR function disabled 【2】 :AVR function disabled for stop 【3】 :AVR function disable for Deceleration 【4】 :AVR function disabled for stop & Deceleration from one speed to another speed. 【5】 :when VDC>(360V/740V), AVR function is disabled for stop and Deceleration

- 08-08=0. AVR enabled stabilizes the motor voltage independent of fluctuation to the input voltage.
- 08-08=1. Input voltage fluctuations will cause fluctuations on output voltage.
- 08-08=2. AVR is disabled during stopping to avoid an increase in stopping time.
- 08-08=3. AVR is disabled only during deceleration from one speed to another speed to avoid a longer deceleration time.

08-09	Input phase loss protection
Range	【0】 :Disabled 【1】 :Enabled

When 08-09= **【1】** : Phase loss warning message PF is displayed when an input phase loss is detected.

08-10	PTC Motor Overheat Function
Range	【0】 : Disable 【1】 : Decelerate to stop 【2】 : Coast to stop 【3】 : Continue running, when warning level is reached. Coast to stop, when protection level is reached.
08-11	PTC Signal Smoothing Time
Range	【0.00 ~ 10.00】 Sec
08-12	PTC Detection Time Delay
Range	【1 ~ 300】 Sec
08-13	PTC Protection Level
Range	【0.1 ~ 10.0】 V
08-14	PTC Detection Level Reset
Range	【0.1 ~ 10.0】 V
08-15	PTC Warning Level
Range	【0.1 ~ 10.0】 V

➤ **Selection for motor overheat protection:**

PTC (Positive temperature coefficient) sensors are used in motor windings to provide additional motor protection against overheating.

PTC thermistor can be connected to terminals AVI and AGND.

A voltage divider resistor R is necessary to be connected as shown below in figure (b).

- 1) If 08-10 = 1 or 2 (Decelerate or Coast to stop on over temperature detection).
When an over temperature condition is detected when the signal connected to terminal AVI rises above the warning detection limit set in parameter 08-15 for the delay time set in parameter 08-12, the display will show "OH4"(motor over heat detection). The output frequency will decelerate or coast to stop based on setting parameter 08-10.

- 2) If 08-10 = 3 Continue running when warning level is reached. (08-15). Coast to stop when protection level is reached. (08-13).

When an over temperature condition is detected when the signal connected to terminal AVI rises above the warning detection limit set in parameter 08-15, the display will show "OH3"(motor over heat warning level) and the motor will continue to run.

If temperature detected rises above the value set in parameter 08-13 and for the delay time specified in 08-12, the the display will show "OH4" (motor over heat detection) and the motor will coast to stop.

- 3) Motor over heat detection "OH4" can be reset when the temperature detection level at terminal AVI falls below the level set in parameter **【08-14 PTC reset level】** .

4) External PTC thermistor characteristics

Figure (a) shows two curves for Class F and Class H temperatures.

Tr = 150°C in class F,

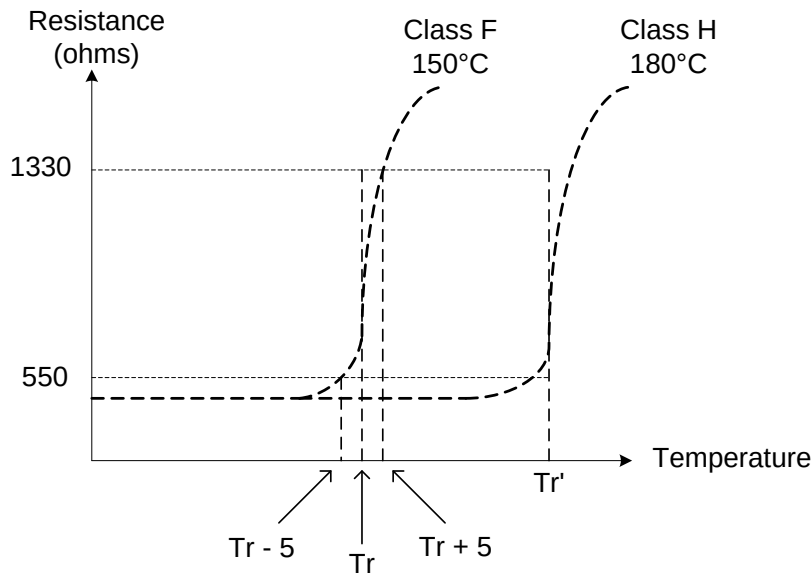
Tr = 180°C in class H.

Tr - 5°C: $R_{PTC} \leq 550\Omega$, put value of R_{PTC} into formula(1) to calculate the value of V to be set in parameter **【08-14 PTC reset level】** .

Tr + 5°C: $R_{PTC} \geq 1330\Omega$, put value of R_{PTC} into formula (1) to calculate, the value of V to be set in parameter **【08-13 PTC protection level】** .

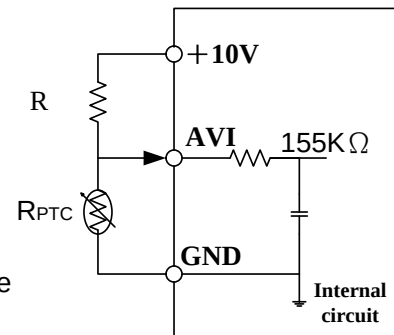
5) For different specifications of PTC thermistors, set the values for parameters 08-13 and 08-14 using the formula below.

$$V = \frac{1}{2} \times 10 \times \frac{R_{PTC} // 155}{R + (R_{PTC} // 155)} \dots\dots\dots \text{formula (1)}$$



Tr : Temperature threshold value

(a) PTC Thermistor Characteristics



(b) PTC Thermistor Connections

08-16	Fan Control Temperature Level
Range	【10.0~50.0】 °C

- When **08-07=【0】** (Heat sink temperature dection control for cooling fan). Fan will run when temperature of heatsink rises above temperature set in 08-16;
When temperature of heatsink falls below "setting value of 08-16 - 20°C", fan will stop.

09-Communication Parameters

09-00	Assigned Communication Station Number
Range	【1 ~ 32】

- 09-00 sets the communication station number when more than one unit on the communication network. Up to 32 inverters can be controlled from one master controller such as a PLC.

09-01	RTU code /ASCII code Selection
Range	【0】 :RTU 【1】 :ASCII 【2】 :BACnet
09-02	Baud Rate Setting (bps)
Range	【0】 : 4800 【1】 : 9600 【2】 : 19200 【3】 : 38400
09-03	Stop Bit Selection
Range	【0】 : 1 stop bit 【1】 : 2 stop bit
09-04	Parity Selection
Range	【0】 : No parity 【1】 : Even parity 【2】 : Odd parity
09-05	Data Format Selection
Range	【0】 : 8 bit data 【1】 : 7 bit data

- Set 09-01~09-05 to configure communication format before communicating the inverter.

09-06	Communication time-out detection time
Range	【0.0~25.5】 Sec
09-07	Communication time-out operation selection
Range	【0】 : Stop in deceleration time 1 and show COT after communication timeout 【1】 : Stop in free run mode and show COT after communication timeout 【2】 : Stop in deceleration time 2 and show COT after communication timeout 【3】 : Keep running and show COT after Communication timeout

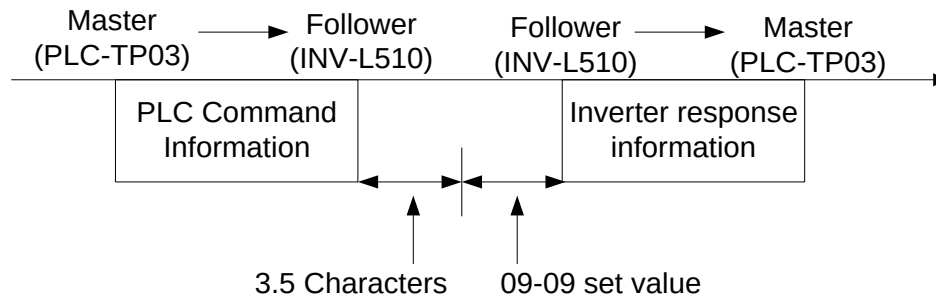
- Time-out detection time: 00.0~25.5 seconds; setting 0.0 seconds disables time-out function.

09-08	Err6 fault tolerance times
Range	【1~20】

- When communication error time ≥ 09-08 setting the keypad display shows ERR6.

09-09	Drive Transmit Wait Time
Range	【5~65】 ms

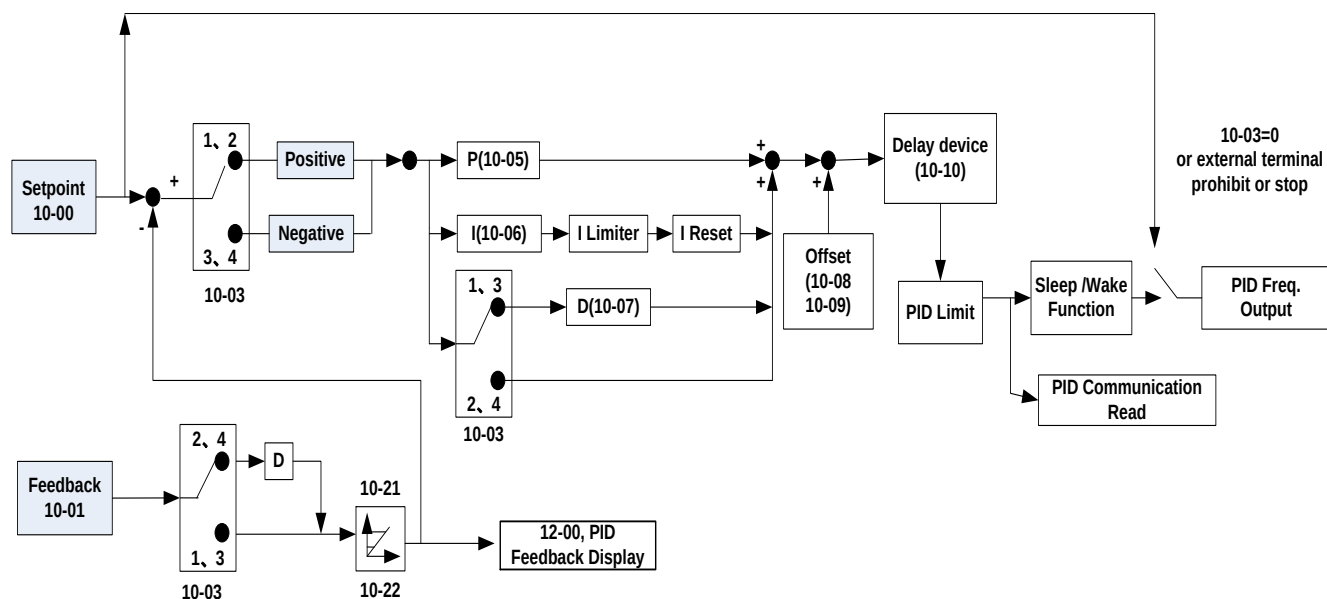
- Inverter response delay time after a valid message is received.



09-10	BACnet stations
Range	【1~254】

10-PID Parameters

PID block diagram



10-00	PID setpoint value selection
Range	【0】 : Potentiometer on Keypad 【1】 : External AVI Analog Signal Input 【2】 : External ACI Analog Signal Input 【3】 : Setpoint Frequency set by Communication method. 【4】 : Set from keypad by parameter 10-02.

➤ 10-00 selections are only effective when frequency source selection is set to PID parameters 00-05\00-06=6.

10-01	PID feedback value selection
Range	【0】 : Potentiometer on Keypad 【1】 : External AVI Analog Signal Input 【2】 : External ACI Analog Signal Input 【3】 : Communication setting Frequency

➤ **Note:** Parameter 10-00 and 10-01 cannot be set to the same value.

10-02	PID keypad input
Range	【0.0~100.0】 %

10-03	PID operation selection
Range	【0】 : PID Function disabled 【1】 : FWD Characteristic. (Deviation is D-controlled) 【2】 : FWD Characteristic. (Feedback is D-controlled) 【3】 : REV Characteristic. (Deviation is D-controlled) 【4】 : REV Characteristic. (Feedback is D-controlled) 【5】 : FWD Characteristic. (Frequency Command +Deviation D Control) 【6】 : FWD Characteristic. (Frequency Command + Feedback D Control) 【7】 : Reverse Characteristic. (Frequency Command + Deviation D Control) 【8】 : Reverse Characteristic. (Frequency Command + Feedback D Control)

- 10-03 = **【1】** : Positive characteristic with PID derivative control of setpoint/target value minus feedback value set by parameter 10-07. If the PID error is positive, the output frequency increases and decreases when PID error is negative.
- 10-03 = **【2】** : Positive characteristic with PID derivative control of feedback value set by parameter 10-07. If the PID error is positive, the output frequency increases and decreases when PID error is negative.
- 10-03 = **【3】** : Negative characteristic with PID derivative control of setpoint/target value minus feedback value set by parameter 10-07. If the PID error is positive, the output frequency decreases and increases when PID error is negative.
- 10-03 = **【4】** : Negative characteristic with PID derivative control of feedback value set by parameter 10-07. If the PID error is positive, the output frequency decreases and increases when PID error is negative.
- 10-03 = **【5~8】** : Output frequency = PID output frequency + frequency command (10-03 = **【1~4】**).

Proportional Gain Control: The error signal (deviation) between the input command (set value) and the actual control value (feedback). This error signal or deviation is amplified by the proportional gain (P) to control the offset between the set value and the feedback value.

Integral Time Control: The output of this control is the integral of the error signal (difference between set value and feedback value) and is used to minimize the offset signal that is left over from the gain control. When the integral time (I) is increased, the system response becomes slower.

Derivative Time Control: This control is the inverse from integral control and tries to guess the behavior of the error signal by multiplying the error with the differential time. The result is added to the PID input. Derivative control slows down the PID controller response and may reduce system oscillation. **Note:** Most applications that use PID control (fan and pump) do not require derivative control.

10-04	Feedback Gain coefficient
Range	【0.00 ~ 10.00】
➤ 10-04 is the calibration gain. Deviation = setpoint – (feedback signal×10-04)	
10-05	Proportional Gain
Range	【0.0 ~ 10.0】
➤ 10-05: Proportion gain for P control.	
10-06	Integral Time
Range	【0.0 ~ 100.0】 s
➤ 10-06: Integration time for I control	
10-07	Derivative Time

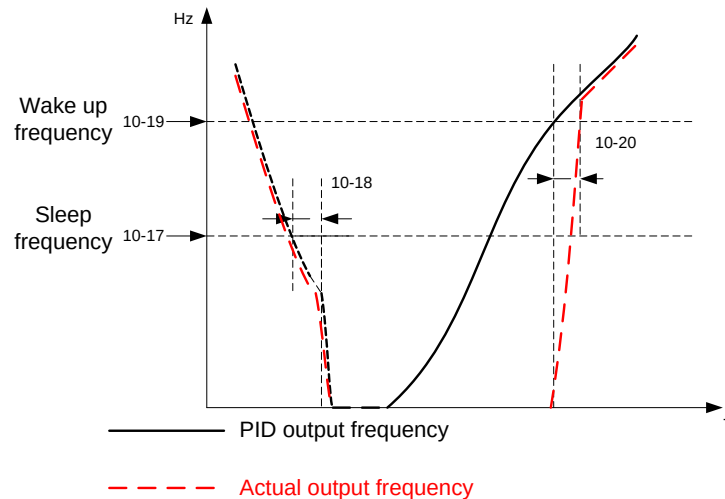
Range	【0.00 ~ 10.00】 s
➤ 10-07: Differential time for D control	
10-08	PID Offset
Range	【0】 : Positive Direction 【1】 : Negative Direction
10-09	PID Offset Adjust
Range	【0 ~ 109】 %
➤ 10-08 /10-09: Calculated PID output is offset by 10-09 (the polarity of offset is according to 10-08)	
10-10	PID Output Lag Filter Time
Range	【0.0 ~ 2.5】 s
➤ 10-10: Update time for output frequency.	
10-11	Feedback Loss Detection Mode
Range	【0】 : Disable 【1】 : Enabled - Drive Continues to Operate After Feedback Loss 【2】 : Enabled - Drive “STOPS” After Feedback Loss
➤ 10-11 = 【1】 : Feedback loss detected, continue running keypad display shows ‘PDER’	
➤ 10-11 = 【2】 : Feedback loss detected, inverter decelerated to a stop and keypad display shows ‘PDER’	
10-12	Feedback Loss Detection Level
Range	【0 ~ 100】
➤ 10-12 is feedback loss detection level. Error = Setpoint – Feedback value. When the error is greater than the feedback loss level for the time set in parameter 10-13 a feedback loss condition is detected.	
10-13	Feedback Loss Detection Delay Time
Range	【0.0 ~25.5】 s
➤ 10-13: Minimum time the error (Setpoint – Feedback) value has to remain above the detection level before a feedback loss condition is detected.	
10-14	Integration Limit Value
Range	【0 ~ 109】 %
➤ 10-14: Integral limit to prevent the PID from saturating.	
10-15	Integration Value Resets to Zero when Feedback Signal Equals the target Value
Range	【0】 : Disabled 【1】 : After 1 Sec 【30】 : After 30 Sec (Range:- 1 ~ 30 Sec)
➤ 10-15=0. When PID feedback value reaches the setpoint, the integral value is not reset.	
➤ 10-15=1~30. When PID feedback value reaches the setpoint, reset to 0 after 1~30 seconds and after inverter stops. The inverter will start running again when the feedback value differs from the setpoint value.	

10-16	Allowable Integration Error Margin (Unit) (1 Unit = 1/8192)
Range	【0 ~ 100】 %

- 10-16 = 0 ~ 100% unit value: Integrator start level after the integrator was reset to 0.

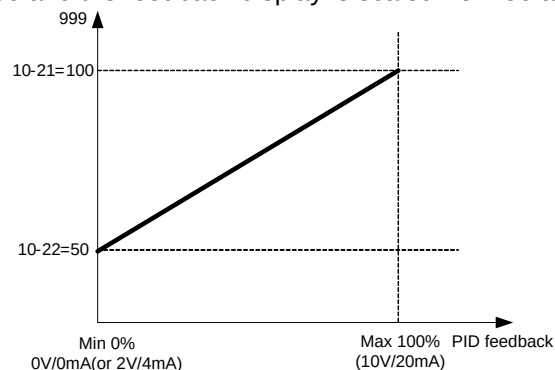
10-17	PID Sleep Frequency Level
Range	【0.00~599.00】 Hz
10-18	PID Sleep Function Delay Time
Range	【0.0 ~25.5】 s
10-19	PID Wake up frequency Level
Range	【0.00 ~ 599.00】 Hz
10-20	PID Wake up function Delay Time
Range	【0.0 ~ 25.5】 s

- When PID output frequency falls below the sleep frequency for a time specified by the sleep delay, the inverter will decelerate to 0 and enters PID sleep mode.
- When PID output frequency is greater than the wake up threshold frequency the inverter will wake up and starts running again as shown in the timing diagram below.



10-21	Max PID Feedback Level.
Range	【0 ~ 999】
10-22	Min PID Feedback Level.
Range	【0 ~ 999】

- Parameters used for feedback display scaling. Set parameter 10-21 to the minimum value and parameter 10-22 to the maximum value of the feedback signal. Example:
- Set 10-21=100 and 10-22=50 and the feedback display is scaled from 50 and 100.



11-Performance Control Parameters

11-00	Prevention of Reverse operation
Range	【0】 : Reverse command is enabled 【1】 : Reverse command is disabled

- 11-00=1: the reverse command is disabled.

