# Emotron VSC
# Variable Speed Drive

Instruction manual

English

emotron®

DEDICATED DRIVE

# Quick Start Guide

This guide is to assist in installing and running the variable speed drive, VSD, to verify that the drive and motor are working properly. Starting, stopping and speed control will be from the keypad. If your application requires external control or special system programming, consult the VSC Instruction Manual supplied with your VSD.

## Step 1 Before Starting the VSD

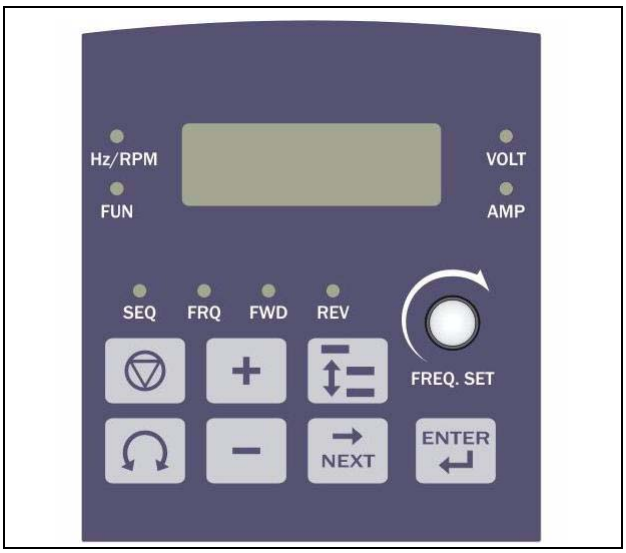
Please review Preface and Safety Precautions of the VSC Instruction Manual. Verify drive was installed in accordance with the procedures as described in VSC Ambient Environment and Installation. If you feel this was abnormal, do not start the drive until qualified personnel have corrected the situation. (Failure to do so could result in serious injury.)

- Check VSD and motor nameplates to determine that they have the same HP and voltage ratings. (Ensure that full load motor amps do not exceed that of the VSD.)
- Remove the terminal cover to expose the motor and power terminals.

  a. Verify that AC power is wired to L1, L2, and L3 (pages 3-12).

  b. Verify that motor leads are connected to T1, T2, and T3 (pages 3-12).

  (The two leads may need to be reversed if motor rotation is not correct.




1. **SEQ LED:** 1_00=1, LED Lit.
2. **FRQ LED:** 1_01=1/2/3/4, LED Lit.
3. **FWD LED:** Forward Direction, LED action (Flashes if stopped, stays lit during operation).
4. **REV LED:** Reverse Direction, LED action (Flashes if stopped, Stays lit during operation).
5. **4-action LED: FUN, Hz/RPM,VOLT and AMP** and four 7-segment display, refer to operation instructions for the keypad.

## Step 2 Apply Power to the Drive

Apply AC power to the drive and observe operator. Four 7-segment display should read power voltage for 3 to 5 seconds and then read frequency/speed, 05.00. Four 7-segment display and FWD LED should flash all the time.

## Step 3 Check Motor Rotation Without Load

- Press the key (FWD LED should light up); four 7-segment display should run from 00.00 to 05.00.
- Check motor rotation.

If it is not correct:

- Press the key. Disconnect AC power. Wait for LED charge lamp to extinguish.
- Reverse motor leads T1 and T2. Restart the drive and check new rotation.
- Press the key to stop the drive.

## Step 4 Check Full Speed at 50Hz/60Hz

- Frequency/Speed can be changed by pressing the + or − keys. To move right or left for next digit, press the NEXT key. Press the ENTER key to set the speed.
- Set frequency up to 50Hz/60Hz in accordance with the last rule.
- Press the key. Check drive acceleration up to full speed.
- Press the key to stop drive and check deceleration.

## Step 5 Other Operations

For information, see VSC Instruction Manual.

Please refer to the following pages:

Set Accel ..... p. 32
Set Decel ..... p. 32
Set Max Speed ..... p. 32
Set Min Speed ..... p. 32
Set Motor Rated Current ..... p. 29
Set Control Mode (Vector, V/F) ..... p. 28

# Contents


**Quick Start Guide ..... 3**

**Contents ..... 1**

**Preface ..... 3**

**Safety Precautions ..... 5**

**1. Model Definition ..... 7**

**2. Ambient Conditions and Installation ..... 9**

2.1 Environment ..... 9
2.2 Environmental precautions ..... 10
2.3 Installation ..... 11
2.3.1 Wiring notes ..... 11
2.3.2 Applicable specification of magnetic contactor and wires ..... 12
2.3.3 Precautions for peripheral applications: ..... 13
2.4 Specifications ..... 15
2.4.1 Products Individual Specifications ..... 15
2.4.2 General Specifications ..... 15
2.5 Wiring diagram for VSC series inverter ..... 18
2.6 Description of terminals of troubleshooting inverter .. 19
2.7 Outline dimensions ..... 21

**3. Software Index ..... 23**

3.1 Keypad description ..... 23
3.1.1 Keypad display and operation instructions ..... 23
3.1.2 Operating instructions for the keypad ..... 24
3.1.3 Operating instructions for the LED keypad ..... 25
3.1.4 Keypad operation ..... 26
3.2 Control mode selection ..... 28
3.3 VSC programmable functions list ..... 29
3.4 Parameter function description ..... 40
3.4.1 Parameter Group 0: Drive Operation Mode ..... 40
3.4.2 Parameter Group 1 - Start/Stop and Frequency Control Modes ..... 40
3.4.3 Parameter Group 2 - Manual/Automatic Restart Modes ..... 43
3.4.4 Parameter Group 3 - Operating Parameters ..... 44
3.4.5 Parameter Group 4 - Digital Display Operation Mode 48
3.4.6 Parameter Group 5 -Multifunction Input Terminals (MFIT) ..... 49
3.4.7 Parameter Group 6 - Jog and Preset (MFIT) Speed Setting on Keypad ..... 53
3.4.8 Parameter Group 7 - Analogue input signal operation mode ..... 54
3.4.9 Parameter Group 8 - Multifunction output terminal and output signal operation mode ..... 55
3.4.10 Parameter Group 9 – Drive and Load Protection Modes ..... 58
3.4.11 Parameter Group 10 – Volts /Hz Pattern Operation Mode ..... 59
3.4.12 Parameter group 11 - PID operation mode ..... 62
3.4.13 Parameter Group 12 - PID "Limits" and "Out of Range" Mode ..... 63
3.4.14 Parameter Group 13 - Communication mode ..... 65
3.4.15 Parameter Group 14 - Autotuning ..... 67
3.4.16 Parameter Group 15 - Operation Status and Function Reset ..... 67

**4. Troubleshooting and Maintenance ..... 69**

4.1 Error display and remedying errors ..... 69
4.1.1 Errors which cannot be recovered manually ..... 69
4.1.2 Errors which can be recovered manually and automatically ..... 69
4.1.3 Errors which can be recovered manually but not automatically ..... 70
4.1.4 Special conditions ..... 71
4.1.5 Operation errors ..... 72
4.2 General troubleshooting ..... 73
4.3 Quick troubleshooting of VSC ..... 74
4.4 Routine inspection and periodical inspection ..... 80
4.5 Maintenance and inspection ..... 81

**5. Peripheral Components ..... 83**

5.1 Reactor specification for input side ..... 83
5.2 Reactor specification on DC side ..... 83
5.3 Braking unit and braking resistor ..... 83
5.4 EMC Filter ..... 84
5.5 Digital operator and extension cable ..... 84
5.5.1 LED Keypad Mounting ..... 84
5.5.2 Keypad Installation Dimension ..... 86
5.6 Interface Card ..... 86
5.6.1 RS485 Interface Card ..... 86
5.6.2 RS232 Interface Card ..... 88
5.6.3 Program Copy Unit ..... 89

**Appendix 1:**
**List of internal parameters for VSC motor 91**

**Appendix 2:**
**VSC parameter setting list 92**

# Preface

To extend the performance of the product and ensure your safety, please read this manual thoroughly before using the VSD. Should there be any problem when using the product that cannot be solved with the information provided in the manual, contact your nearest Emotron distributor or sales representative who will be willing to help you.

## Precautions

The VSD is an electronic product. For your safety, there are symbols such as “Danger” and “Caution” in this manual to remind you to pay attention to safety instructions on handling, installing, operating and checking the VSD. Be sure to follow the instructions for optimum safety.

**WARNING: Indicates a potential hazard could cause death or serious personal injury if misused.**

**CAUTION: Indicates that the VSD or the mechanical system might be damaged if misused.**

**WARNING: Do not touch any circuit boards or components if the charging indicator is still lit after turned the power off.**

**Do not wire when the VSD is electrified. Do not check parts and signals on circuit boards during the VSD operation.**

**Do not disassemble the VSD or modify internal wires, circuits and parts.**

**Earth the ground terminal of the VSD properly. As per 400 V class, earth to 10 Ohm or below.**

**CAUTION: Do not perform a voltage test on parts inside the VSD. High voltage will easily destroy these semiconductor parts.**

**Do not connect the VSD’s T1 (U), T2 (V) and T3 (W) terminals to an AC power supply.**

**CMOS ICs on the VSD’s main board are susceptible to static electricity. Do not touch the main circuit board**

## Products Inspection

Emotron’s VSDs are all function tested before delivery. Please check the following when you receive and unpack the VSD:

- The model and capacity of the VSD are the same as those specified in your purchase order.
- That there is not any damage caused by transportation.

Please do not switch on the power, and do contact Emotron’s sales representatives if you experience any problems.

# Safety Precautions

## Operation Precaution

### Before Power ON

**CAUTION: The line voltage applied must comply with the VSD's specified input voltage.**

**WARNING: Make sure the main circuit connections are correct. L1, L2 and L3 are power-input terminals and must not be mistaken for T1, T2 and T3. If they are, the VSD might get damaged.**

**CAUTION: To avoid the front cover disengaging, do not pull the cover during handling or the heat sink may fall off. This will damage the VSD or cause a personal injury, which should be avoided.**

**To avoid the risk of fire, do not install the VSD on a flammable object. Install it on a non-flammable object such as metal.**

**If several VSDs are placed in the same control panel, add an extra heat sink to keep the temperature below 40°C to avoid overheating or fire.**

**When removing or installing the operator, turn OFF the power first, and follow the instructions in the diagram to avoid operator error or no display due to bad contact.**

**WARNING: According to IEC 61800-3, this product belongs to the restricted sales distribution class. In a domestic environment this product may cause radio interference in which case the user may be required to take appropriate measures.**

**CAUTION: To ensure the safety of peripheral devices, it is strongly recommended to install the right fuse in the mains input side. Check chapter 2.3.1. for specifications and information concerning fuse type.**

### During Power ON

**WARNING: Do not plug or unplug the connectors on the VSD when electrified, otherwise the control panel may be damaged as a result of an erratic transition voltage surge from contact bounce.**

**When momentary power loss is longer than 2 seconds (the greater the horsepower, the longer the time), the VSD does not have enough power stored to control the circuit. Therefore, when power is regenerated, the operation of the VSD is based on the setup for 1-00 / 2-05 and the condition of the external switch. This is the definition or restart in the following paragraphs.**

**When the momentary power loss is short, the VSD still has enough power stored to control the circuit. Therefore, when power is regenerated, the VSD will automatically restart according on the setup of 2-00/2-01.**

**When the VSD is restarted, the operation is based on the setup for 1-00 and 2-05 and the condition of the external switch ( key). Note: The start operation is irrelevant with 2-00/2-01/2-02/2-03.**

**1. When 1-00=0000, the VSD will not automatically run after restart.**

**2. When 1-00=0001 and the external switch ( key) is OFF, the VSD will not run after restart.**

**3. When 1-00=0001, the external switch ( key) is ON, and 2-05=0000, the VSD will run automatically after restart. Note: For safety reasons, please turn off the external switch ( key) after power loss to body if the power resumes suddenly.**

**To ensure personal and machinery safety, please refer to the description and suggestion in 2-05**

## Before Operation

**WARNING: Make sure the model and capacity are the same as those set with 15-0.**

**CAUTION: The VSD will flash the power voltage set by 0-07 for 5 seconds when power is applied.**

## During Operation

**WARNING: Do not engage or disengage the motor during operation. Otherwise, the over-current will cause the VSD to disconnect or the main circuit to burn.**

**WARNING: To avoid electric shock, do not take the front cover off when the power is on.**

**The motor will restart automatically after stop when the auto-restart function is enabled. In this case, do not get close to the machine.**

**Note: The stop switch is not used in the same way as the emergency stop switch. It must first be set to be effective.**

**CAUTION: Do not touch heat-generating components such as the heat sink and braking resistor.**

**The VSD can drive the motor from low speed to high speed. Verify the motor's range of permitted capacities and the mechanism.**

**Note the settings related to the braking reactor.**

**Do not check signals on circuit boards while the VSD is running.**

**CAUTION: The components cannot be disassembled or checked until five minutes after the power supply has been turned OFF and the indicator is off.**

## During Maintenance

**CAUTION: The VSD should be used in a non-condensed environment with temperature from –10 to +40°C and relative humidity of 95%.**

**CAUTION: When the VSD top cover has been removed, it can be used in a non-condensed environment with temperature from –10 to +50°C and relative humidity of 95%, but the environment should be free from water and metal dust.**

# 1. Model Definition

VSD model

Input voltage

Output specifications

Model: VSC48-013

I/P : AC 3 PH

480V 50/60Hz

013 : AC 3PH 0~480V

5.5kW 13 A

EMOTRON AB

**VSC 48 001**

Series

Supply voltage
48: 380-480 VAC

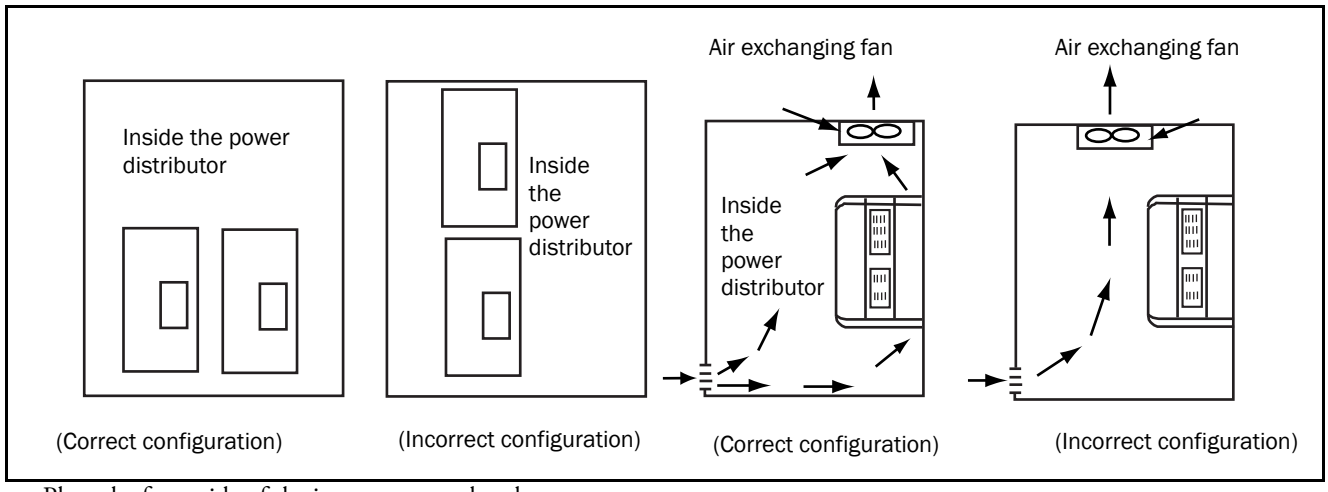
Power
009:4 kW
013:5.5 kW
018:7.5 kW

# 2. Ambient Conditions and Installation

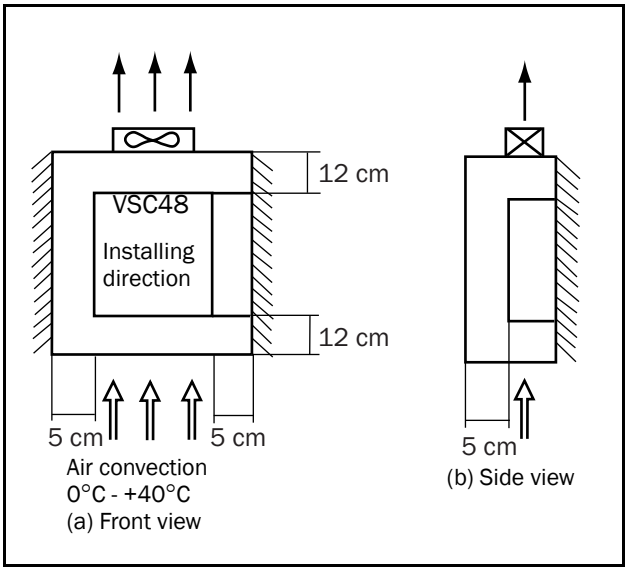
## 2.1 Environment

The environment will directly affect the proper operation and the life span of the inverter, so install the inverter in an environment complying with the following conditions:

| | |
|---|---|
| Ambient temperature: -10°C - +40°C; without cover: -10°C - +50°C | |
| Avoid exposure to rain or moisture. | Avoid direct sunlight. |
| Avoid oil mist and salinity. | Avoid erosive liquid and gas. |
| Avoid dust, bats, and small metal pieces. | Keep away from radioactive and flammable materials. |
| Avoid electromagnetic interference (soldering machine, power machine). | |
| Avoid vibration (punching machine). Add a vibration-proof pad if the situation cannot be avoided. | |
| If several inverters are placed in the same control panel, add extra heat sinks to keep the temperature below 40°C. | |




- Place the front side of the inverter onward and top upward to in favour of heat sink.
- Install the inverter according to the following figures: (take the dust proof cover off in favour of heat sinking if it is installed in a box or the environment allows to do so).



## 2.2 Environmental precautions

Do not use the inverter in an environment with the following conditions.

## 2.3 Installation

### 2.3.1 Wiring notes

#### A. Fastening terminals:

Connect wiring with a screwdriver or other tool and take the fastening torque listed below in account:

| Fastening torque | | |
|---|---|---|
| **Power** | **Power source** | **Nominal torque for TM1 terminal** |
| 4/5.5/7.5 | 380-480V | 1.5/0.21, (LBS-FT / KG-M) |

#### B. Power wires:

Power wires are connected to L1, L2, L3, T1, T2, T3, P, BR and P1. Choose wires in accordance with the following criteria:

1. Use copper wires only. Deciding diameters of wires should be based on rating working at 105°C.
2. For rating voltage of wires, the minimum voltage of 460VAC type is 600V.
3. For safety reason, the power wires should be fixed by type terminal.

#### C. Control wires:

Control wires are wires connected to TM2 control terminal. Choose the wire in accordance with the following criteria:

1. Use copper wires only. Deciding diameters of wires should be based on rating working at 105°C.
2. For rating voltage of wires, the minimum voltage of 460VAC type is 600V.
3. To avoid noise interference, do not route the control wires in the same conduit with power wires and motor wires.

