TECO Westinghouse

INVERTER

L510

STARTUP 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.

DOCUMENT - TECO-L510SM
Ver 01: 2015.08

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

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

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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 description on parameters.

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

Warning	Failure to ignore the information indicated by the warning symbol may result in death or serious injury.
Caution	Failure to ignore 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 of 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 any 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 suppresseur 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 pourrai 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

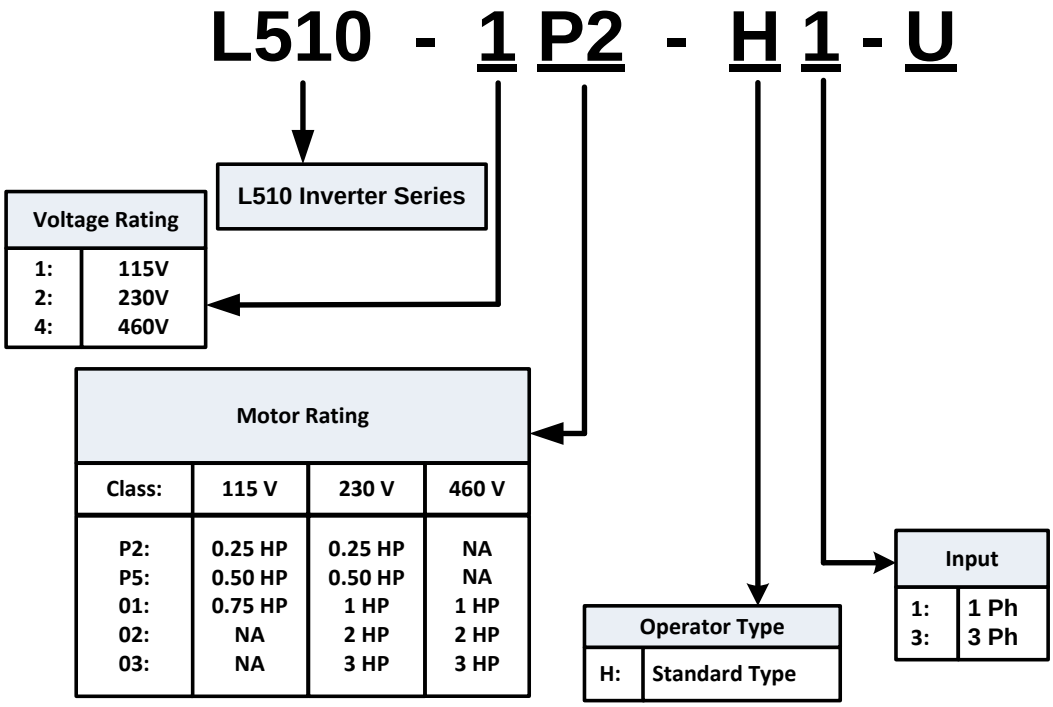
2.1 Nameplate Data

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

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/s²), for 20 Hz and below 0.6 G (5.88m/s²), 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

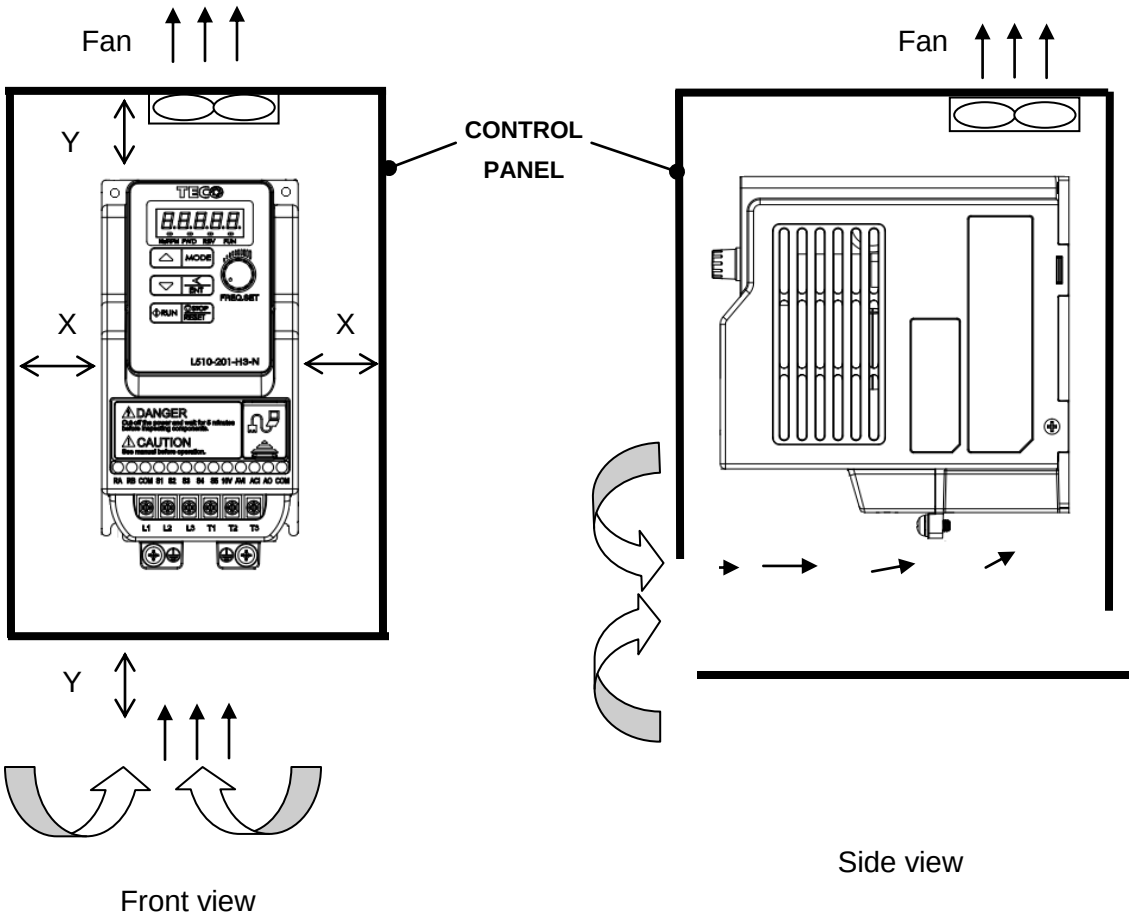


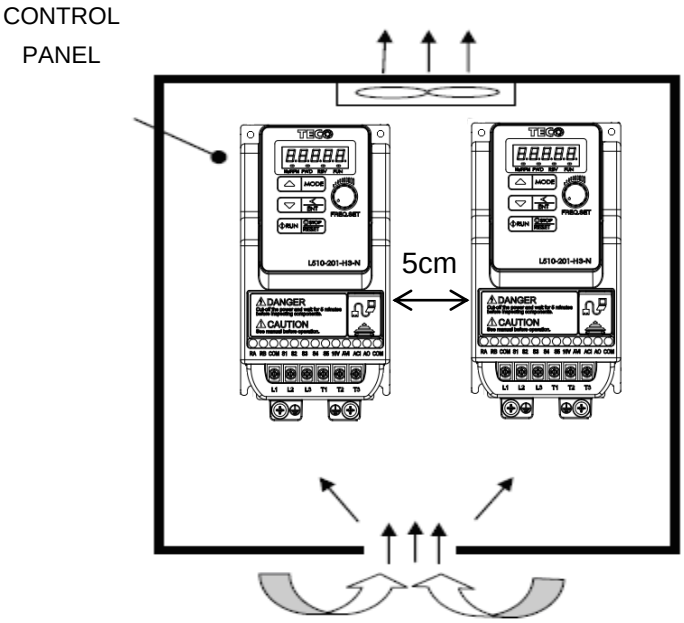
Fig 3.2.1: L510 Installation space

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.

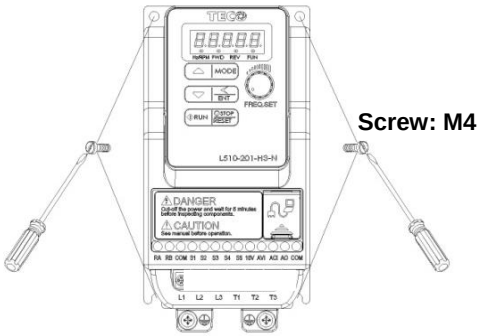
Side by side Installation

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



3.3 Mounting on a flat surface

Frame1: Mounting on a flat surface.



Din rail type installation:

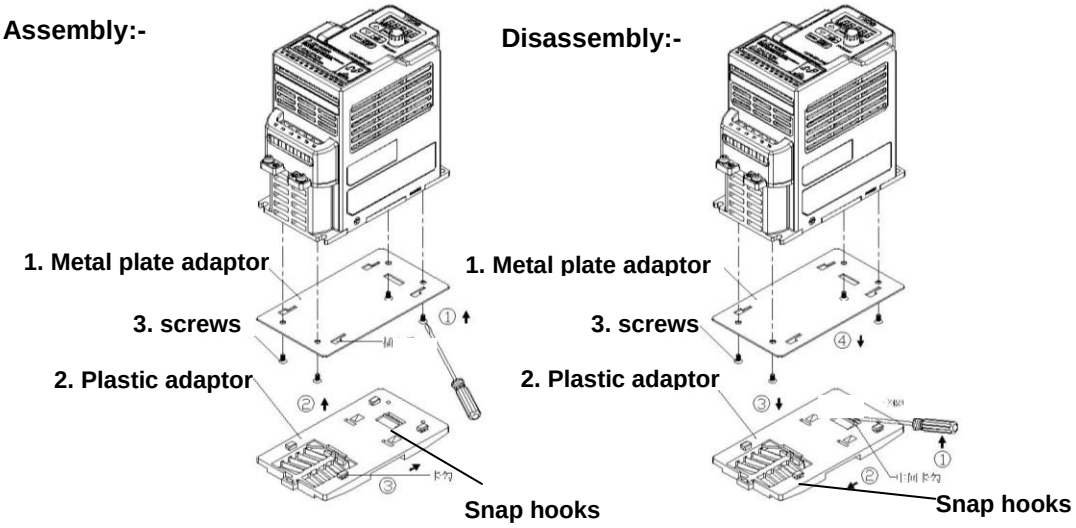
Din rail kit includes a plastic and a metal adaptor plate.