11-01	Carrier Frequency
Range	【1~16】 KHz

11-02	Carrier mode selection
Range	【0】 : Carrier mode0 3-phase PWM modulation 【1】 : Carrier mode1 2-phase PWM modulation 【2】 : Carrier mode2 2-phase soft PWM modulation

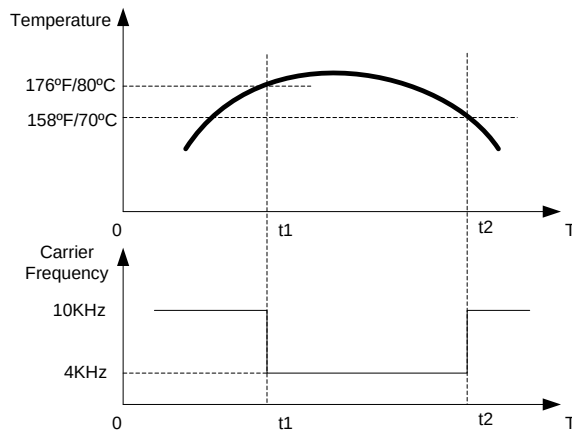
- Mode 0: 3-phase PWM Modulation Three output transistors on at the same time (Full Duty).
- Mode 1: 2-phase PWM Modulation Two output transistors on at the same time (2/3 Duty).
- Mode 2: Soft PWM Modulation: 3-phase PWM and 2-phase PWM modulation used randomly.

Note: Mode 2 can improve life of the IGBTs, control temperature rise and suppress electromagnetic noise.

Modes	Name	IGBT Duty	Heat Losses	Torque Performance	Waveform Distortion	Motor Noise
0	3-Phase PWM	100%	High	High	Low	Low
1	2-Phase PWM	66.6%	Low	Low	High	High
2	Soft PWM	66.6%	Low	Low	High	High

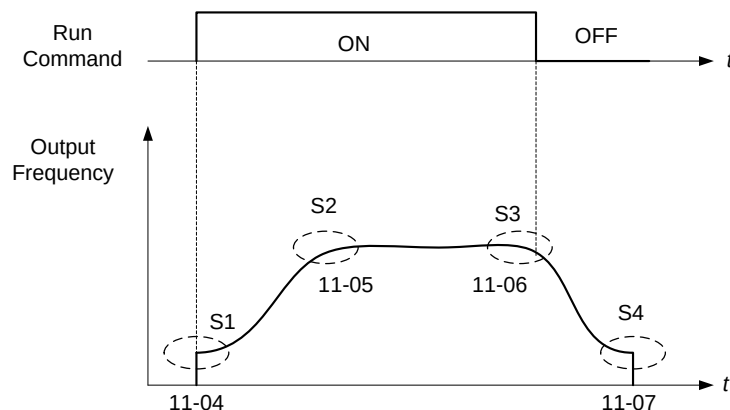
11-03	Carrier Frequency auto reduction due to temperature rise
Range	【0】 :Disable 【1】 :Enable

- When inverter (heatsink) temperature rises above 176°F/80°C the Carrier Frequency is automatically reduced to 4 kHz.
- When the temperature falls below 158°F/70°C, Carrier Frequency is reset back to its original setting.
- Temperature can be displayed by setting parameter 12-00=04000.



11-04	S-Curve Acc 1
11-05	S-Curve Acc 2
11-06	S-Curve Dec 3
11-07	S-Curve Dec 4
Range	【0.0 ~ 4.0】 s

- The S curve function for acceleration / deceleration is used to reduce mechanical impact caused by the load during momentary starting and stopping of the inverter. To use the S curve function set the time for acceleration start point (11-04), acceleration end point (11-05), deceleration start point (11-06) and deceleration end point (11-07).



Note:

- Independent of the stall prevention, actual acceleration and deceleration time preset acceleration divided by deceleration time + S curve time.
- To set S curve times use parameters (11-04~11-07).
- When S curve time (11-04~11-07) is set as 0, the S curve function is disabled.
- The calculation of S curve time is based on the Maximum output frequency of motor (01-02), Please refer to the parameters (00-14/00-15/00-16/00-17).

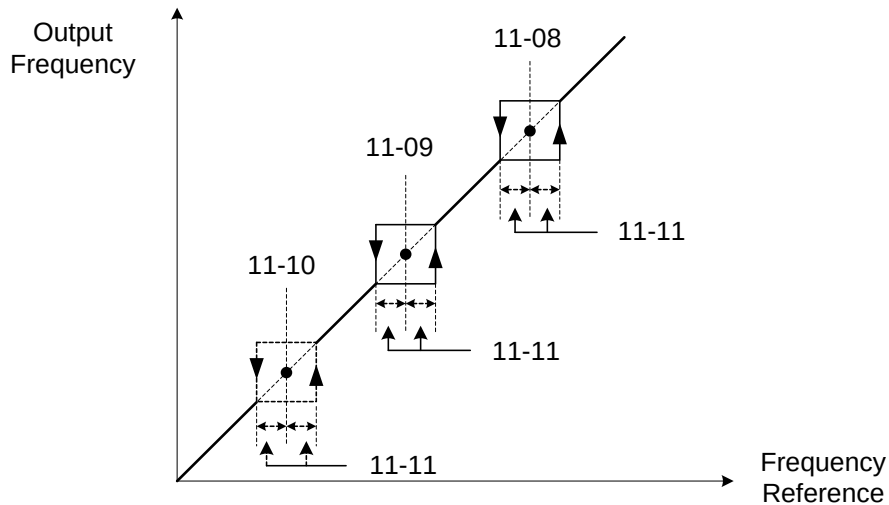
11-08	Skip frequency 1
11-09	Skip frequency 2
11-10	Skip frequency 3
Range	【0.00 ~ 599.00】 Hz
11-11	Skip frequency range. (± frequency band)
Range	【0.00 ~ 30.00】 Hz

These parameters allow “skipping over” of certain frequencies that can cause unstable operation due to resonance within certain applications.

Note: Prohibit any operation within the skip frequency range. During acceleration and deceleration the frequency is continuous without skipping the jump frequency.

To enable skip frequency 1 – 3 (11-08 – 11-10) set the frequency to a value greater than 0.0 Hz.

Use the jump frequency width (11-11) to create a jump frequency range. Refer to figure below.

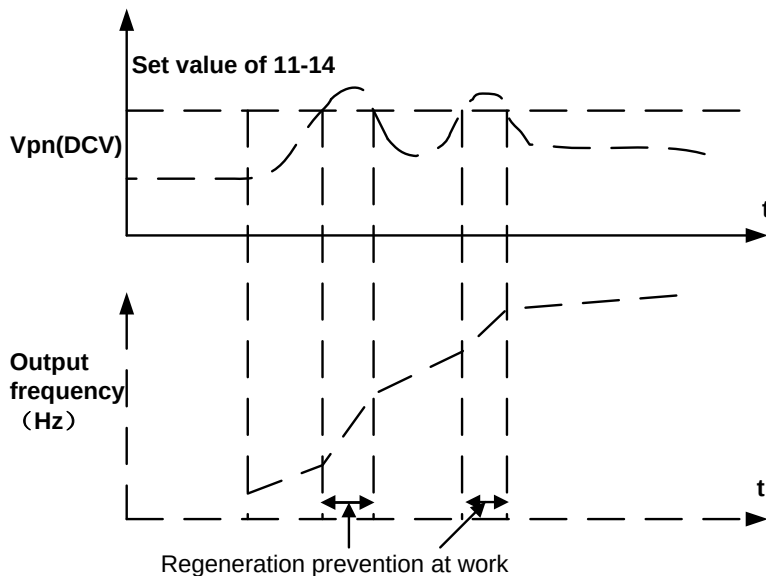


11-13	Regeneration Prevention Function
Range	【0】 : Regeneration prevention function is disabled 【1】 : Regeneration prevention function is enabled 【2】 : Regeneration prevention function is enabled only during constant speed

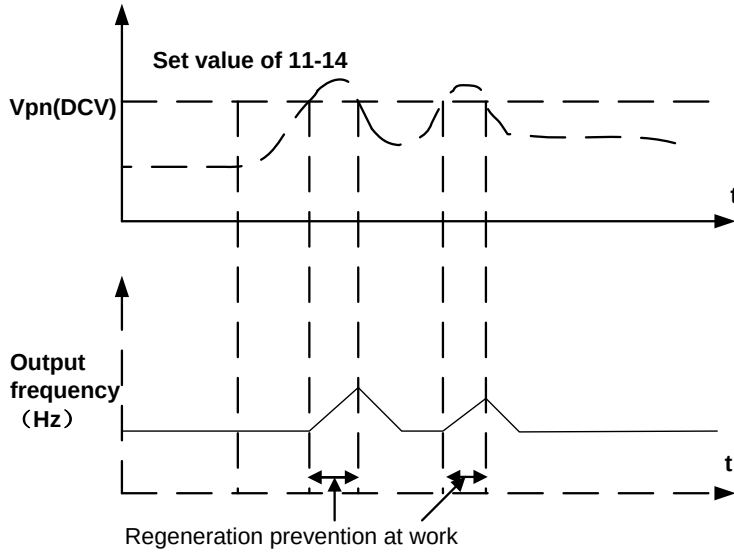
- Regeneration Prevention Function:
During excessive energy regeneration, the Vpn (DC bus) voltage rises and could result in an OV (over voltage), to avoid an over voltage condition during regeneration the output frequency is increased.

Regeneration prevention function can be set according to the selections above.

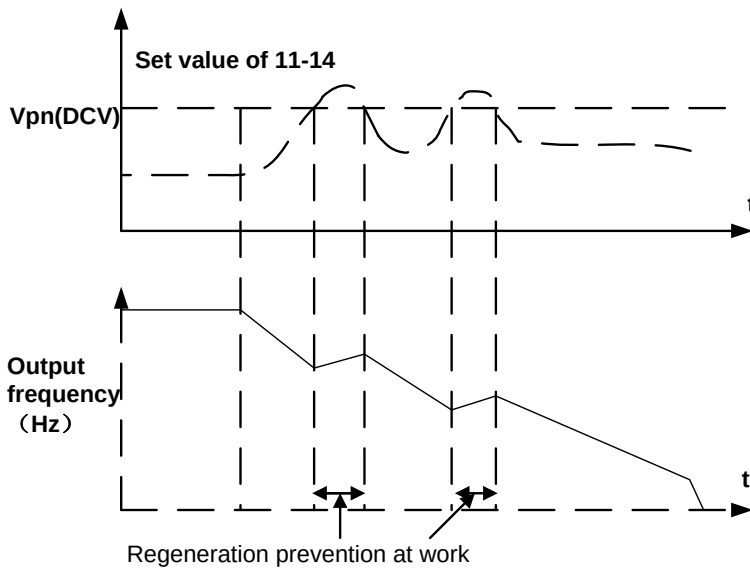
Example: Regeneration prevention during acceleration.



Example: Regeneration prevention while operating at constant speed.



Example: Regeneration prevention during deceleration.



11-14	Regeneration Prevention Voltage Level
Range	200v: 300.0~400.0 V 400v: 600.0~800.0 V

- Regeneration prevention voltage level: If the DC bus voltage level is set too low, then over-voltage protection level is never reached, but the actual deceleration time will be extended.

11-15	Regeneration Prevention Frequency Limit
Range	【0.00~15.00】 Hz

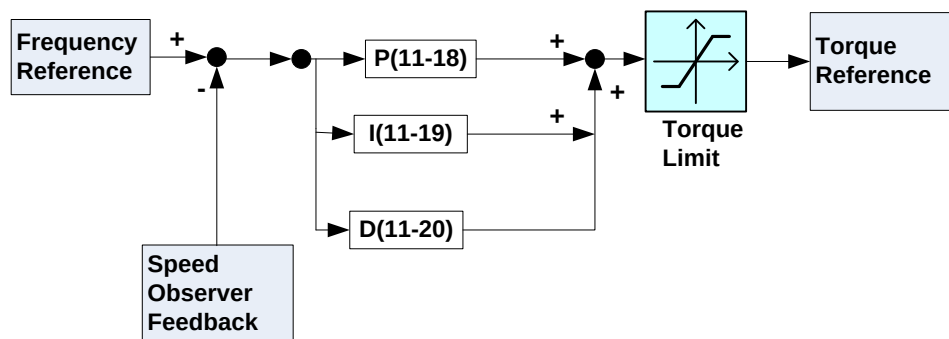
- Sets the regeneration prevention frequency limit.

11-16	Regeneration Prevention Voltage Gain
Range	【0~200】 %
11-17	Regeneration Prevention Frequency Gain
Range	【0~200】 %

- 11-16 and 11-17 are used to set the regeneration prevention function response. A higher value increased the response in output frequency when the DC bus voltage rises but may result instability.
- If parameter 11-16 is set to small the regeneration prevention function might not be fast enough to prevent an over voltage condition, adjust both parameters accordingly.

11-18	Speed loop proportion gain
Range	【0~65535】
11-19	Speed loop integration gain
Range	【0~65535】
11-20	Speed loop differential gain
Range	【0~65535】

- SLV control mode uses the output speed estimator for its speed feedback value. Speed control system adjusts the output frequency to match the value of speed feedback command. The output torque command is set by the controller output via a limiter.



12-Monitoring Parameters

12-00	Display Mode
Range	Highest digit => <u>0</u> <u>0</u> <u>0</u> <u>0</u> <u>0</u> <= lowest digit 00000~77777 Each digit can be set from 0 to 7 as listed below. 【0】 : Disable display 【1】 : Output Current 【2】 : Output Voltage 【3】 : DC voltage 【4】 : Temperature 【5】 : PID feedback 【6】 : AVI 【7】 : ACI

- MSD= Most significant digit. LSD= Least significant digit.
- The highest bit is used for power-up monitor. The 4 least significant bits can be used to customize the display sequence.

12-01	PID Feedback Display Mode
Range	【0】 : Displayed as Integer (xxx) 【1】 : Display the feedback value with one place after the decimal point (xx.x) 【2】 : Display the feedback value (x.xx) with two places after the decimal point
12-02	PID Feedback Display Unit Setting
Range	【0】 :xxx-- 【1】 :xxxpb(pressure) 【2】 :xxxfl(flow)

12-03	Custom Units (Line Speed) Display Mode
Range	【0~65535】 rpm

- Set motor rated RPM in this parameter to display motor RPM instead of output frequency.
- The line speed display is linearly proportional to the output frequency 0 to 50Hz or 0 - 60 Hz as appropriate.
Motor synchronous speed = 120 x motor rated frequency ÷ Number of poles.

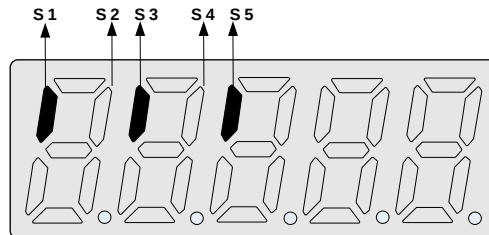
12-04	Custom Units (Line Speed) Display Mode
Range	【0】 :Drive Output Frequency is displayed 【1】 :Line Speed is Displayed in Integer (xxxxx) 【2】 :Line Speed is Displayed with one place after the decimal point (xxxx.x) 【3】 :Line Speed is Displayed with two places after the decimal point (xxx.xx) 【4】 :Line Speed is Displayed with three places after the decimal point (xx.xxx)

- **12-04≠0**, line speed is displayed when the inverter is running or stopped.

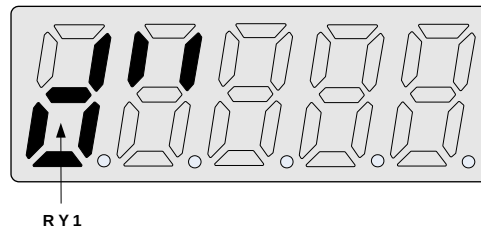
12-05	Input and output terminal status display
Range	Read only (Keypad read only)

- Terminals S1-S5 are represented using two segments of each digit. Segment turns on when input is active.
- When relay output RY1 is on, the bottom segments of the first digit turns on (see below).
- When no Digital input and no relay output the display will show -----.

Example 1: Figure shows 12-05 display status: S1, S3, S5 Inputs are ON and S2, S4 and RY1 are OFF.



Example 2: Figure shows 12-05 display status: S2, S3, S4 Inputs are ON and S1, S5 and RY1 are ON.



13-Maintenance Parameters

13-00	Drive Horsepower Code
Range	----

Inverter Model:	13-00 show	Inverter Model:	13-00 show	Inverter Model:	13-00 show
L510-1P2-SXX	1P2	L510-2P2-SXX	2P2	L510-401-SXX	401
L510-1P5-SXX	1P5	L510-2P5-SXX	2P5	L510-402-SXX	402
L510-101-SXX	101	L510-2P7-SXX	2P7	L510-403-SXX	403
		L510-201-SXX	201	L510-405-SXX	405
		L510-202-SXX	202		
		L510-203-SXX	203		
		L510-205-SXX	205		

13-01	Software Version
Range	----

13-02	Fault Log Display (Latest 3 faults)
Range	----

- Last three faults are stored in order with the latest fault first. Whenever there is a new fault the previous faults are pushed down. So the fault stored in 2.xxx is moved to position 3.xxx, and fault 1.xxx to 2.xxx. The most recent fault will be stored in register 1.xxx.
- Use Up▲ and Down▼ keys to scroll between fault registers.
- Pressing reset key when parameter 13-02 is displayed will clear all three fault registers and the display for each register will change to 1. ---, 2. ---, 3. ---.
- E.g. fault log content is '1.OC-C'; indicates the latest fault was OC-C, etc.

13-03	Accumulated Inverter Operation Time 1
Range	【0~23】 Hours
13-04	Accumulated Inverter Operation Time 2
Range	【0~65535】 Days
13-05	Accumulated Inverter Operation Time Mode
Range	【0】 : Power on time 【1】 : Operation time

- When the operation time in accumulator 1 (Parameter 13-03) reaches 24 hours the recorded value in accumulator 2 parameter 13-04 increases by 1 day and the value in accumulator 1 is reset to 0000.

13-06	Parameter lock
Range	【0】 : Enable all Functions 【1】 : Preset speeds 05-01~05-08 cannot be changed 【2】 : Only preset speeds parameter 05-01~05-08 can be changed 【3】 : Disable All Function Except 13-06

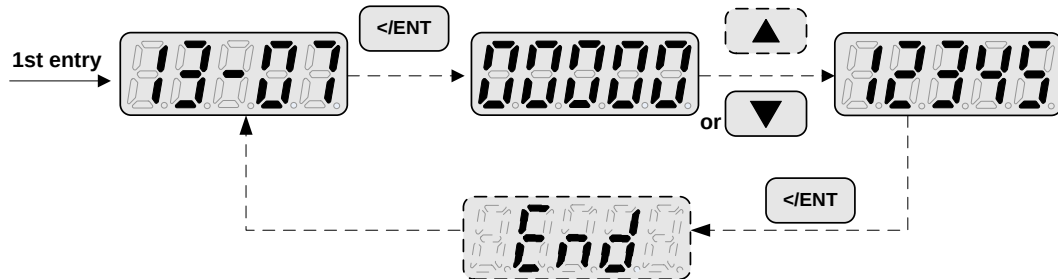
- When the 13-07=00000 (password not set), parameters 05-01~05-08 and 13-06 can be set.

13-07	Parameter Lock Key Code
Range	【00000~65535】

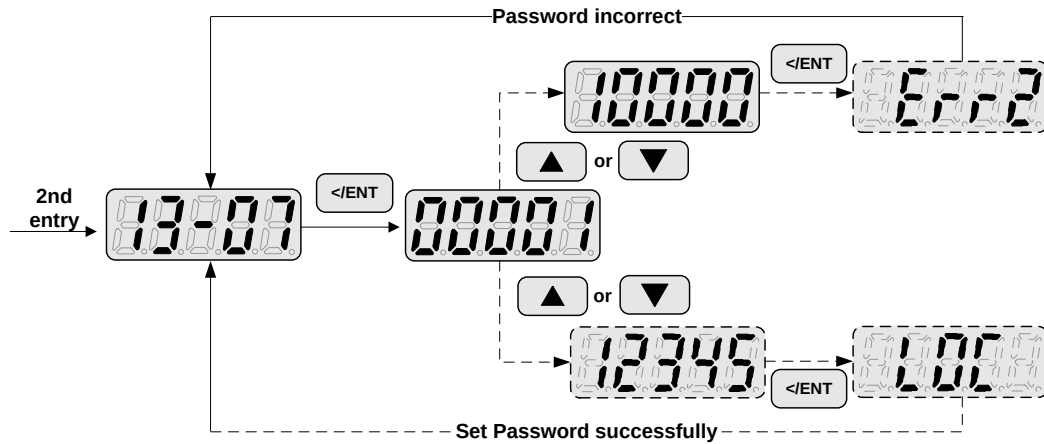
- When a parameter lock key code is entered in parameter 13-07 requires the lock key code to be entered for each parameter modification. See Parameter lock key setting example.