#### D. Nominal electrical specifications of the terminals Block:

The following list is nominal values of TM1:

| Power | Power source | Volts | Amps |
|---|---|---|---|
| 4/5.5/7.5 | 380-480V | 600 | 40A |

**Note: Nominal values of input and output signals (TM2) – follow the specifications of class 2 wiring.**

#### E. Fuse types

Drive input fuses are provided to disconnect the drive from power in the event that a component fails in the drive's power circuitry. The drive's electronic protection circuitry is designed to clear drive output short circuits and ground faults without blowing the drive input fuses. The table below shows the VSC input fuse ratings.

To protect the inverter most effectively, use fuses with current-limiting function, non delay type, and also consider the applicable local regulations for short circuit and overload protection.
For UL approval, select one of the following fuse type: RK5, CC or T.
For non UL applications the fuse type gG or aR can be used.
RK5, C/T TYPE FUSE FOR VSC

440V class (3φ)

| VSC48- | HP | KW | KVA | 100% CONT Output AMPS (A) | MaxRK5 FUSE Rating (A) | Max.CC or T FUSE Rating (A) |
|---|---|---|---|---|---|---|
| 009 | 5 | 4 | 6.7 | 8.8 | 20 | 30 |
| 013 | 7.5 | 5.5 | 9.9 | 13 | 25 | 35 |
| 018 | 10 | 7.5 | 13.3 | 17.5 | 30 | 50 |

*Fuse ratings are based upon 600V fuses for 460V inverters

Notice

- To avoid shock hazards, do not touch any electrical component when the power is applied or until the power plug has been disconnected for five minutes. Other action should be performed after the charge indicator goes off.
- Do not wire the inverter while it is still electrified. Disregarding this could cause serious injury or death.

This product is designed for use in Pollution Degree 2 environments or equivalent.

## 2.3.2 Applicable specification of magnetic contactor and wires

Moulded-case circuit breaker/magnetic contactor

- Emotron bears no responsibility to service for failures caused by the following conditions:

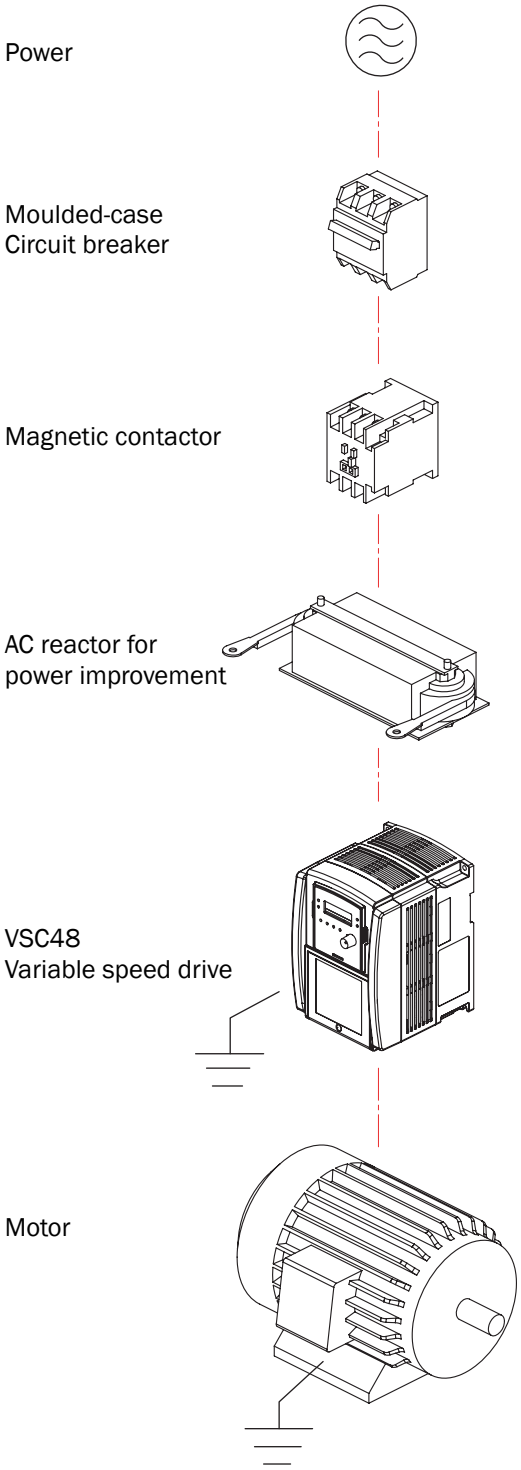
  A moulded-case circuit breaker is not installed, or an improper or overrated breaker is used, between the power source and the inverter.
  A magnetic contactor, a phase capacitor, or a burst absorber is connected between the inverter and the motor.

| VSC model | VSC48- | | |
|---|---|---|---|
| | 009 | 013 | 018 |
| Moulded-case circuit breaker | TO-50E 15A | TO-50E 20A | TO-50E 30A |
| Magnetic contactor (MC) | CN-11 | CN-16 | CN-18 |
| Main circuit terminals (TM1) | Wire gauge 2.0mm$^2$ | Wire gauge 3.5mm$^2$ | |
| Signal terminals (TM2) | Wire gauge 0.75mm$^2$ (# 18 AWG), terminal screw M3 | | |

Use three-phase cage induction motor with power suitable for the inverter.

- One inverter is driving several motors, the total current of all motors running simultaneously must be less than the rated current of the inverter, and each motor has to be equipped with a proper thermal relay.
- Do not add capacitive component, such as a phase capacitor, LC or RC, between the inverter and the motor.

## 2.3.3 Precautions for peripheral applications:




### Power supply:

- Make sure the correct voltage is applied to avoid damaging the inverter.
- A moulded-case circuit breaker must be installed between the AC source and the inverter.

### Moulded-case circuit breaker:

- Use a moulded-case circuit breaker that conforms to the rated voltage and current of the inverter to control the power ON/OFF and protect the inverter.
- Do not use the inverter as the switch for the run/stop switch.

### Leakage breaker:

- Install a leakage breaker to prevent error operation caused by electric leakage and to protect operators.
- Setting current should be 200 mA or above and the operating time at 0.1 second or longer to prevent malfunction.

### Magnetic contactor:

- Normal operations do not need a magnetic contactor. But a contactor has to be installed on the primary side when performing functions such as external control and auto restart after power failure, or when using brake controller.
- Do not use the magnetic contactor as the run/stop switch for the inverter.

### AC reactor for power improvement:

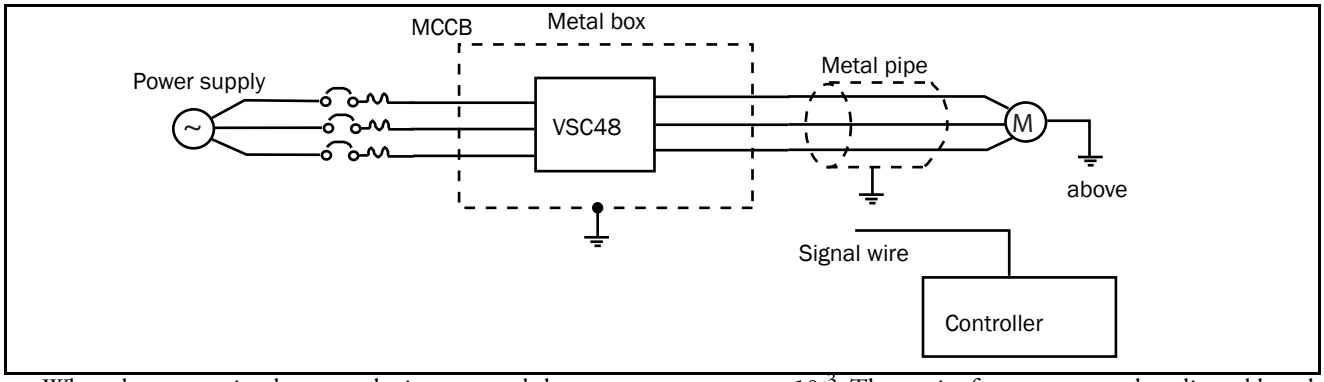
- When inverters below 400V 15 kW are supplied with a high capacity (above 600 kVA) power source or an AC reactor can be connected to improve the power performance.

### Inverter:

- Input power terminals L1, L2, and L3 can be used in any sequence regardless of phases.
- Output terminals T1, T2, and T3 are connected to the motor's U, V, and W terminals. If the motor is reversed while the inverter is forward, just swap any two terminals of T1, T2, and T3.
- To avoid damaging the inverter, do not connect the output terminals T1, T2, and T3 to AC power.
- Connect the ground terminal properly. 400 V series: <10Ω

A: Main circuit's wiring must be separated from other high voltage or high current power line to avoid noise interference.:

A noise filter in the output of the main circuit can suppress conductive noise. To prevent radiative noise, the wires should be put in a metal pipe and distance from signal lines of other control machines for more than 30 cm.

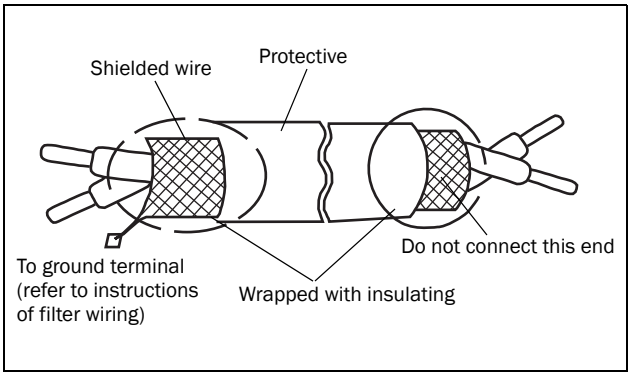



- When the connection between the inverter and the motor is too long, consider the voltage drop of the circuit. Phase-to-phase voltage drop (V) = 3×resistance of wire (/km)×length of line (m)×current×$10^{-3}$. The carrier frequency must be adjusted based on the length of the line.

| The length (L) of the line between the inverter and the motor | L < 25m | 25m < L < 50m | 50m < L < 100m | L > 100m |
|---|---|---|---|---|
| Number of carriers allowed | Below 16KHz | Below 12KHz | Below 8KHz | Below 5KHz |
| Settings of 3-22 parameter | 16 | 12 | 8 | 5 |

(B) The wiring of the control circuit must be separated and routed away from the main circuit control line or other high voltage or current power lines to avoid noise interference

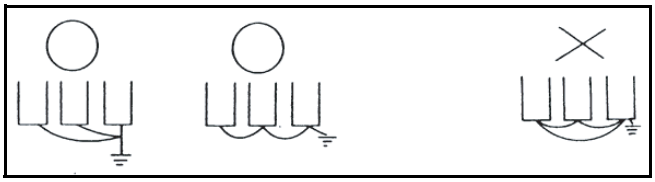
- To avoid error actions caused by noise interference, shield the control circuit wiring with a twisted wire, and connect the shielded wire to a ground terminal. Refer to the figure below.




The wiring distance should not exceed 50 m.

(C) Ground the ground terminal of the inverter properly. For 400V class ground 10Ω or less.

- Ground wiring is based on the electrical equipment technical basis (AWG). The shorter, the better.
- Do not share the ground of the inverter to other high current loads (welding machine, high power motor). Connect the terminals to ground respectively.
- Do not make a loop when several inverters share a common ground point.



(a) Good (b) Good (c) Bad

(D) To ensure maximum safety, use proper wire gauges (AWG) for the main power circuit and control circuit according to relative regulations.

(E) After wiring, check that the wiring is correct, wires are intact, and terminal screws are secured.

# 2.4 Specifications

## 2.4.1 Products Individual Specifications

Three phases, 380 – 480V model

| VSC48 | 009 | 013 | 018 |
|---|---|---|---|
| Horsepower (HP) | 5 | 7.5 | 10 |
| Suitable Motor Capacity (KW) | 3.7 | 5.5 | 7.5 |
| Rated Output Current (A) | 8.8 | 13.0 | 17.5 |

| | | | |
|---|---|---|---|
| Rated Capacity (KVA) | 6.7 | 9.9 | 13.3 |
| Max. Input Voltage | Three phase:380~480V +10% -15% 50/60Hz± 5% | | |
| Max. Output Voltage | Three phase: 380~480V | | |
| Input Current (A) | 11.6 | 17 | 23 |
| Net Weight (KG) | 2.2 | 6.6 | 6.6 |
| Allowable momentary power loss time (second) | 2.0 | 2.0 | 2.0 |

## 2.4.2 General Specifications

| Item | | VSC TYPE |
|---|---|---|
| Control Mode | | V/F or Current Vector Control |
| Frequency Control | Range | 0.1~650.0 Hz |
| | Start control torque | 150%/1Hz (Current Vector) |
| | Speed control range | 1:50 (Current Vector) |
| | Speed Control Precision | ±0.5% (Current Vector) |
| | Setting resolution | Digital0.01Hz (Note *1) Analogue: 0.06Hz/ 60Hz (10bits) |
| | Keypad setting | Set directly with keys or the VR on the keypad |
| | Display Function | Four digital LED (or 2×16 LCD) and status indicator; display frequency/ speed/ line speed/ DC voltage/ Output voltage/ Current/ Rotation direction/ Inverter parameter/ Trouble Log/ Program Version |
| | External signal setting | External variable resistor/ 0-10V/ 0-20mA/ 10-0V/ 20-0mA<br>Performs up/down controls, speed control or automatic procedure control with multifunctional contacts on the terminal block (TM2) |
| | Frequency Limit Function | Respectively setting upper/lower frequency limits and three-stage prohibited frequencies |

| | | |
|---|---|---|
| | Carrier frequency | 2 ~ 16 kHz |
| | V/F pattern | 18fixable patterns, 1programable curve |
| | Acc/Dec control | Two-stage Acc/Dec time (0.1 – 3,600 seconds) and two-stage S curves (refer to descriptions on 3-05) |
| | Multifunctional analog output | 6 functions (refer to description on 8-00/8-01) |
| | Multifunctional input | 30 functions (refer to description on 5-00~5-06) |
| | Multifunctional output | 16 functions (refer to description on 8-02~8-03) |
| | Digital Input Signal | NPN (SINK) / PNP (SOURCE) toggle |
| | Other Function | Momentary Power Loss Restart, Speed Search, Overload Detection, 8 preset speeds (PLC use 16 preset speeds). Acc/Dec Switch (2 Stages), S Curves, 3-wire Control, PID control, torque boost, Slip Compensation, Frequency Upper/ Lower Limit, Auto energy saving, Modbus slave, Auto Restart. |

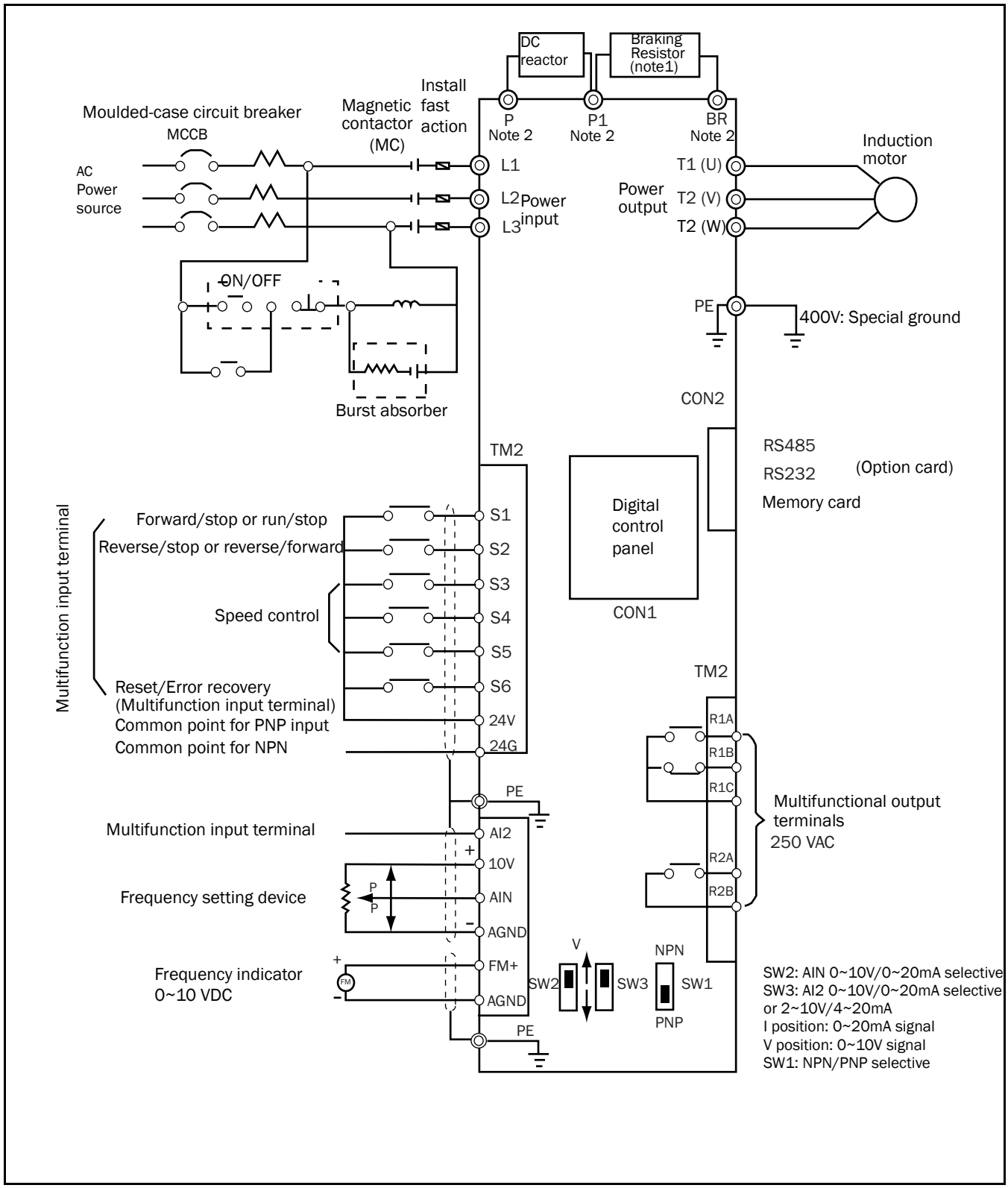
| Item | VSC TYPE |
|---|---|
| Communication Control | Control by RS232 or RS485<br>One to one or One to more (RS485 ONLY) control.<br>BAUD RATE/STOP BIT/PARITY/bit can be set |
| Braking Torque | About 20%, the model built-in braking transistor and connected braking resistor is 100% |
| Operation temperature | -10 ~ 50°C (note 2) |
| Storage temperature | -20 ~ 60°C |
| Humidity | 0 – 95% Relative Humidity (Non-condense) |
| Vibration Sustention | 1G (9.8m/$s^2$) |
| EMC | Comply with requirement EN 61800-3 (1st environment, restricted distribution). |
| LVD | Comply with requirement EN 50178 |
| Enclosure | IP20 (NEMA 1 by external box attached) |
| Safety Level | UL 508C |

| | | |
|---|---|---|
| Protective Functions | Overload protection | The relays to protect the motor (the curve can be set) and the inverter (150% / 1min) |
| | FUSE protection | The motor stops after FUSE melt |
| | Over Voltage | 400V class DC Voltage 820V |
| | Under Voltage | 400V class DC Voltage 380V |
| | Momentary Power Loss Restart | Stop for more than 15ms-power-loss can be restarted with spin start after momentary power loss in Max 2 sec.15ms |
| | Stall Prevention | Stall prevention for Acceleration/ Deceleration/ Operation. |
| | Short-circuit output terminal | Electronic Circuit Protection |
| | Grounding Fault | Electronic Circuit Protection |
| | Other Function | Protection for overheating of heat sink, over torque detection, error contact control, reverse restriction, restrictions for direct start after power up and error recovery, parameter lock up. |