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.

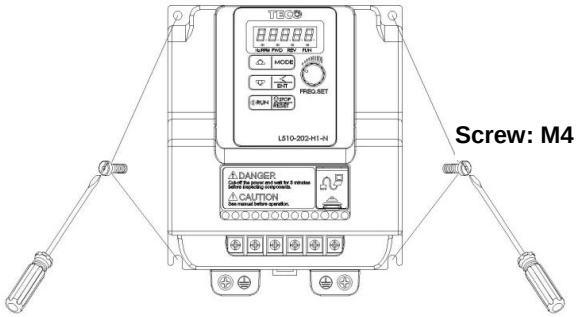
Disassembly Steps:

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



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.



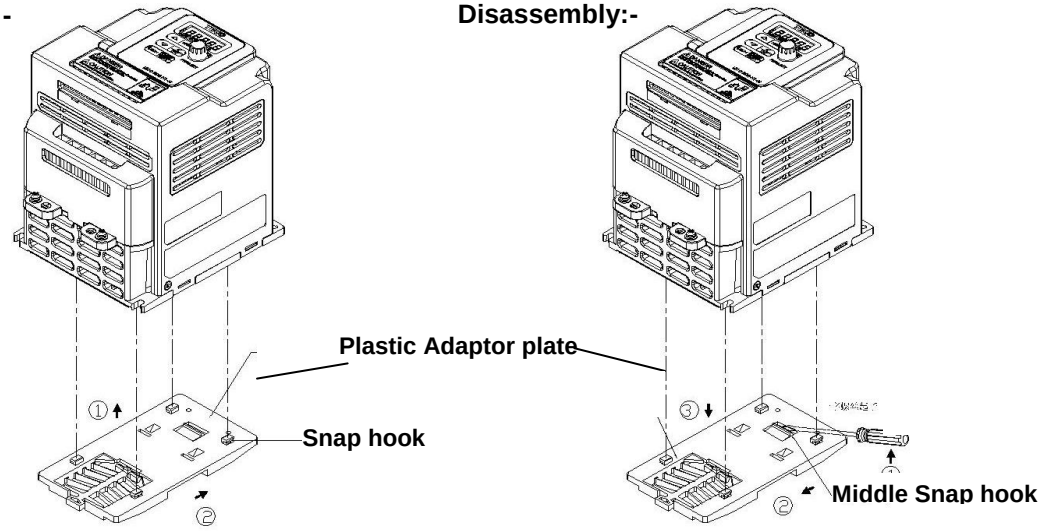
Din rail type installation:

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

Refer to Diagram below:

Assembly:-

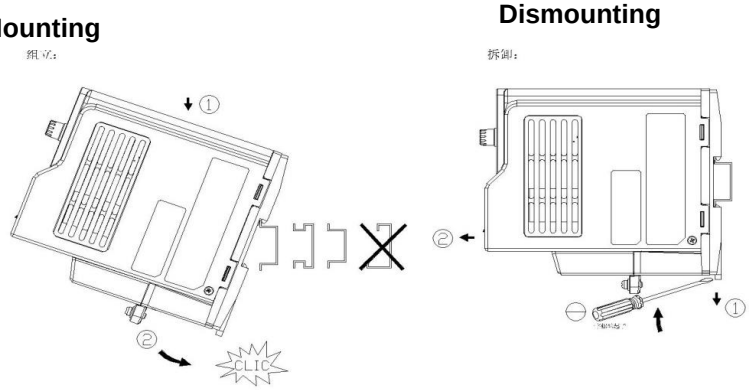
Disassembly:-



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

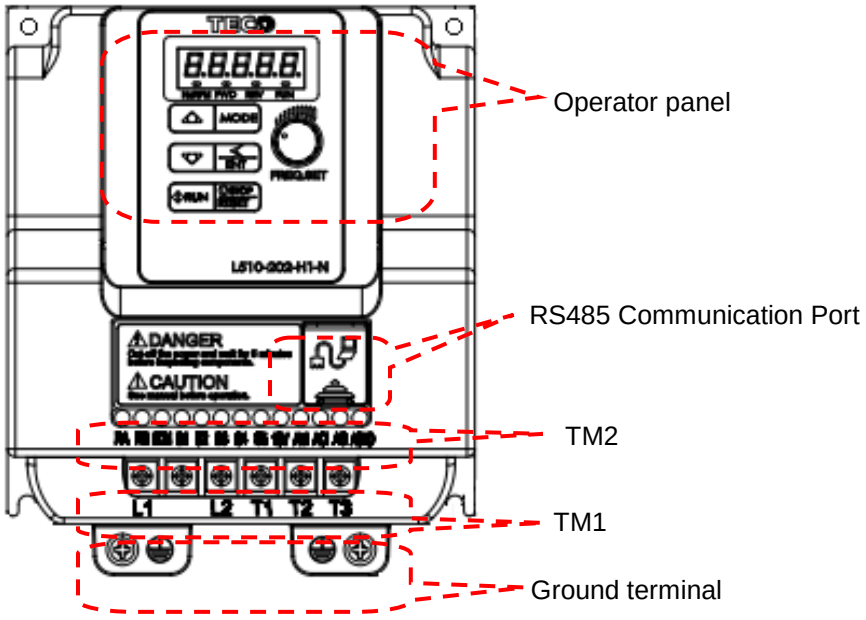
Mounting

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	mm²	kgf.cm	lbf.in	Nm	AWG	mm²	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

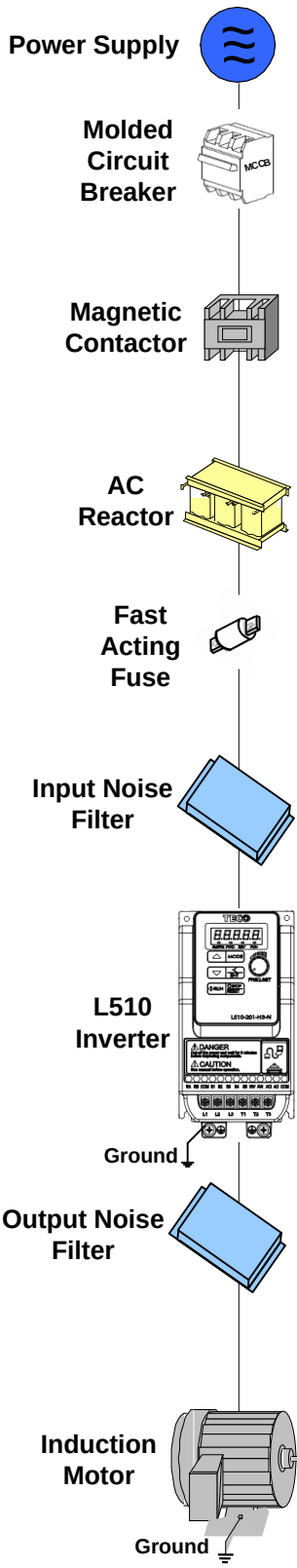
- After power is shut off to the inverter the capacitors will slowly discharge. Do NOT touch and of the inverter circuitry or replace any components until the “CHARGE” indicator is off.
- Do NOT wire or connect/disconnect internal connectors of the inverter when the inverter is powered up or when powered 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 by 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%.

  Phase-to-phase voltage drop (V) = $\sqrt{3}$ ×resistance of wire (Ω/km) × length of line m) × current×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.



Power supply:

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

Molded-case circuit breaker (MCCB) or fused disconnect:

- A molded-case circuit breaker or fused disconnect must be installed between the AC source and the inverter that conforms to the rated voltage and current of the inverter to control the power and protect the inverter.
- ⚠ Do not use the circuit breaker as the run/stop switch for the inverter.

Ground fault detector / breaker:

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

Magnetic contactor:

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

AC line reactor for power quality:

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

Install Fast Acting Fuse:

- To protect peripheral equipment, install fast acting fuses in accordance with the specifications in section 11 for peripheral devices.

Input Noise filter:

- A filter must be installed when there are inductive loads affecting the inverter. The inverter meets EN55011 Class A, category C3 when the TECO special filter is used. See section 11 for peripheral devices.