Setting Parameter lock key number example:-

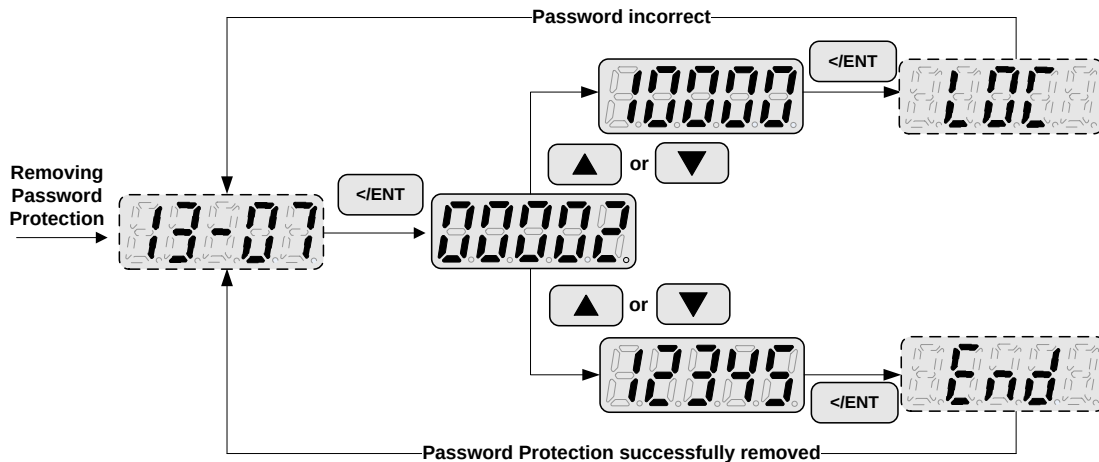
Step1:



Step2:



Removing Key code (password)



13-08	Reset Drive to Factory Settings
Range	【1150】 : Reset to factory setting. (50Hz,220V/380V system) 【1160】 : Reset to factory setting. (60Hz,220V/380V system) 【1250】 : Reset to factory setting. (50Hz,230V/400V system) 【1260】 : Reset to factory setting. (60Hz,230V/460V system) 【1350】 : Reset to factory setting. (50Hz,220V/415V system) 【1360】 : Reset to factory setting. (60Hz,230V/400V system)

- When a Parameter lock key number is set parameter 13-07. This lock key code must be entered first before parameter 13-08 can be set.

Group 14 PUMP Application Function

14-00	Function Selection
Range	0: Disable 1: PUMP

- Select function of pump via parameter 14-00. This function is enabled if PID control mode (10-03) is enabled.
- When 14-00=1 and 10-03=1(PID function is enabled), PUMP function will be enabled.
- When 14-00 set to 1, 07-12 will be set to 0 at the same time. (After version 1.13)

14-01	Setting of Single & Multiple Pumps and Master & Slave Machines
Range	0: Single Pump 1: Multiple pumps-Master 2: Multiple pumps-Slave 1 3: Multiple pumps-Slave 2 4: Multiple pumps-Slave 3

- Set the inverter as the Master or Slave 1~3 via parameter 14-01. Refer chapter 3 for the functional process of dual pump start to enable multiple pumps in parallel. It is required to reconnect to write in the parameter after it is set.

14-02	Operation Pressure Setting
Range	0.1~(the value of 14-03)

- Set the pressure value depending on the pressure transmitter of pump system after setting 10-00 to 0 (keypad given). °

14-03	Maximum Pressure Setting of Pressure Transmitter
Range	【0.1~650】PSI

- Set the maximum pressure value depending on the pressure transmitter of pump system. Parameter 14-02 is limited to this maximum value.

14-04	Pump Pressure Command Source
Range	0 : Set by 14-02 1 : Set by AI

- Pressure command source is given the value set by 14-02 (Operation Pressure Setting) or AI. Refer to parameter 10-00 for the setting of AI terminal.)

14-05	Display Mode Selection
Range	0: Display of Target and Pressure Feedback (14-03<99) 1: Target Pressure Only 2: Feedback Pressure Only

- This function can have the common display of target & feedback pressure or display separately
- (1) When 14-05=0, LED keypad displays pressure setting value and pressure feedback. Two-digit in the left is the pressure value setting and two-digit in the right is the pressure feedback value in the seven-segment monitor.

20 10

(2) When 14-05=1, keypad only displays the pressure setting value.

020

(3) When 14-05=2 : LED keypad only displays the pressure feedback value. °

018

Note:

If Pump mode is used LED keypad, parameter 14-03 is required to ≤ 99.0 PSI.

14-06	Proportion Gain(P)
Range	【0.00~10.00】
14-07	Integral Time(I)
Range	【0.0~100.0】 s
14-08	Differential Time(D)
Range	【0.00~10.00】 s

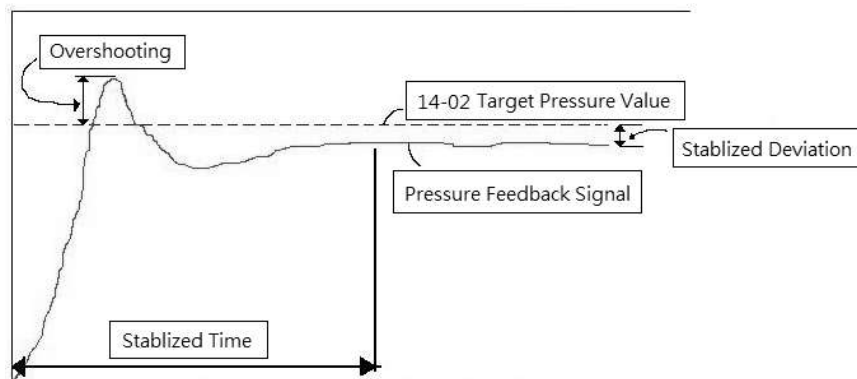
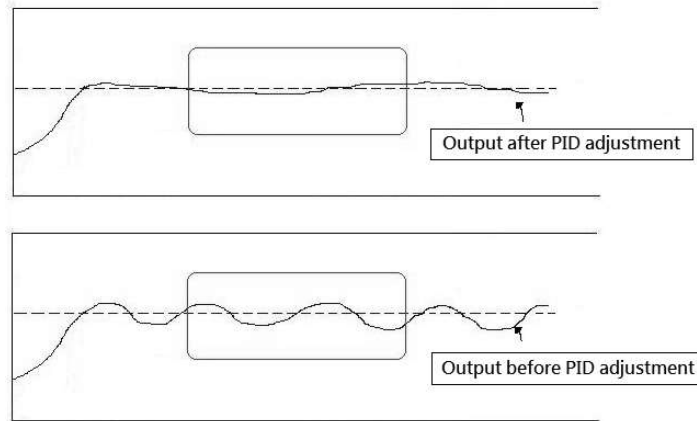


Diagram of pressure feedback value

	Increase Setting Value	Decrease Setting Value	Main Feature
Proportional Gain (P)	(Pros) Increase response time (Cons) Might cause pump jittering	(Pros) Reduce jittering (Cons) Slow down response	Increase stabilized time
Integral Time (I)	(Pros) Smooth output frequency (Cons) Slow down response	(Pros) Fast response (Cons) Change rapidly output frequency	For smooth feedback variations
Differential Time (D)	(Pros) Avoid overshooting (Cons) System instability or motor jittering	(Pros) System stability (Cons) Overshooting easily	Respond to system rapid variations

Guide for PID parameter adjustment



PID Diagram for PID parameter adjustment

* PID parameters can be modified during the inverter is running.

14-09	Tolerance Range of Constant Pressure
Range	When 14-20=0, range is 0.00~650.00 When 14-20=1, range is 0~100

- When pressure feedback value is in the range of 14-02+14-09, inverter output frequency will decrease downward into sleep status.

14-10	Sleep Frequency of Constant Pressure
Range	【0.00~599.00】 Hz

- When inverter output frequency falls below 14-10 (sleep frequency of constant pressure), it starts to count the sleep time (14-11).

14-11	Sleep Time of Constant Pressure
Range	【0.00~255.5】 s

- When the inverter finishes counting the sleep time (14-11), the output frequency falls downward at the deceleration time (00-15) and gets into sleep status. Parameter 14-10 (sleep frequency of constant pressure) is dedicated by the pump and it is not applied to parameter 10-17 (start frequency of PID sleep).

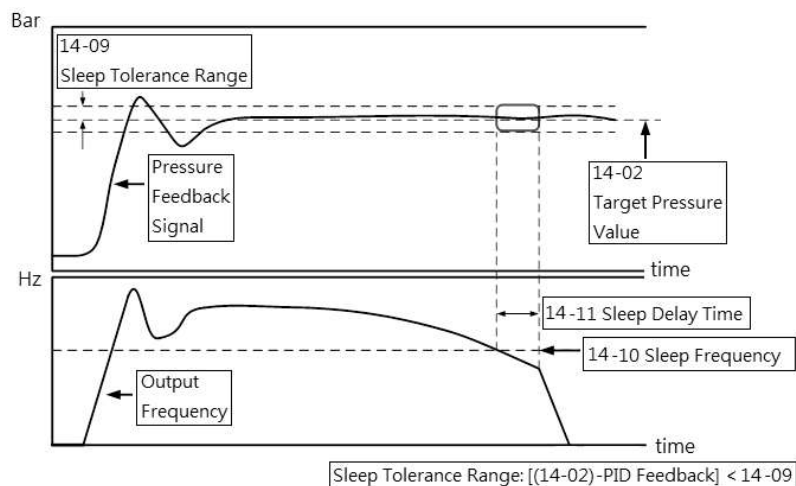


Diagram for stop time of constant pressure

14-12	Maximum Pressure Limit
Range	When 14-20=0, range is 0.00~650.00 When 14-20=1, range is 0~100

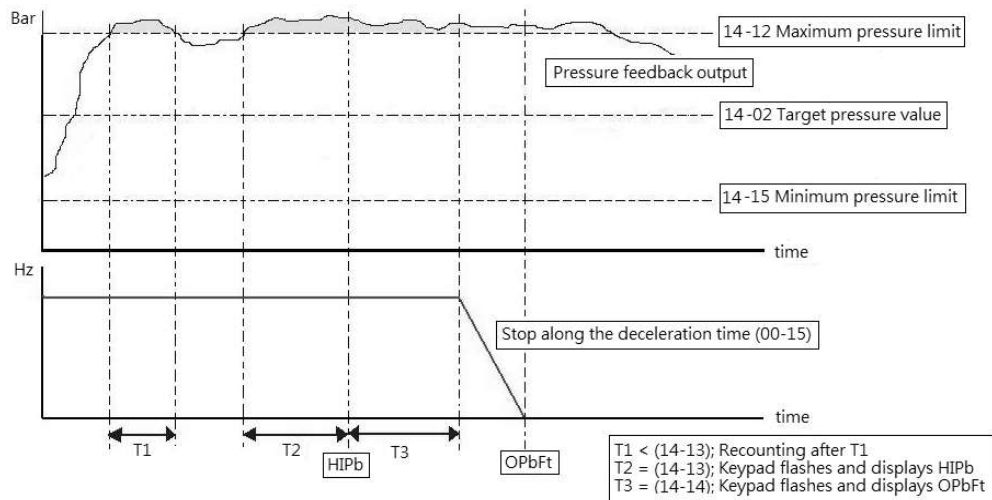
- It is convenient for user to limit maximum pressure. When pressure feedback value is higher than maximum pressure limit, the inverter displays warning signal and then stops.

14-13	Warning Time of High Pressure
Range	【0.0~600.0】 s

- When pressure feedback value is higher than maximum pressure limit, warning time of high pressure starts to count. If pressure feedback value is lower than maximum pressure limit during counting time, the warning time will recount and the inverter will display the warning signal of HIPb when the warning time ends.

14-14	Stop Time of High Pressure
Range	【0.0~600.0】 s

- When the warning signal of high pressure occurs and pressure feedback value is higher than maximum pressure limit, stop time of high pressure starts to count. If pressure feedback value is lower than maximum pressure limit during counting time, the stop time will recount and the inverter will display stop error signal of OPbFt when the stop time ends.



14-15	Minimum Pressure Limit
Range	When 14-20=0, range is 0.00~650.00 When 14-20=1, range is 0~100

- It is convenient for user to limit minimum pressure. When pressure feedback value is lower than minimum pressure limit, the inverter displays warning signal and then stops.

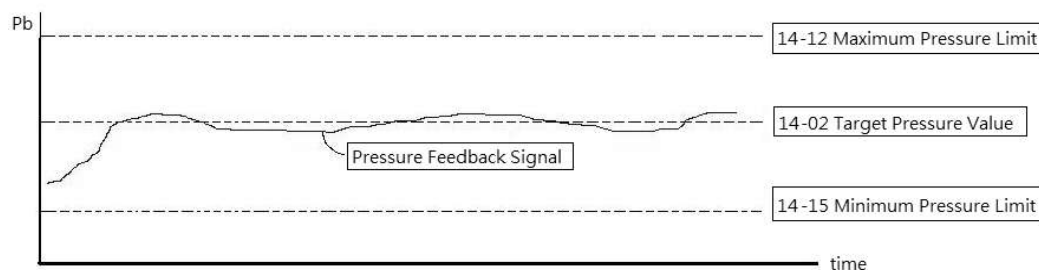


Diagram for pressure feedback limit

Note:

The pressure under the control of PID is between the maximum pressure limit (14-12) and minimum pressure limit (14-15).

14-16	Warning Time of Low Pressure
Range	【0.0~600.0】 s

- When pressure feedback value is lower than minimum pressure limit, warning time of low pressure starts to count. If pressure feedback value is higher than minimum pressure limit during counting time, the warning time will recount and the inverter will display the warning signal of LoPb when the warning time ends.

14-17	Fault Stop Time of Low Pressure
Range	【0.0~600.0】 s

- When the warning signal of low pressure occurs and pressure feedback value is lower than minimum pressure limit, stop time of low pressure starts to count. If pressure feedback value is higher than minimum pressure limit during counting time, the stop time will recount and the inverter will display stop error signal of LPbFt when the stop time ends.

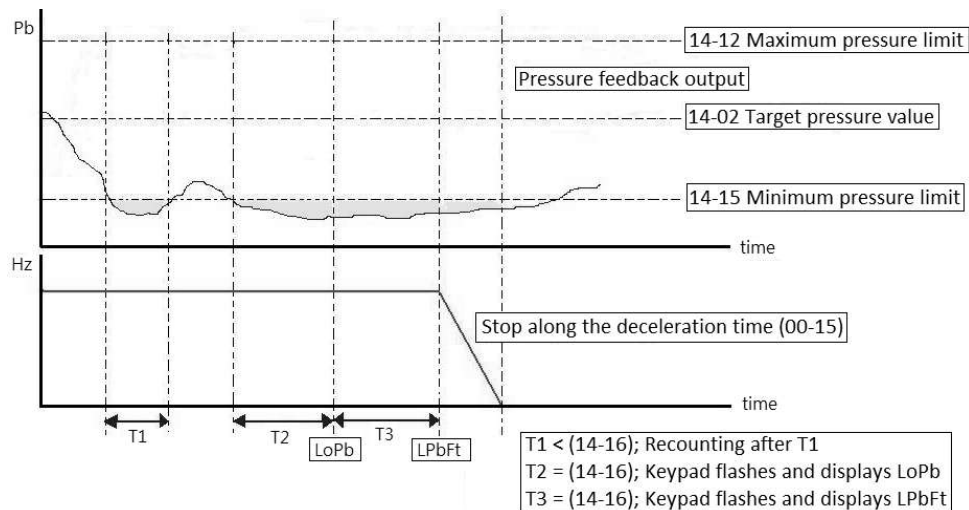


Diagram for warning to stop at low pressure limit

14-18	Time of Loss Pressure Detection
Range	【0.0~600.0】 s
14-19	Proportion of Loss Pressure Detection
Range	【0~100】 %

- When 14-19=0, function of loss pressure detection is disabled. °
- When 14-19 > 0, If the feedback pressure value is lower than the value of $[(14-02) \times (14-19)]$ and the detection time of loss pressure (14-18) passes, the inverter jumps to fault signal (FBLSS).

14-20	Switching of Pressure and Percentage
Range	0: Pressure 1: Percentage

- When 14-20=0, 14-09/14-12/14-15/14-24/14-34/14-38/14-39 is displayed and set via pressure mode.
- When 14-20=1, 14-09/14-24/14-34/14-38/14-39 are proceeding to switch percentage on the basis of parameter 14-02 and parameter 14-12/14-15 are on the basis of parameter 14-03.

For example, 14-02=4.00PSI, 14-03=10.00PSI, 14-09=0.5PSI, 14-12=5.00PSI

When 14-20=0→1,

$[(14-09)/(14-02)] \times 100\% \rightarrow 14-09=13\%$ (Rounded to integer)

$[(14-15)/(14-03)] \times 100\% \rightarrow 14-15=50\%$ (Rounded to integer)

When 14-20=1→0,

$[(14-09)/100] \times (14-02) \rightarrow 14-09=0.52\text{PSI}$

$[(14-15)/100] \times (14-03) \rightarrow 14-15=5.00\text{PSI}$

14-22	Slave Trip Frequency
Range	【 0.00~599.00 】 Hz
14-23	Direction of Water Pressure Detection
Range	0: Upward Detection 1: Downward Detection
14-24	Range of Water Pressure Detection
Range	When 14-20=0, range is 0.00~650.00 When 14-20=1, range is 0~100
14-25	Period of Water Pressure Detection
Range	【 0.0~200.0 】 s
14-26	Acceleration Time of Water Pressure Detection
Range	【 0.1~3600.0 】 s
14-27	Deceleration Time of Water Pressure Detection
Range	【 0.1~3600.0 】 s

- 14-26 and 14-27 are corresponding to 00-16 and 00-17, so the setting of 14-26 changed with the setting of 00-16. Thus, avoid using multi-speed application function while using PUMP function.