**NOTE 1: The setting resolution of above 100Hz is 0.1Hz when controlled with operation keypad, and 0.01 Hz when controlled using computer (PC) or programmable controller (PLC).**

**NOTE 2: -10 ~ 50°C in distributor (without dust proof cover), -10 ~ 40°C outside distributor (with dustpans cover).**

## 2.5 Wiring diagram for VSC series inverter




**NOTE 1: Please refer to description of main circuit terminals (P1,BR) and specification of braking resistor for value selection.**

**NOTE 2: the diagram above refers to 440V: 4~7.5 kW only.**

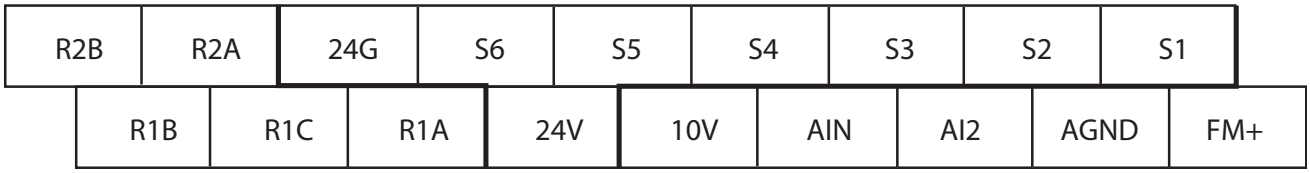
## 2.6 Description of terminals of troubleshooting inverter

Descriptions of main circuit terminals

| Symbol | Description | |
|---|---|---|
| R / L1 | Main power input: Three-phase: L1/L2/L3 | |
| S / L2 | | |
| T / L3 | | |
| P1 | Braking resistor or connecting terminal: Used in cases where the inverter frequently disconnects due to large load inertia or short deceleration time (refer to specifications for braking resistor) | For 440V: 4~7.5 kW |
| BR | | |
| U / T1 | Inverter outputs | |
| V / T2 | | |
| W / T3 | | |

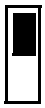
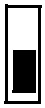
Descriptions of VSC control circuit terminals

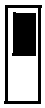
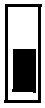
| Symbol | Description | | |
|---|---|---|---|
| R2A | Multifunctional terminal – Normal open | | Contact rated capacity: (250VAC/1A or 30VDC/1A)<br>Contact using description: (refer to 8-02, 8-03) |
| R2B | | | |
| R1C | Common contact | Multifunctional output terminals | |
| R1B | Normal closed contact | | |
| R1A | Normal open contact | | |
| 10V | Frequency knob (VR) power source terminal (pin 3) | | |
| AIN | Analogue frequency signal input terminal or multifunction input terminals S7 (H level:>8V, L level:<2V, PNP only) (refer to 5-06 description) | | |
| AI2 | Analogue signal input terminal (refer to 5-12 description) | | |
| 24V | Common contact for S1~S6 in PNP (Source) input. Shift to PNP position (refer to VSC wiring diagram) of SW1 when using PNP input | | |
| 24G | Common contact and analog input /output signal for S1~S6 in NPN (Sink) input. Shift SW1 to NPN position (refer to VSC wiring diagram) when using NPN input mode. | | |
| AGND | COMMON for AIN, AI2 and FM+ (analogue input/output signals). | | |
| FM+ | The positive analogue output for multifunction (refer to 8-00 description), the signal for output terminal is 0-10VDC (below 2mA). | | |



| Symbol | Function Description |
|---|---|
| S1 | Multifunction input terminals (refer to 5-00 ~ 5-05 description)<br>(S5 = Encoder input terminal, the Encoder voltage range: 19.2V~24.7V) |
| S2 | |
| S3 | |
| S4 | |
| S5 | |
| S6 | |

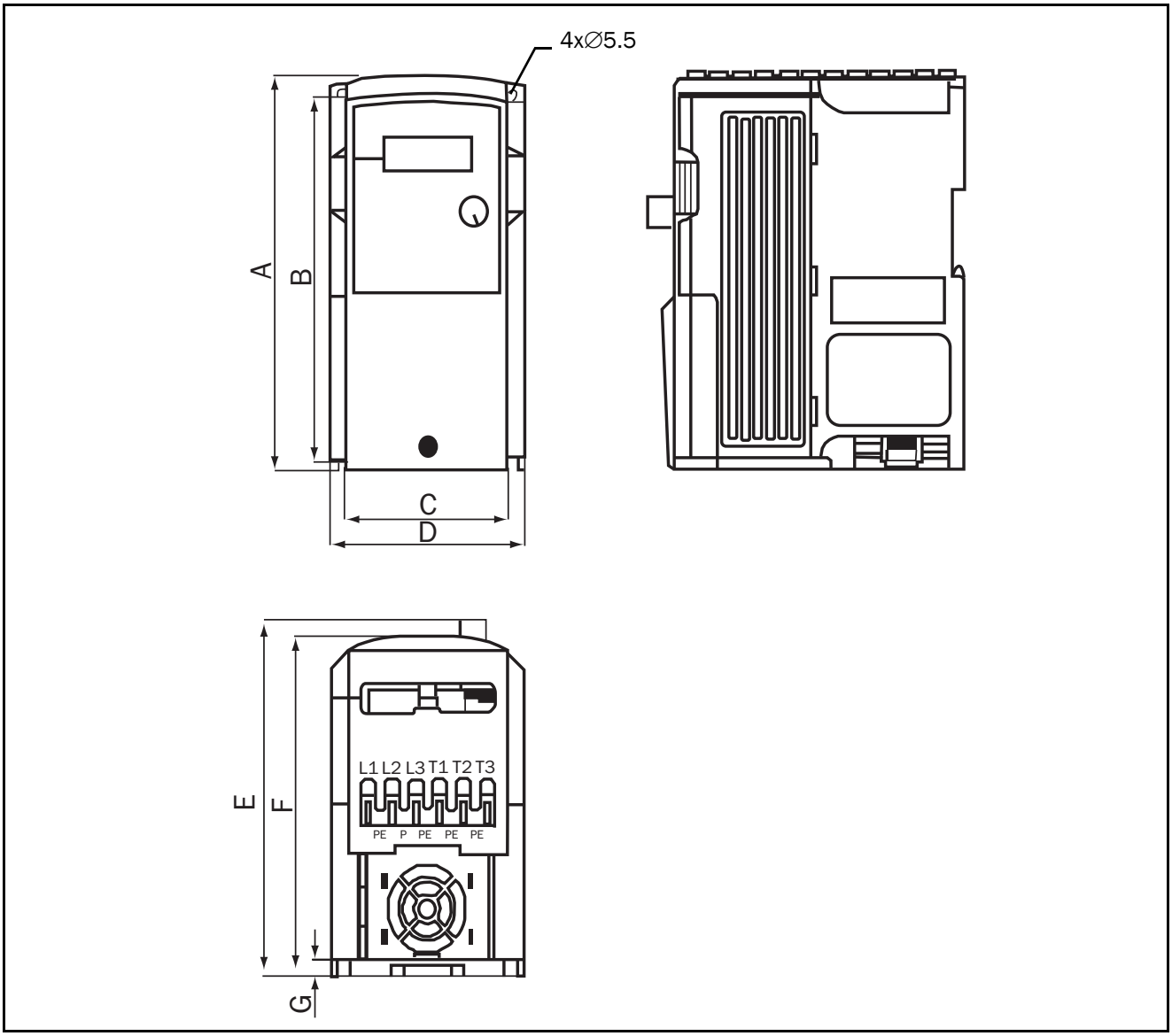
Descriptions of SW function

| SW2/ SW3 | Type of external signal | Remarks |
|---|---|---|
|  | 0~10VDC analogue signal | External control is available as 1-06=0002 |
|  | 0~20mA analogue signal | |

| SW1 | Type of external signal | Remarks |
|---|---|---|
|  | NPN (SINK) input | |
|  | PNP (SOURCE) input | Factory default |

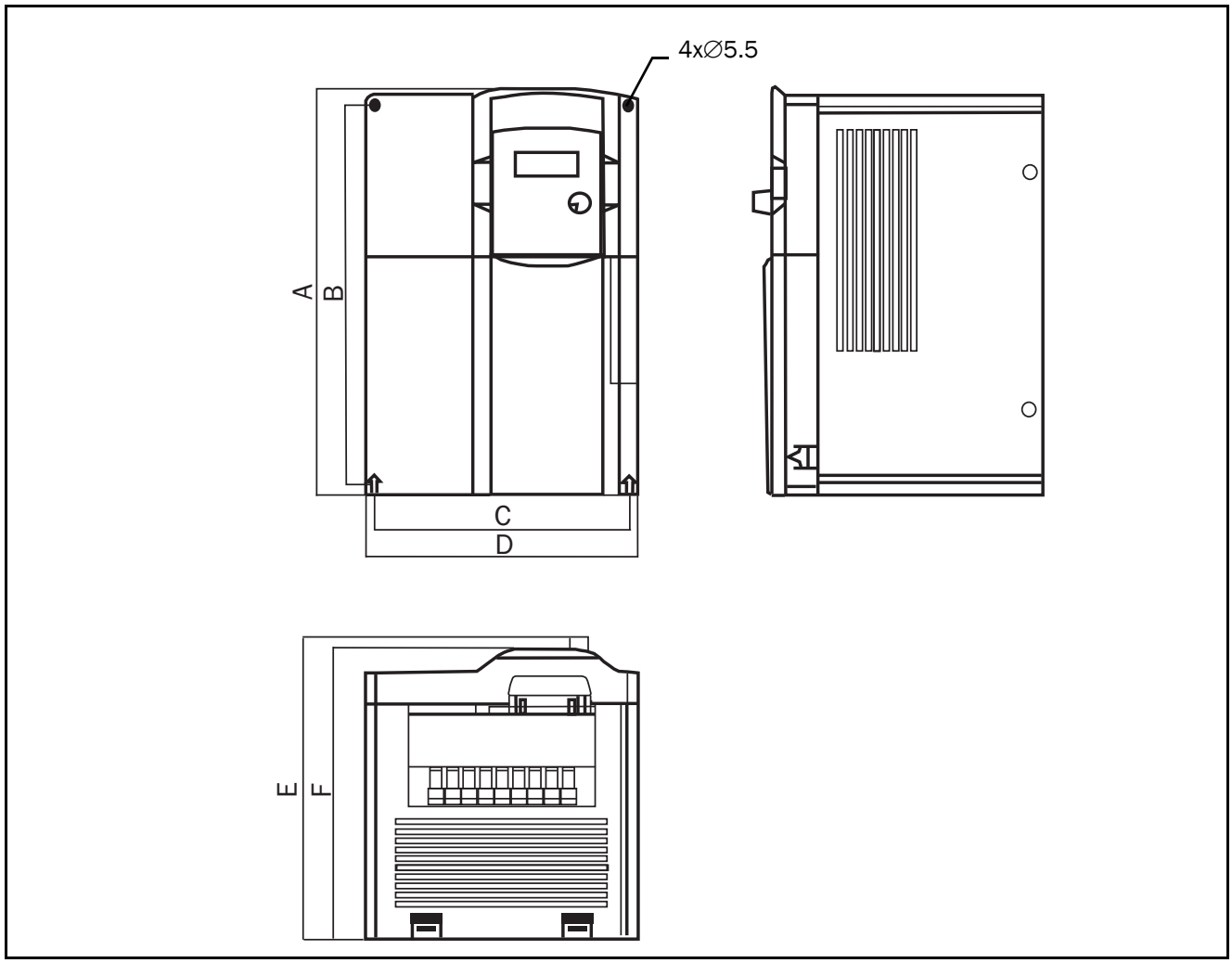
## 2.7 Outline dimensions

Frame2: Three phase VSC48-009




| LENGTH MODEL | A mm/inches | B mm/inches | C mm/inches | D mm/inches | E mm/inches | F mm/inches | G mm/inches |
|---|---|---|---|---|---|---|---|
| Frame 2 | 187.1/7.36 | 170.5/6.71 | 114.6/4.51 | 128/5.04 | 148/5.83 | 142.1/5.59 | 7/0.28 |

Frame3: Three phase VSC48-013, VSC48-018



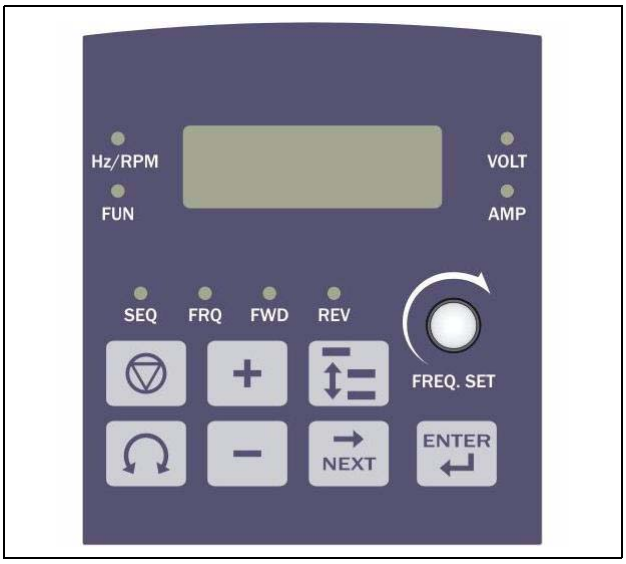

| LENGTH MODEL | A mm/inches | B mm/inches | C mm/inches | D mm/inches | E mm/inches | F mm/inches |
|---|---|---|---|---|---|---|
| Frame 3 | 260/10.24 | 244/9.61 | 173/6.81 | 186/7.32 | 195/7.68 | 188/7.4 |

Open Chassis TypeIP00

# 3. Software Index

## 3.1 Keypad description

### 3.1.1 Keypad display and operation instructions




1. SEQ LED: 1_00=1/2/3, LED Lit.
2. FRQ LED: 1_06=1/2/3/4, LED Lit.
3. FWD LED: Forward Direction, LED action (flash if stopped, Stays lit during operation).
4. REV LED: Reverse Direction, LED action (flash if stopped, Stays lit during operation)).
5. 4-action LED: FUN, Hz/RPM, VOLT and AMP and four 7-segment display, refer to operating instructions for the keypad.

**CAUTION: To avoid damaging the keypad, do not operate it with a screwdriver or any other sharp and hard tool.**

*1: The VSD will flash the current setting of 0-07 (power supply voltage) after power up.

Remote/Local Mode

Local mode – Operation Command with the key on the keypad

– Frequency Command with the + − key on the key-pad

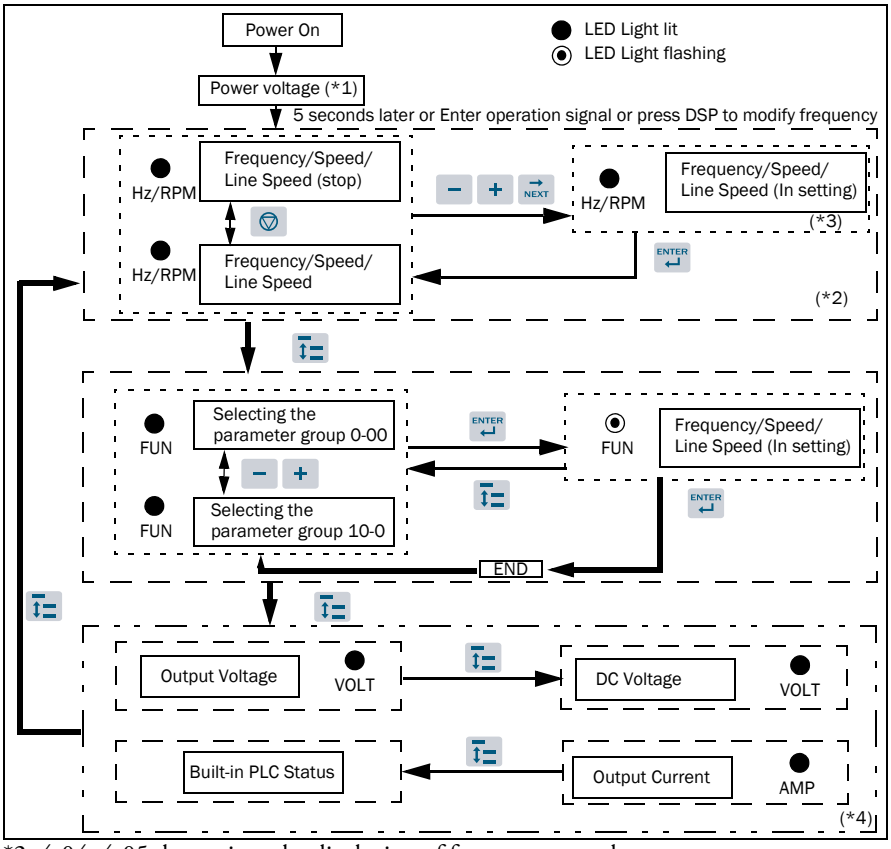
Remote mode – Operating Command by 1-00

– Frequency Command by 1-06

To Change the Remote/Local mode, you must push and NEXT at the same time.

The Remote /Local mode of change can used in mode, it cannot be used in Run mode.