Inverter:

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

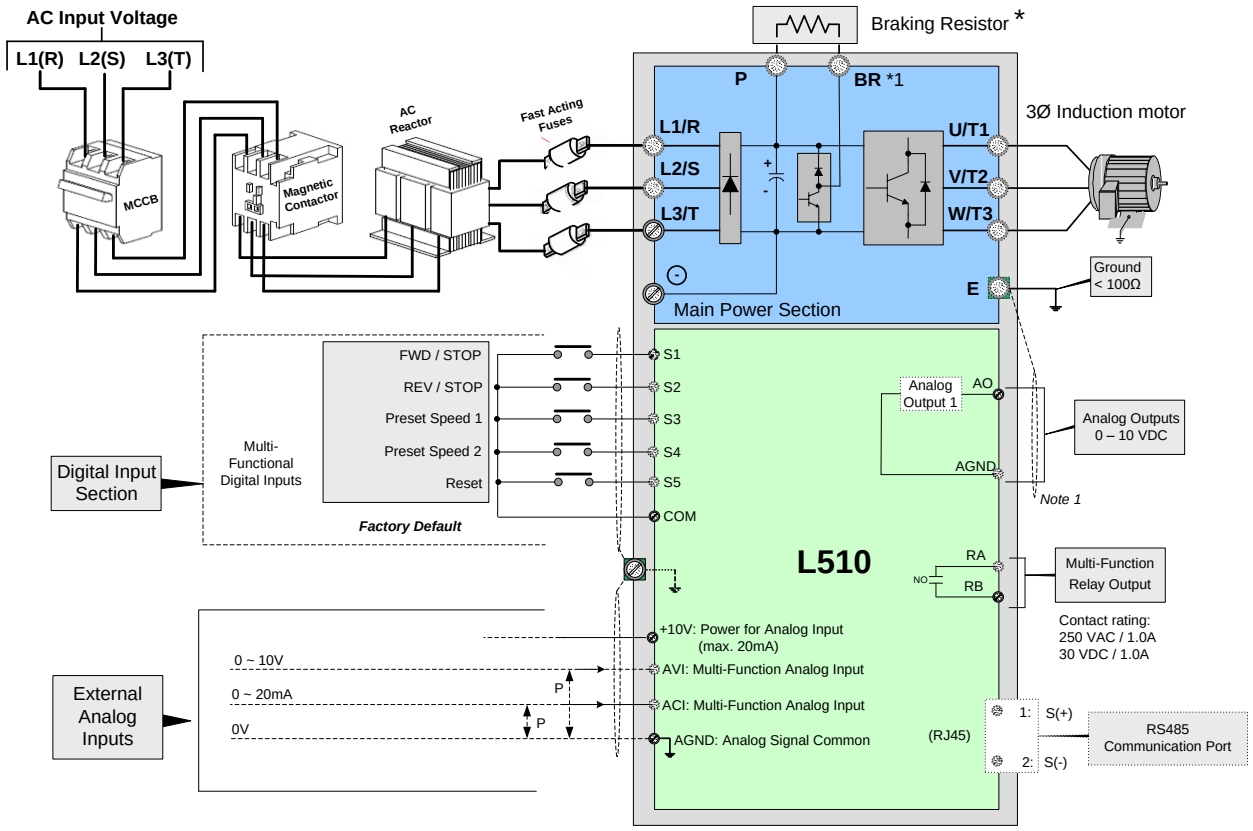
Output Noise filter:

- An output noise filter may reduce system interference and induced noise. See section 11 for peripheral devices.

Motor:

- If the inverter drives multiple motors the output rated current of the inverter must be greater than the total current of all the motors.

3.7 General Wiring Diagram



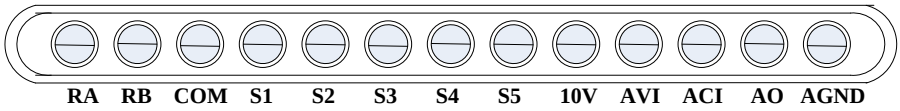
Notes:

*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

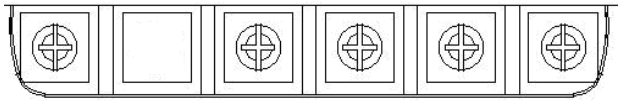
- Maximum output current capacity for terminal 12V is 20mA.
- Multi-function analog output AO is used for an analog output meter. Do not use these output for feedback control.
- Control board's 12V/24V are to be used for internal control only, Do not use the internal power-supply to power external devices.

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**

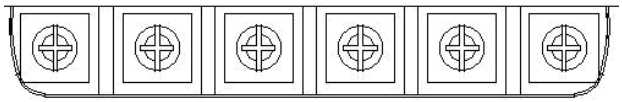
Single phase



L1(L) L2 L3(N) T1 T2 T3

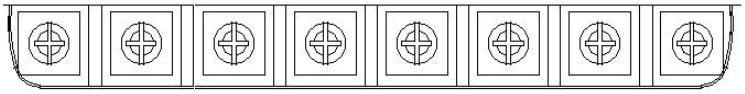
Note: Screw for terminal L2 is removed for the single phase models.

Three phase (230V series)



L1(L) L2 L3(N) T1 T2 T3

Three phase (460V series)



L1 L2 L3 P BR T1 T2 T3

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

Danger	• 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 and. 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.

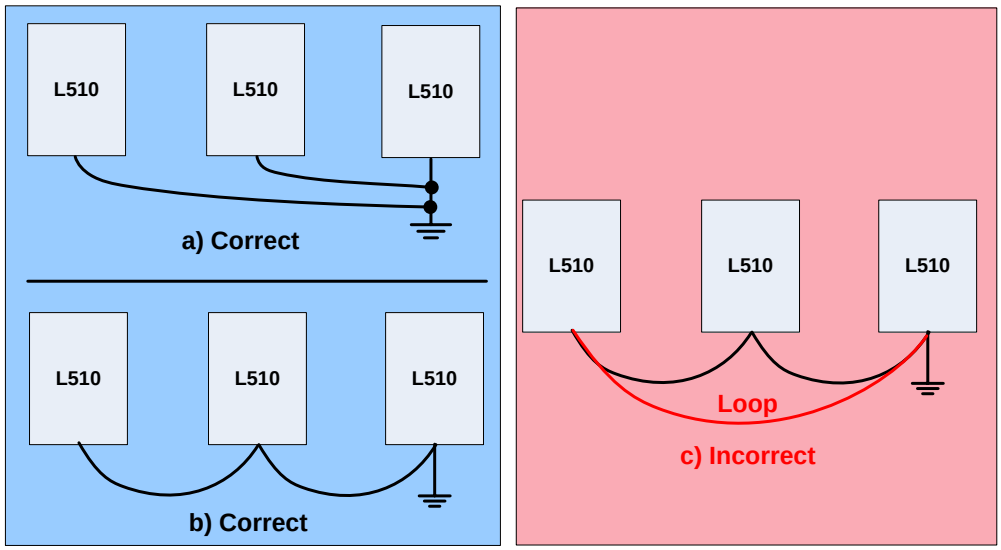


Fig. 3.10.1 Inverter Grounding

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 tot phase voltage drop, apply the following formula:

Phase-to-phase voltage drop (V) = $\sqrt{3}$ ×resistance of wire (Ω/km) × length of line m) × current×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 mm^2) shown in Fig. 3.13.1 for control circuits to minimize noise problems. The maximum wiring distance should not exceed 50m (165 ft).

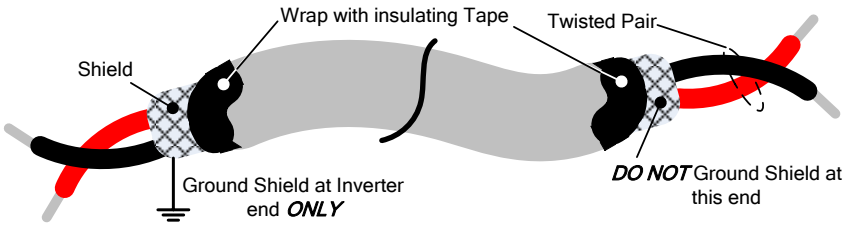


Fig. 3.13.1 Shielded Twisted-Pair

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.

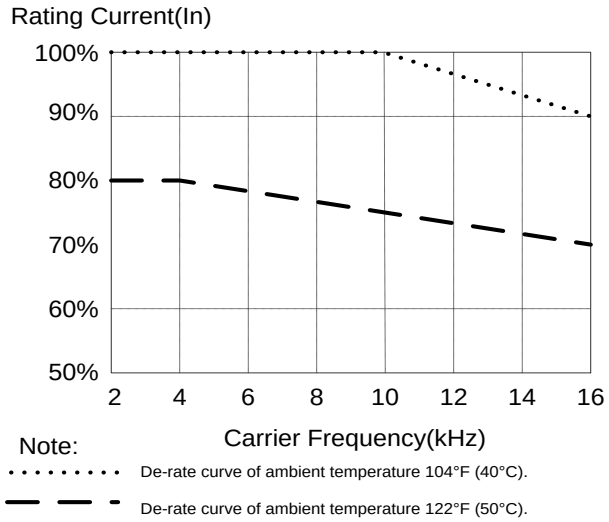
3.15 General Specification

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.
	Frequency limit	Lower and upper frequency limits 3 -skip frequency settings.
Run	Operation set	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	Heaksink 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/s²); 20～50Hz 0.6G(5.88m/s²)
	EMC Compliance	EN61800-3, First Environment
	LVD Compliance	EN50178
	Electrical Safety	UL508C
	Protection level	IP20