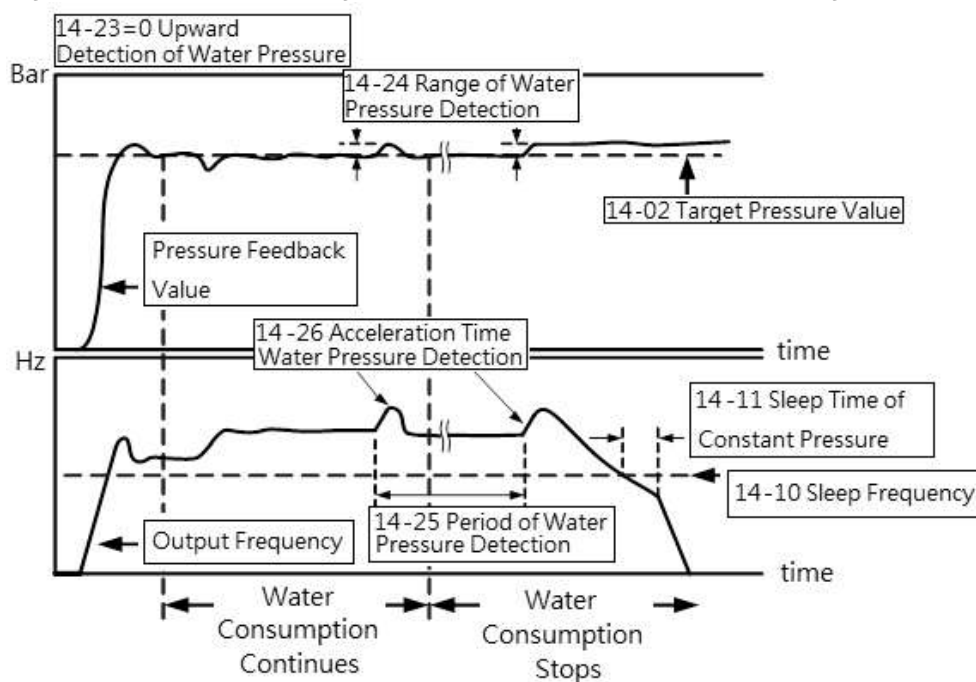


Diagram for upward detection of water pressure

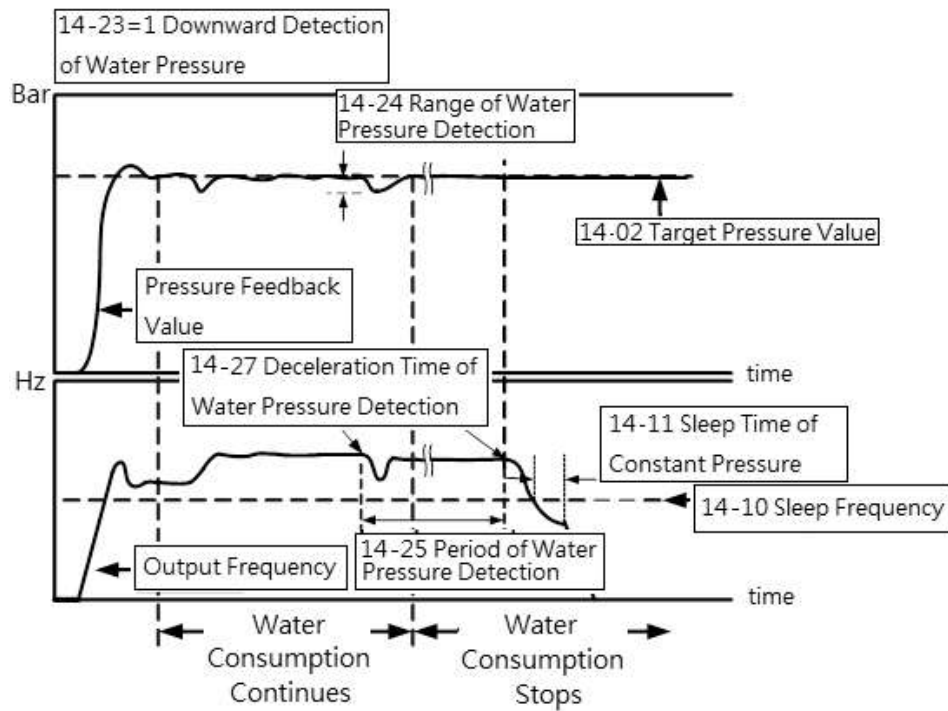


Diagram for download detection of water pressure

- When 14-25=0.0(sec) means to disable the function of water pressure detection.
- When function of water pressure detection is enabled, it can shorten the time of jumping into sleep without water consumption or with mild water consumption. °
- If water consumption frequently continues, it is recommended to extend the cycle of water pressure detection (14-25) so as the detection times can be reduced and the occurrence of fluttering or instability during water pressure detection in constant pressure can be avoided. °
- When upward detection of water pressure starts, water pressure will slightly increase. At this time, it may cause shortly pressure fluttering or instability if water consumption continues. It is recommended to reduce the range of water pressure detection (14-24) but it will extend the time of inverter jumping into sleep without water consumption or with mild water consumption.

	Pros	Cons
Upward detection of water pressure	● Keep the pressure above the target pressure during this process. ● For strict and precise applications	● If “Pump lift” is too high, operation frequency is higher without water consumption or with mild water consumption. So this detection effect is too restricted to jump into sleep. ● Energy-saving of water flow is not obvious and slave is not easy to sleep under the multiple pumps in parallel.
Downward detection of water pressure	● Jump into sleep status without water consumption or with mild water consumption. ● For energy-saving purpose, under the multiple pumps in parallel regulate the pumps to the optimum operation state during this process. ● Startup frequency is by Master, Slave 1, Slave 2, and Slave 3. Sleep frequency is by Slave 1, Slave 2, and Slave 3 and Master. After the switching time is allowable, alternate Master and Slave reach the average of life expectancy.	● Pressure fluctuations may occur during this process if user inappropriately regulates the range of water pressure detection (23-24) and the deceleration time of water pressure detection (23-27).

Guide for comparison of water pressure detection direction

14-28	Forced Run Command
Range	0.00~(the value of 00-12)

- This function is enabled when PID mode (10-03) is selected. Pump will not depend on the feedback to make any PID output adjustment and runs the frequency of 00-05 (Frequency command) when multi-function digital input (S1~S6) is set to 16 (PID control disable). ◦
- And when the other digital input is set to 57(forced frequency run), inverter sets the frequency to run depending on the parameter 14-28 (forced run command). If PID function disable is removed, the inverter is controlled by PID.

14-29	Switching Time of Water Pressure Detection
Range	【0~240】 Hr

- If function of multiple pumps in parallel is enabled, the switching way is Master→Slave1→Slave2→Slave3 → Master → ... and the switching time is set via parameter 14-72.

14-30	Detection Time of Multiple Pumps in Parallel Running Start
Range	【0~30】 s

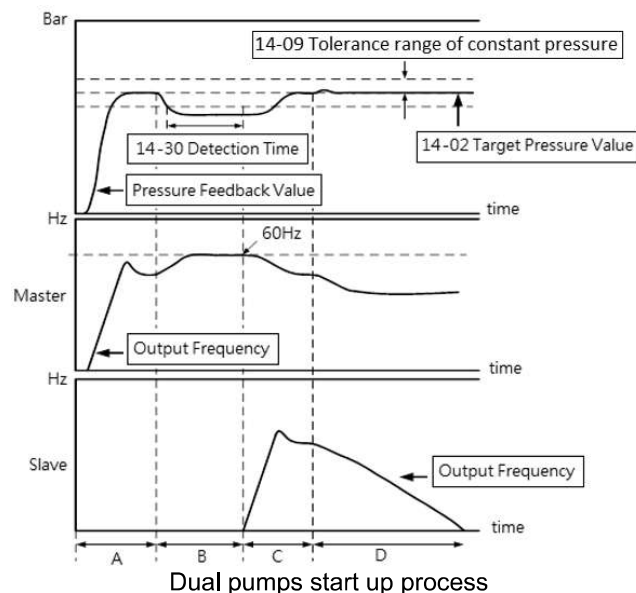
- When parameter 14-31 is set to 1 or 3, detection time of multiple pumps in parallel running start is enabled. If water pressure can not reach the error range of constant pressure and water flow time is over the detection time (14-30), Master will inform Slave of running start.

14-31	Synchronous Selection of Multiple Pumps in Parallel
Range	0: Disable 1: Pressure Setting Run/Stop 2: Pressure Setting 3: Run/Stop

- When 14-31=0: Disabled
- When 14-31=1: Set 14-01 to 1, Pressure setting and Run/ Stop command are modified by master and Slave follows Master's command. Run/Stop command from Slave can be regarded as the emergency stop command with the highest priority.
- When 14-31=2: Pressure setting is modified by Master and Slave follows Master's command to update synchronously.
- When 14-31=3: Run/ Stop command is set by Master and Slave follows Master's command. Run/Stop command from Slave can be regarded as the emergency stop command with the highest priority.

Note:

1. When Master modifies the pressure setting, it requires pressing ENTER key to modify the pressure setting of Slave.
2. When the switching time of multiple pumps in parallel (14-29) changes and reconnection, it will recount the time.



- A. Dual pumps are enabled during this time. Master starts up first and Slave is in standby to enter constant-pressure operation.
- B. Large water consumption results in the higher operation frequency of Master. If water pressure is not lower than the tolerance range of constant-pressure and the operation time is not over the detection time (14-30), Slave is still in standby.
- C. If it is over the detection time (14-30), and Master runs at 60Hz, Master informs Slave of auxiliary kicking water. After Slave operates, the operation frequency of Master and Slave reduces to the operation of constant-pressure if water consumption is stable.
- D. If water consumption is mild, the operation frequency of Master and Slave reduces. Because the water consumption is less than that of the operation of dual pumps, Slave stops to sleep (please refer to parameter 14-22 for dual pump slave sleep requirements) and only Master runs to reach constant-pressure operation.

Note :

- When 14-35=3, If the operation time is over the switching time (14-29) or sleep to stop under the operation of dual pumps, the dominance between Master and Slave will exchange to operate.
- When 14-01≠0, the parameter 14-01 of these two inverters can not be simultaneously set to 1 or 2. That is, the parameter 14-01 of one inverter is set to 1 and that of the other inverter should be set to 2 and vice versa.

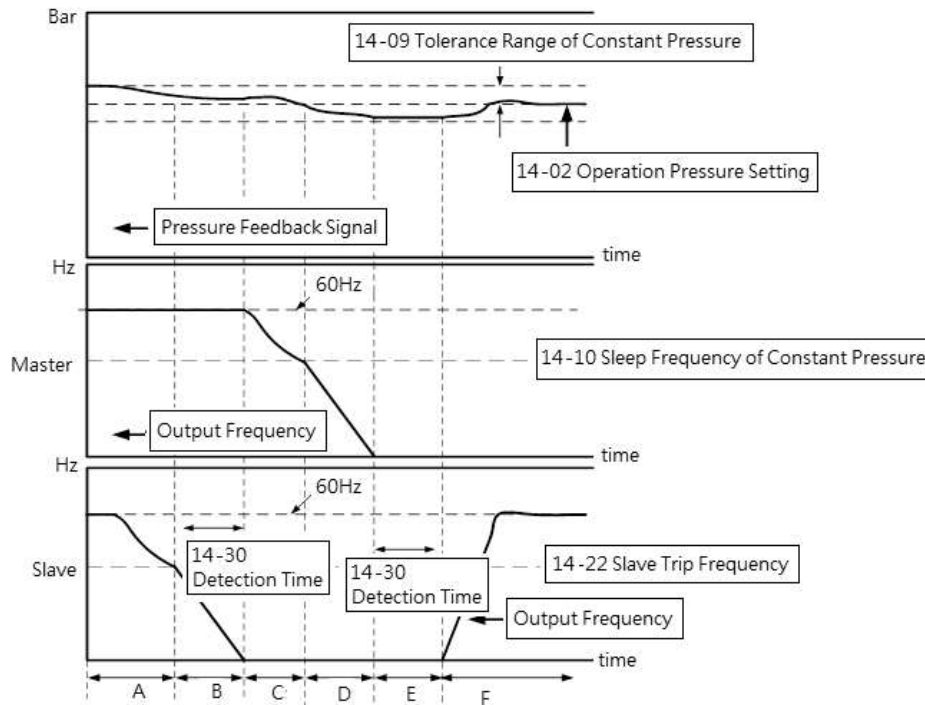


Diagram of sleep stop alternative selection action

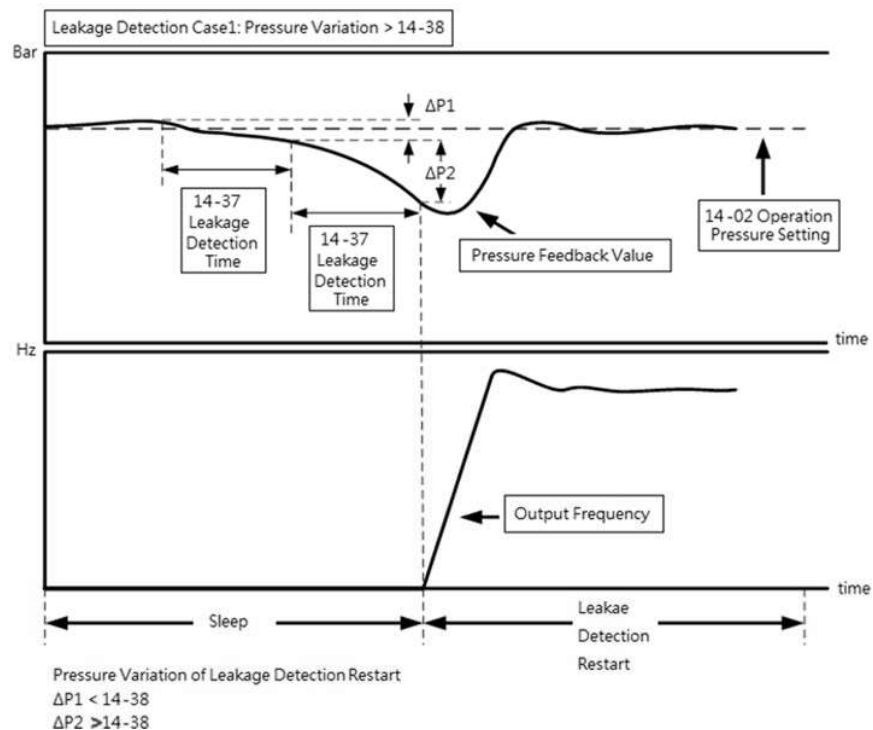
- A. Dual pumps are enabled during this time. Higher operation pressure occurs, Master keeps operation and Slave output frequency decreases.
- B. Master operation frequency maintains 60Hz. If water pressure doesn't decrease to the target constant pressure and Slave continuously decreases to the set trip frequency (14-22), Slave detection time (14-30) starts and Slave decelerates to stop.
- C. If milder water consumption and higher water pressure occur and Slave operation command is in sleep status, Master output frequency decreases to let the water pressure be in constant status when the detection time (14-30) is over.
- D. When Master operation frequency decreases to the sleep frequency of constant pressure (23-10), Master will decrease to stop, water consumption is continuously mild and water pressure will reduce slowly. °
- E. When water consumption stops, Master jumps into sleep and the pressure remains the same, and Slave's detection time (14-30) starts.
- F. When the detection time (14-30) is over, shift operation stops and virtual Master starts to become Slave. The inverter operates in constant pressure under the target pressure value.

14-34	Tolerance Range of Constant Pressure 2
Range	When 14-20=0, range is 0.00~650.00 When 14-20=1, range is 0~100
14-35	Selection of Multiple Pumps Shift Operation
Range	0: No Function 1: Timer Alternately Selection 2: Sleep Stop Alternately Selection 3: Timer and Sleep Stop Alternately Selection 4: Multiple Pumps Test Mode

- 14-35=1, if the operation time is over the switching time (14-29) or sleep to stop under the operation of dual pumps, the dominance between Master and Slave will exchange to operate.
- 14-35=2, when the Master and Slave of multiple pumps in parallel are both in sleep mode, and after the detecting time (14-30), the Master and Slave of multiple pumps in parallel will be exchange. Every time the multiple pumps start, the exchange will be processed. Please refer to the diagram of sleep stop alternative selection action.
- 14-35=3, timer and sleep stop alternately selected will be enabled at the same time.
- 14-35=4, when master stop running and the slave need to run, no exchange between Master and Slave.

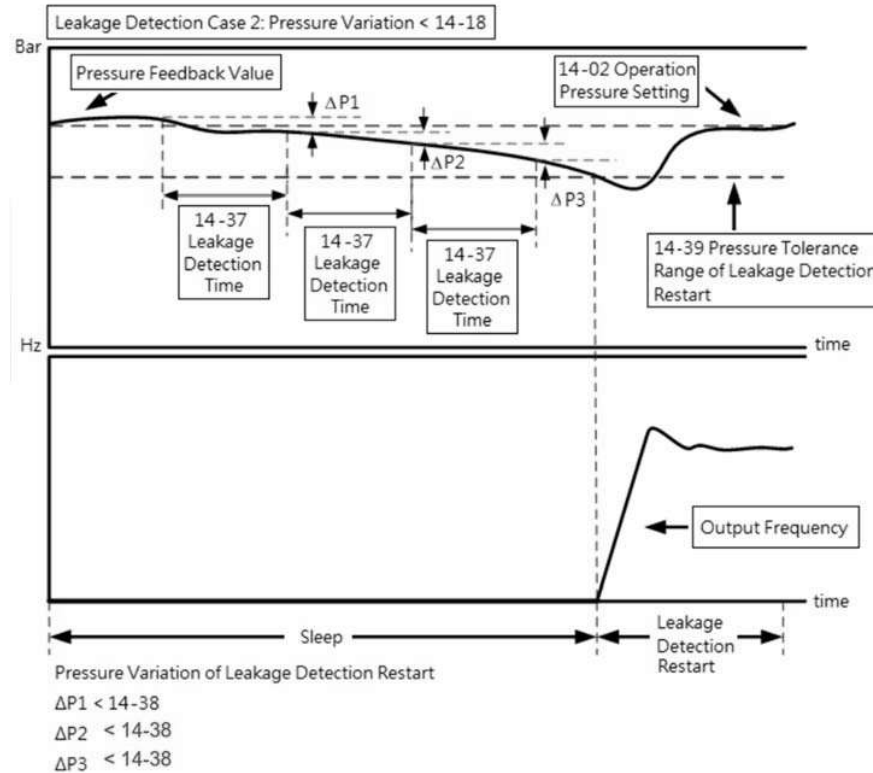
14-37	Leakage Detection Time
Range	【0.0~100.0】s
14-38	Pressure Variation of Leakage Detection Restart
Range	When 14-20=0, range is 0.00~65.00 When 14-20=1, range is 0~100
14-39	Pressure Tolerance Range of Leakage Detection Restart
Range	When 14-20=0, range is 0.00~650.00 When 14-20=1, range is 0~100

Leakage detection case 1: Pressure tolerance higher than 14-38



- To limit single inverter to use leakage detection.
- When 14-37 = 0.0 (sec), switch off this function.
- When pump is at shutdown state, pressure will drop over time if pipeline leaks. Pump will restart if pressure variation is larger than the value of parameter 14-38 in every detection time (14-37).

Leakage detection case 2: Pressure tolerance lower than 14-38



- When 14-37=0.0 (sec), switch off this function.
- When pump is at shutdown state, pressure will drop over time if pipeline leaks. Inverter will keep sleep state if pressure variation is lower than the value of parameter 14-38 in every detection time (14-37) and pump will restart if pressure variation is larger than that of 14-38 or pressure tolerance range is over the value of parameter 14-39 in the detection time. °
- Properly adjust the relevant leakage detection parameters 14-37, 14-38 and 14-39 to improve the condition of frequently pump start and stop caused from the dropping pressure of water system due to leakage.
- Function of leakage detection is enabled only in the setting of single pump.

14-71	Maximum Pressure Setting
Range	【0.1~650.0】PSI
14-72	Switching Time of Alternation in Parallel
Range	0: Hour 1: Minute

- When 14-72=0, parameter 14-29 will be in the unit of hour.
- When 14-72=1, parameter 14-29 will be in the unit of minute.

14-73	Slave Wake-Up Selection
Range	0: Disable 1: Enable

- When multiple pumps are in parallel and the requirements of slave wake-up can not be achieved in tolerance range, user can set parameter 14-73=1 and refer to the following conditions to wake up Slave.
- Master is in full speed operation (01-02 maximum output frequency) but pressure feedback value can not achieve the target pressure value.
- Slave is forced to start after 30secs+the value of 14-30, even if the requirement of sleep to wake-up is not achieved and the pressure feedback value is under the tolerance range of constant pressure) and keeps operation to achieve the target pressure value.
- It is required to follow the formula (the set method 1) and refer to the following diagram to set the wake-up requirements.

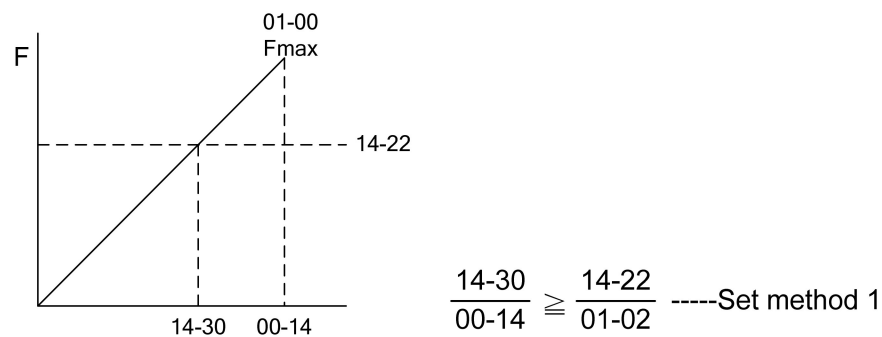


Diagram of requirements for waking up slave

14-74	Proportion Time 2 (P)
Range	0.00~10.00
14-75	Integral Time 2 (I)
Range	0.0~100.0
14-76	Differential Time 2 (D)
Range	0.00~10.00
14-77	The Value of Water Pressure Detection
Range	0~100

14-78	Maximum Current Limit
Range	0.1~6553.5
14-79	Minimum Current Limit
Range	0.1~6553.5
14-80	Current limit cumulative time
Range	0~600.0

- When 14-80=0, the current limit function is disable.
- When 14-80>0 and the output frequency is always equal to the rated frequency, if the output current is between 14-78 and 14-79, and the cumulated time exceeds 14-80, the inverter will trip the LOCu fault and stop output.
- The function of these parameters is to prevent the motor from burning when it is detected that the water pump cannot pump water.