## 3.1.2 Operating instructions for the keypad

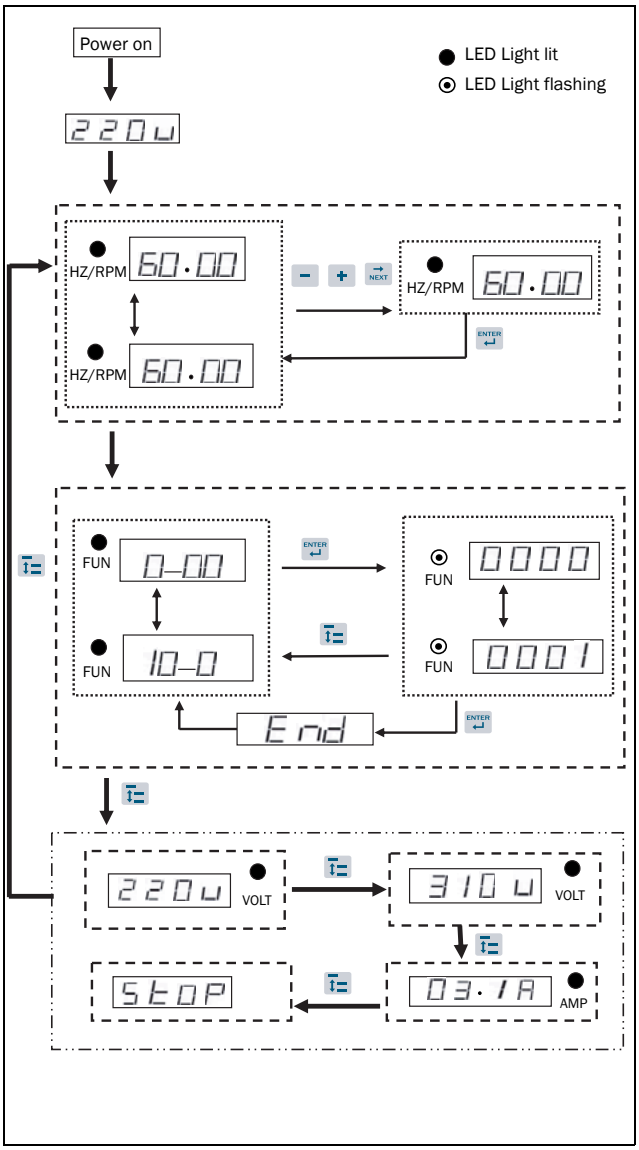



*2: 4-04, 4-05 determines the displaying of frequency, speed or line speed.

*3: It is not necessary to press the ENTER key when stopped for modification. Refer to example 1 and 2.

*4: Whether output current, output voltage, DC voltage, status of built-in PLC is displayed or not is determined by 4-00 to 4-03 respectively.

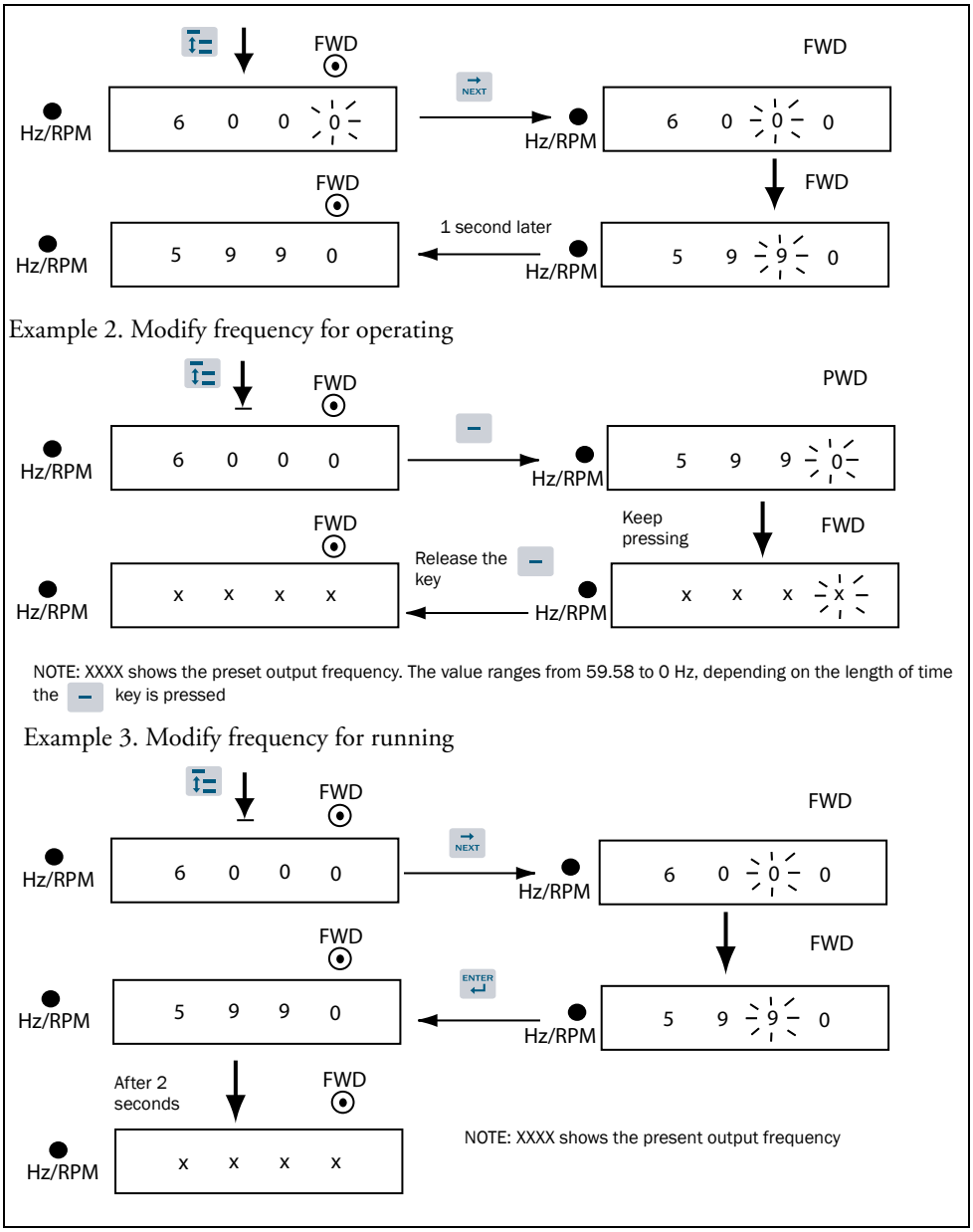
### 3.1.3 Operating instructions for the LED keypad




5 seconds later or Enter operation signal or press DSP to modify the display frequency.

## 3.1.4 Keypad operation

Example 1. Modify frequency for stopping.



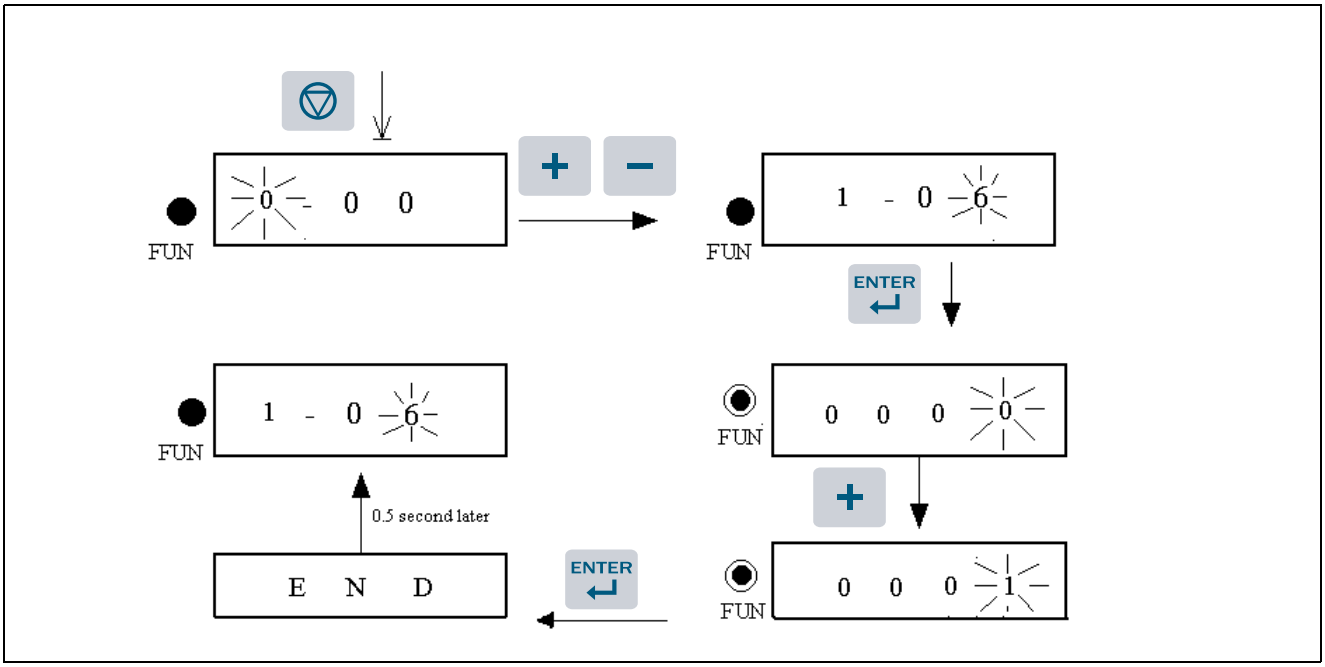

Example 2. Modify frequency for operating



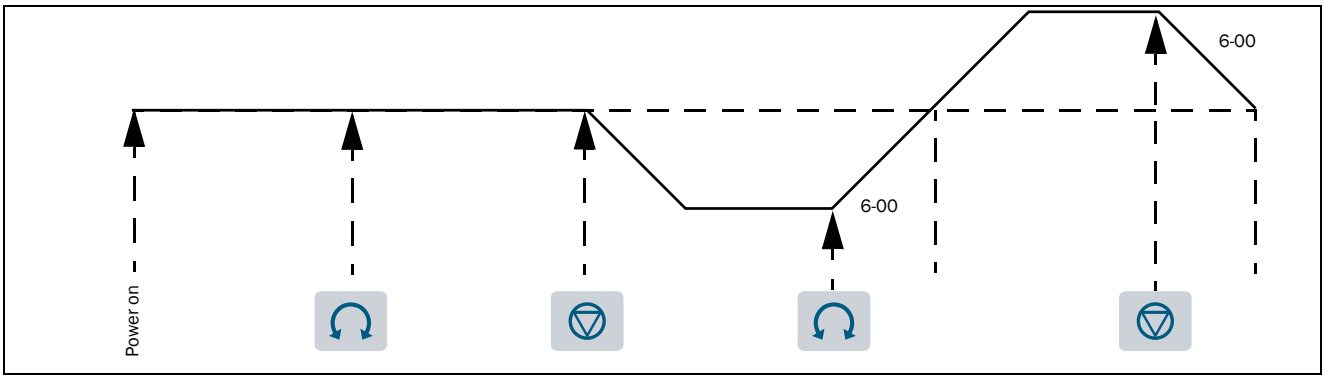

NOTE: XXXX shows the preset output frequency. The value ranges from 59.58 to 0 Hz, depending on the length of time the – key is pressed

Example 3. Modify frequency for running

Example 4. Modify the parameter value




Example 5 Operation control




| | | | | | |
|---|---|---|---|---|---|
| FWD LED | ⦿ | ○ | ○ | ● | ⦿ |
| REV LED | ○ | ⦿ | ● | ○ | ○ |

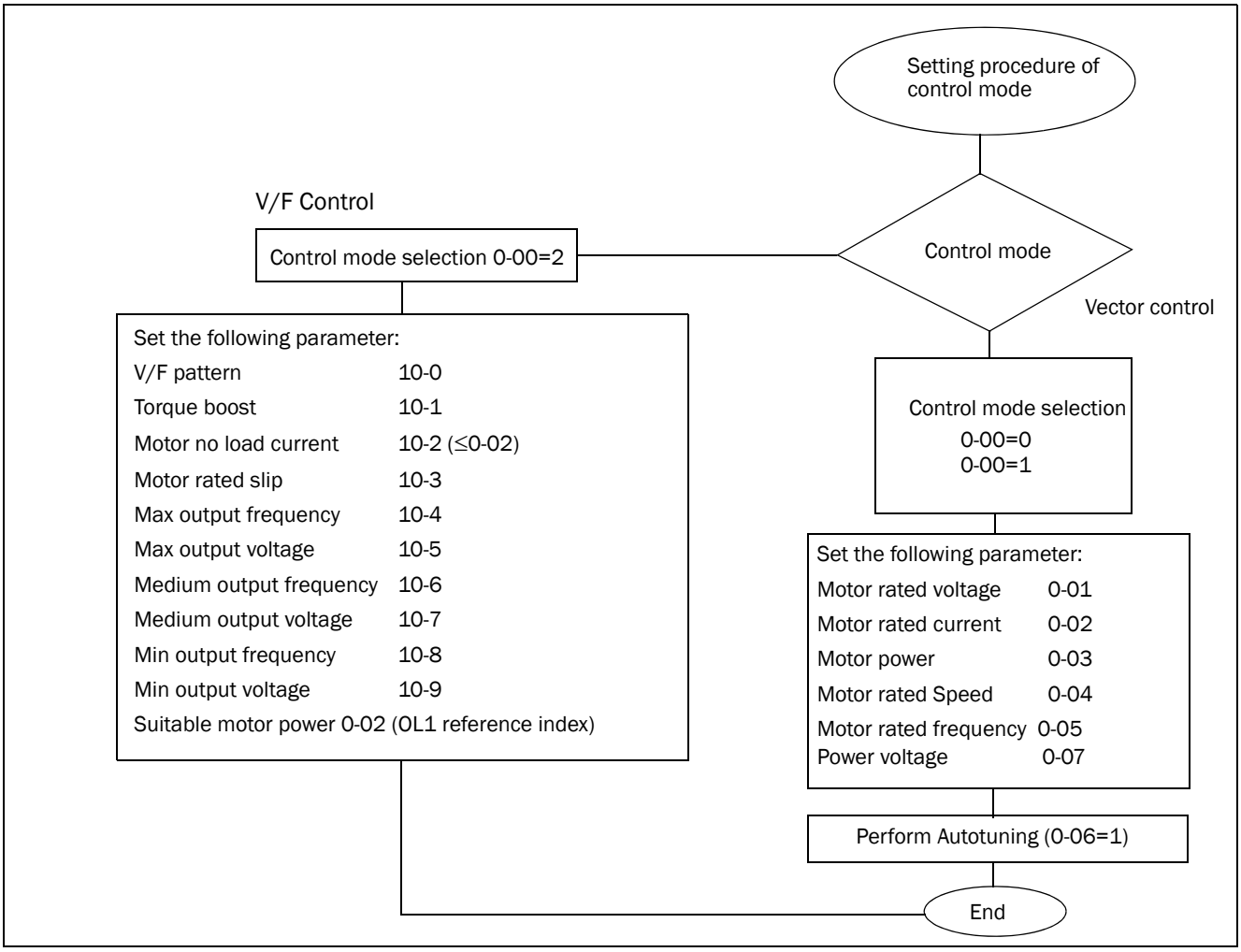
●: LED lit, ⦿: LED flash, ○: LED goes out

## 3.2 Control mode selection

The VSC series VSD has three control modes:

1. General Vector Control Mode
2. VT Vector Control Mode (especially for blower, pump).
3. V/F Control Mode

The user can choose these modes using the digital keypad according to the application characteristics. The factory setting is general vector control mode. Before operation, please set the control mode and the relative parameters of the motor in accordance with the following flow chart. (The Vector control mode is only suitable for an VSD with the same capacity as the motor, or a class larger or smaller)



.

**NOTE:**
**1. Use V/F Control Mode if:**
**(1) You want one VSD to drive several motors simultaneously.**
**(2) The motor's nameplate is unknown or the motor specifications are too specialised, this will cause an autotuning fault.**
**(3) The specification of VSD and motor differ by more than 1 class.**

**2. One VSD drives several motors (only V/F mode available), set the motor parameter to comply with the following rules:**
**(1). As for the current, total up the rated current of all motors.**
**(2). As for others, input correct VF pattern parameter (10-4 to 10-9).**

**3. When the nameplate of the motor is unknown, the VSD will set the internal parameter as if for the standard Emotron motor.**

**4. When parameter 0-00 is set to 2, the keypad will display 'Err2' when performing autotuning.**

**5. When using Vector control, set to 0-01 to 0-05 for max. and min. values with a standard motor specification limit (one level less and one level more). When using V/F Control, no range to be set.**

# 3.3 VSC programmable functions list

| Parameter Group No. | Description |
|---|---|
| 0- | Drive Operation Mode |
| 1- | Start/Stop and Frequency Control Modes |
| 2- | Manual/Automatic Restart Modes |
| 3- | Operating Parameters |
| 4- | Digital Display Operation Mode |
| 5- | Multifunction Input Terminals (MFIT) |
| 6- | Jog, and Preset (MFIT) Speed Setting on Keypad |
| 7- | Analogue Input Signal Operation |
| 8- | Multifunction Output Relays and Output Signal Operation |
| 9- | Drive and Load Protection Modes |
| 10- | Volts/Hz Pattern Operation Mode |
| 11- | PID Operation Mode |
| 12- | PID "Limits" and "Out of Range" Mode |
| 13- | Communication Mode |
| 14- | Motor Autotuning Parameters |
| 15- | Drive Status and Function Reset |

## 0- Drive Operation Mode

| Function Code No. | Description | Range/Code | Factory Setting | Remarks |
|---|---|---|---|---|
| 0-00 | Control Mode | 0000:Vector (General Purpose)<br>0001:Vector (Variable Torque)<br>0002:Volts/Hz (Refer to Parameter Group 10-Volts/Hz Mode) | 0000 | *3 |
| 0-01 | Motor Rated Voltage (VAC) | ----- | | *3*5 |
| 0-02 | Motor Rated Current (Amp) | ----- | | *3*5 |
| 0-03 | Motor Rated Power (kW) | ----- | | *3*5 |
| 0-04 | Motor Rated Speed (RPM) X100*7 | ----- | | *3*5 |
| 0-05 | Motor Rated Frequency (Hz) | ----- | | *3*5 |
| 0-06 | Motor Parameter Autotuning | 0000: Invalid<br>0001: Valid | 0000 | |
| 0-07 | AC Line Input Voltage (VAC) | 440V SERIES:323.0 to 528.0 | | *3 |

## 1- Start/Stop and Frequency Control Modes

| Function Code No. | Description | Range/Code | Factory Setting | Remarks |
|---|---|---|---|---|
| 1-00 | Run Command Source Selection | 0000: Keypad<br>0001: External Run/Stop Control (See 1-01)<br>0002: Communication<br>0003: Built-In PLC | 0000 | |
| 1-01 | Run/Stop-Forward/Reverse Operation Mode with External Terminals | 0000: Forward/Stop-Reverse/Stop<br>0001: Run/Stop-Forward/Reverse<br>0002: 3-Wire Control Mode- Run/Stop | 0000 | |
| 1-02 | Prohibition of Reverse operation | 0000: Enable Reverse Command<br>0001: Disable Reverse Command | 0000 | |
| 1-03 | Keypad Stop Button | 0000: Stop Button Enabled<br>0001: Stop Button Disabled | 0000 | |
| 1-04 | Starting Method Selection | 0000: Normal Start<br>0001: Enable Speed Search | 0000 | |
| 1-05 | Stopping Method Selection | 0000: Controlled Deceleration-to- Stop with DC Injection Braking (Rapid Stop)<br>0001: Free run Stop | | |
| 1-06 | Frequency Command Source Selection | 0000: Keypad<br>0001: Potentiometer on Keypad<br>0002: External analogue signal Input or Remote Potentiometer<br>0003: Up/Down Frequency Control using MFIT (S1 - S6)<br>0004: Communication setting frequency<br>0005: Impulse (S5) setting frequency (ver2.3) | 0000 | |
| 1-07 | Keypad Operation with Up/Down Keys in Run Mode | 0000: “Enter” must be pressed after frequency change with the up/down keys on keypad.<br>0001: Frequency will be changed directly when the up/down keys are pressed | 0000 | |