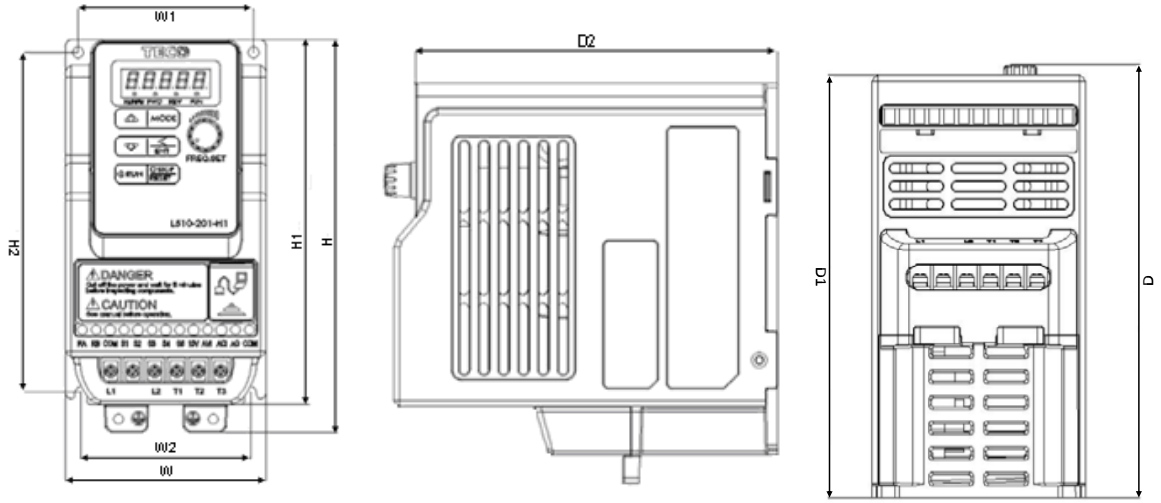
3.16 De-rating curve

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

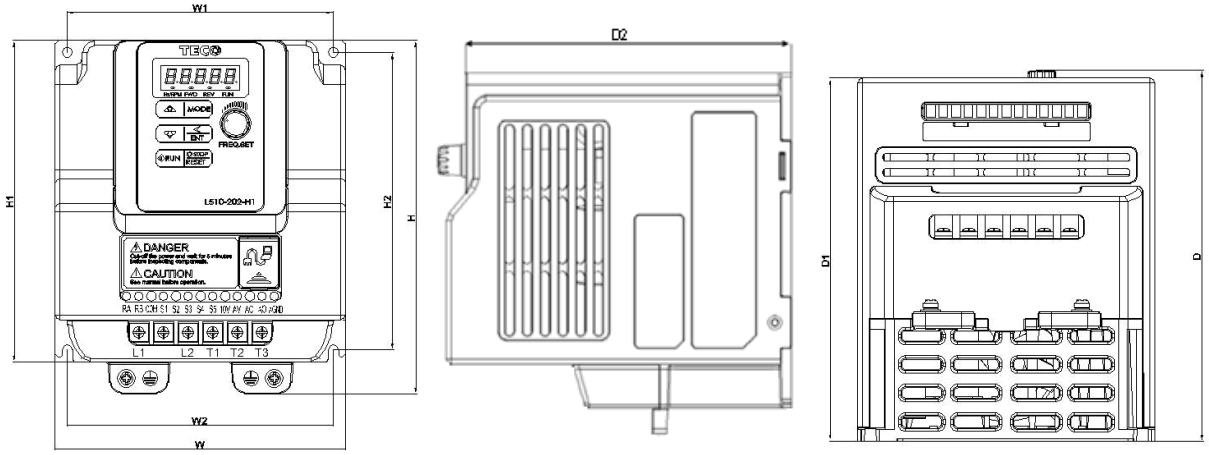
Frame 1:



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

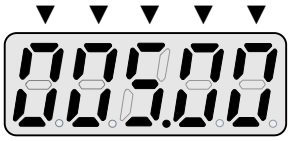
4.1.1 Keypad Display and Keys

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

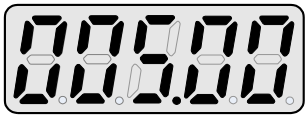
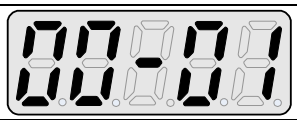
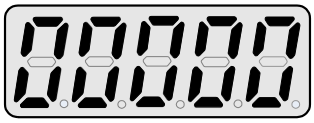
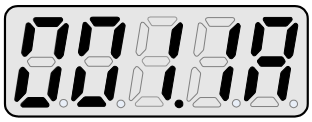
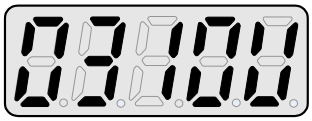
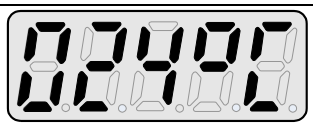
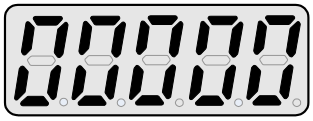
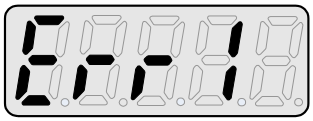
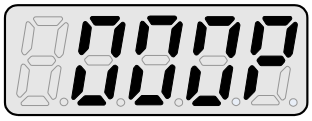
4.1.2 Digital display Description

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**	o	**°**	o
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**	I	**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

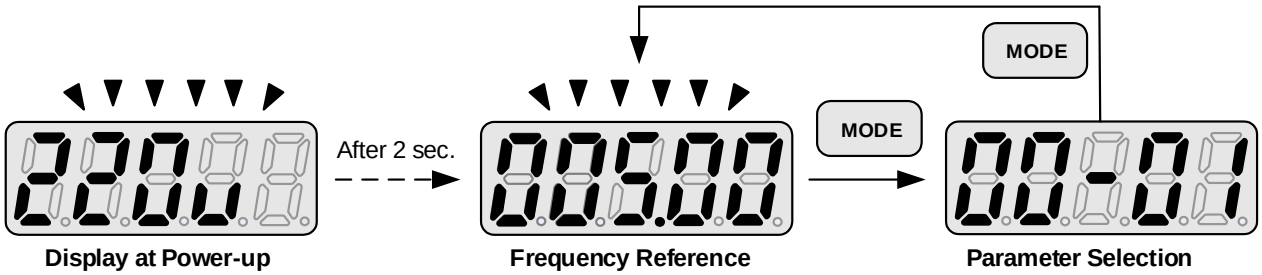
State	Description	REV LED
Off	Inverter in forward direction	
Illuminated	Inverter is running in reverse direction	
Flashing	Reverse direction active, no run command	

FUN LED

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

4.1.4 Power-Up Monitor

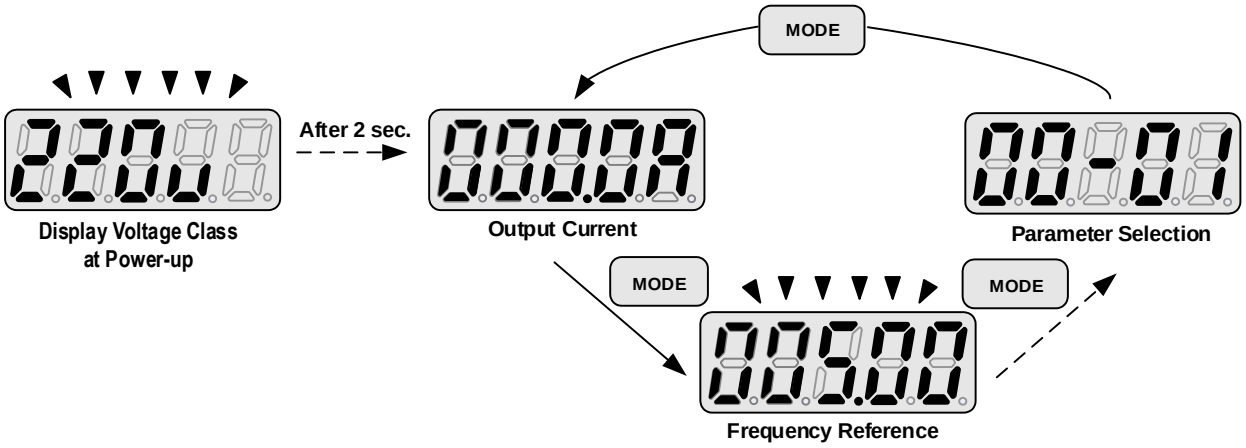
Power Up:



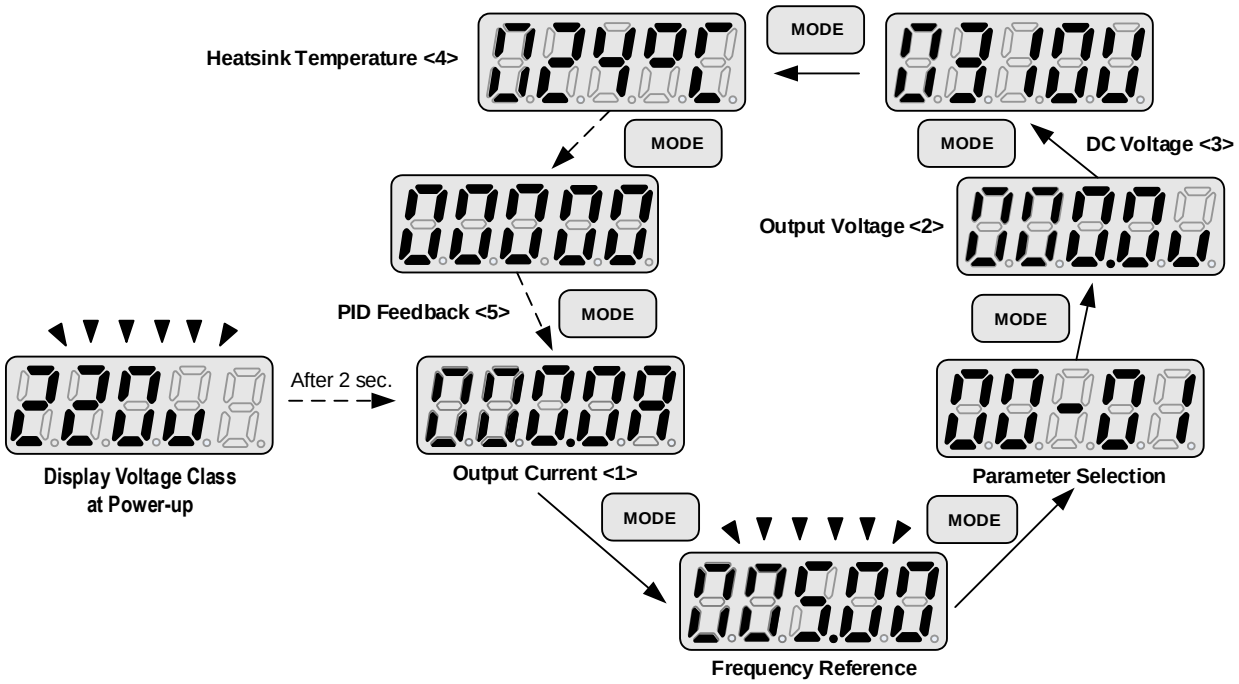
Change Monitor at Power-Up

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**.** **0:** No display **1:** Output current **2:** Output voltage **3:** DC voltage **4:** Temperature **5:** PID feedback **6:** AVI value **7:** ACI value

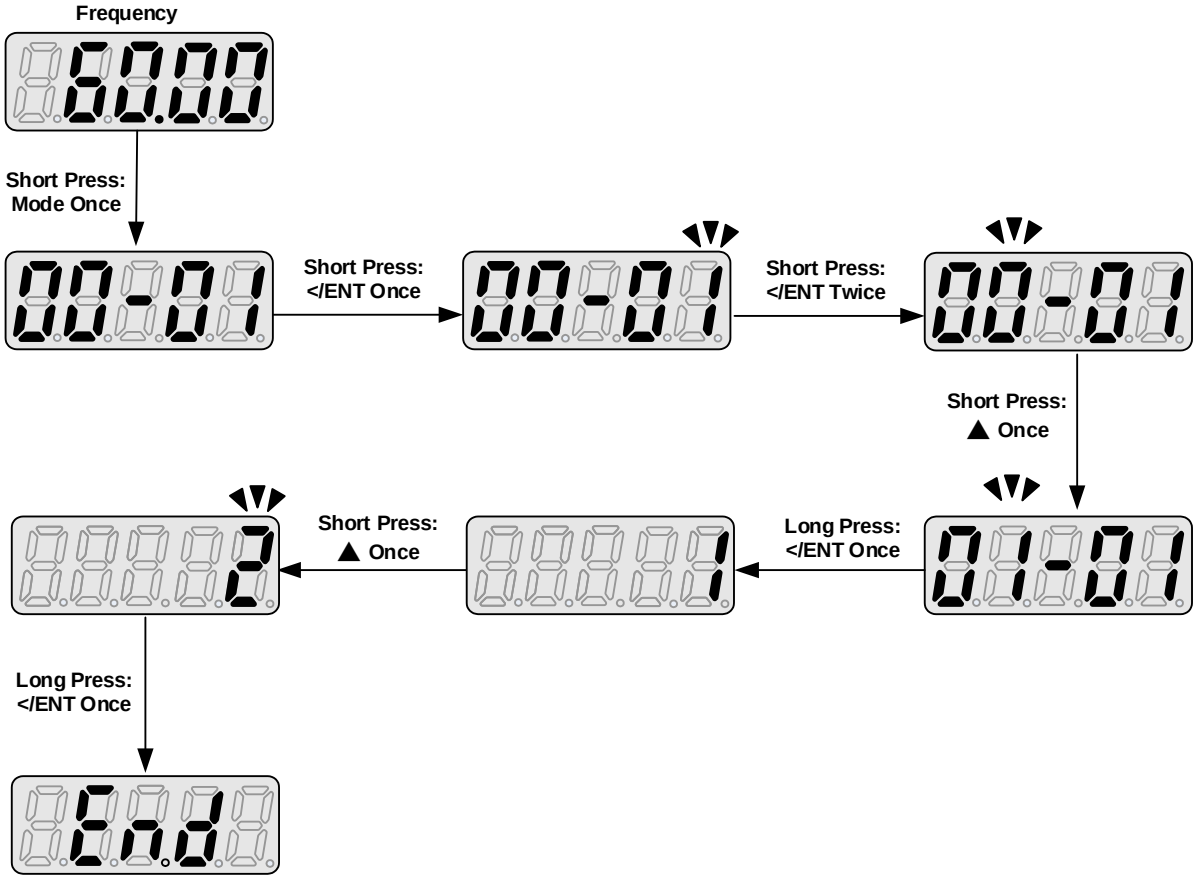
Example: 12-00 = 10000



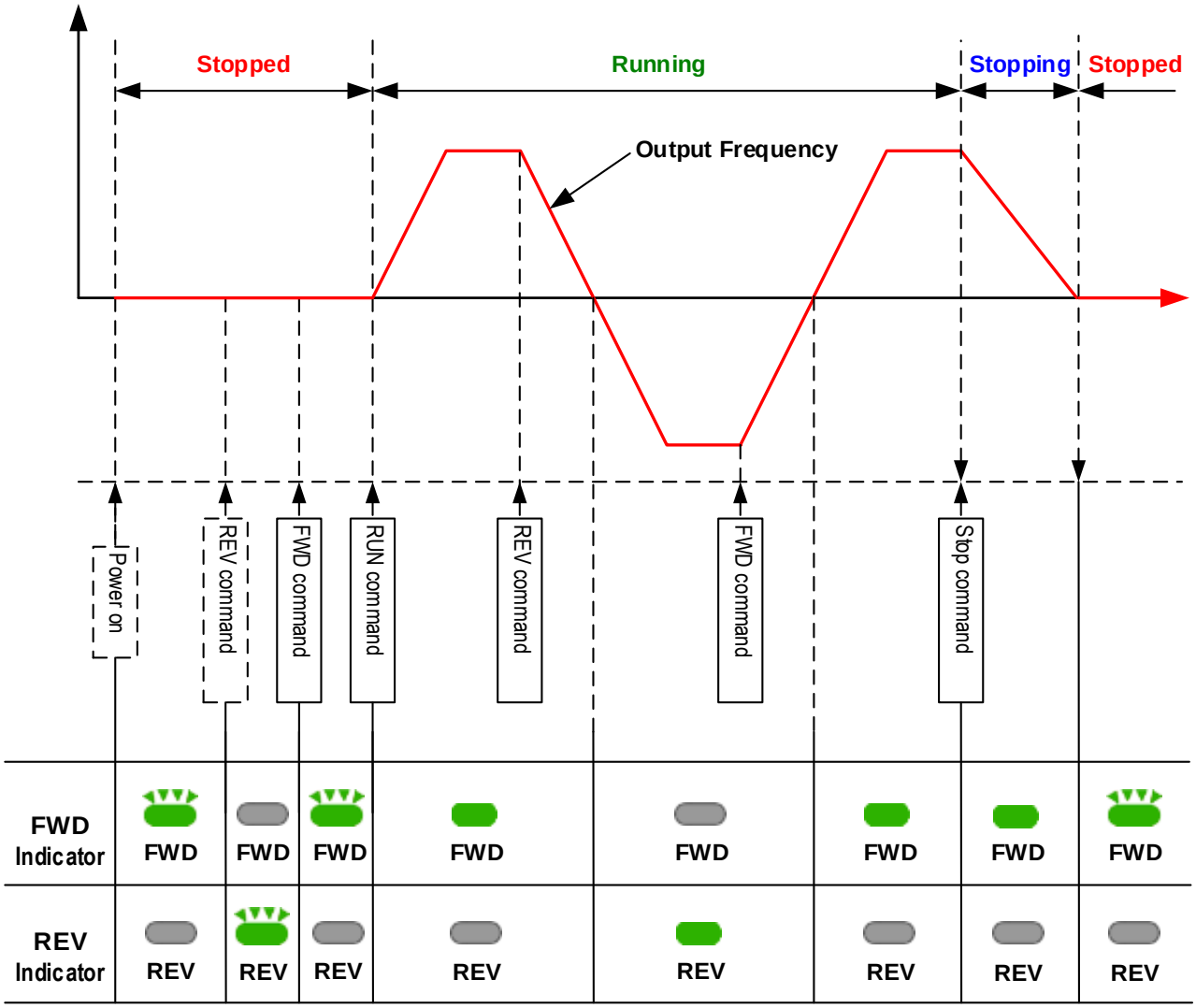
Example: 12-00 = 12345



4.1.5 Modifying Parameters / Set Frequency Reference



4.1.6 Operation Control



4.2 Parameters

Parameter group	Name
Group 00	Basic Parameters
Group 01	V/F Control Parameters
Group 02	Motor Parameters
Group 03	External Digital Input and Output Parameters
Group 04	External Analog Input and Output Parameters
Group 05	Multi-Speed Parameters
Group 06	Automatic Program Operation Parameters
Group 07	Start /Stop Parameters
Group 08	Protection Parameters
Group 09	Communication Parameters
Group 10	PID Parameters
Group 11	Performance Control Parameters
Group 12	Monitoring Parameters
Group 13	Maintenance Parameters