5. Check motor rotation and direction

This test is to be performed solely from the inverter keypad. Apply power to the inverter after all the electrical connections have been made and protective covers have been re-attached. At this point, **DO NOT RUN THE MOTOR**, the keypad should display as shown below in Fig. 5.1 and the speed reference **5.00Hz** should be blinking at the parameter code “05-01”.

Important: Motor rotation and direction only applies to standard AC motors with a base frequency of 60Hz. For 50Hz or other frequency AC motors please set V/F pattern in group 01 before running the motor.



Fig 5.1: Keypad (Stopped)



Fig 5.2: Keypad (Running)

Next press the **RUN** key, see Fig 5.2. The motor should now be operating at low speed running in forward (clockwise) direction. Next press **STOP** key to stop the motor.

If the motor rotation is incorrect, power down the inverter.

After the power has been turned OFF, wait at least ten minutes until the charge indicator extinguishes completely before touching any wiring, circuit boards or components.

Using Safety precaution, and referring to section 3.9 exchange any two of the three output leads to the motor (U/T1, V/T2 and W/T3). After the wiring change, repeat this step and recheck motor direction.

6. Speed Reference Command Configuration

The inverter offers users several choices to set the speed reference source. The most commonly used methods are described in the next sections.

Frequency reference command is selected with parameter 00-05.

00-05: Main Frequency Source Selection (Frequency Source)

This function sets the frequency command source.

Setting Range: 0 to 6

To set parameter 00-05:

- After power-up press the **MODE** key
- Select 00-05 using the arrow keys and up/down keys
- Press **</ENTER** key
- Set parameter 00-05 using the arrow keys and **</ENTER** key to save setting.

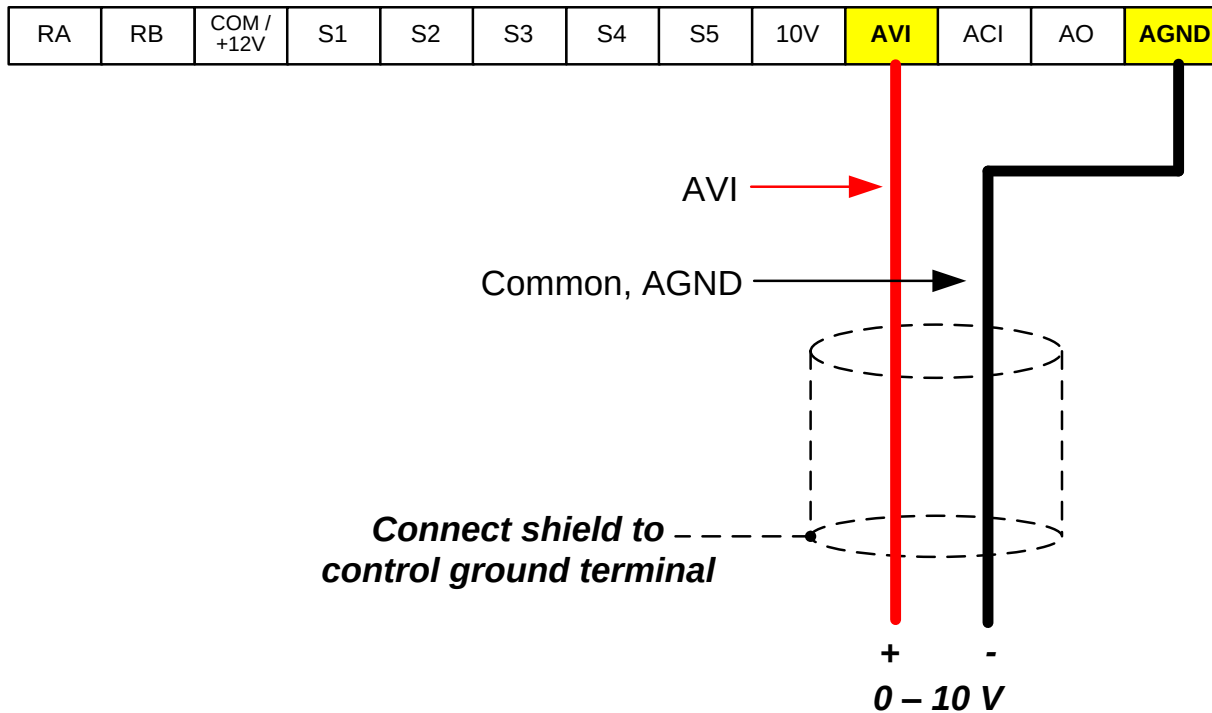
00-05	Main Frequency Command Source Selection
Range	0: Keypad 1: Potentiometer on Keypad 2: External AVI Analog Signal Input 3: External ACI Analog Signal Input 4: External Up/Down Freq. Control 5: Communication Setting Freq. 6: PID Output Freq.

6.1 Reference from Keypad

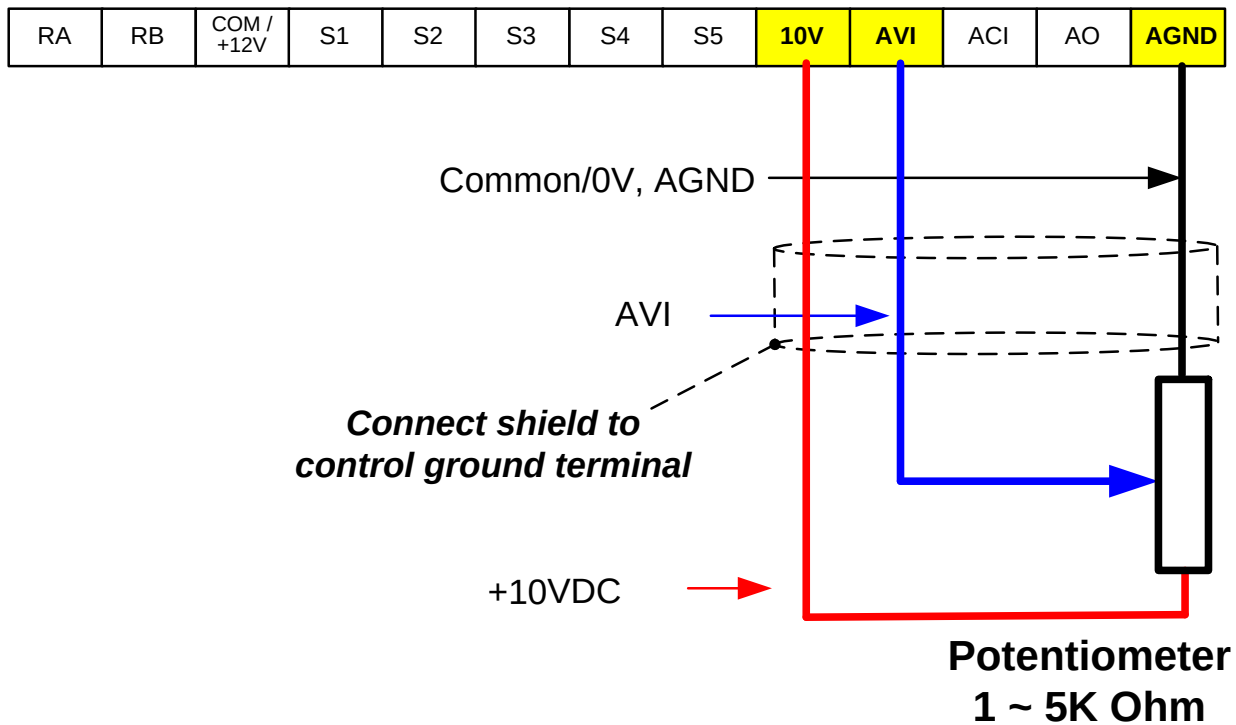
Speed reference from the keypad is the default setting. Press ▲ and ▼ keys to change the speed reference.

6.2 Reference from External Analog Signal (0-10V / 4-20mA)

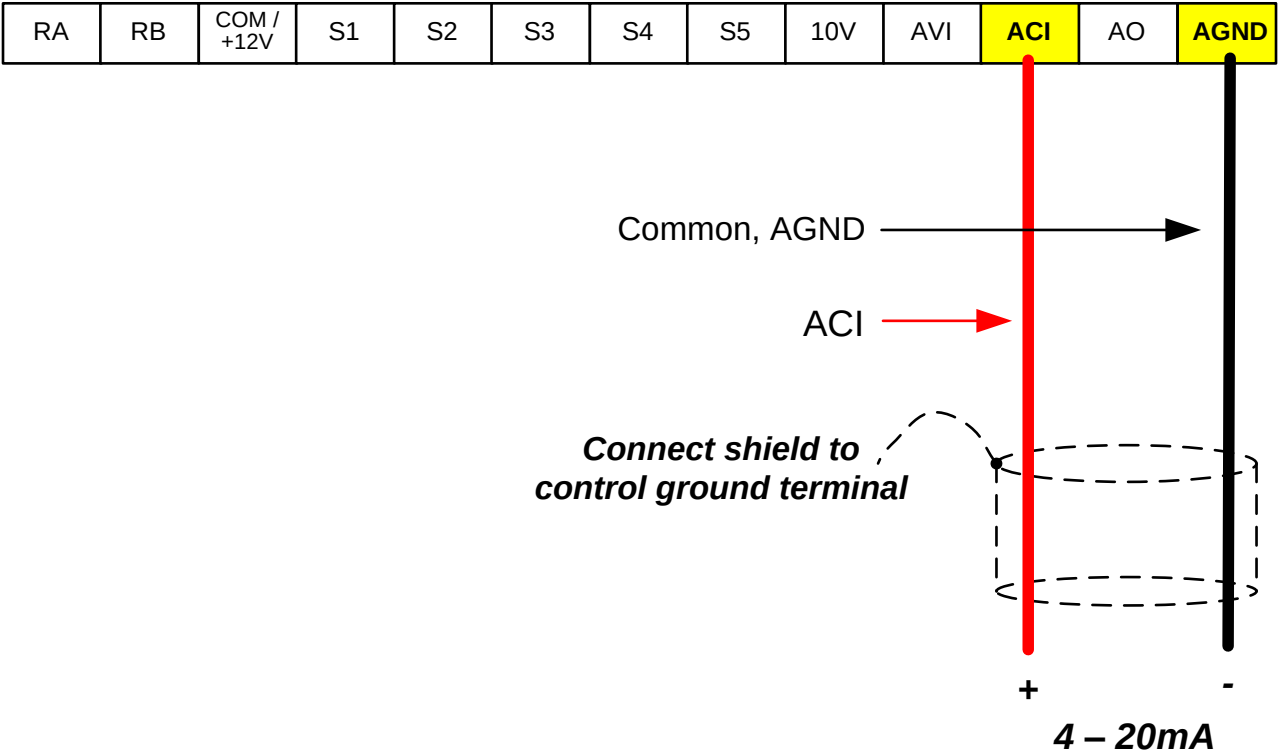
Analog Reference: 0 – 10 V (Setting 00-05 = 2)



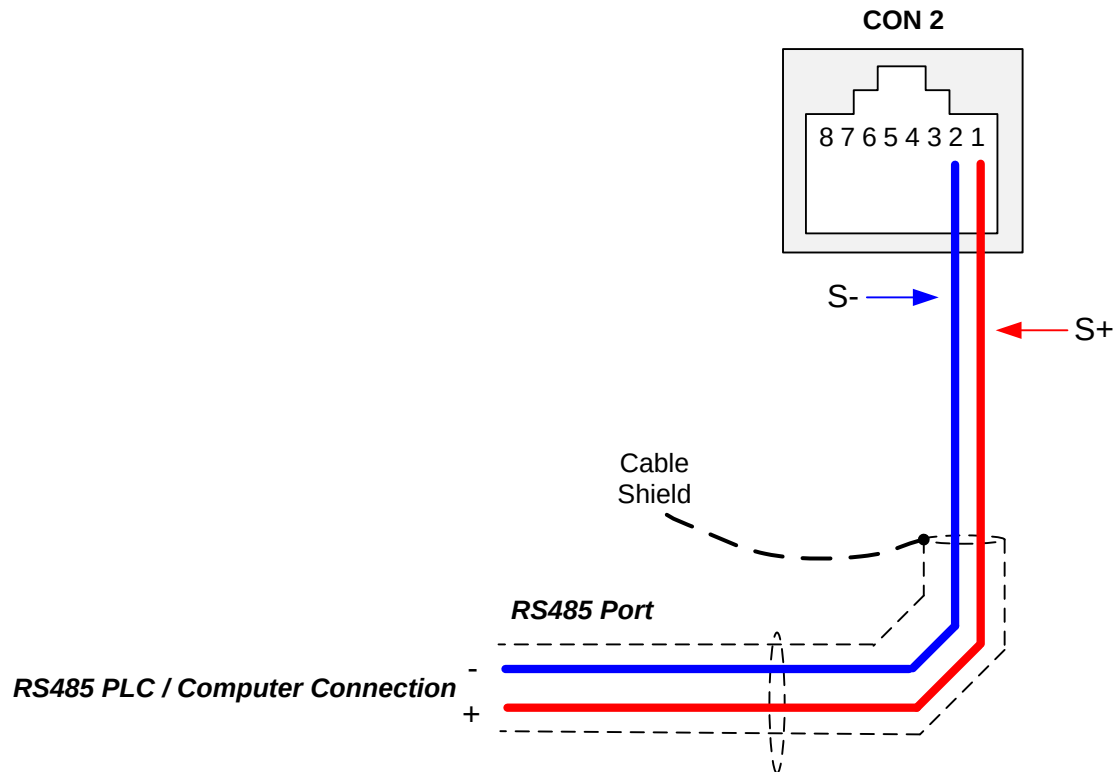
Analog Reference: Potentiometer / Speed Pot (Setting 00-05 = 2)



Analog Reference: 4 – 20mA (Setting 00-05 = 3)



6.3 Reference from Serial Communication RS485 (00-05=5)



To set the speed reference for the inverter via serial communication parameter 00-05 has be set to “5” for frequency command via serial communication.

Default Communication Setting is: Address “1”, 9600 Bits/sec, 1 Start Bit, 1 Stop Bit, and No Parity

The serial communication link function uses RS485 Modbus RTU protocol and allows for:

- 1) Monitoring (data monitoring, function data check).
- 2) Frequency setting.
- 3) Operation command (FWD, REV, and other commands for digital input).
- 4) Write function data.

Frequency Reference Command Register

Inverter Frequency Reference Register: 2502 (Hexadecimal) - Bit 0 – Bit 15: 0.00 ~ 650.00 Hz

Examples:

Frequency Reference Command: 10.00 Hz (Inverter Node Address: 01)

Command String (hexadecimal): 01 06 25 02 03 E8 23 B8

To set the frequency reference to 10.00, a value of '1000' (03E8h) has to be send to the inverter.

Frequency Reference Command: 30.00 Hz (Inverter Node Address: 01)

Command String (hexadecimal): 01 06 25 02 0B B8 24 44

To set the frequency reference to 30.00, a value of '3000' (0BB8h) has to be send to the inverter.

Frequency Reference Command: 60.00 Hz (Inverter Node Address: 01)

Command String (hexadecimal): 01 06 25 02 17 70 2D 12

To set the frequency reference to 60.00, a value of '6000' (1770h) has to be send to the inverter

Note: The last 2 bytes of the command strings consist of a CRC16 checksum.

6.4 Change Output Frequency Unit from Hz to rpm

Enter motor base rpm into parameter 12-03 to change the display units from Hz to rpm.

12-03	Custom Units (Line Speed) Value
Range	0 - 65535

7. Operation Method Configuration (Run / Stop)

The inverter offers users several choices to run and stop from different sources. The most commonly used methods are described in the next sections.

Operation command is selected with parameter 00-02.

00-02: Run Command Selection

This function sets the frequency command source.

Setting Range: 0 to 2

To set parameter 00-02:

- After power-up press the **MODE** key
- Select 00-02 using the arrow keys and up/down keys
- Press **</ENTER** key
- Set parameter 00-02 using the arrow keys and **</ENTER** key to save setting.

In the parameter list move cursor to 00-01 with the **UP/DOWN** keys and press **READ/ ENTER** key to select.

00-02	Run Command Selection
Range	0: Keypad control 1: External terminal control 2: Communication control

7.1 Run/Stop from the Keypad (00-02=0) – Default Setting

Use the **RUN** key to run the drive in forward direction.

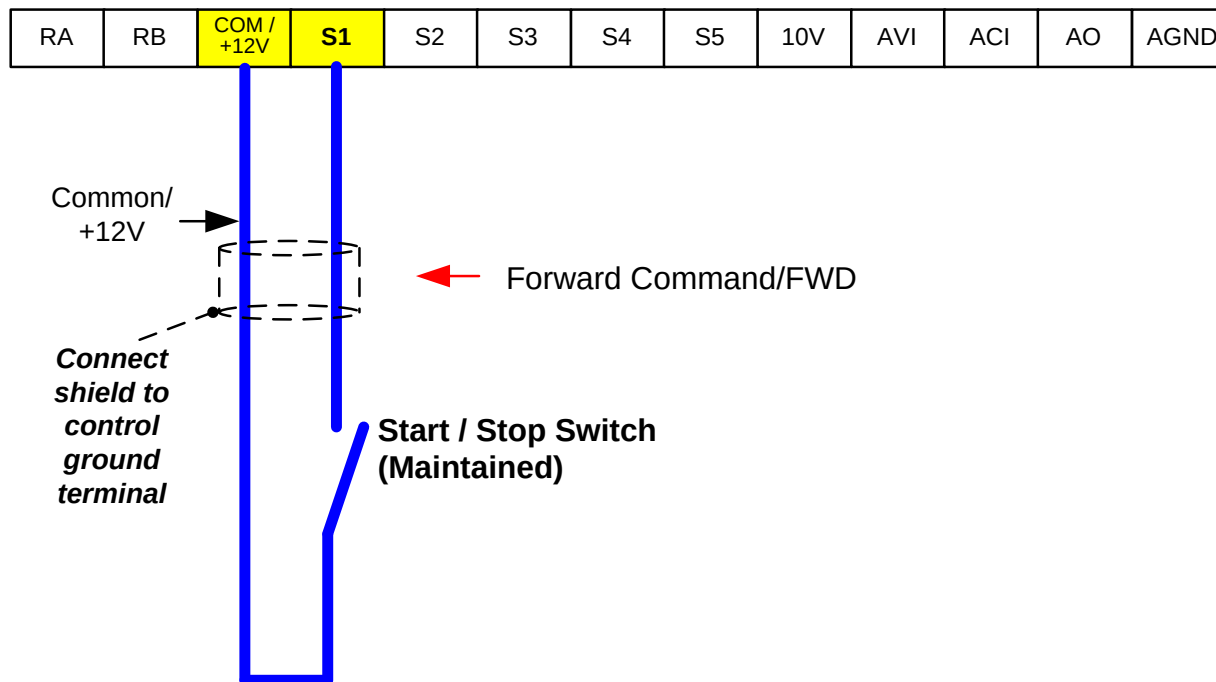
Press **STOP** key to stop the inverter. (Note: Stop method can be set with parameter 07-09, default is **deceleration to stop**).



7.2 Run/Stop from External Switch / Contact or Pushbutton (00-02=1)

Use an external contact or switch to Run and Stop the inverter.