## 2- Manual/Automatic Restart Modes

| Function Code No. | Description | Range/Code | Factory Setting | Remarks |
|---|---|---|---|---|
| 2-00 | Momentary Power Loss and Restart | 0000: Momentary power loss and restart disable<br>0001: Momentary power loss and restart enable<br>0002: Momentary power loss and restart enable while CPU is operating. (According to the capacity of DC power) | 0000 | |
| 2-01 | Momentary Power Loss Ride-Thru Time (s) | 0.0 to 2.0 | 0.5 | |
| 2-02 | Auto Restart Delay Time (s) | 0.0 to 800.0 | 0.0 | |
| 2-03 | Number of Auto Restart Attempts | 0 to 10 | 0 | |
| 2-04 | Auto Restart Method | 0000: Enable Speed Search<br>0001: Normal Start | 0000 | |
| 2-05 | Direct Running After Power Up | 0000: Enable Direct running after power up<br>0001: Disable Direct running after power up | 0001 | *8 |
| 2-06 | Delay-ON Timer (s) | 0.0 to 300.0 | 0.0 | |
| 2-07 | Reset Mode Setting | 0000: Enable Reset Only when Run Command is Off<br>0001: Enable Reset when Run Command is On or Off | 0000 | |
| 2-08 | Kinetic Energy Back-up Deceleration Time | 0.0: Disable<br>0.1 to 25.0: KEB Deceleration Time | 0.0 | |

| Function Code No. | Description | Range/Code | Factory Setting | Remarks |
|---|---|---|---|---|
| 3-00 | Frequency Upper Limit (Hz) | 0.01 to 650.00 | 50.00<br>60.00 | *4 |
| 3-01 | Frequency Lower Limit (Hz) | 0.00 to 650.00 | 0.00 | |
| 3-02 | Acceleration Time #1 (s) | 0.1 to 3600.0 | 10.0 | *1 |
| 3-03 | Deceleration Time #1 (s) | 0.1 to 3600.0 | 10.0 | *1 |
| 3-04 | S-Curve Acc/Dec #1 (s) | 0.0 to 4.0 | 0.2 | |
| 3-05 | S-Curve Acc/Dec #2 (s) | 0.0 to 4.0 | 0.2 | |
| 3-06 | Acceleration Time #2 (MFIT) (s) | 0.1 to 3600.0 | 10.0 | *1 |
| 3-07 | Deceleration Time #2 (MFIT) (s) | 0.1 to 3600.0 | 10.0 | *1 |
| 3-08 | Jog Acceleration Time (MFIT) (s) | 0.1 to 25.5 | 0.5 | *1 |
| 3-09 | Jog Deceleration Time (MFIT) (s) | 0.1 to 25.5 | 0.5 | *1 |
| 3-10 | DC Injection Brake Start Frequency (Hz) | 0.1 to 10.0 | 1.5 | |
| 3-11 | DC Injection Brake Level (%) | 0.0 to 20.0 | 5.0 | *7 |
| 3-12 | DC Injection Brake Time (s) | 0.0 to 25.5 | 0.5 | |
| 3-13 | Skip Frequency #1 (Hz) | 0.00 to 650.00 | 0.0 | *1 |
| 3-14 | Skip Frequency #2 (Hz) | 0.00 to 650.00 | 0.0 | *1 |
| 3-15 | Skip Frequency #3 (Hz) | 0.00 to 650.00 | 0.0 | *1 |
| 3-16 | Skip Frequency Bandwidth (±Hz) | 0.00 to 30.00 | 0.0 | *1 |
| 3-17 | Parameter Lock | 0000: Enable all Functions<br>0001: 6-00 - 6-08 cannot be changed<br>0002: All Functions Except 6-00 - 6-08 cannot be changed<br>0003: Disable All Function | 0000 | |
| 3-18 | Copy Unit | 0000: Disable<br>0001: VSD to Copy Unit<br>0002: Copy Unit to VSD<br>0003: Verify | 0000 | |
| 3-19 | Fan Control | 0000: Auto (Depend on temp.)<br>0001: Operate while in RUN mode<br>0002: Always Run<br>0003: Always Stop | 0000 | |
| 3-20 | Energy Saving Mode *1 | 0000: Disabled<br>0001: Controlled by MFIT at Set Frequency | 0000 | *6 |
| 3-21 | Energy Saving Gain (%)*1 | 0 to 100 | 80 | *6 |
| 3-22 | Carrier Frequency (kHz) | 2 to 16 | 10 | |
| 3-23 | Centre Frequency (CF) of Traverse Run (%) | 5.00 to 100.00 | 20.00 | |
| 3-24 | Amplitude (A) of Traverse Run (%) | 0.1 to 20.0 | 10.0 | |
| 3-25 | Drop (D) of Traverse Run (%) | 0.0 to 50.0 | 0.0 | |
| 3-26 | Acc Time (AT) of Traverse Run (s) | 0.5 to 60.0 | 10.0 | |
| 3-27 | Dec Time (DT) of Traverse Run (s) | 0.5 to 60.0 | 10.0 | |
| 3-28 | Rise (X) Deviated Traverse (%) | 0.0 to 20.0 | 10.0 | |
| 3-29 | Lower (Y) Deviated Traverse (%) | 0.0 to 20.0 | 10.0 | |
| 3-30 | Start Frequency (Hz) | 0.00 to 10.0 | 0.0 | |

**NOTE: 1. Energy Saving Mode is available only in Volts/ Hz Mode (0-00=0002).**

## 4- Digital Display Operation Mode

| Function Code No. | Description | Range/Code | Factory Setting | Remarks |
|---|---|---|---|---|
| 4-00 | Motor Current Display Selection | 0000: Disable Motor Current Display<br>0001: Enable Motor Current Display | 0000 | *1 |
| 4-01 | Motor Voltage Display Selection | 0000: Disable Motor Voltage Display<br>0001: Enable Motor Voltage Display | 0000 | *1 |
| 4-02 | DC Bus Voltage Display Selection | 0000: Disable Bus Voltage Display<br>0001: Enable Bus Voltage Display | 0000 | *1 |
| 4-03 | PLC Status Display Selection | 0000: Disable PLC Status Display<br>0001: Enable PLC Status Display | 0000 | *1 |
| 4-04 | Custom Units (Line Speed) Value | 0 to 9999 | 1800 | *1 |
| 4-05 | Custom Units (Line Speed) Display Mode | 0000: Drive Output Frequency is displayed<br>0001: Line Speed is displayed in Integer (xxxx)<br>0002: Line Speed is displayed with one decimal place (xxx.x)<br>0003: Line Speed is displayed with two decimal places (xx.xx)<br>0004: Line Speed is displayed with three decimal places (x.xxx) | 0000 | *1 |
| 4-06 | PID Feedback Display Selection | 0000: Disable PID Feedback Display<br>0001: Enable PID Feedback Display | 0000 | *1 |

## 5- Multifunction Input Terminals (MFIT)

| Function Code No. | Description | Range/Code | Factory Setting | Remarks |
|---|---|---|---|---|
| 5-00 | Multifunction Input Term. S1 | 0000: Forward/Stop Command *1<br>0001: Reverse/Stop Command *2<br>0002: Preset Speed #1 (6-02)<br>0003: Preset Speed #2 (6-03)<br>0004: Preset Speed #3 (6-05) *3<br>0005: Jog<br>0006: Acc/Dec #2<br>0007: Emergency Stop A Contact<br>0008: Base Block<br>0009: Speed Search<br>0010: Energy Saving<br>0011: Control Signal Selection<br>0012: Communication Selection<br>0013: Acc/Dec Disabled<br>0014: Up Command<br>0015: Down Command<br>0016: Master/Auxiliary Speed<br>0017: PID Function Disabled<br>0018: Reset<br>0019: Encoder input terminal (terminal S5)<br>0023: Analogue input (terminal AIN)<br>0024: PLC Application<br>0025: Traverse Run<br>0026: Traverse Run upper deviation<br>0027: Traverse Run lower deviation<br>0028: Power Source Detect for KEB Function<br>0029: Emergency Stop B Contact *7 | 0000 | |
| 5-01 | Multifunction Input Term. S2 | | 0001 | |
| 5-02 | Multifunction Input Term. S3 | | 0002 | |
| 5-03 | Multifunction Input Term. S4 | | 0003 | |
| 5-04 | Multifunction Input Term. S5 | | 0004 | |
| 5-05 | Multifunction Input Term. S6 | | 0018 | |
| 5-06 | Multifunction Input Term. AIN | | 0023 | |
| 5-07 | Multifunction Input Term. S1 - S6 Signal Verification Scan Time (ms X 4) | 1 to 100 | 5 | |

| | | | | |
|---|---|---|---|---|
| 5-08 | Stop Mode Using MFIT | 0000: When the MFITs are Programmed for Up/ Down Frequency Control, the Set Frequency will remain when the Drive stops. And when the Drive stops, Up/Down Function is disabled.<br>0001: Up/Down is used. The preset frequency is reset to 0 Hz as the VSD stops.<br>0002: When the MFITs are Programmed for Up/ Down Frequency Control, the Set Frequency will remain when the Drive stops. And when the Drive stops, Up/Down Function is enabled. *7 | 0000 | |
| 5-09 | Step of Up/Down Function (Hz) | 0.00 to 5.00 | 0.00 | |
| 5-10 | Encoder Impulse Ratio | 0.001 to 9.999 | 1.000 | *7 |
| 5-11 | Select the source of auxiliary frequency command | 0=refer to 6-00<br>1= VR on keypad<br>2=AIN on control terminal TM2<br>3=Up/Down on TM2<br>4= reference via serial communication | 0 | *7 |
| 5-12 | AI2 function selection | 0020 PID feedback<br>0021 Bias Signal 1 input<br>0022 Bias Signal 2 input | 0020 | |

**NOTE:**
**1. To switch to Run/Stop with Function 1-01=0001.**
**2. To switch to Forward/Reverse with Function 1-01=0001.**
**3. Preset Speed #3 is obtained by activating Terms. S3 and S4 simultaneously.**

## 6- Jog, and Preset (MFIT) Frequency Setting on Keypad

| Function Code No. | Description | Range/Code | Factory Setting | Remarks |
|---|---|---|---|---|
| 6-00 | Keypad Frequency (Hz) | 0.00 to 650.00 | 5.00 | *1 |
| 6-01 | Jog Frequency (Hz) | 0.00 to 650.00 | 2.00 | *1 |
| 6-02 | Preset Speed #1 (Hz) | 0.00 to 650.00 | 5.00 | *1 |
| 6-03 | Preset Speed #2 (Hz) | 0.00 to 650.00 | 10.00 | *1 |
| 6-04 | Preset Speed #3 (Hz) | 0.00 to 650.00 | 20.00 | *1 |
| 6-05 | Preset Speed #4 (Hz) | 0.00 to 650.00 | 30.00 | *1 |
| 6-06 | Preset Speed #5 (Hz) | 0.00 to 650.00 | 40.00 | *1 |
| 6-07 | Preset Speed #6 (Hz) | 0.00 to 650.00 | 50.00 | *1 |
| 6-08 | Preset Speed #7 (Hz) | 0.00 to 650.00 | 60.00 | *1 |

## 7- Analogue Input Signal Operation

| Function Code No. | Description | Range/Code | Factory Setting | Remarks |
|---|---|---|---|---|
| 7-00 | AIN Gain (%) | 0 to1000 | 100 | *1 *10 |
| 7-01 | AIN Bias (%) | 0 to 100 | 0 | *1 |
| 7-02 | AIN Bias Selection | 0000: Positive<br>0001: Negative | 0000 | *1 |
| 7-03 | AIN Slope | 0000: Positive<br>0001: Negative | 0000 | *1 |
| 7-04 | AIN Signal Verification Scan Time (AIN, AI2) (ms x 2) | 1 to 100 | 50 | |
| 7-05 | AI2 Gain (%)(S6) | 0 to 200 | 100 | *1 |

**NOTE: Group 7 is available when 5-06=0023 (AIN term.=Analogue input)**

## 8- Multifunction Output Relays and Output Signal Operation

| Function Code No. | Description | Range/Code | Factory Setting | Remarks |
|---|---|---|---|---|
| 8-00 | Analogue Output Voltage Mode (0 - 10 VDC, Term. FM+) | 0000: Output Frequency<br>0001: Frequency Setting<br>0002: Output Voltage<br>0003: DC Voltage<br>0004: Output Current<br>0005: PID Feedback *7 | 0000 | *1 |
| 8-01 | Analogue Output Gain (%) | 0 - 200 | 100 | *1 |
| 8-02 | Output Relay R1 Operation Mode | 0000: Run<br>0001: Frequency Reached (Frequency Command) (Set Frequency ± 8-05)<br>0002: Set Frequency (8-04 ± 8-05)<br>0003: Frequency Threshold Level (> 8-04) - Frequency Reached<br>0004: Frequency Threshold Level (< 8-04) - Frequency Reached<br>0005: Over torque Threshold Level<br>0006: Fault<br>0007: Auto Restart<br>0008: Momentary AC Power Loss<br>0009: Rapid Stop Mode<br>0010: Coast-to-Stop Mode<br>0011: Motor Overload Protection<br>0012: Drive Overload Protection<br>0013: PID Feedback Signal Loss<br>0014: PLC Operation<br>0015: Power On *7 | 0006 | |
| 8-03 | Output Relay R2 Operation Mode | | 0000 | |
| 8-04 | Frequency Reached (Hz) (Refer to 8-02: 0001) | 0.00 to 650.00 | 0.00 | *1 |
| 8-05 | Frequency Reached Bandwidth (± Hz) | 0.00 to 30.00 | 2.00 | *1 |

## 9- Drive and Load Protection Modes

| Function Code No. | Description | Range/Code | Factory Setting | Remarks |
|---|---|---|---|---|
| 9-00 | Trip Prevention Selection During Acceleration | 0000: Enable Trip Prevention During Acceleration<br>0001: Disable Trip Prevention<br>During Acceleration | 0000 | |
| 9-01 | Trip Prevention Level During Acceleration (%) | 50 to 300 | 200 | |
| 9-02 | Trip Prevention Selection During Deceleration | 0000: Enable Trip Prevention During Deceleration<br>0001: Disable Trip Prevention During Deceleration | 0000 | |
| 9-03 | Trip Prevention Level During Deceleration (%) | 50 to 300 | 200 | |
| 9-04 | Trip Prevention Selection in Run Mode | 0000: Enable Trip Prevention in Run Mode<br>0001: Disable Trip Prevention in Run Mode | 0000 | |
| 9-05 | Trip Prevention Level In Run Mode (%) | 50 to 300 | 200 | |
| 9-06 | Trip Prevention Deceleration Time Selection in Run Mode | 0000: Trip Prevention Deceleration Time Set by 3-03<br>0001: Trip Prevention Deceleration Time Set by 9-07 | 0000 | |
| 9-07 | Deceleration Time In Trip Prevention Mode (s) | 0.1 to 3600.0 | 3.0 | |
| 9-08 | Electronic Motor Overload Protection Operation Mode | 0000: Enable Electronic Motor Overload Protection<br>0001: Disable Electronic Motor Overload Protection | 0000 | |
| 9-09 | Motor Type Selection | 0000: Electronic Motor Overload Protection Set for Non-VSD Duty Motor<br>0001: Electronic Motor Overload Protection Set for VSD Duty Motor | 0000 | |
| 9-10 | Motor Overload Protection Curve Selection | 0000: Constant Torque (OL=103%) (150% for 1 Minute)<br>0001: Variable Torque (OL=113%) (123% for 1 Minute) | 0000 | |
| 9-11 | Operation After Overload Protection is Activated | 0000: Coast-to-Stop After Overload Protection is Activated<br>0001: Drive Will Not Trip when Overload Protection is Activated (OL1) | 0000 | |
| 9-12 | Over torque Detection Selection | 0000: Disable Over torque Operation<br>0001: Enable Over torque Operation Only if at Set Frequency<br>0002: Enable Over torque Operation while the Drive is in Run Mode | 0000 | |
| 9-13 | Operation After Over torque Detection is Activated | 0000: Drive will Continue to Operate After Over torque is Activated<br>0001: Coast-to-Stop After Over torque is Activated | 0000 | |
| 9-14 | Over torque Threshold Level (%) | 30 to 200 | 160 | |
| 9-15 | Over torque Activation Delay Time (s) | 0.0 to 25.0 | 0.1 | |

## 10- Volts/Hz Operation Mode

| Function Code No. | Description | Range/Code | Factory Setting | Remarks |
|---|---|---|---|---|
| 10-0 | Volts/Hz Patterns | 0 to 18 | 0/9 | *4*6 |
| 10-1 | Volts/Hz Curve Modification (Torque Boost) (%) | 0 to 30.0 | 0.0 | *1*6 |
| 10-2 | Motor No Load Current (Amps AC) | ----- | | *5*6 |
| 10-3 | Motor Slip Compensation (%) | 0.0 to 100.0 | 0.0 | *1*6 |
| 10-4 | Maximum Frequency (Hz) | 0.20 to 650.00 | 50.00/ 60.00 | *4*6 |
| 10-5 | Maximum Frequency Voltage Ratio (%) | 0.0 to 100.0 | 100.0 | *6 |
| 10-6 | Mid Frequency (Hz) | 0.10 to 650.00 | 25.00/ 30.00*7 | *4*6 |
| 10-7 | Mid Frequency Voltage Ratio (%) | 0.0 to 100.0 | 50.0 | *6 *7 |
| 10-8 | Minimum Frequency (Hz) | 0.10 to 650.00 | 0.50/ 0.60 | *6 |
| 10-9 | Minimum Frequency Voltage Ratio (%) | 0.0 to 100.0 | 1.0 | *6 *7 |

## 11- PID Operation Mode

| Function Code No. | Description | Range/Code | Factory Setting | Remarks |
|---|---|---|---|---|
| 11-0 | Mode Selection | 0000: Disabled<br>0001: Bias D Control<br>0002: Feedback D Control<br>0003: Bias D Reversed Characteristics Control<br>0004: Feedback D Reversed Characteristics Control<br>0005: Frequency Command + Bias D Control<br>0006: Frequency Command + Feedback D Control<br>0007: Frequency Command + Bias D Reversed Characteristics Control<br>0008: Frequency Command + Feedback D Reversed Characteristics Control | 0000 | |
| 11-1 | Feedback Gain (%) | 0.00 to 10.00 | 1.00 | *1 |
| 11-2 | Proportional Gain (%) | 0.0 to 10.0 | 1.0 | *1 |
| 11-3 | Integration Time (s) | 0.0 to 100.0 | 10.0 | *1 |
| 11-4 | Differentiation Time (s) | 0.00 to 10.00 | 0.00 | *1 |
| 11-5 | PID Offset | 0000: Positive<br>0001: Negative | 0000 | *1 |
| 11-6 | PID Offset Adjust (%) | 0 to 109 | 0 | *1 |
| 11-7 | Output Lag Filter Time (s) | 0.0 to 2.5 | 0.0 | *1 |