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

Group 00: Basic Parameters					
Code	**Parameter Name**	**Setting Range**	**Default**	**Unit**	**Note**
00-00	Control Method	0: V/F mode 1: SLV mode	0	-	*1
00-01	Motor Rotation	0: Forward 1: Reverse	0	-	*1
00-02	Main Run Source Selection	0: Keypad 1: External Run/Stop 2: Communication	0	-	
00-03	Alternative Run Source Selection	0: Keypad 1: External Run/Stop 2: Communication	0	-	
00-04	Operation modes for external terminals	0: Forward/Stop-Reverse/Stop 1: Run/Stop-Reverse/Forward 2: 3-Wire Control Mode-Run/Stop	0	-	
00-05	Main Frequency Source Selection	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.	0	-	
00-06	Alternative Frequency Source Selection	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.	4	-	
00-07	Main and Alternative Frequency Command modes	0: Main or Alternative Freq. 1: Main + Alternative Freq.	0	-	
00-08	Communication Frequency Command	0.00~599.00		Hz	*4
00-09	Frequency command Save mode (Communication mode)	0: Save Freq. before powering down 1: Save communication Freq.	0	-	
00-10	Initial Frequency Selection (keypad mode)	0: Set by Current Freq. Command 1: Set by 0 Freq. Command 2: Set by 00-11	0	-	
00-11	Initial Frequency Keypad mode	0.00~599.00	50.00/60.00	Hz	
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	*1

Group 00: Basic Parameters					
Code	**Parameter Name**	**Setting Range**	**Default**	**Unit**	**Note**
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

Group 01: V/F Control Parameters					
Code	**Parameter Name**	**Setting Range**	**Default**	**Unit**	**Notes**
01-00	Volts/Hz Patterns	1~7	1/4	-	
01-01	V/F Max voltage	200V:170.0~264.0 400V:323.0~528.0	220.0/380.0/440.0	Vac	
01-02	Max Frequency	1.40 ~ 599.00	50.00/60.00	Hz	
01-03	Max Frequency Voltage Ratio	0.0 ~ 100.0	100.0	%	
01-04	Mid Frequency 2	1.30 ~ 599.00	2.50/3.00	Hz	
01-05	Mid Frequency Voltage Ratio 2	0.0 ~ 100.0	10.0/6.8	%	
01-06	Mid Frequency 1	1.30 ~ 599.00	2.50/3.00	Hz	
01-07	Mid Frequency Voltage Ratio 1	0.0 ~ 100.0	10.0/6.8	%	
01-08	Min Frequency	1.30 ~ 599.00	1.30/1.50	Hz	
01-09	Min Frequency Voltage Ratio	0.0 ~ 100.0	8.0/3.4	%	
01-10	Volts/Hz Curve Modification (Torque Boost)	0 ~ 10.0	0.0	%	*1
01-11	V/F start Frequency	0.00~10.00	0.00	Hz	
01-12	No-load oscillation suppression gain	0.0~200.0	0	%	
01-13	Motor Hunting Prevention Coefficient	1~8192	800		
01-14	Motor Hunting Prevention Gain	0~100	Frame1/2 100V/200V series: 7 others: 0	%	
01-15	Motor 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	30	%	
01-18	Auto-torque Compensation Frequency	1.30~5.00	2	Hz	

Group 02: Motor Parameters					
Code	**Parameter Name**	**Setting Range**	**Default**	**Unit**	**Notes**
02-00	Motor Mo Load Current	----		A	*4
02-01	Motor Rated Current (OL1)	----		A	*4
02-02	V/F Slip Compensation	0.0 ~ 100.0	0.0	%	*1
02-03	Motor Rated Speed	----		Rpm	*4
02-04	Motor Rated Voltage	----		Vac	*4
02-05	Motor Rated Power	0~22.0	by series	kW	
02-06	Motor Rated Frequency	0~599.0	50.0		
02-07	Motor Auto Tuning	0: Disable 1: Static auto tuning	0		
02-08	Stator Resistor Gain	0~600	by series		
02-09	Rotor Resistor Gain	0~600	by series		
02-10	Reserved				
02-11	Reserved				
02-12	Reserved				

Group 02: Motor Parameters					
02-13	SLV Slip Compensation Gain	0~150	by series	%	
02-14	SLV Torque Compensation Gain	0~100	100	%	
02-15	Low Frequency Torque Gain	0~100	50	%	
02-16	SLV Without Load Slip Compensation Gain	0~200	by series	%	
02-17	SLV With Load Slip Compensation Gain	0~200	150	%	

Group 03: External Digital Input and Output Parameters					
Code	**Parameter Name**	**Setting Range**	**Default**	**Unit**	**Notes**
03-00	Multi-function Terminal Function Setting-S1	0: Forward/Stop Command or Run /Stop 1: Reverse/Stop Command Or REV/FWD 2: Preset Speed 1 (5-02) 3: Preset Speed 2 (5-03) 4: Preset Speed 4 (5-05) 6: Jog Forward Command 7: Jog Reverse Command 8: Up Command 9: Down Command 10: Acc/Dec 2 11: Acc/Dec Disabled 12: Main/Alternative Run Command select 13: Main/Alternative Frequency Command select 14: Rapid Stop (Decel to stop) 15: Base Block 16: Disable PID Function 17: Reset 18: Auto Run Mode enable	0	-	
03-01	Multi-function Terminal Function Setting-S2		1	-	
03-02	Multi-function Terminal Function Setting-S3		2	-	
03-03	Multi-function Terminal Function Setting-S4		3	-	
03-04	Multi-function Terminal Function Setting-S5		17	-	
03-05	Reserved				
03-06	Up/Down Frequency Band	0.00~5.00	0.00	Hz	
03-07	Up/Down Frequency Modes	0: When Up/Down is used, the preset frequency is held as the inverter stops, and the UP/Down function is disabled. 1: When Up/Down is used, the preset frequency is reset to 0 Hz as the inverter stops. 2: When Up/Down is used, the 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 Select	xxxx0:S1 NO xxxx1:S1 NC xxx0x:S2 NO xxx1x:S2 NC xx0xx:S3 NO xx1xx:S3 NC x0xxx:S4 NO x1xxx:S4 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	0	-	

Group 03: External Digital Input and Output Parameters					
Code	**Parameter Name**	**Setting Range**	**Default**	**Unit**	**Notes**
		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			
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	
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	
03-18	External Brake Engage Level	0.00~20.00	0.00	Hz	
03-19	Relay Output Function Type	0: A (Normally Open) 1: B (Normally Closed)	0	-	
03-20	Braking Transistor On Level	100.0~800.0	220v:380 380/400v:690 415/460v:780	VDC	
03-21	Braking Transistor Off Level	100.0~800.0	220v:340 380/400v:670 415/460v:760	VDC	

Group 04: External Analog Input and Output Parameters					
Code	**Parameter Name**	**Setting Range**	**Default**	**Unit**	**Notes**
04-00	AVI/ACI analog Input signal type select	AVI ACI 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	100	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	100	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	0	-	*1

Group 04: External Analog Input and Output Parameters					
Code	**Parameter Name**	**Setting Range**	**Default**	**Unit**	**Notes**
		1: Negative			
04-11	Analog Output mode(AO)	0: Output Frequency 1: Frequency Command 2: Output Voltage 3: DC Bus Voltage 4: Motor Current	0	-	*1
04-12	Analog Output AO Gain (%)	0 ~ 1000	100	%	*1
04-13	Analog Output AO Bias (%)	0 ~ 100	0	%	*1
04-14	AO Bias Selection	0: Positive 1: Negative	0	-	*1
04-15	AO Slope	0: Positive 1: Negative	0	-	*1

Group 05: Multi-Speed Function Group					
Code	**Parameter Name**	**Setting Range**	**Default**	**Unit**	**Notes**
05-00	Preset Speed Control mode Selection	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	Preset Speed 0 (Keypad Freq)	0.00 ~ 599.00	5.00	Hz	
05-02	Preset Speed1 (Hz)	0.00 ~ 599.00	5.00	Hz	*1
05-03	Preset Speed2 (Hz)	0.00 ~ 599.00	10.00	Hz	*1
05-04	Preset Speed3 (Hz)	0.00 ~ 599.00	20.00	Hz	*1
05-05	Preset Speed4 (Hz)	0.00 ~ 599.00	30.00	Hz	*1
05-06	Preset Speed5 (Hz)	0.00 ~ 599.00	40.00	Hz	*1
05-07	Preset Speed6 (Hz)	0.00 ~ 599.00	50.00	Hz	*1
05-08	Preset Speed7 (Hz)	0.00 ~ 599.00	50.00	Hz	*1
05-09 ~ 05-16	Reserved				
05-17	Preset Speed0-Acctime	0.1 ~ 3600.0	10.0	s	*1
05-18	Preset Speed0-Dectime	0.1 ~ 3600.0	10.0	s	*1
05-19	Preset Speed1-Acctime	0.1 ~ 3600.0	10.0	s	*1
05-20	Preset Speed1-Dectime	0.1 ~ 3600.0	10.0	s	*1
05-21	Preset Speed2-Acctime	0.1 ~ 3600.0	10.0	s	*1
05-22	Preset Speed2-Dectime	0.1 ~ 3600.0	10.0	s	*1
05-23	Preset Speed3-Acctime	0.1 ~ 3600.0	10.0	s	*1
05-24	Preset Speed3-Dectime	0.1 ~ 3600.0	10.0	s	*1
05-25	Preset Speed4-Acctime	0.1 ~ 3600.0	10.0	s	*1
05-26	Preset Speed4-Dectime	0.1 ~ 3600.0	10.0	s	*1
05-27	Preset Speed5-Acctime	0.1 ~ 3600.0	10.0	s	*1
05-28	Preset Speed5-Dectime	0.1 ~ 3600.0	10.0	s	*1
05-29	Preset Speed6-Acctime	0.1 ~ 3600.0	10.0	s	*1
05-30	Preset Speed6-Dectime	0.1 ~ 3600.0	10.0	s	*1