Permanent Switch / Contact



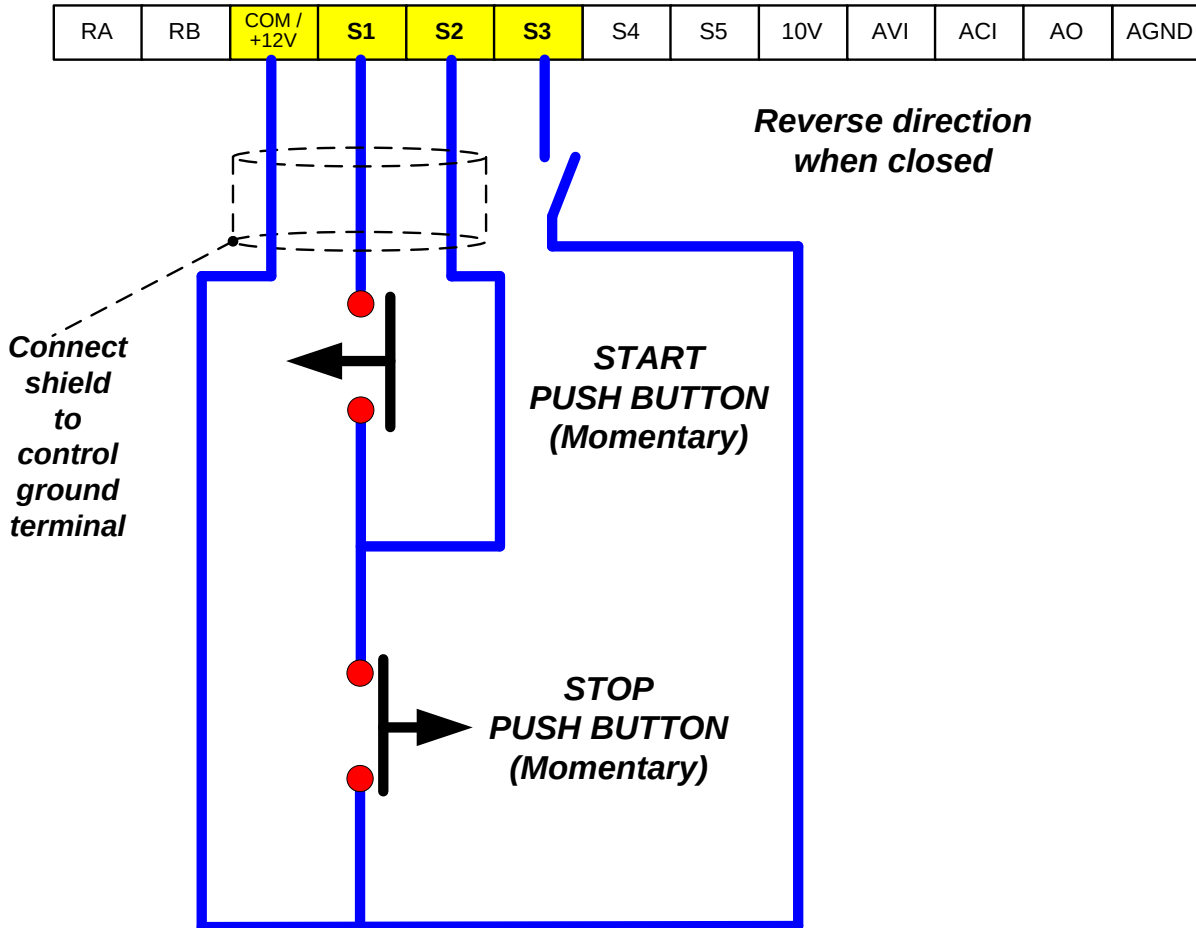
Momentary Contacts (Push Buttons)

Use push button / momentary switch to Run and Stop the inverter.

Set parameter 00-04 to 2 for 3-wire program initialization, multi-function input terminal S1 is set to run operation, S2 for stop operation and S3 for forward/reverse command.

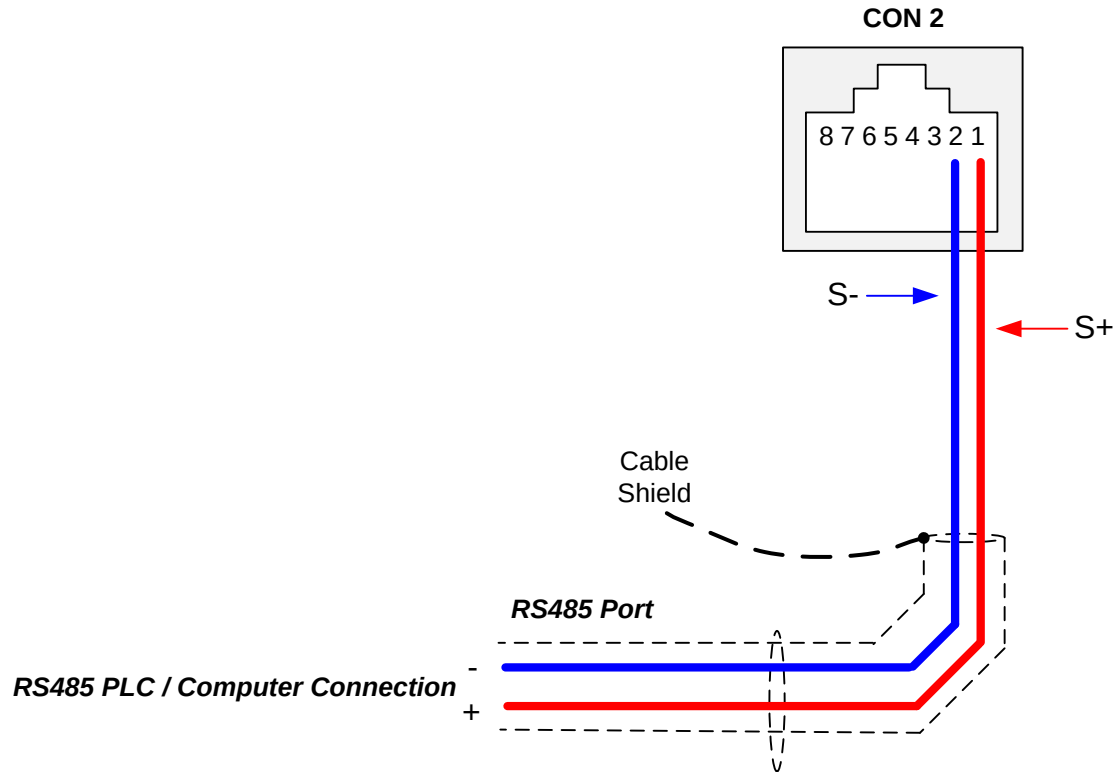
00-01 Operation Method = 1

00-04 Operation modes for external terminals = 2



Note: Stop mode selection can be set with parameter 07-09, default is **deceleration to stop**.

7.3 Run/Stop from Serial Communication RS485 (00-02=3)



To control (Run/Stop) the inverter via serial communication parameter 00-02 has be set to either a “3” for communication control.

Default Communication Setting is: Address “1”, 9600 Bits/sec, 1 Start Bit, 1 Stop Bit, and No Parity

The serial communication link function uses RS485 Modbus RTU protocol and allows for:

- 1) Monitoring (data monitoring, function data check).
- 2) Frequency setting.
- 3) Operation command (FWD, REV, and other commands for digital input).
- 4) Write function data.

Command Register

Inverter Command Register: 2501 (Hexadecimal)

Bit 0: Run Forward

Bit 1: Run Reverse

Bit 2 ~ Bit 15: Refer to the chapter XX of this manual

Examples:

Run Forward Command (Inverter Node Address: 01)

Command String (hexadecimal): 01 06 25 01 00 01 12 C6

Run Reverse Command (Inverter Node Address: 01)

Command String (hexadecimal): 01 06 25 01 00 03 93 07

Stop Command (Inverter Node Address: 01)

Command String (hexadecimal): 01 06 25 01 00 00 D3 06

Note: The last 2 bytes of the command strings consist of a CRC16 checksum.

8. Motor and Application Specific Settings

It is essential that before running the motor, the motor nameplate data matches the motor data in the inverter.

8.1 Set Motor Nameplate Data (02-01)

02-01 Motor Rated Current (OL1)

The motor rated current is set at the factory based on the inverter model. Enter the motor rated current from the motor nameplate if it does not match the value shown in parameter 02-01.

Setting range: Varies by model.

To set parameter 02-01:

- After power-up press the **MODE** key
- Select 02-01 using the arrow keys and up/down keys
- Press **</ENTER** key
- Set parameter 02-01 using the arrow keys and **</ENTER** key to save setting.

8.2 Acceleration and Deceleration Time (00-14, 00-15)

Acceleration and Deceleration times directly control the system dynamic response. In general, the longer the acceleration and deceleration time, the slower the system response, and the shorter time, the faster the response. An excessive amount of time can result in sluggish system performance while too short of a time may result in system instability.

The default values suggested normally result in good system performance for the majority of general purpose applications. If the values need to be adjusted, caution should be exercised, and the changes should be in small increments to avoid system instability.

00-14 Acceleration time 1

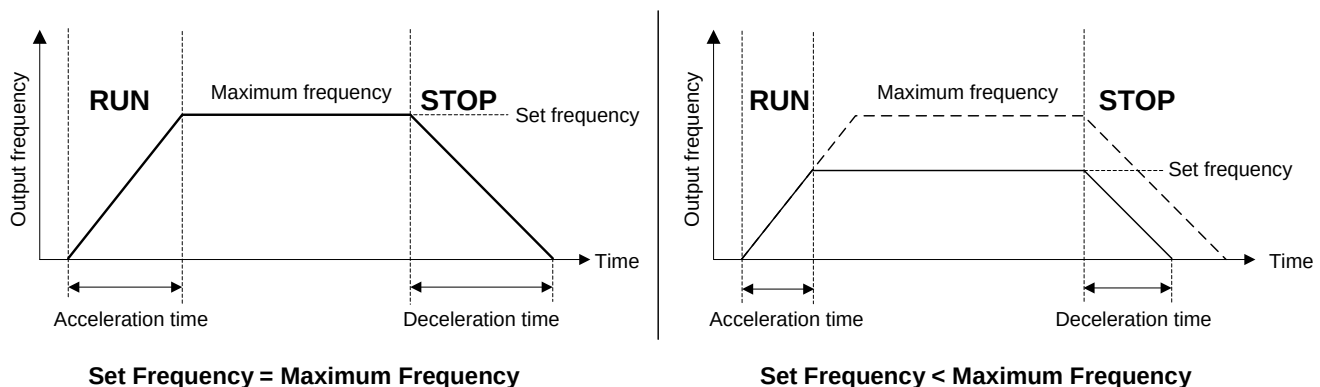
00-15 Deceleration time 1

These parameters set the acceleration and deceleration times of the output frequency from 0 to maximum frequency and from maximum frequency to 0.

To set parameter 00-14 / 00-15 :

- After power-up press the **MODE** key
- Select 00-14 or 00-15 using the arrow keys and up/down keys
- Press **</ENTER** key
- Set parameter 00-14 or 00-15 using the arrow keys and **</ENTER** key to save setting.

Acceleration and deceleration times are represented by the three most significant (high order) digits. Set acceleration and deceleration times with respect to maximum frequency. The relationship between the set frequency value and acceleration/deceleration times is as follows:



Note: If the set acceleration and deceleration times are set too low, the torque limiting function or stall prevention function can become activated if the load torque and or inertia are relatively high. This will prolong the acceleration and or deceleration times and not allow the set times to be followed. In this case the acceleration and or the deceleration times should be adjusted.

8.3 Volts/Hz Curve Modification (Torque Boost) (01-10)

This parameter sets the relationship between output frequency and output voltage. Constant torque applications have the same torque requirements at low speed as well as at high speed.

Initial Setup

For Variable Torque / Normal Duty applications set parameter 01-10 to an initial value of 0.5.

For Constant Torque / Heavy Duty applications set parameter 01-10 to an initial value of 1.0.

01-10 Torque compensation gain

This parameter sets the torque boost for motor 1.

Setting range: 0.0 to 10.0

To set parameter 01-10:

- After power-up press the **MODE** key
- Select 01-10 using the arrow keys and up/down keys
- Press **</ENTER** key
- Set parameter 01-10 using the arrow keys and **</ENTER** key to save setting.

Increase value when:

- The wiring between the inverter and the motor very too long
- The motor size is smaller than the inverter size

Note: Gradually increase the torque compensation value and make sure the output current does not exceed inverter rated current.

Reduce value when:

- Experiencing motor vibration
- Over Current Fault
- Overload Fault

Important: Confirm that the output current at low speed does not exceed the rated output current of the inverter.



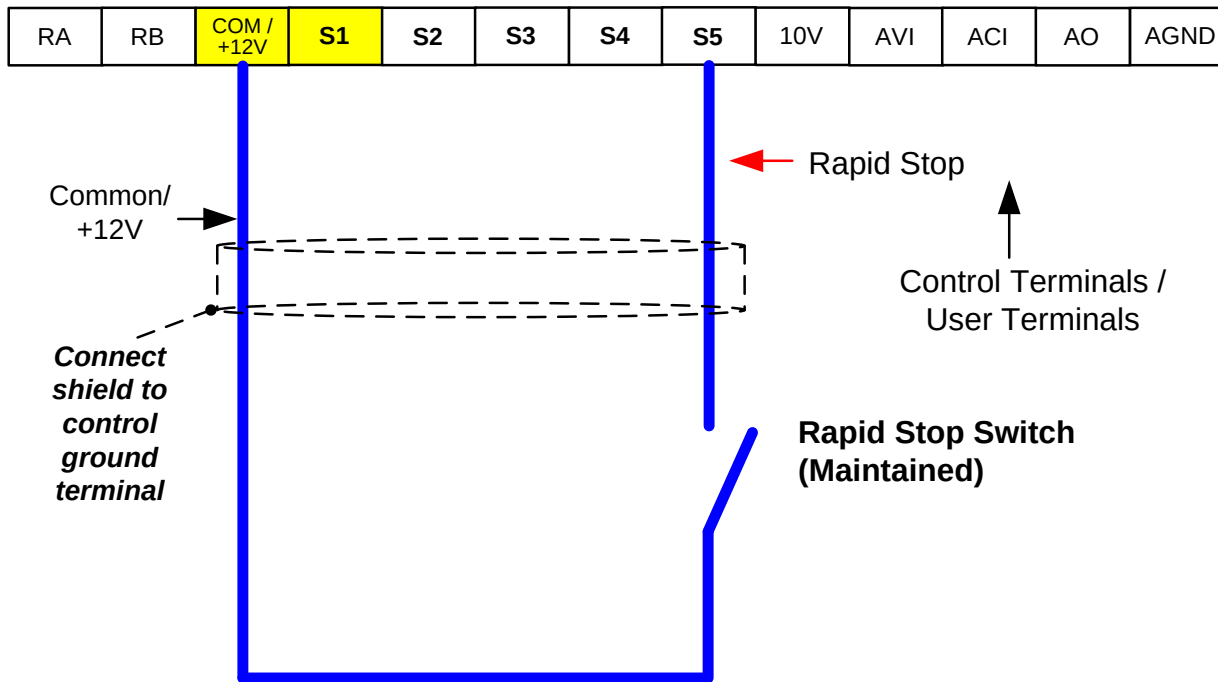
Warning: A larger than required torque boost value creates over-excitation at low speeds, continued operation may cause the motor to overheat. Check the characteristics of the motor for additional information.

8.4 Rapid Stop / Decel to Stop

To use the rapid stop function set any of the multi-function digital input function to #14 (Rapid stop). When rapid stop input is activated the inverter will decelerate to a stop and display the [ES] condition on the keypad.

Note: To cancel the emergency stop condition the run command has to be removed and emergency stop input deactivated.

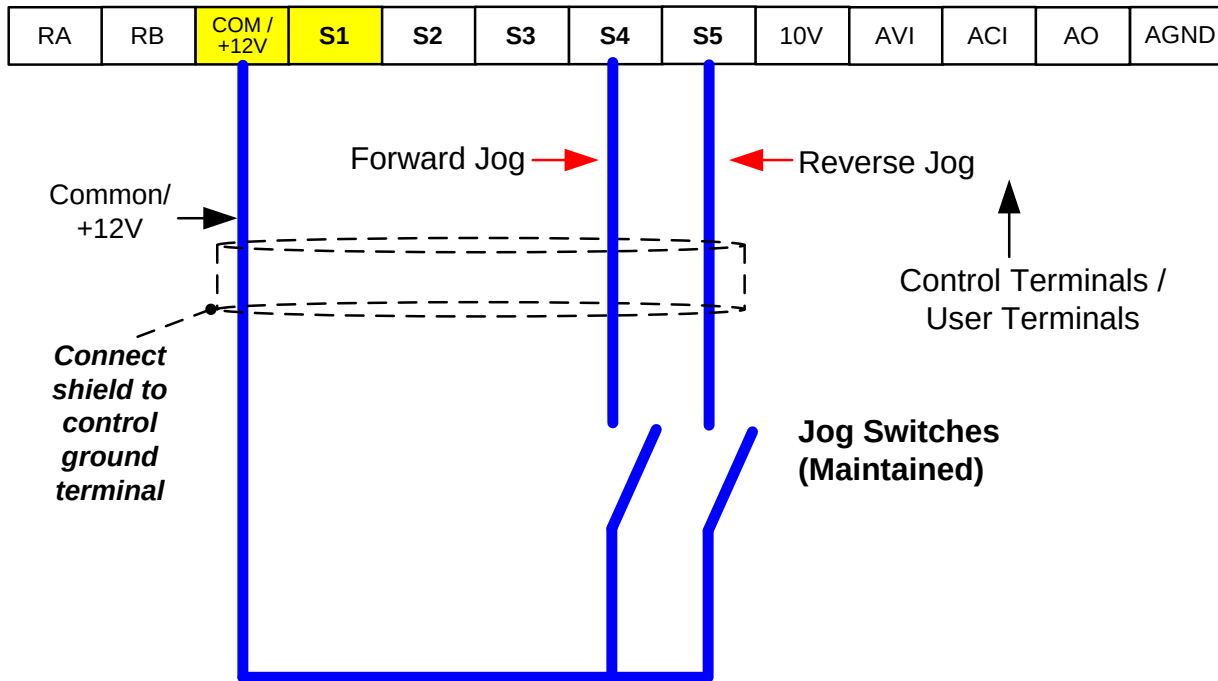
Example: Rapid Stop Switch set for input terminal S5 (03-04 = 14).



8.5 Forward and Reverse Jog

The jog forward command is used in combination with multi-function digital input function #6 (Jog Forward) and the jog reverse command is used in combination with multi-function digital input function #7 (Jog Reverse).

Example: Jog Forward input terminal S4 (03-03 = 06) and Jog Reverse input terminal S5 (03-04=7)



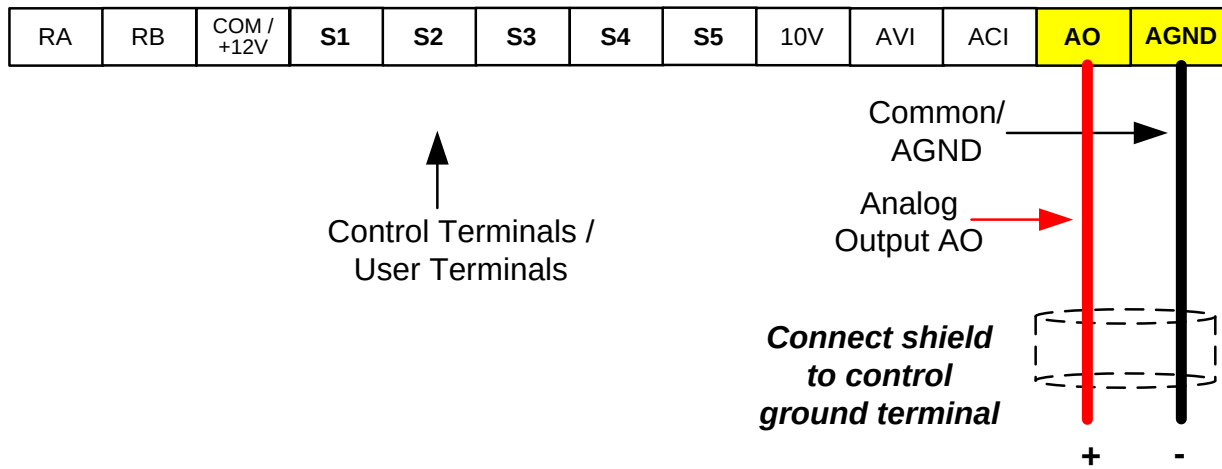
8.6 Analog Output Setup

Signal: Use parameter 04-11 to select the analog output signal for AO.