## 12- PID "Limits" and "Out of Range" Mode

| Function Code No. | Description | Range/Code | Factory Setting | Remarks |
|---|---|---|---|---|
| 12-0 | Feedback Loss Detection Mode | 0000: Disabled<br>0001: Enabled - Drive Continues to Operate After Feedback Loss<br>0002: Enabled - Drive "STOPS" After Feedback Loss | 0000 | |
| 12-1 | Feedback Loss Detection Level (%) | 0 to 100 | 0 | |
| 12-2 | Feedback Loss Detection Delay Time (s) | 0.0 to 25.5 | 1.0 | |
| 12-3 | Integration Limit Value (%) | 0 to 109 | 100 | *1 |
| 12-4 | Integration Value Resets to Zero when Feedback Signal Equals the Intended Value | 0000: Disabled<br>0001: 1 Second<br>0030: 30 Seconds | 0000 | |
| 12-5 | Allowable Integration Error Margin (Units)<br>(1 Unit=1/8192) | 0 to 100 | 0 | |
| 12-6 | AIN or AI2 Source signal | 0000: AIN=0-10V or 0-20mA<br>AI2=0-10V or 0-20mA<br>0001: AIN=0-10V or 0-20mA<br>AI2=2-10V or 4-20mA<br>0002: AIN=2-10V or 4-20mA<br>AI2=0-10V or 0-20mA<br>0003: AIN=2-10V or 4-20mA<br>AI2=2-10V or 4-20mA | 0000 | *7 |
| 12-7 | Sleep Function Operation Level | 0.00 to 650.00 | 0.0 | |
| 12-8 | Sleep Function Delay Time | 0.0 to 25.5 | 0.0 | |

## 13- Communication Mode

| Function Code No. | Description | Range/Code | Factory Setting | Remarks |
|---|---|---|---|---|
| 13-0 | Assigned Communication Station Number | 1 to 254 | 1 | *2*3 |
| 13-1 | Baud Rate Setting (bps) | 0000: 4800<br>0001: 9600<br>0002: 19200<br>0003: 38400 | 0003 | *2*3 |
| 13-2 | Stop Bit Selection | 0000: 1 Stop Bit<br>0001: 2 Stop Bits | 0000 | *2*3 |
| 13-3 | Parity Selection | 0000: Without Parity<br>0001: With Even Parity<br>0002: With Odd Parity | 0000 | *2*3 |
| 13-4 | Data Format Selection | 0000: 8-Bits Data<br>0001: 7-Bits Data | 0000 | *2*3 |
| 13-5 | Communication time-out operation selection | 0000: Deceleration to stop<br>According Deceleration time 1 (3-03)<br>0001: Coast to stop<br>0002: Deceleration to stop<br>According Deceleration time 2 (3-07)<br>0003: continue operation | 0000 | |
| 13-6 | Communication time-out, detection time | 00,0 to 25,5 sec | 00,00 | *11 |

## 14- Motor Autotune Parameters

| Function Code No. | Description | Range/Code | Factory Setting | Remarks |
|---|---|---|---|---|
| 14-0 | Stator Resistance (Ohms) | ----- | | *3*5 |
| 14-1 | Rotor Resistance (Ohms) | ----- | | *3*5 |
| 14-2 | Equivalent Inductance (mH) | ----- | | *3*5 |
| 14-3 | Magnetizing Current (Amps AC) | ----- | | *3*5 |
| 14-4 | Ferrite Loss Conductance (gm) | ----- | | *3*5 |

## 15- Drive Status and Function Reset

| Function Code No. | Description | Range/Code | Factory Setting | Remarks |
|---|---|---|---|---|
| 15-0 | Drive Horsepower Code | (See page 53) | | *3 |
| 15-1 | Software Version | ----- | ----- | *3 |
| 15-2 | Fault Jog (Last 3 Faults) | (See page 53) | ----- | *3 |
| 15-3 | Accumulated Operation Time (Hours) | 0 to 9999 | ----- | *3 |
| 15-4 | Accumulated Operation Time (Hours X 10000) | 0 to 27 | ----- | *3 |
| 15-5 | Accumulated Operation Time Mode | 0000: Time Under Power<br>0001: Run Mode Time Only | 0000 | *3 |
| 15-6 | Reset Drive to Factory Settings | 1110: Reset for 50 Hz Motor Operation<br>1111: Reset for 60 Hz Motor Operation<br>1112: Reset PLC Program | 0000 | *4 |

**Remarks:**
***1 can be modified during operation.**

***2 cannot be modified during communication.**

***3 do not change while making factory setting.**

***4 as parameter related to factory setting.**

***5 the parameter will be changed by replacing model.**

***6 only available in V/F mode.**

***7 only for version 2.3 and above.**

***8 only for version 2.4 and above.**

***10 only for version 2,6 A and above.**

***11 only for version 2,9 and above.**

## 3.4 Parameter function description

### 3.4.1 Parameter Group 0: Drive Operation Mode

0-00: Control Mode
0000: Vector mode (General Mode)
0001: Vector mode (VT Mode)
0002: V/F mode

Selects the most suitable vector control mode or V/F mode according to the load characteristics.

1. Vector (general mode) is intended to control the general load or rapidly-changed torque load.
2. Vector (VT mode) is suitable for Blower/ Pump and HVAC load. motor's magnetic current will vary according to the torque, which will reduce the current to save energy.
3. If V/F mode is selected, set parameter group10 to comply with the load features.

0-01: Motor Rated Voltage (VAC)
0-02: Motor Rated Current (A)
0-03: Motor Rated Power (kW)
0-04: Motor Rated Speed (RPM)
0-05: Motor Rated Frequency (Hz)
0-06: Motor Parameter Auto Tuning
0000: Disabled 0001: Enabled

It is necessary to enter nameplate and autotuning data as long as vector mode is selected to change the motor.

Autotuning: firstly enter the data for 0-01to 0-05 according to the nameplate after power off, then set 0-06=0001and perform autotuning; The internal data detected will be automatically written to parameter group 14 when the display shows "End".

Example, if the motor rated speed is 1700 rpm, please set 0-04 to 17.0

**PRECAUTION: 1. The motor parameter autotuning covers stationary autotuning. During motor autotuning, the motor does not rotate, and the keypad display shows -AT-.**

**2. During motor parameter autotuning, the input signal in the control circuit is invalid.**

**3. Before motor parameter autotuning, please confirm the stop state of the motor.**

**4. The motor parameter autotuning is only available for vector control mode (0-00=0000 or 0-00=0001).**

0-07 AC Line Input Voltage (Volts AC)
220V series: 170.0 to 264.0
440V series: 323.0 to 528.0

To make sure of the voltage level of the VSD, enter the actual on-site voltage value.

### 3.4.2 Parameter Group 1 - Start/ Stop and Frequency Control Modes

1-00: Run Command Source Selection

0000: Keypad
0001: External terminal control
0002: Communication control
0003: Built-in PLC

1. 1-00=0000 the VSD is controlled by the keypad.
2. 1-00=0001 the VSD is controlled by the external terminals, and the Emergency Stop key does work. (Refer to 1-03 description).

**NOTE: 1-00=0001, please refer to parameter group 2-00, 2-01, 2-02 and 2-03 for a detailed description of how to ensure personal and machine safety.**

3. 1-00=0002 the VSD is communication controlled.
4. 1-00=0003 the VSD controlled by the built-in PLC, and 1-06 preset value is invalid.

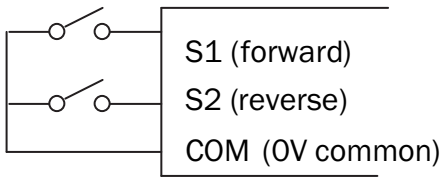
1-01: Operation modes for external terminals

0000: Forward/stop-reverse/stop
0001: Run/stop-forward/reverse
0002: 3-wire control mode -run/stop

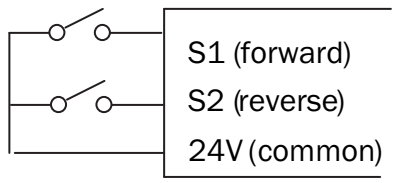
1. When operation command 1-00=0001 (external terminal), 1-01 is valid.
2. When operation command 1-00=0001 (external terminal control), the emergency stop button for is available. (Refer to 1-03 for detailed description).
3. If both forward and reverse commands are ON this will be treated as STOP.

1-01=0000, Control mode is as below:

(1) Input signal is NPN

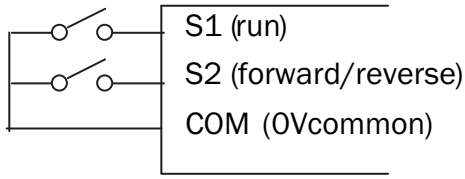


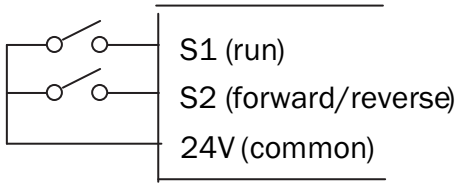

(2) Input signal is PNP




1-01=0001, Control mode is as below:

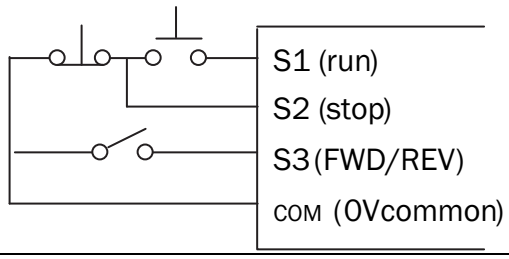
(1) Input signal is NPN(2) Input signal is PNP

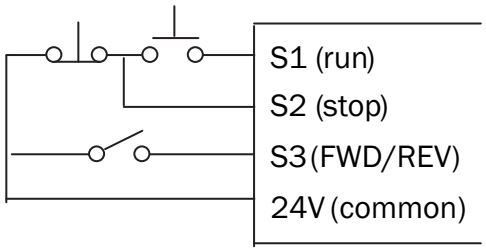


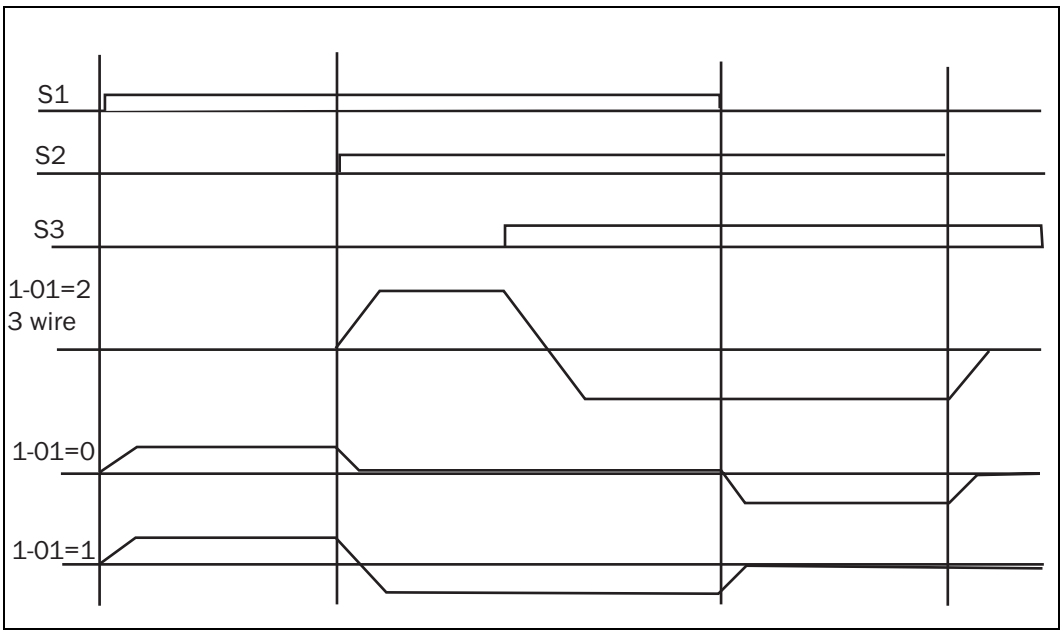

1-01=0002, Control mode is as below:

(1) Input signal is NPN(2) Input signal is PNP




**NOTE: If 3-wire control mode is selected, the terminal S3 is not controlled by 5-02.**




1-02=0001, the reverse command is unavailable.

**NOTE: 1-02=0001, the reverse command is unavailable.**

1-02: Prohibition of Reverse Operation

0000: Enable Reverse Command
0001: Disable Reverse Command

1-03: Keypad Stop Button

0000: Stop Button Enable
0001: Stop Button Disable

1-03=0000, the STOP key is available for controlling the stopping of the VSD.

**NOTE: 1-03=0001 is valid only for 1-00=0001 and 0002,**

| 1-04: Starting Method Selection |
|---|
| 0000: Normal Start<br>0001: Enable Speed Search |

1. 1-04=0000: When starting, the VSD accelerates from 0 to target frequency in the set time.
2. 1-04=0001: When starting, the VSD accelerates to target frequency from the detected motor speed.

| 1-05: Stopping Method |
|---|
| 0000: Controlled Deceleration-to-Stop with DC Injection Braking (Rapid Stop)<br>0001: Free run stop |

1. 1-05=0000: the VSD will decelerate to 0Hz in preset deceleration time after receiving the stop command.
2. 1-05=0001: the VSD will stop output when it receives the stop command. The motor will use inertia to free run to stop.

| 1-06: Frequency Command Source Selection |
|---|
| 0000: Set the frequency with the keypad<br>0001: Potentiometer on the keypad<br>0002: External Analogue Signal Input or Remote Potentiometer<br>0003: Up/Down Frequency Control using MFIT (S1-S6)<br>0004: Communication Setting Frequency<br>0005: Impulse frequency (S5) setting frequency (ver 2.3) |

1. 1-06=0001, if one of the parameter in group 5-00 to 5-06 is set to 16 and multifunction terminal is OFF, the frequency is set by the KNOB (VR for principal speed) on the keypad. While the multifunction is ON, the frequency is set by analogue signal (auxiliary speed) on terminal block (TM2).
2. 1-06=0002, if one of the parameter in group 5-00 to 5-06 is set to 16 and the multifunction terminal is OFF, the frequency is set by analogue signal (principal speed) on terminal block (TM2). While the multifunction is ON, the frequency is set by the KNOB (VR for auxiliary speed) on the keypad.
3. Please refer to the description of parameter group 5-00 to 5-06 (multifunction input terminals) for the function of the Up/Down terminal.
4. The priority for reading frequency is PLC frequency control >traverse run >Jog> preset speed> on the keypad or Up/Down keys or communication control.
5. Impulse frequency command input source should be set for S5 terminal and needs to coordinate with the 5-10 frequency exchange times ratio. For example, the input value for S5 is 4 KHz, 5-10 is 1.500 times, and the output frequency is 4000/100*1.500=60.00 Hz. 5-04(S5) should be set to19.

| 1-07: Keypad Operation using the up/down keys in Run Mode. |
|---|
| 0000: “Enter” must be pressed after frequency change with the up/down keys on the keypad.<br>0001: Frequency will be changed directly when the up/down keys are pressed. |

### 3.4.3 Parameter Group 2 - Manual/ Automatic Restart Modes

2-00: Momentary Power Loss and Restart

0000: Momentary Power Loss and Restart Disable
0001: Momentary Power Loss and Restart Enable
0002: Momentary Power Loss and Restart Enable while CPU is Operating.

2-01: Momentary Power Loss Ride-Thru Time (sec): 0.0 - 2.0 seconds.

1. As starting the power supply for the other load results in the voltage going down to less than the under voltage level, the VSD will stop output at once. If the power supply recovers in the 2-01 preset time, it will start a speed search start tracing from the trip frequency, or the VSD will trip with "LV-C" displayed.
2. The allowable power time loss varies from model to model. The range is from 1 to 2 seconds.
3. 2-00=0000: if power is lost, the VSD will not start.
4. 2-00=0001: if the loss time is less than the value of 2-01, the VSD will Spin Start in 0.5 seconds as the power supplied and restart times are infinite.
5. 2-00=0002: if the power lost lasts for long time and is before the VSD loses the control power for the CPU, the VSD will restart according to the 1-00 and 2-04 settings and the status of the external switch when the power is turned back on.

**NOTE: 1-00=0001, 2-04=0000, 2-00=0001 or 0002 after power loss for a long time, turn OFF the power and power switches to prevent personal injury and machine damage when the power is turned back on.**

2-02: Auto restart Delay Time: 0 to 800.0 seconds

2-03: Number of Auto restart Attempts: 0 to 10 times

1. 2-03=0: the VSD will not auto restart if it was tripped accidentally.
2. 2-03>0, 2-02=0: the VSD will conduct SPEED SEARCH 0.5 seconds after it is accidentally tripped. The motor will use inertia to run to the frequency at the trip stop, then accelerate or decelerate time to target frequency according to its setting.
3. 2-03>0, 2-02>0: the output will be stopped for a period which is determined by 2-02 after an accidental trip. A speed search is then performed to find the target frequency.
4. As the VSD is set to braking deceleration or DC braking, it will not restart after accidental trip.

2-04: Start Method:

0000: Enable Speed Search
0001: Normal Start

1. 2-04=0000: the VSD will detect motor speed and accelerate the setting frequency via speed search enable.
2. 2-04=0001: the VSD will accelerate the motor speed from stop (zero speed) to setting frequency.

2-05: Direct running after power up:

0000: Enable Direct Running After Power Up
0001: Disable Direct Running After Power Up

**WARNING: 1.) 2-05=0000 and the VSD is set to external terminal controlled (1-00=0001). If the run switch is ON as power is supplied, the VSD will auto start. It is recommend that you turn off the power switch and run switch to avoid personal injury or machine damage when the power turned back on.**

**2.) 2-05=0001 and the VSD is set to external terminal controlled (1-00=0001). If the run switch is ON as power is supplied, the VSD will not auto start and STP1 will flash. It is necessary to OFF the run switch and then ON again to start normally.**

2-06: Delay-ON Timer (seconds): 0 to 300.0 seconds

When power is on and 2-05=0000, the VSD will perform auto restart within the setting delay time.