Group 05: Multi-Speed Function Group					
Code	**Parameter Name**	**Setting Range**	**Default**	**Unit**	**Notes**
05-31	Preset Speed7-Acctime	0.1 ~ 3600.0	10.0	s	*1
05-32	Preset Speed7-Dectime	0.1 ~ 3600.0	10.0	s	*1

Group 06: Automatic Program Operation Parameters					
Code	**Parameter Name**	**Setting Range**	**Default**	**Unit**	**Notes**
06-00	Auto Run (sequencer) mode selection	0: Disabled 1: Single cycle. (Continues to run from the Unfinished step if restarted). 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, and then hold the speed of final step to run (Starts a new cycle if restarted).	0	-	
06-01	Auto _ Run Mode frequency command 1	0.00~599.00	0.00	Hz	*1
06-02	Auto _ Run Mode frequency command 2	0.00~599.00	0.00	Hz	*1
06-03	Auto _ Run Mode frequency command 3	0.00~599.00	0.00	Hz	*1
06-04	Auto _ Run Mode frequency command 4	0.00~599.00	0.00	Hz	*1
06-05	Auto _ Run Mode frequency command 5	0.00~599.00	0.00	Hz	*1
06-06	Auto _ Run Mode frequency command 6	0.00~599.00	0.00	Hz	*1
06-07	Auto _ Run Mode frequency command 7	0.00~599.00	0.00	Hz	*1
06-08 ~ 06-15	Reserved				
06-16	Auto_ Run Mode running time setting 0	0.0 ~ 3600.0	0.0	s	
06-17	Auto_ Run Mode running time setting 1	0.0 ~ 3600.0	0.0	s	
06-18	Auto_ Run Mode running time setting 2	0.0 ~ 3600.0	0.0	s	
06-19	Auto_ Run Mode running time setting 3	0.0 ~ 3600.0	0.0	s	
06-20	Auto_ Run Mode running time setting 4	0.0 ~ 3600.0	0.0	s	
06-21	Auto_ Run Mode running time setting 5	0.0 ~ 3600.0	0.0	s	
06-22	Auto_ Run Mode running time setting 6	0.0 ~ 3600.0	0.0	s	
06-23	Auto_ Run Mode running time setting 7	0.0 ~ 3600.0	0.0	s	
06-24	Reserved				

Group 06: Automatic Program Operation Parameters					
Code	**Parameter Name**	**Setting Range**	**Default**	**Unit**	**Notes**
~ 06-31					
06-32	Auto_ Run Mode running direction 2	0: Stop	0	-	
06-33	Auto_ Run Mode running direction 3		0	-	
06-34	Auto_ Run Mode running direction 4	1: Forward	0	-	
06-35	Auto_ Run Mode running direction 5		0	-	
06-36	Auto_ Run Mode running direction 6	2: Reverse	0	-	
06-37	Auto_ Run Mode running direction 7		0	-	
06-38	Auto_ Run Mode running direction 2		0	-	
06-39	Auto_ Run Mode running direction 3		0	-	

Group 07: Start /Stop Parameters					
Code	**Parameter Name**	**Setting Range**	**Default**	**Unit**	**Notes**
07-00	Momentary Power Loss and Restart	0: Disabled 1: Enabled	0	-	
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 0: 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 Freq in Stop Mode	0.10 ~ 10.00	1.5	Hz	
07-07	DC Injection Braking Current	0 ~ 20%	5	%	
07-08	DC Injection Brake Time in Stop Mode	0.0 ~ 25.5	0.5	s	
07-09	Stopping Method	0: Deceleration to Stop 1: Coast to Stop	0		

Group 08: Protection Parameters					
Code	**Parameter Name**	**Setting Range**	**Default**	**Unit**	**Notes**
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	00000	-	

Group 08: Protection Parameters					
Code	**Parameter Name**	**Setting Range**	**Default**	**Unit**	**Notes**
		x1xxx: Disable over voltage Prevention in Run Mode			
08-01	Trip Prevention Level During Acceleration (%)	50 ~ 200	by series	%	
08-02	Trip Prevention Level During Deceleration (%)	50 ~ 200	by series		
08-03	Trip Prevention Level In Run Mode (%)	50 ~ 200	by series		
08-04	over voltage Prevention Level in Run Mode	350~390	380	VDC	*1
08-05	Electronic Motor Overload Protection Operation Mode	xxxx0: Disable Electronic Motor Overload Protection	00001	-	
		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)			
08-06	Operation After Overload Protection 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	Over heat Protection (cooling fan control)	0: Auto (Depends on temp.) 1: Operate while in RUN mode 2: Always Run 3: Disabled	1	-	
08-08	AVR Function (Auto Voltage Regulation)	0: AVR function enable	4	-	
		1: AVR function Disable			
		2: AVR function disable for stop			
		3: AVR function disable for deceleration			
		4: AVR function disable for stop and deceleration.			
		5: When VDC>(360V/740V), AVR function disable for stop and deceleration.			
08-09	Input phase lost protection	0: Disabled 1: Enabled	0	-	
08-10	PTC Overheat Function	0: Disable	0		
		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	0.01~10.00	0.2	Sec	

Group 08: Protection Parameters					
Code	**Parameter Name**	**Setting Range**	**Default**	**Unit**	**Notes**
08-12	PTC Detection Time Delay	1~300	60	Sec	
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	

Group 09: Communication Parameters					
Code	**Parameter Name**	**Setting Range**	**Default**	**Unit**	**Notes**
09-00	Assigned Communication Station Number	1~32	1	-	*2*3
09-01	Communication Mode Select	0: RTU Code 1: ASCII Code 2: BACnet	0	-	*2*3
09-02	Baud Rate Setting (bps)	0: 4600 1: 9600 2: 19200 3: 38400	2	bps	*2*3
09-03	Stop Bit Selection	0: 1 Stop Bit 1: 2 Stop Bits	0	-	*2*3
09-04	Parity Selection	0: No Parity 1: Even Parity 2: Odd Parity	0	-	*2*3
09-05	Data Format Selection	0: 8-Bits Data 1: 7-Bits Data	0	-	*2*3
09-06	Communication time-out detection time	0.0 ~ 25.5	0.0	s	
09-07	Communication time-out operation	0: Deceleration to Stop (00-15) 1: Coast to Stop 2: Deceleration to Stop (00-17) 3: Continue Operating	0	-	
09-08	Error 6 verification time	1 ~ 20	3		
09-09	Drive Transmit delay Time (ms)	5 ~ 65	5	ms	
09-10	BACnet Stations	1 - 124	1		

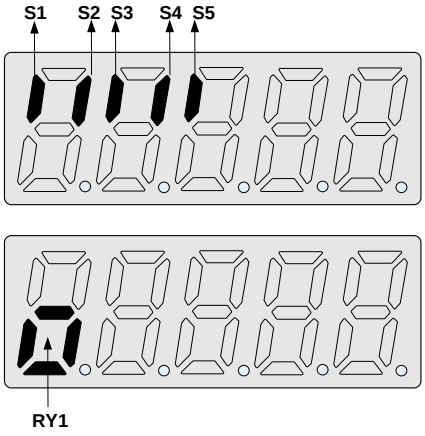
Group 10: PID Parameters					
Code	**Parameter Name**	**Setting Range**	**Default**	**Unit**	**Notes**
10-00	PID target value selection (when 00-05\00-06=6	0: Potentiometer on Keypad 1: Analog Signal Input (AVI)	1	-	*1

Group 10: PID Parameters					
Code	**Parameter Name**	**Setting Range**	**Default**	**Unit**	**Notes**
	,this function is enabled)	2: Analog Signal Input (ACI)			
		3: Freq. set by Communication			
		4: Keypad Freq. Parameter 10-02			
10-01	PID feedback value selection	0: Potentiometer on Keypad	2	-	*1
		1: Analog Signal Input (AVI)			
		2: Analog Signal Input (ACI)			
		3: Freq. set by Communication			
10-02		0.0 ~ 100.0	50.0	%	*1
10-03	PID Mode Selection	0: Disabled	0	-	
		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.			
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	0	-	*1
		1: Negative			
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	0	-	
		1: Enabled – Drive continues to operate after feedback loss			
		2: Enabled – Drive “stops” after feedback loss			
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 the Target Value	0: Disabled	0	-	
		1: 1 Second			
		30: 30 Seconds (0~30)			
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 function Delay Time	0.0 ~ 25.5	0.0	s	

Group 10: PID Parameters					
Code	**Parameter Name**	**Setting Range**	**Default**	**Unit**	**Notes**
10-21	Max PID Feedback Setting	0 ~999	100	-	*1
10-22	Min PID Feedback Setting	0 ~999	0	-	*1

Group 11: Auxiliary Parameters					
Code	**Parameter Name**	**Setting Range**	**Default**	**Unit**	**Notes**
11-00	Reverse operation control	0: Reverse command is enabled 1: Reverse command is disabled	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, 2phase soft 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		

Group12: Monitoring Parameters					
Code	**Parameter Name**	**Setting Range**	**Default**	**Unit**	**Notes**
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 5:PID feedback 6:Analog Signal Input. (AVI)	00000	-	*1

Group12: Monitoring Parameters					
Code	**Parameter Name**	**Setting Range**	**Default**	**Unit**	**Notes**
		7:Analog Signal Input. (ACI)			
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		-----	-	*4

Group 13: Maintenance Parameters					
Code	**Parameter Name**	**Setting Range**	**Default**	**Unit**	**Notes**
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 Time1 1	0~23	-	hour	*3
13-04	Accumulated Operation Time1 2	0~65535	----	day	*3
13-05	Accumulated Operation Time Mode	0:Time Under Power 1:Run Mode Time Only	0	-	*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 Function	0	-	
13-07	Parameter Lock Code	00000~65535	00000	-	
13-08	Reset Drive to Factory Settings	1150: Reset to factory setting 50Hz, 220V/380V drive. 1160: Reset to factory setting 60Hz, 220V/380V drive. 1250: Reset to factory setting 50Hz, 230V/400V drive. 1260: Reset to factory setting 60Hz, 230V/460V drive. 1350: Reset to factory setting 50Hz, 220V/415V drive.	00000	-	

5. Troubleshooting and Fault Diagnostics

5.1 General

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.