Gain: Use parameter 04-12 to adjust the gain for AO. Adjust the gain so that the analog output (10V) matches 100% of the selected analog output signal (04-11 for AO).

Bias: Use parameter 04-13 to adjust the bias for AO. Adjust the bias so that the analog output (0V) matches 0% of the selected analog output signal (04-11 for AO).

Example: Analog Output AO Wiring



04-11	AO function Setting
Range	0: Output frequency 1: Frequency command 2: Output voltage 3: DC voltage 4: Motor current

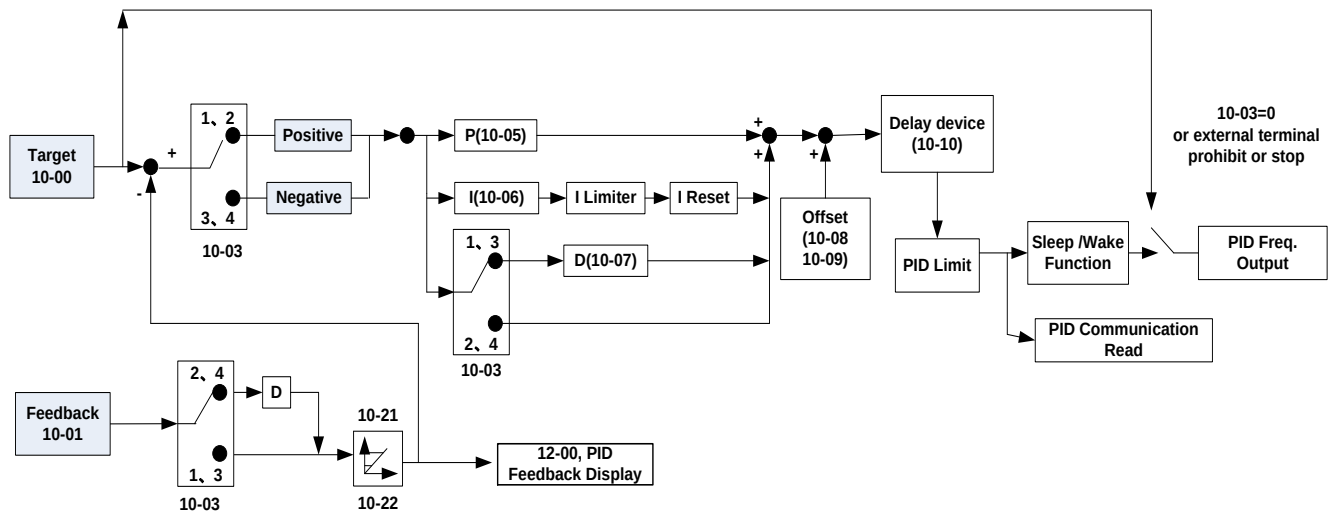
04-12	AO Gain
Range	【0 ~ 1000】 %
04-13	AO Bias
Range	【0 ~ 100】 %
04-14	AO Bias Selection
Range	【0】 : Positive 【1】 : Negative
04-15	AO Slope
Range	【0】 : Positive 【1】 : Negative

9. Using PID Control for Constant Flow / Pressure Applications

9.1 What is PID Control?

The PID function in the inverter can be used to maintain a constant process variable such as pressure, flow, temperature by regulating the output frequency (motor speed). A feedback device (transducer) signal is used to compare the actual process variable to a specified setpoint. The difference between the set-point and feedback signal is called the error signal.

The PID control tries to minimize this error to maintain a constant process variable by regulating the output frequency (motor speed).



The amplitude of the error can be adjusted with the Proportional Gain parameter 10-05 and is directly related to the output of the PID controller, so the larger gain the larger the output correction.

Example 1:

Gain = 1.0

Set-Point = 80%

Feedback = 78%

Error = Set-point - Feedback = 2%

Control Error = Gain x Error = 2%

Example 2:

Gain = 2.0

Set-Point = 80%

Feedback = 78%

Error = Set-point - Feedback = 2%

Control Error = Gain x Error = 4%

Please note that an excessive gain can make the system unstable and oscillation may occur.

The response time of the system can be adjusted with the Integral Gain set by parameter 10-06. Increasing the Integral Time will make the system less responsive and decreasing the Integral Gain Time will increase response but may result in instability of the total system.

Slowing the system down too much may be unsatisfactory for the process. The end result is that these two parameters in conjunction with the acceleration (00-14) and deceleration (00-15) times are adjusted to achieve optimum performance for a particular application.

For typical fan and pump applications a Proportional Gain (10-05) of 2.0 and an Integral Time (10-06) of 5.0 sec. is recommended.

10-03 PID control mode

PID control can be enabled by setting parameter 00-05 to 6 and parameter 10-03 to a value greater than 0.

10-03	PID control mode
Range	0: Disabled 1: Deviation D Control. FWD Characteristic 2: Feedback D Control. FWD Characteristic 3: Deviation D Control. Reverse Characteristic 4: Feedback D Control. Reverse Characteristic

Commonly used PID control modes

1: Forward operation: PID operation enabled, motor speeds increases when feedback signal is smaller than set-point (most fan and pump applications)

3: Reverse operation: PID operation enabled, motor slows down when feedback signal is smaller than set-point (e.g. level control applications)

To set parameter 10-03:

- After power-up press the **MODE** key
- Select 10-03 using the arrow keys and up/down keys
- Press **</ENTER** key
- Set parameter 10-03 using the arrow keys and **</ENTER** key to save setting.

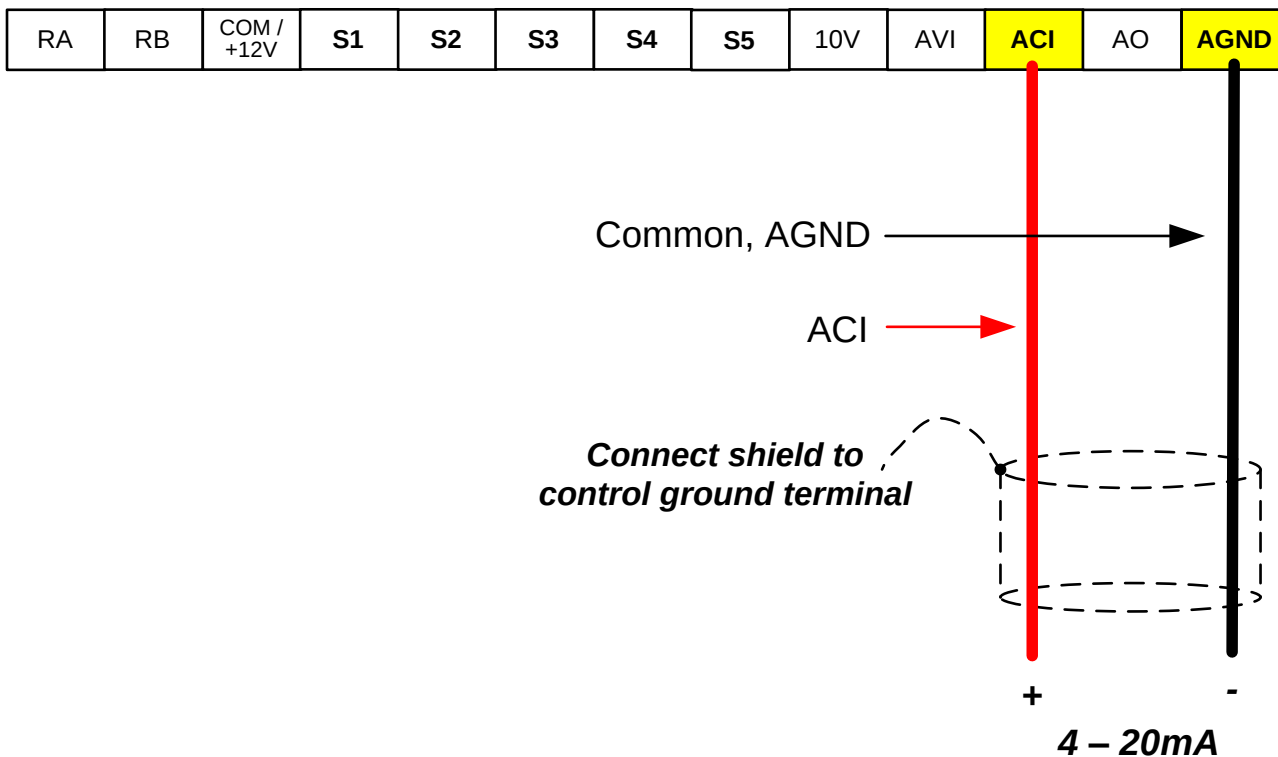
Important: To use the PID function parameter 00-05 (Main Frequency Source Selection) has to be set to 6 for PID reference.

9.2 Connect Transducer Feedback Signal (10-01)

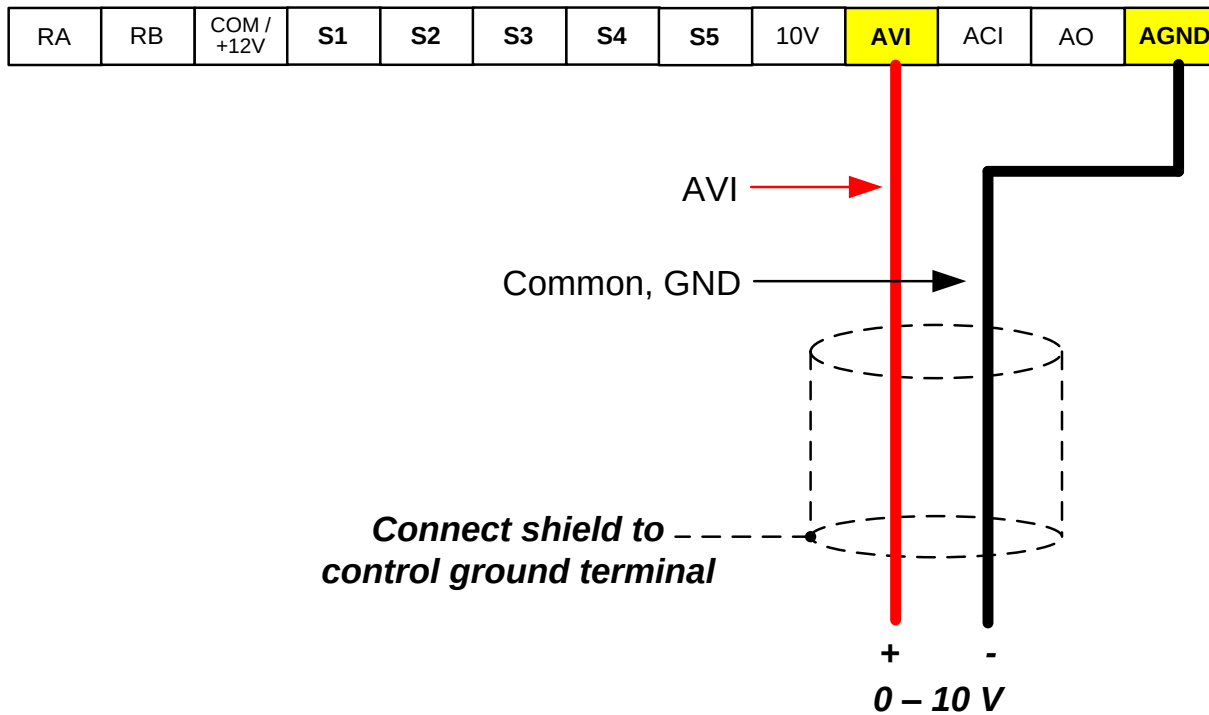
The PID function in the inverter

Depending on the type of feedback transducer used, the inverter can be setup for either 0-10V or a 4-20mA feedback transducer.

Feedback Signal 4 – 20mA (10-01 = 2)



Feedback Signal 0 – 10V (10-01 = 1)



9.3 Engineering Units

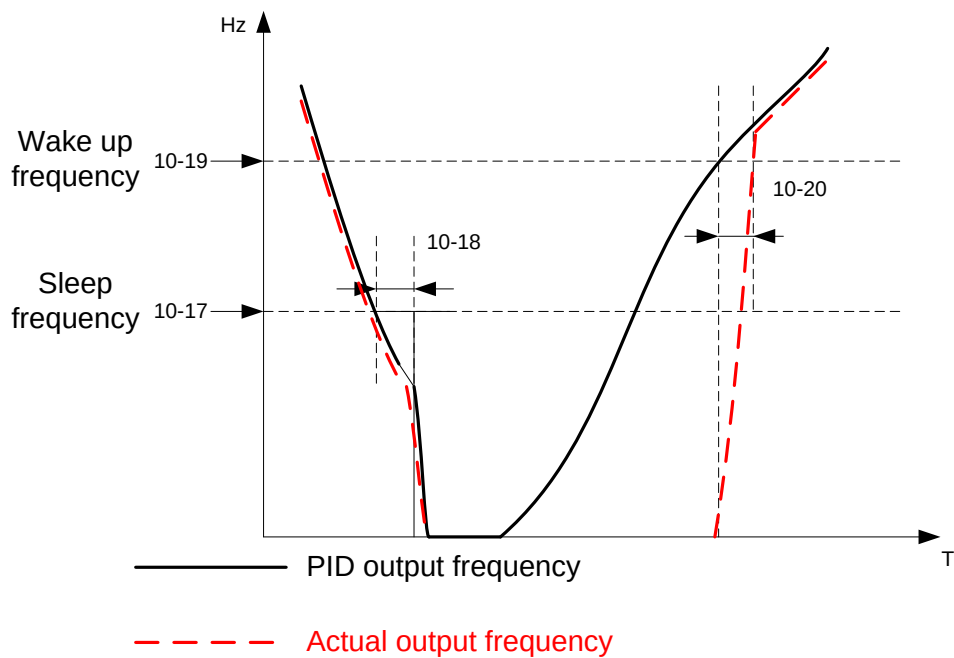
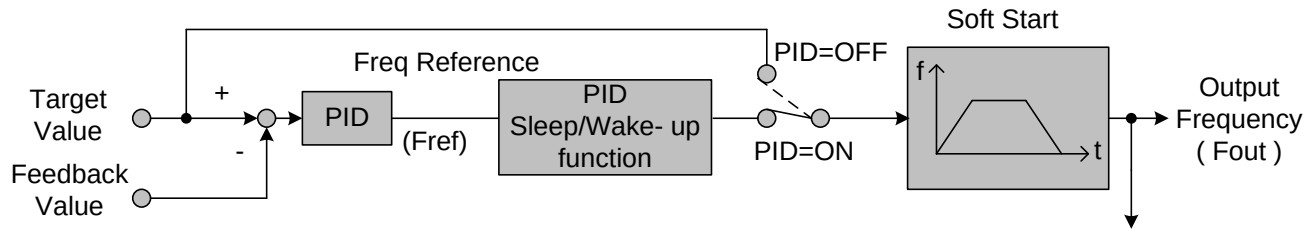
The PID feedback scaling can be selected with parameter 10-21 and 10-22.

Example: 0 – 200.0 PSI feedback, set 10-21 to 200 and 10-22 to 0.

9.4 Sleep / Wakeup Function

The PID Sleep function can be used to prevent a system from running at low speeds and is frequently used in pumping application. The PID Sleep function is turned on by parameter 10-29 set to 1. The inverter output turns off when the PID output falls below the PID sleep level (10-17) for the time specified in the PID sleep delay time parameter (10-18).

The inverter wakes up from a sleep condition when the PID output (Reference frequency) rises above the PID wake-up frequency (10-19) for the time specified in the PID wake-up delay time (10-20).



PID Sleep Function

10. Troubleshooting and Fault Diagnostics

10.1 General

This chapter covers inverter fault detection and early warning / self-diagnosis function. When the inverter detects a fault, a fault message is displayed on the keypad.

When the inverter detects a warning / self-diagnostics error, the digital operator will display a warning or self-diagnostic code, the fault output does not energize in this case. Once the warning is removed, the system will automatically return to its original state.

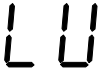
10.2 Fault Detection Function

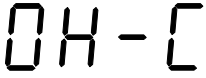
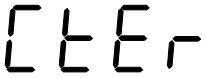
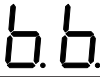
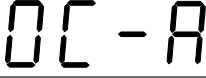
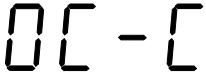
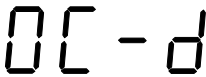
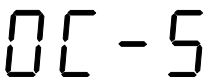
When a fault occurs, please refer to the table below for possible causes and take appropriate measures.

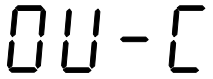
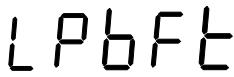
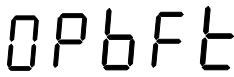
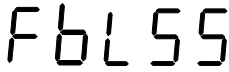
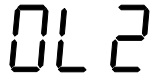
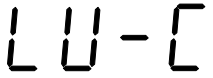
Use one of the following methods to restart:

1. Set one of multi-function digital input terminals (03-00 ~ 03-04) to 17 (Fault reset); activate input
2. Press the reset button on the keypad.
3. Power down inverter wait until keypad goes blank and power-up the inverter again.

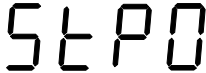
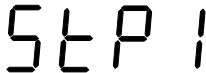
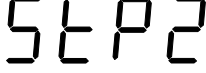
When a fault occurs, the fault message is stored in the fault history (see group 12 parameters).

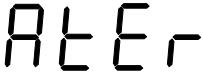
Fault Information and Possible Solutions			
Display	Description	Cause	Possible Solutions
OV Over Voltage	The DC bus voltage exceeds the OV detection level: 230V Class: 410VDC 460V class : 820VDC	• Deceleration time set too short, resulting in regenerative energy flowing back from motor to the inverter. • The inverter input voltage is too high. • Use of power factor correction capacitors. • Excessive braking load. • Braking transistor or resistor defective. • Speed search parameters set incorrectly.	• Increase deceleration time • Reduce input voltage to comply with the input voltage requirements or install an AC line reactor to lower the input voltage. • Remove the power factor correction capacitor. • Use dynamic braking unit. • Replace braking transistor or resistor. • Adjust speed search parameters.
	For 460V class, if input voltage 01-14 is set lower than 460V, the OV detection value is decreased to 700Vdc.		
LV Under Voltage	DC bus voltage is lower than the UV detection level or the pre-charge contactor is not active while the inverter is running. 230V class: 190 VDC 460V class: 380 VDC	• The input voltage is too low. • Input phase loss. • Acceleration time set too short. • Input voltage fluctuation. • Pre-charge contactor damaged. • DC bus voltage feedback signal value is not correct.	• Check the input voltage. • Check input wiring. • Increase acceleration time. • Check power source • Replace pre-charge contactor • Replace control board or complete inverter.
	The detection value can be adjusted by (07-13).		
OH Heatsink Overheat	The temperature of the heat sink is too high while stopped.	• Ambient temperature too high. • Cooling fan failed. • Carrier frequency set too high. • Load too heavy.	• Install fan or AC to cool surroundings. • Replace cooling fan. • Reduce carrier frequency. • Reduce load / measure output current.
	Note: When OH fault occurs three times within five minutes, it is required to wait 10 minutes before resetting the fault.		