2-07: Error reset mode setting

0000: Enable Reset Only when Run Command is Off
0001: Enable Reset when Run Command is On or Off

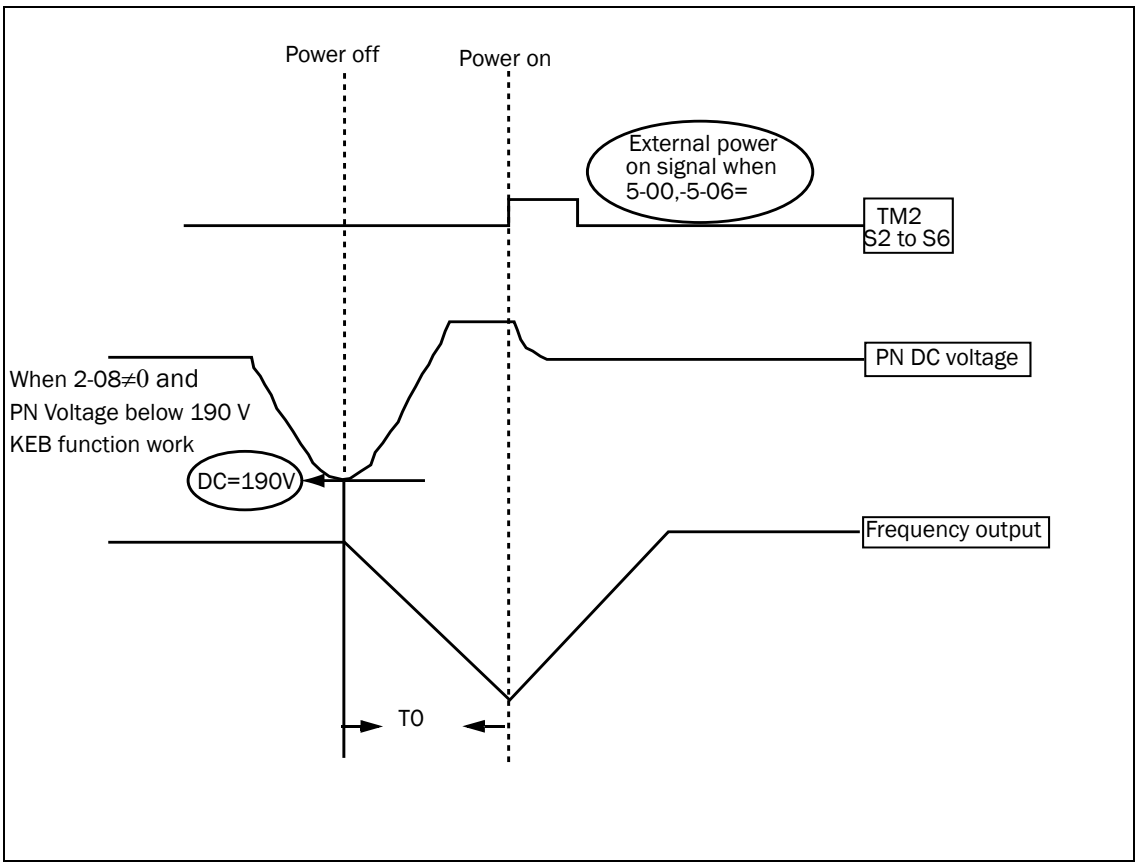
2-07=0000 when the VSD detects the accidental trip, please turn off the Run switch to perform reset, or restarting does not work.

2-08: Kinetic Energy Back-up Deceleration Time: 0.00 to 25.00 seconds

2-08=0 KEB function disable

2-08≠0 KEB function enable

Example: 220 V system




**NOTE: 1. For 2-08 Function.**

**2. When the power is off CPU detect the DC Voltage. KEB function is enabled when DC Voltage lower than 190V/220V system or 380V/440V system.**

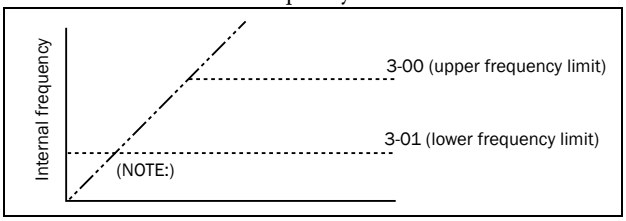
**3. When the KEB function is enabled, the VSD decelerates to zero using 2-08, and the VSD stops.**

**4. If the power on signal enabled during the KEB function, the VSD accelerates to its original frequency.**

## 3.4.4 Parameter Group 3 - Operating Parameters

| |
|---|
| 3-00: Frequency Upper limit (Hz): 0.01 to 650.00 |
| 3-01: Frequency Lower limit (Hz): 0.01 to 650.00 |

When 3-01 > 0 Hz and frequency command




**NOTE: When 3-01=0 Hz and frequency command is 0 Hz, the VSD will stop at 0 speed.**

**When 3-01 > 0 Hz and frequency command is 3-01, the VSD will output the 3-01 preset value.**

| |
|---|
| 3-02: Acceleration Time #1 (s): 0.1 to 3600.0 |
| 3-03: Deceleration Time #1 (s): 0.1 to 3600.0 |
| 3-04: S Curve of First Acceleration Stage (s): 0.0 to 4.0 |
| 3-05: S Curve of Second Acceleration Stage (s): 0.0 to 4.0 |
| 3-06: Acceleration Time #2 (s): 0.1 to 3600.0 |
| 3-07: Deceleration Time #2 (s): 0.1 to 3600.0 |
| 3-08: Jog Acceleration Time (s): 0.1 to 25.5 |
| 3-09: Jog Deceleration Time (s): 0.1 to 25.5 |

1. Formula for calculating acceleration and deceleration time: The denominator is base on the rated frequency of motor.

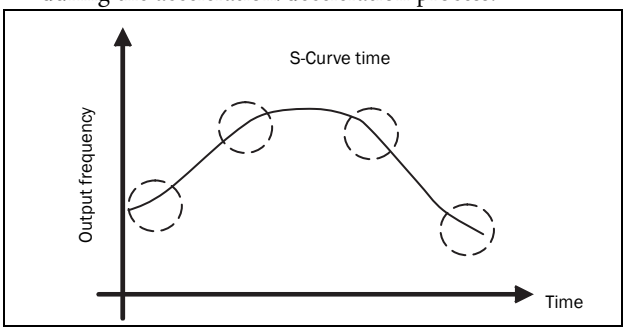
$$\text{Acceleration time} = 3\text{-}02 \text{ (or } 3\text{-}06) \times \frac{\text{Preset frequency}}{0\text{-}05}$$

$$\text{Deceleration time} = 3\text{-}03 \text{ (or } 3\text{-}07) \times \frac{\text{Preset frequency}}{0\text{-}05}$$

2. When 5-00 – 5-06 is set as 06 (the second acceleration and deceleration time), the first acceleration/ deceleration/ S-curve or the second acceleration/ deceleration/ S-curve will be selected with off or on the external input terminal.
3. When 5-00 – 5-06 is set to 05 (Jog), Jog run is controlled by external terminals. The acceleration and deceleration action will be at Jog acceleration and deceleration time.
4. When 5-00 – 5-06 is set as 05 (Jog) and 06 (acceleration and deceleration time toggle), change the acceleration and deceleration time with ON on the external terminals. Here is a list of setting:

| Function<br><br>preset value | Acc/ Dec time 1 (3-02/3-03)<br>1-06 determines the output frequency | Acc/ Dec time 2 (3-06/3-07)<br>1-06 determines the output frequency | JOG Acc/Dec time (3-08/3-09)<br>Run at 6-01Jog frequency |
|---|---|---|---|
| 5-00 to 5-05=06 Jog command | Off | Off | On |
| 5-00 to 5-06=04<br>Toggle Acc/Dec time. | Off | On | Off |

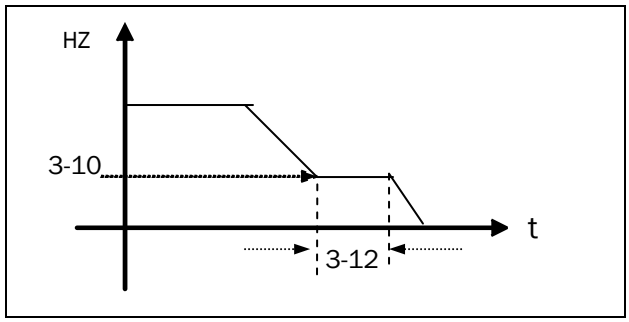
5. When S-curve time (3-04/3-05) is set as 0, the S curve is useless. The line shows acceleration and deceleration.
6. When S-curve time (3-04/3-05) is greater than 0, the acceleration and deceleration action is as per the following diagram.
7. Regardless of the stall prevention period, actual acceleration and deceleration time = preset acceleration / deceleration time + S-curve time. For example: acceleration time = 3-03+3-04.
8. During the acceleration and deceleration process, there may be residual error in acceleration and deceleration toggling. Please set the S-curve time as 0 (3-04/3-05) if you need to toggle acceleration and deceleration time during the acceleration/deceleration process.




3-10: DC Injection Brake Start Frequency (Hz): 0.1 to 10.0

3-11: DC Injection Brake Level (%): 0.0 to 20.0

3-12: DC Injection Brake Time (s): 0.0 to 25.5




3-12 / 3-10 is the action time and start frequency of DC braking, as graph below:

The upper setting of 3-11 will be corrected 20.0 after manual V2.3.

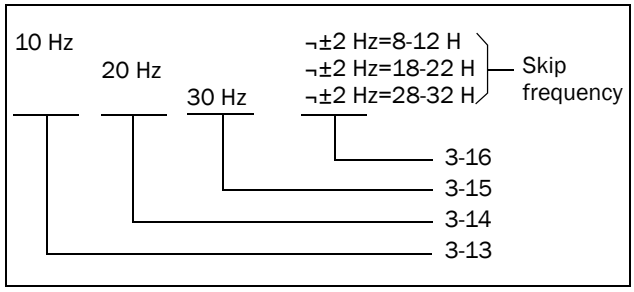
3-13: Skip Frequency #1 (Hz): 0.00 to 650.00

3-14: Skip Frequency #2 (Hz): 0.00 to 650.00

3-15: Skip Frequency #3 (Hz): 0.00 to 650.00

3-16: Skip Frequency Bandwidth (± Hz): 0.00 to 30.00

Example: 3-13 is set to 10.0 Hz / 3-14 to 20.0 Hz / 3-15 to 30.0 Hz / 3-16 as 2.0Hz



3-17: Parameter lock function

0000: Enable all Functions
0001: 6-00 to 6-08 cannot be changed
0002: All Functions Except 6-00 to 6-08 cannot be changed
0003: Disable all Functions

3-18: Copy Unit

0000: Disable
0001: VSD to Copy Unit
0002: Copy Unit to VSD
0003: Verify

1. 3-18=0000: VSD can not copy parameter.
2. 3-18=0001: Copy the VSD parameters to module.
3. 3-18=0002: Copy the module parameters to VSD.
4. 3-18=0003: Copy the parameters to VSD or module to mutually verify the parameters.

**NOTE: The copy function is available for the models with same capacity.**

3-19: Fan Running Control

0000: Auto (Depend on temp.)
0001: Operate while in RUN Mode
0002: Always Run
0003: Always Stop

1. 3-19=0000: The fan runs as the VSD senses temperature rises. Extend the service period accordingly.
2. 3-19=0001: The fan runs while the VSD is running.
3. 3-19=0002: The fan runs continuously regardless of what the VSD is doing.
4. 3-19=0003: The fan always stops regardless what the VSD is doing.

3-20: Energy Saving Mode Operation

0000: Disabled
0001: Controlled by MFIT at Set Frequency

3-21: Energy saving operation gain (%): 0-100

1. While operation, FAN, PUMP or other heavy inert loads which need greater starting torque, do not need such high torque. As a result, use setting 3-20 to save energy by reducing the output voltage.
2. 5-00 to 5-06 (Multifunction input terminal) set to 10 in order to save energy.
3. 3-20=0001, if the multifunction terminal is set to 10 (energy saving control terminal), the output voltage will gradually decline to "original voltage" x "3-21" preset value when the terminal' is ON. The output voltage will rise to the original voltage when the terminal is OFF.

**NOTE:1.The declining and rising voltage speeds for energy saving are same as those for SPEED SEARCH.**

**2. Energy saving mode is only available under V/F mode. (0-00=0002).**

3-22: Carrier Frequency (KHz): 2 to 16

| 3-22 | Carrier Frequency | 3-22 | Carrier Frequency | 3-22 | Carrier Frequency | 3-22 | Carrier Frequency |
|---|---|---|---|---|---|---|---|
| 2 | 2KHz | 6 | 6KHz | 10 | 10KHz | 14 | 14KHz |
| 3 | 3KHz | 7 | 7KHz | 11 | 11KHz | 15 | 15KHz |
| 4 | 4KHz | 8 | 8KHz | 12 | 12KHz | 16 | 16KHz |
| 5 | 5KHz | 9 | 9KHz | 13 | 13KHz | | |

**NOTE: The external electronic components may experience interference or, more seriously, motor vibration if the high carrier frequency waveform is turned off, even though the VSD is very quiet during operation. As a result, it is necessary to regulate the carrier frequency.**

3-23: Centre Frequency (CF) of Traverse Run (%): 2 to 16

3-24: Amplitude (%) 0.1 to 20.0

3-25: Amplitude Drop(%): 0.0 to 50.0

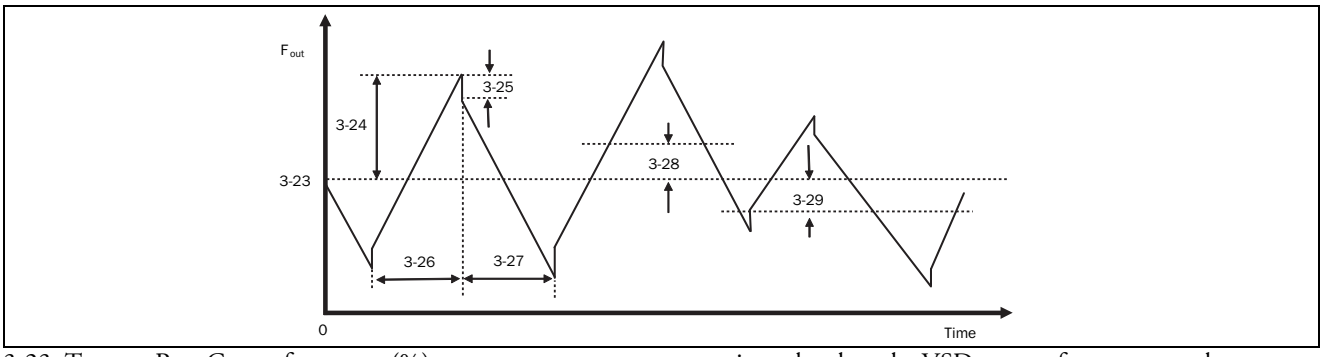
3-26: Acceleration Time (s): 0.5 to 60.0

3-27: Deceleration Time (s): 0.5 to 60.0

3-28: Deviated traverse (X upper deviation) (%): 0.0 to 20.0

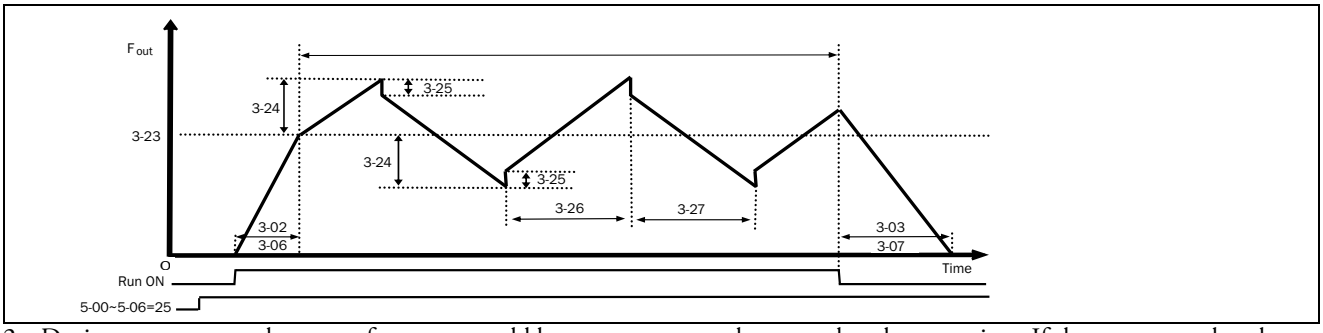
3-29: Deviated traverse (Y lower deviation (%: 0.0 to 20.0)

Traverse Run (dedicated feature for textile machinery) is defined as adding a triangle wave to the basic operation frequency of VSD output frequency at the preset acceleration and deceleration time. The motion is as per the graph below:

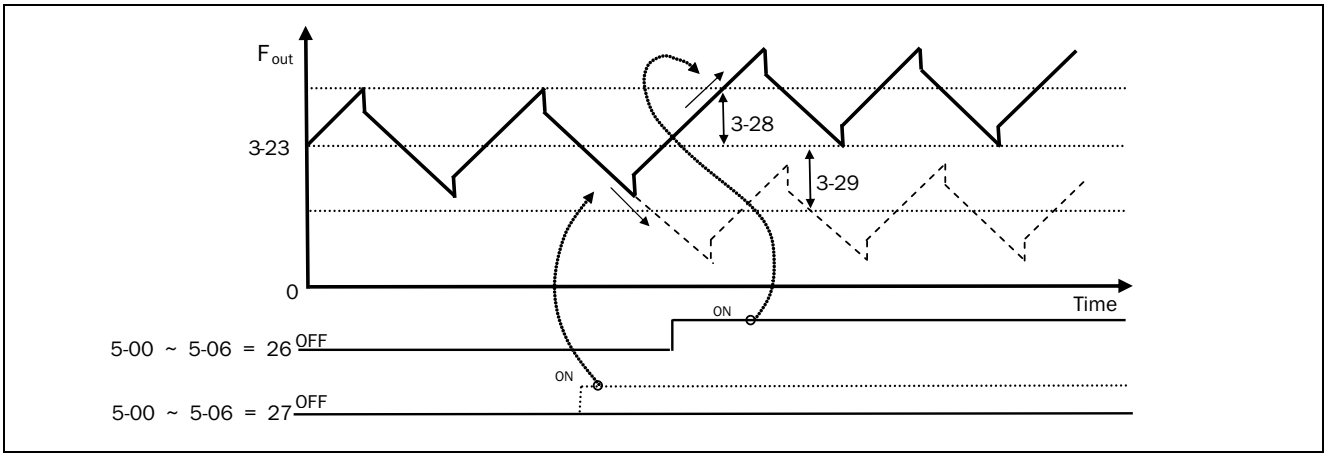



3-23: Traverse Run Centre frequency (%)
3-24: Amplitude (%)
3-25: Amplitude Drop (%)
3-26: Acceleration Time (s)
3-27: Deceleration Time (s)
3-28: Deviated traverse (X upper deviation)
3-29: Deviated traverse (Y lower deviation)

1. The traverse run is available when the run command and the terminal (5-00 to 5-05=0025) for such operation both ON. When the VSD is operating, the traverse run is ready when the VSD output frequency reaches centre frequency (3-23). During acceleration to centre frequency, the acceleration time is at the original preset value (3-02/3-06). When the traverse run is OFF or the VSD is OFF, the deceleration time is also at the original preset value (3-03/3-07). However, during traverse running, the VSD is at traverse run acceleration time (3-36) and deceleration time (3-27). The motion is as the following diagram:




2. During traverse run, the centre frequency could be controlled by the multifunction input terminals. However, the X upper deviation and Y lower D deviation cannot be entered at the same time. If they are entered at the same time, the VSD will maintain the original centre frequency. The motion is as per the graph below:




3. The stall prevention is idle during the acceleration and deceleration time of traverse run. But it is valid during first acceleration to centre frequency process when the traverse run function is OFF or the VSD is in deceleration time after the STOP command is received.
4. The frequency range of the traverse run is restricted by the VSD's upper and lower frequency limits, i.e. if the (centre frequency + amplitude) is greater than the upper limit, it will operate at the upper frequency limit. And if (centre frequency - amplitude) is less than the lower limit, vice versa.