5.2 Fault Detection Function

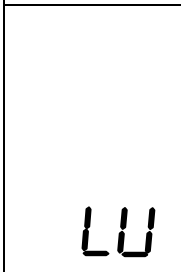
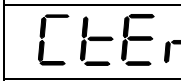
When a fault occurs, please refer to Table 5.2.1 for possible causes and take appropriate measures.

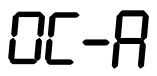
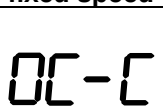
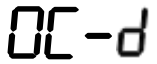
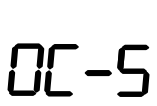
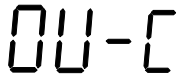
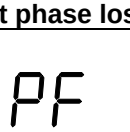
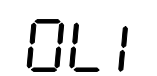
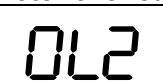
Use one of the following methods to restart:
1. Set one of multi-function digital input terminals (03-00 ~ 03-04) to 17 (Fault reset); activate input
2. Press the reset button on the keypad.
3. Power down inverter wait until keypad goes blank and power-up the inverter again.

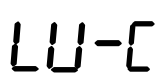
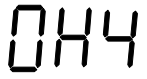
When a fault occurs, the fault message is stored in the fault history (see group 12 parameters).

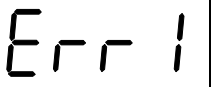
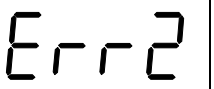
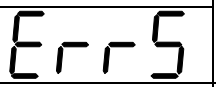
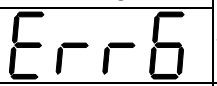
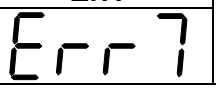
Table 5.2.1 Fault information and possible solutions

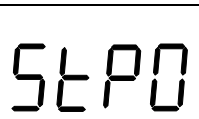
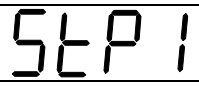
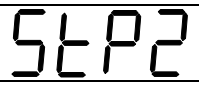
LED display	Description	Cause	Possible solutions
OV **Over voltage** OU	DC bus voltage exceeds the OV detection level: 410Vdc: 230V class 820Vdc: 460V class (For 460V class, if input voltage 01-14 is set lower than 460V, the OV detection value will is decreased to 700Vdc).	• Deceleration time set too 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.

LED display	Description	Cause	Possible solutions
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. 190Vdc: 230V class; 380Vdc: 460V class; The detection value can be adjusted by 07-13).	• 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 not incorrect.	• Check the input voltage. • Check input wiring. • Increase acceleration time. • Check power source • Replace pre-charge contactor • Replace control board or complete inverter.
OH **Heatsink overheat** 	The temperature of the heat sink is too high. 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
OH **Heatsink overheat** 	The temperature of the heat sink is too high. 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
CT Fault 	Input voltage fault	• Abnormal input voltage, too much noise or malfunctioning control board.	• Check input voltage signal and the voltage on the control board.
HPErr 	Inverter capacity setting error: Inverter capacity 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.
Err4 	CPU unusual interrupt	• External noise interference	• Remove interference source then restart drive by switching power OFF/ON. • If not resolved contact supplier.
OC-A **over current at acceleration**	The inverter output current exceeds the	• Acceleration / Deceleration time is too short. • Contactor at the inverter output side. • A special motor or applicable capacity is	• Extend acceleration / deceleration time. • Check the motor wiring.

	overcurrent level (200% of the inverter rated current).	greater than the inverter rated value. • Short circuit or ground fault.	• Disconnect motor and try running inverter.
OC-C over current at fixed speed 	The inverter output current exceeds the overcurrent level (200% of the inverter rated current).	• Acceleration / Deceleration time is too short. • Contactor at the inverter output side. • A special motor or applicable capacity is greater than the inverter rated value. • Short circuit or ground fault.	• Extend acceleration / deceleration time. • Check the motor wiring. • Disconnect motor and try running inverter.
OC-d over current at deceleration 	The inverter output current exceeds the overcurrent level (200% of the inverter rated current).	• Acceleration / Deceleration time is too short. • Contactor at the inverter output side. • A special motor or applicable capacity is greater than the inverter rated value. • Short circuit or ground fault.	• Extend acceleration / deceleration time. • Check the motor wiring. • Disconnect motor and try running inverter.
OC-S over current at start 	The inverter output current exceeds the overcurrent level (200% of the inverter rated current).	• Acceleration / Deceleration time is too short. • Contactor at the inverter output side. • A special motor or applicable capacity is greater than the inverter rated value. • Short circuit or ground fault.	• Extend acceleration / deceleration time. • Check the motor wiring. • Disconnect motor and try running inverter.
OV-C over voltage during operation / deceleration 	Excessive Voltage during operation/ deceleration	• Deceleration time setting too short or excessive load inertia • Power voltage varies widely (fluctuates)	• 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 	Input phase Loss	• Abnormal fluctuations in the main circuit voltage	• Check the main circuit power supply wiring. • Check the power supply voltage
OC over current 	The inverter output current exceeds the overcurrent level (200% of the inverter rated current).	• Acceleration / Deceleration time is too short. • Contactor at the inverter output side. • A special motor or applicable capacity is greater than the inverter rated value. • Short circuit or ground fault.	• Extend acceleration / deceleration time. • Check the motor wiring. • Disconnect motor and try running inverter.
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 too heavy.	• Check V/f curve. • Check motor rated current • Check and reduce motor load, check and operation duty cycle.
OL2 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 too heavy.	• Check V/f curve. • Check motor rated current • Check and reduce motor load, check and operation duty cycle.

LED display	Description	Cause	Possible solutions
CL 	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 over current warning: Inverter current reached over current protection level.	• Check motor load and operating time..
LV **Low voltage during operation** 	Voltage too low during operation	• Power voltage too low • Power voltage varies widely (fluctuates)	1.Improve power quality 2.Consider adding a reactor at the power input side
OVSP 	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.
OH4 	motor over heat error	• If temperature detected increases above the set limit in parameter 08-13 and for the delay time set in parameter 08-12 then the display will show “OH4” (motor over heat detection), and the motor will coast to stop. • Motor over heat detection “OH4” can be reset when the temperature detection level is lower than the set level in parameter【08-14 PTC reset level】.	• Improve ventilation • Adjust parameter 08-15

LED display	Description	Cause	Possible solutions
LOC locked 	1.Parameter already locked 2.Motor direction locked 3.Parameter password (13-07) enabled	• Attempt to modify frequency parameter while 13-06>0. • Attempt to reverse direction when 11-00=1 • Parameter (13 - 07) enabled, set the correct password will show LOC.	• Adjust 13-06 • Adjust 11-00
Err1 	Keypad operation error	• Press ▲ or ▼while 00-05/00-06>0 or running at preset speed. • Attempting to modify a parameter that cannot be modified during operation (refer to the parameter list)	• The ▲ or▼ is available for modifying the parameter only when 00-05/00-06=0 • Modify the parameter in STOP mode.
Err2 	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
Err5 	Modification of parameter is not available in communication	• Control command sent during communication • Attempt 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	• Wiring error • Communication parameter setting error. • Incorrect communication protocol	• Check hardware and wiring • Check Functions(09-00~09- 05)
Err7 	Parameter conflict	• Attempt to modify parameter 13-00/13-08. • Voltage and current detection circuit not working properly.	• Consult factory if unable to reset inverter.

LED display	Fault	Description
StP0 	Zero speed at stop	Occurs when preset frequency <0.1Hz
StP1 	Fail to start directly On power up.	• If the inverter is set for external terminal control mode (00-02/00-03=1) and direct start is disabled (07-04=1) • The inverter cannot be started and will flash STP1. • The run input is active at power-up, refer to descriptions of (07-04).
StP2 	Keypad Stop Operated when inverter 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.
E.S. 	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.
b.b. 	External base block	When external base block input is activated the inverter stops immediately and then the display will flash with b.b. message.
PdEr 	PID feedback loss	PID feedback loss is detected.

Appendix 1: 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/cUL Mark

❖ 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 mm2 , (AWG)		Terminal	Crimp Terminal	Tool	Insulation Cap
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.lHp 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 1he 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.

TECO Westinghouse

INVERTER

L510

Distributor

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