Fault Information and Possible Solutions			
Display	Description	Cause	Possible Solutions
OH-C Heatsink Overheat 	The temperature of the heat sink is too high while running. Note: When OH fault occurs three times within five minutes, it is required to wait 10 minutes before resetting the fault.	• Ambient temperature too high. • Cooling fan failed. • Carrier frequency set too high. • Load too heavy.	• Install fan or AC to cool surroundings. • Replace cooling fan. • Reduce carrier frequency. • Reduce load / measure output current.
CtEr Current Sensor Error 			
HPErr Capacity Setting Error 	13-00 does not match the rated voltage.	The inverter capacity setting (13-00) does not match the hardware voltage levels.	Check inverter capacity setting (13-00) to meet the hardware voltage levels.
bb External Baseblock 			
EPr EEPROM Error 	EEPROM problem.	Faulty EEPROM.	Consult with the supplier.
OC Overcurrent 			
OC-A Overcurrent at Acceleration 	The inverter output current exceeds the 200% of the inverters rated current.	• Acceleration / deceleration time is too short. • Contactor at the inverter output side. • The motors rated current is greater than the inverters. • Short circuit or ground fault.	• Extend acceleration / deceleration time. • Check the motor wiring. • Disconnect motor and try running inverter.
OC-C Overcurrent at Fixed Speed 			
OC-d Overcurrent at Deceleration 	The inverter output current exceeds 200% of the inverters rated current.	• Deceleration time is too short. • Contactor at the inverter output side. • The motors rated current is greater than the inverters. • Short circuit or ground fault.	• Extend deceleration time. • Check the motor wiring. • Disconnect motor and try running inverter.
OC-S Overcurrent at Start 			

Fault Information and Possible Solutions			
Display	Description	Cause	Possible Solutions
OV-C Over Voltage During Operation 	Excessive voltage during operation/ deceleration.	- Deceleration time setting too short or excessive load inertia. - Excessive input power fluctuation.	- Set a longer deceleration time - Consider use of a brake resistor and/or brake module (in case of 400V models) - Consider use of a reactor at the power input side.
PF Input Phase Loss 			
LPBFT Low Pressure 	Low pressure.	Feedback value of pump pressure is lower than limit of minimum pressure.	- Check feedback signal is correct and with connection. - Check if feedback value of pressure is lower than limit of minimum pressure (14-15).
OPBFT High Pressure 			
FBLSS PID Feedback Signal Loss 	PID Feedback Signal Loss.	Proportion of loss pressure (14-19) is enabled and over high, the inverter trips to fault. Thus, feedback sensor cannot operate properly or is not installed correctly.	- Check if the proportion of loss pressure (14-19) is set correctly. - Make sure the feedback sensor is installed correctly and PID feedback signal operates normally.
Cot Communication Error 			
OL1 Motor Overload 	Internal motor overload protection tripped, active when protection curve 08-05 = xxx1.	- Voltage setting V/F mode too high, resulting in over-excitation of the motor. - Motor rated current (02-01) set incorrectly. - Load is too heavy.	- Check V/f curve. - Check motor rated current. - Check and reduce motor load, check and operation duty cycle.
OL2 Inverter Overload 			
CL Inverter Overcurrent 	Inverter over current. Wait 1 minute to reset. If it occurs CL or OL2 up to 4 successive times then wait 5 minutes to reset.	Inverter current reached over the current protection level.	Check motor load and operating time.
LV-C Low Voltage 			
OVSP Rotation Over Speed 	Motor rotation over speed.	Actual rotation speed is different from set speed.	- Check V/f curve. - Check motor rated current. - Check and reduce motor load, check and operation duty cycle.

Fault Information and Possible Solutions			
Display	Description	Cause	Possible Solutions
OH3 Motor Overheat Warning 	Motor over heat warning.	If 08-10 = 3, When AVI is reading motor tempeture, and its value is over the limit set in 08-15 the display will show "OH3" and the motor will continue to run.	• Improve ventilation. • Adjust parameter 08-15.
OH4 Motor Overheat 			
OH4 Motor Overheat 	Motor over heat error.	When AVI is reading motor tempeture, and its value is over the limit set in 08-13 this fault will occur and the motor will coast to stop.	• Improve ventilation. • Adjust parameter 08-13.
Err1 Keypad Operation Error 			
Err2 Parameter Setting Error 	Parameter setting error.	00-13 is within the range of (11-08 ±11-11) or (11-09±11-11) or (11-10±11-11) 00-12~00-13 Set 00-05 and 00-06 to the same value When 01-00≠7, modify parameter 01-01~01-09	Modify 11-08~11-10 or 11-11 Set 00-12>00-13.
Err4 CPU Error 			
Err5 Can Not Be Changed In Comm 	Modification of parameter is not available in communication.	• Control command sent during communication. • Attempting to modify the function 09-02~ 09-05 during communication.	• Issue enable command before communication. • Set parameters 09-02~09-05 function before communication.
Err6 Communication Failed 			
Err7 Parameter Conflict 	Parameter conflict.	• Attempt to modify parameter 13-00/13-08. • Voltage and current detection circuit is not working properly.	If reset is not possible, please consult with the supplier.
Err7 Parameter Conflict 			

Fault Information and Possible Solutions			
Display	Description	Cause	Possible Solutions
StP0 Zero Speed Stop 	Zero speed at stop.	Occurs when frequency command is less than 0.1Hz.	Increase frequency command.
StP1 Direct Start Fail 	Fail to start directly on power up.	The run input is active at power-up and direct start is disabled (07-04=1).	• Enable direct start by setting 07-04 to 0. • Release and re-activate the run contact.
StP2 Keypad Stop When in External Control 	Keypad stop button pressed when the inverter is in external control mode.	If the stop key is pressed while the inverter is set to external control mode (00-02/00-03=1) then 'STP2' flashes after stop.	Release and re-activate the run contact to restart the inverter.
OPErr Operator Setting Error 	Operator setting error.	When 09-02 set to 4, remote keypad (JN5-OP-L01) is disconnected.	• Use "RESET" key of inverter to remove the error code. • Set 09-02 to 0~3.
L0Pb Low Pressure 	Low pressure error.	• The feedback signal is not connected. • Due to feedback value of pump pressure is lower than limit of minimum pressure.	• Check pump pressure. • Check feedback signal wiring.
H1Pb High Pressure 	High pressure error.	Due to feedback value of pump pressure is higher than limit of maximum pressure.	• Check pump pressure. • Check feedback signal wiring.
COPuP Multi-Pump Breaking Error 	Breaking error of multiple pumps communication.	Communication breaking or disconnection of pump cascade control.	Check communication wiring.
PdEr PID Feedback Loss 	PID feedback loss.	PID feedback loss is detected.	Check feedback signal wiring.
E.S. External Rapid Stop 	External rapid stop.	When external rapid stop input is activated the inverter will decelerate to stop and the display will flash with E.S message.	Remove external rapid stop command.

Fault Information and Possible Solutions			
Display	Description	Cause	Possible Solutions
AtEr Auto Tune Error 	Auto tuning error.	Other errors show up in the process of auto tuning.	Clear other errors are reattempt auto tune.
LOC Parameters Locked 			
	1.Parameter already locked. 2.Motor direction locked. 3.Parameter password enabled (13-07).	• Attempt to modify frequency parameter while 13-06>0. • Attempt to reverse direction when 11-00=1. • Parameter (13-07) is enabled, set the correct password will show LOC.	• Adjust 13-06 • Adjust 11-00

11. Inverter Options and AC Line Reactors

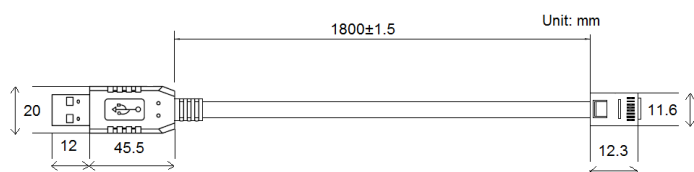
11.1 Options

Accessories	Model	Function	Notes
Keypad Extension cable	JN5-CB-01M	Used for remote control purposes with the remote keypad operator (JN5-CU).	3.14ft (1m)
	JN5-CB-02M		6.28ft (2m)
	JN5-CB-03M		9.84ft (3m)
	JN5-CB-05M		16.4ft (5m)
Copy module	JN5-CU	Duplicate parameters setting from one inverter to another inverter. Use the RJ45 port to connect to the inverter when a remote keypad is used. Use extension cable JN5-CM-0XM when using the copy module operator as a remote keypad.	

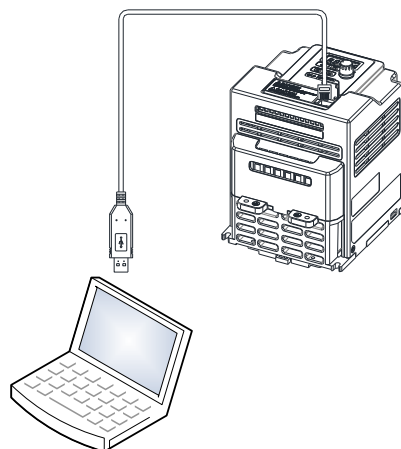
RJ45 to USB Communication Cable (6ft / 1.8m) (JN5-CM-USB) / (JN5-CM-USB-3 for 10ft / 3m cable)

The communication cable is used to communicate with the TECO Link software directly to the inverter using the PC USB port.

- Cable:



- Connect to the RS45 port:



11.2 AC Line Reactors

An AC line reactor can be used for any of the following:

- Capacity of power system is much larger than the inverter rating.
- Inverter mounted close to the power system (in 33ft / 10 meters).
- Reduce harmonic contribution (improve power factor) back to the power line.
- Protect inverter input diode front-end by reducing short-circuit current.
- Minimize overvoltage trips due to voltage transients.

Please select the AC line reactor based on the inverter rating according to the following table.

Table 11.2 List of AC Line Reactors (3%) - Chassis

Model			AC reactor
Input Voltage	HP	Rated Current(A) HD/ND	Part Number
230V 1Ø/3Ø	0.25	4.6	KDRULA25L
	0.5	4.6	KDRULA25L
	1	4.6	KDRULA25L
	1.5	6.6	KDRULA26L
	2	7.5	KDRULA27L
	3	10.6	KDRULA28L

Model			AC reactor
Input Voltage	HP	Rated Current(A) HD/ND	Part Number
460V 3Ø	1	2.1	KDRULA8L
	2	3.4	KDRULA1L
	3	4.8	KDRULA2L

Contact TWMC for any assistance

Note: AC reactors listed in this table can only be used for the inverter input side. Do not connect AC reactor to the inverter output side.

11.3 Communication Options

(a) PROFIBUS communication interface module (JN5-CM-PDP)

For wiring example and communication setup refer to JN5-CM-PDP communication option manual.

(b) DEVICENET communication interface module (JN5-CM-DNET)

For wiring example and communication setup refer to JN5-CM-DNET communication option manual.

(c) CANopen communication interface module (JN5-CM-CAN)

For wiring example and communication setup refer to JN5-CM-VAN communication option manual.

(d) TCP-IP communication interface module (JN5-CM-TCPIP)

For wiring example and communication setup refer to JN5-CM-TCPIP communication option manual.

Appendix: UL Instructions

Danger

Electric Shock Hazard

Do not connect or disconnect wiring while the power is on.
Failure to comply will result in death or serious injury.

Warning

Electric Shock Hazard

Do not operate equipment with covers removed.

Failure to comply could result in death or serious injury.

The diagrams in this section may show inverters without covers or safety shields to show details. Be sure to reinstall covers or shields before operating the inverters and run the inverters according to the instructions described in this manual.

Always ground the motor-side grounding terminal.

Improper equipment grounding could result in death or serious injury by contacting the motor case.

Do not touch any terminals before the capacitors have fully discharged.

Failure to comply could result in death or serious injury.

Before wiring terminals, disconnect all power to the equipment. The internal capacitor remains charged even after the power supply is turned off. After shutting off the power, wait for at least the amount of time specified on the inverter before touching any components.

Do not allow unqualified personnel to perform work on the inverter.

Failure to comply could result in death or serious injury.

Installation, maintenance, inspection, and servicing must be performed only by authorized personnel familiar with installation, adjustment, and maintenance of inverters.

Do not perform work on the inverter while wearing loose clothing, jewelry, or lack of eye protection.

Failure to comply could result in death or serious injury.

Remove all metal objects such as watches and rings, secure loose clothing, and wear eye protection before beginning work on the inverter.

Do not remove covers or touch circuit boards while the power is on.

Failure to comply could result in death or serious injury.

Warning

Fire Hazard

Tighten all terminal screws to the specified tightening torque.

Loose electrical connections could result in death or serious injury by fire due to overheating of electrical connections.

Do not use an improper voltage source.

Failure to comply could result in death or serious injury by fire.

Verify that the rated voltage of the inverter matches the voltage of the incoming power supply before applying power.

Do not use improper combustible materials.

Failure to comply could result in death or serious injury by fire. Attach the inverter to metal or other noncombustible material.

NOTICE

Observe proper electrostatic discharge procedures (ESD) when handling the inverter and circuit boards.

Failure to comply may result in ESD damage to the inverter circuitry.

Never connect or disconnect the motor from the inverter while the inverter is outputting voltage.

Improper equipment sequencing could result in damage to the inverter.

Do not use unshielded cable for control wiring.

Failure to comply may cause electrical interference resulting in poor system performance. Use shielded twisted-pair wires and ground the shield to the ground terminal of the inverter.

Do not modify the inverter circuitry.

Failure to comply could result in damage to the inverter and will void warranty. TECO is not responsible for any modification of the product made by the user. This product must not be modified.

Check all the wiring to ensure that all connections are correct after installing the inverter and connecting any other devices.

Failure to comply could result in damage to the inverter.

❖ **UL Standards**

The UL/cUL mark applies to products in the United States and Canada and it means that UL has performed product testing and evaluation and determined that their stringent standards for product safety have been met. For a product to receive UL certification, all components inside that product must also receive UL certification.



❖ **UL Standards Compliance**

This inverter is tested in accordance with UL standard UL508C and complies with UL requirements. To ensure continued compliance when using this inverter in combination with other equipment, meet the following conditions:

■ **Installation Area**

Do not install the inverter to an area greater than pollution severity 2 (UL standard).

Main Circuit Terminal Wiring

UL approval requires crimp terminals when wiring the inverter's main circuit terminals. Use crimping tools as specified by the crimp terminal manufacturer. TECO recommends crimp terminals made by NICHIFU for the insulation cap.

The table below matches inverter models with crimp terminals and insulation caps. Orders can be placed with a TECO representative or directly with the TECO sales department.

Closed-Loop Crimp Terminal Size

Drive Model	Wire Gauge		Terminal	Crimp Terminal	Tool	Insulation Cap
	mm2 , (AWG)					
L510	R/L1 / S/L2 / T/L3	U/T1 / V/T2 / W/T3	Screws	Model No.	Machine No.	Model No.
1P2	1.3(16)		M3.5	R2-3.5	Nichifu NH 1 / 9	TIC 2
1P5	2.1 (14)					TIC 2
101	3.3(12)		M4	R3.5-4	Nichifu NH 1 / 9	TIC 3.5
2P2	1.3(16)		M3.5	R2-3.5	Nichifu NH 1 / 9	TIC 2
2P5	1.3 (16)				Nichifu NH 1 / 9	TIC 2
201	2.1 (14)				Nichifu NH 1 / 9	TIC 2
202	3.3(12)		M4	R3.5-4	Nichifu NH 1 / 9	TIC 3.5
203	5.3(10)			R5.5-4	Nichifu NH 1 / 9	TIC 3.5
401	2.1 (14)			R3.5-4	Nichifu NH 1 / 9	TIC 2
402	2.1 (14)				Nichifu NH 1 / 9	TIC 2
403	2.1 (14)				Nichifu NH 1 / 9	TIC2
					Nichifu NH 1 / 9	

Type 1

During installation, all conduit hole plugs shall be removed, and all conduit holes shall be used.

Recommended Input Fuse Selection

Drive Model L510	Fuse Type	
	Manufacturer: Bussmann	
	Model	Fuse Ampere Rating (A)
	100 V Class Single-Phase Drives	
1P2	Bussmann 16CT	690V 16A
1P5	Bussmann 20CT	690V 20A
101	Bussmann 25ET	690V 25A

Drive Model L510	Fuse Type	
	Manufacturer: Bussmann	
	Model	Fuse Ampere Rating (A)
	200 V Class Single-Phase Drives	
2P2	Bussmann 10CT	690V 10A
2P5	Bussmann 10CT/16CT	690V 10A / 690V 16A
201	Bussmann 16CT/20CT	690V 16A / 690V 20A
202	Bussmann 30FE	690V 30A
203	Bussmann 50FE	690V 50A

Drive Model L510	Fuse Type	
	Manufacturer: Bussmann	
	Model	Fuse Ampere Rating (A)
	200 V Class Three-Phase Drives	
2P2	Bussmann 10CT	690V10A
2P5	Bussmann 10CT	690V 10A
201	Bussmann 10CT	690V 10A
202	Bussmann 16CT	690V 16A
203	Bussmann 20CT	690V 20A

Drive Model L510	Fuse Type	
	Manufacturer: Bussmann	
	Model	Fuse Ampere Rating (A)
	460 V Class Three-Phase Drives	
401	Bussmann 10CT	690V 10A
402	Bussmann 16CT	690V 16A
403	Bussmann 20CT	690V 20A

Motor Over Temperature Protection

Motor over temperature protection shall be provided in the end use application.

■ Field Wiring Terminals

All input and output field wiring terminals not located within the motor circuit shall be marked to indicate the proper connections that are to be made to each terminal and indicate that copper conductors, rated 75°C are to be used.

■ Inverter Short-Circuit Rating

This inverter has undergone the UL short-circuit test, which certifies that during a short circuit in the power supply the current flow will not rise above value. Please see electrical ratings for maximum voltage and table below for current.

- The MCCB and breaker protection and fuse ratings (refer to the preceding table) shall be equal to or greater than the short-circuit tolerance of the power supply being used.
- Suitable for use on a circuit capable of delivering not more than (A) RMS symmetrical amperes for DiJ2.IHp in 240 / 480 V class drives motor overload protection.

Horse Power (Hp)	Current (A)	Voltage (V)
1 - 50	5,000	240 / 480
51 - 200	10,000	240 / 480
201 - 400	18,000	240 / 480
401 - 600	30,000	240 / 480

❖ Inverter Motor Overload Protection

Set parameter 02-01 (motor rated current) to the appropriate value to enable motor overload protection. The internal motor overload protection is UL listed and in accordance with the NEC and CEC.

■ 02-01 Motor Rated Current

Setting Range Model Dependent
Factory Default: Model Dependent

The motor rated current parameter (02-01) protects the motor. The motor protection parameter 08-05 is set as factory default. Set 02-01 to the full load amps (FLA) as shown on the nameplate of the motor.

■ 08-05 Motor Overload Protection Selection

The inverter has an electronic overload protection function (OL1) based on time, output current, and output frequency, which protects the motor from overheating. The electronic thermal overload function is UL-recognized, so it does not require an external thermal overload relay for single motor operation.

This parameter selects the motor overload curve used according to the type of motor applied.

08-05	Selection for motor overload protection (OL1)
Range	0: Disabled 1: Enabled

Sets the motor overload protection function in 08-05 according to the applicable motor.

08-05 = 0: Disables the motor overload protection function when two or more motors are connected to a single inverter. Use an alternative method to provide separate overload protection for each motor such as connecting a thermal overload relay to the power line of each motor.

08-05 = 1: The motor overload protection function should be set to hot start protection characteristic curve when the power supply is turned on and off frequently, because the thermal values are reset each time when the power is turned off.

■ 08-06 Motor Overload Operation Selection

08-06	Start-up mode of overload protection operation (OL1)
Range	0: Coast-to-Stop After Overload Protection is Activated 1: Drive Will Not Trip when Overload Protection is Activated (OL1)

08-06=0: When the inverter detects a motor overload the inverter output is turned off and the OL1 fault message will flash on the keypad. Press RESET button on the keypad or activate the reset function through the multi-function inputs to reset the OL1 fault.

08-06=1: When the inverter detects a motor overload the inverter will continue running and the OL1 alarm message will flash on the keypad until the motor current falls within the normal operating range.



INVERTER

L510

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