5. During traverse run, not all the preset values, such as centre frequency, amplitude, amplitude drop, acceleration time, deceleration time, traverse run upper deviation and lower deviation, can be modified. The modified acceleration and deceleration time is priority for the original one, but not traverse run acceleration and deceleration time. The motion is as per the graph below:
6. The stall prevention protection is unavailable during traverse run acceleration and deceleration time. Therefor this must be taken into consideration when designing equipment so that the actual system capacity complies with the proper VSD capacity.
7. Centre frequency = 3-23*max. frequency (3-00)
   Amplitude = 3-24*centre frequency Acceleration/Deceleration time = amplitude acceleration/deceleration time
   Amplitude Drop = 3-25*amplitude

Deviated traverse (X upper deviation) = 3-28*traverse run centre.

Deviated traverse (lower deviation) = 3-29* traverse run centre.

If you want to change the max. frequency of 3-00, reset 3-23 to 3-29 values where necessary.

3-30: Start Frequency (Hz)  INV Start Frequency

The Inverter can start at 5Hz and still have an operational control range of 0.0 - 60Hz. To accomplish this (3-01 will need to be set to 0Hz and (3-30) to 5Hz.

## 3.4.5 Parameter Group 4 - Digital Display Operation Mode

| 4-00: Motor Current Display Selection:<br>0000: Disable Motor Current Display<br>0001: Enable Motor Current Display |
|---|

| 4-01: Motor Voltage Display Selection:<br>0000: Disable Motor Voltage Display<br>0001: Enable Motor Voltage Display |
|---|

| 4-02: DC Bus Voltage Display Selection:<br>0000: Disable Bus Voltage Display<br>0001: Enable Bus Voltage Display |
|---|

| 4-03: PLC Status Display Selection:<br>0000: Disable PLC Status Display<br>0001: Enable PLC Status Display |
|---|

This function is available for the LCD keypad, but not for the LED one.

| 4-04: Custom Units (Line Speed) Value: 0-9999 |
|---|

The max preset line value of 4-04 is equal to the rated frequency (0-05) of the motor. For instance, given line speed 1800 is equal to display 900 when output is 30 Hz while the operation frequency is 60 Hz.

| 4-05: Custom Units (Line Speed) Display Mode<br>0000: Drive Output Frequency is Displayed<br>0001: Line Speed is Displayed in Integers (xxxx)<br>0002: Line Speed is Displayed to One Decimal Place (xxx.x)<br>0003: Line Speed is Displayed to Two Decimal Places (xx.xx)<br>0004: Line Speed is Displayed to Three Decimal Places (x.xxx) |
|---|

The preset frequency is displayed when the VSD stops while the operation line speed is displayed when the VSD is running.

| 4-06: PID Feedback Display<br>0000: Disable<br>0001: Enable |
|---|

Keypad displays PID feedback value:

Parameter 5-05=20 (That is, S6 is set as the PID feedback analogue terminal, refer to PID), 11-0=1 (PID is enabled), and 4-06=1 (Display S6 as PID analogue feedback value 0–100, the formula as follows:)

If feedback signal is 0–10V, (12-6=0000), keypad display value = (S6/10V)*100.

If feedback Signal is 4–20mA, (12-6=0001), keypad display value = (S6/20mA)*100.

**NOTE: Please press the Key to switch between the output frequency and PID feedback value.**

**NOTE: The VSD displays XXXF as Running, while XXXr as Stop.**

## 3.4.6 Parameter Group 5 - Multifunction Input Terminals (MFIT)

Multifunction input terminals (TM2 S1-S6/AIN) controlling:

5-00 to 06

000: Forward/Stop Command *1
0001: Reverse/Stop Command *2
0002: Preset Speed # 1 (6-02)
0003: Preset Speed # 2 (6-03)
0004: Preset Speed # 3 (6-05) *3
0005: Jog
0006: Acc/Dec time # 2
0007: Emergency Stop Contact A
0008: Base Block
0009: Speed Search Stop
0010: Energy Saving
0011: Control Signal Selection
0012: Communication Control Signal Selection
0013: Acc/Dec Disabled
0014: Up Command
0015: Down Command
0016: Principal/Auxiliary Speed
0017: PID Function Disabled
0018: Reset
0019: Encoder Input Terminal (Terminal S5)
0020: PID Feedback Signal AI2 (only for terminal AI2)
0021: AI2 Bias Signal 1 Input (only for terminal AI2)
0022: AI2 Bias Signal 2 Input (only for terminal AI2)
0023: Analogue Input Terminal AIN
0024: PLC Application
0025: Traverse Run
0026: Traverse Run Upper Deviation
0027: Traverse Run Lower Deviation
0028: Power Source Detect for KEB Function
0029: Emergency Stop Contact B

A. The terminals S1-AIN on terminal block (TM2) are multifunction input terminals. The above 30 functions can be set in these terminals.

B. Function Description for 5-00 to 06:

1. 5-00 to 06=0/1 (Forward/Reverse/Stop)
   When forward command is ON, the VSD runs and stops when it is OFF. The 5-00 factory setting is forward. When reverse command is ON, the VSD runs and stops when it is OFF. The 5-01factory setting is reverse.
2. 5-00 to 06=2-4 (Preset speed 1 to 3)
   When the external multifunction input terminals are ON, the VSD operates for the preset time, and the duration is determined by the time the terminal is ON. The corresponding frequency parameter is illustrated below:
3. 5-00 to 06=5 (Jog)
   To select Jog operation the external input terminals must be ON. The VSD operates for the Jog acceleration and deceleration time. The corresponding frequency parameter is illustrated below:

The priority order of frequency: Jog SpeedPreset SpeedKeypad frequency or external frequency signal

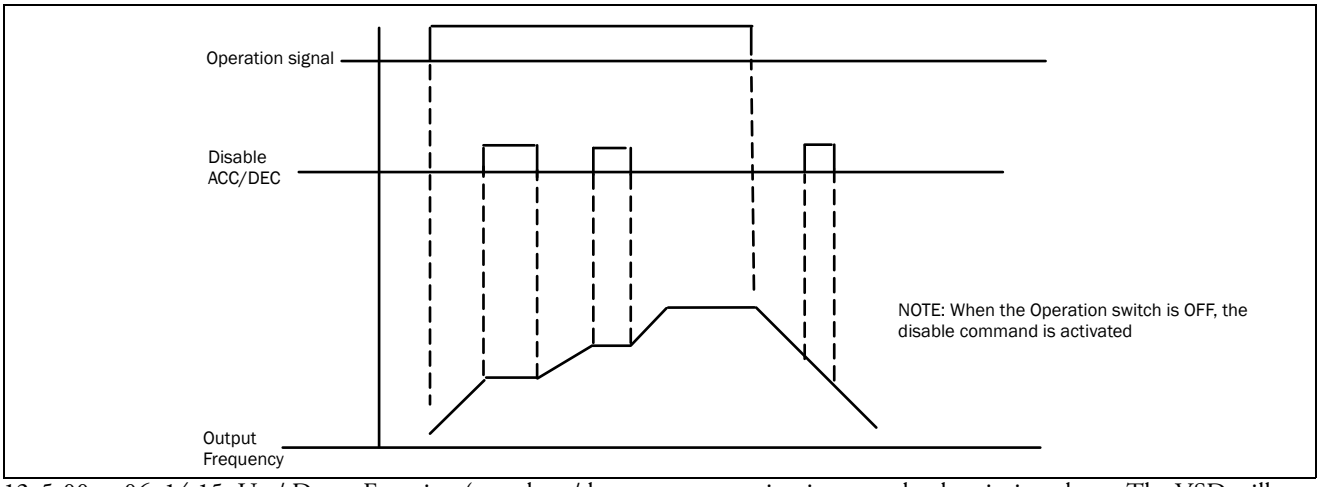
| Multifunction terminal 3 Preset value=04 | Multifunction terminal 2 Preset value=03 | Multifunction terminal 1 Preset value=02 | Jog Command terminal Preset value=05 | Output frequency preset value |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 6-00 |
| X | X | X | 1 | 6-01 |
| 0 | 0 | 1 | 0 | 6-02 |
| 0 | 1 | 0 | 0 | 6-03 |
| 0 | 1 | 1 | 0 | 6-04 |
| 1 | 0 | 0 | 0 | 6-05 |
| 1 | 0 | 1 | 0 | 6-06 |
| 1 | 1 | 0 | 0 | 6-07 |
| 1 | 1 | 1 | 0 | 6-08 |

4. 5-00 to 06=6 (toggle acceleration and deceleration time)
   On the external input terminal, to select the acceleration 1/ deceleration 1/ S-curve 1 or acceleration 2/ deceleration 2/ S-curve 2.

5. 5-00 to 06=7 /29: External emergency stop contact A or B. The VSD will decelerate to stop and flash E.S when the emergency stop signal is received regardless of the 1-05 setting. After this signal is released, turn OFF the operation switch then turn it ON or press the Operation Key, the VSD will restart from the start frequency. If the emergency signal was released before the VSD came to complete stop, the VSD will still perform an emergency stop. The 8-02/03 determines the action of the error terminal. When 8-02/0=0 the error terminal does not act when the external emergency signal is received. When 8-02/03=9, the error terminal does act when an emergency signal is received.
6. 5-00 to 06=8: Base Block
   The VSD stops output when it receives a STOP command, and the motor Free-Run stops.
7. 5-00 to 06=9: Speed Search Stop
   When starting, the VSD detects the present speed of the motor first, then the VSD accelerates from the present speed to preset speed.
8. 5-00 to 06=10: Energy-saving operation
   While in operation FAN, PUMP or other heavy inertia loads which need high start torque, do not need such high torque over full speed range. As a result, energy can be saved by reducing the output voltage. The output voltage gradually decreases when the multifunction terminal is ON. It will gradually increase (to the original voltage) when the multifunction terminal is OFF.

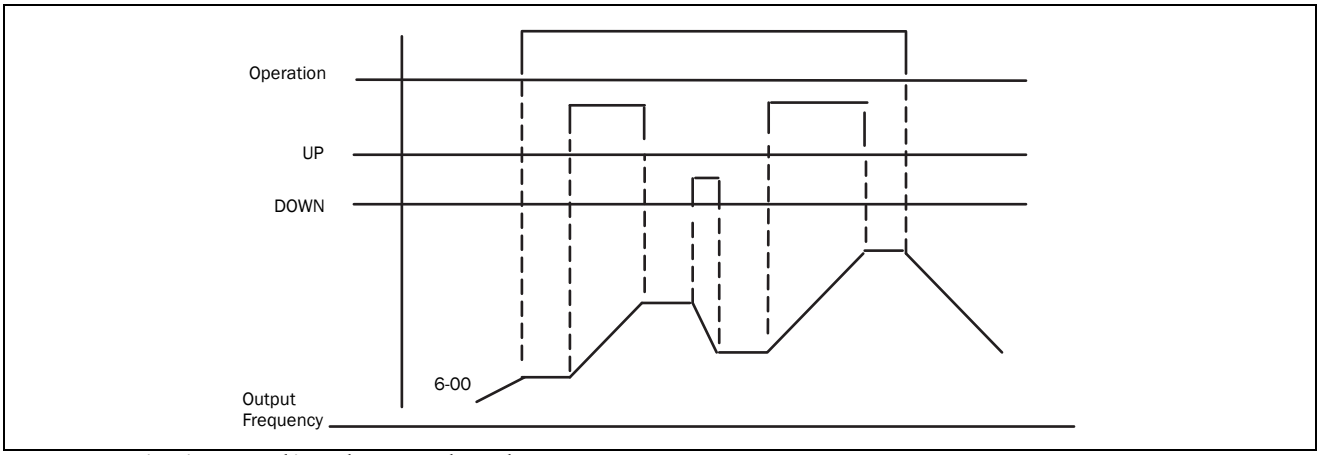
**NOTE: The output voltage decrease and increase speed in energy saving operation is the same as the speed of SPEED SEARCH.**

9. 5-00 to 06=11: Control signal switch
   External switch terminal is OFF: 1-00/01 determines the operation signal and frequency signal.
   External switch terminal is ON: Keypad controls the operation signal and frequency signal but not controlled by 1-00/01.
10. 5-00 to 06=12: The VSD switch controlling communication.
    External switch terminal is OFF: for communication, the master (PC or PLC) can control the VSD operation and frequency signal and allow the modification of parameters. The operation signals from the keypad and TM2 are idle. Furthermore, the keypad can only display the voltage, current and frequency; the parameters are readable but not writable, and Emergency Stop is valid.
    External switch terminal is ON: for communication, the VSD is controlled by the keypad regardless of the setting of 1-00/1-06 and master. In this situation, the master can still read and write the VSD parameters.




12. 5-00 to 06=14,15: Up / Down Function (actual acc/dec time is based on the setting):

    (1) Please set 1-06=3 if you want to use the Up/Down function, and the other frequency signals are useless.
    (2) Set 5-08=0 and 5-09=0, the VSD accelerates to the preset value of 6-00 when the operation terminal is ON. It then maintains the known speed. As the VSD receives the Up/Down command, it will accelerate / decelerate until the command is released. The VSD runs at the known speed. The VSD will either ramp stop or Free-Run stop, this is determined by the 1-05 setting as long as the VSD receives the STOP command. The stopping frequency will be stored in 6-00. The Up/Down key is invalid when the VSD stops. You need to use the keypad to modify the preset parameter.
    (3) Set 5-08=1 and the VSD will operate from 0 Hz when the operation terminal is ON. The Up/Down action is as per the description above. The VSD will ramp stop or free-run stop, which is determined by the 1-05 setting when it receives the Stop Command and go back to 0 Hz. The next operation will start at 0 Hz.
    (4) If the UP/Down signal cannot act simultaneously.
    (5) 5-09 0, the VSD will accelerate to the setting of 6-00 and maintain this speed. When the Up/Down terminal is ON, the setting frequency is the present value of 6-00±5-09, and the VSD will accelerate/decelerate to frequency 6-00. The upper frequency limit and lower frequency limit also restrict the operation. If the Up/ Down signal is maintained for 2 seconds, the VSD will begin to accelerate/decelerate. If 5-09=0, the operation is the same, until the Up/ Down signal stops. Please refer to the time diagram for 5-09.




13. 5-00 to 06=16 Principal/Auxiliary speed toggle
    Multifunction terminal = OFF, the frequency is set by Master Speed, whereas, Multifunction terminal = ON, the frequency is set by Auxiliary Speed.
    Example. 1-06=0001, the master speed is the VR on the keypad and the auxiliary speed is the analogue signal on the TM2 terminal block.

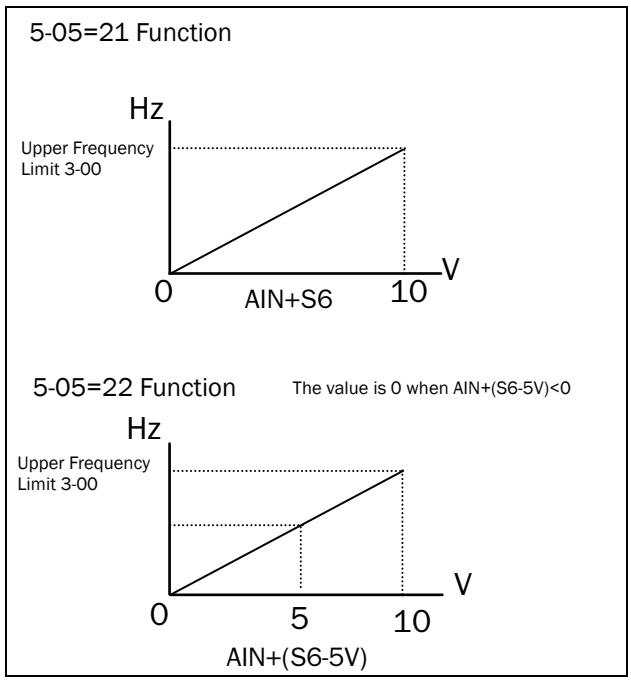
14. 5-00 to 06=17 (PID Function Disable)
    The PID Function Disable is ON. PID is not controlled by 11-0, while OFF, it is controlled by 11-0.

15. 5-00 to 06=18 (Reset Command)
    The Reset command is the same as when the Reset Key on the panel is ON. The command is OFF, and the VSD does not respond. The factory setting of 5-05 is Reset command.

16. 5-04=19 (Encoder Input terminal)
    The multifunction terminal S5 is set to 19, which means it is the input terminal for the PLC program Encoder.

17. 5-05=20 (PID feedback input terminal)
    The multifunction terminal S6 = 20, which means the PID feedback input terminal and 0–10V (0–20 mA) or 2–10V (4–20mA) is available by setting 11-0.

18. 5-05=21 /22 (Bias signal 1/2 input)
    To regulate the Offset of the Keypad VR or AIN analogue input, only a signal of 0–10V (0– 20 mA) or 2–10V (4–20mA) is available.




19. 5-06=23 (Analogue input AIN)
    The multifunction terminal AIN = 23. The action is provided for setting the frequency.

20. 5-00–06=24 (PLC Application)
    The multifunction terminal S1-AIN = 24, which means the terminal is for PLC application. The terminal is provided for the PLC program input.

21. 5-00–06=25 (Traverse Run); 5-00–06=26 (Upper Deviation Traverse); 5-00–06=27 (Lower deviation Traverse). Refer to 3-23–3-29 for a detailed motion description.

22. 5-00–06=28 (Power Source Detect for KEB Function)
    Please refer to the description of 2-08.

Digital/Analogue input signal scan times:

5-07: Multifunction terminal S1-S6 and AIN signal confirm the scan times (ms X 4), 1 to 100 times

1. TM2 terminal used for scanning. If the same signals are continuously entered for N times (i.e. scan times), the VSD will treated the signal as normal. If the scan times are less than N, the signal will be audible.
2. Each scan period is 4ms.
3. The user can specify the duration of the scan times interval according to the noise environment. If the noise is serious, increase the value of 5-07, but the response speed will be slowed down.

**NOTE: If the S6 and AIN are for a digital signal, the voltage level for a digital signal above 8 V is treated as ON, below 2 V is OFF.**

Stop Mode Using MFIT:

5-08:

0000: When Up/Down is used, the preset frequency is held when the VSD stops, and the Up/Down is idle.
0001: When Up/Down is used, the preset frequency is reset to 0 Hz as the VSD stops.
0002: When Up/Down is used, the preset frequency is held when the VSD stops, and the Up/Down is available.

(1) Set 5-08=0, the VSD will accelerate to the speed of 6-00 as it receives the Run command and run at that speed. The VSD begins to accelerate (decelerate) as the Up (Down) terminal is energised. The VSD will hold the speed as the Up/Down command is released. When the Run Signal releases, the VSD will ramp stop or stop output (determined by the 1-05 setting). It will store the frequency when the operation signal disappears. Up/Down keys are idle when the VSD is at rest. The keypad allows you to modify the preset frequency (6-00). If 5-08=0002 the Up/Down is available when the VSD stops.

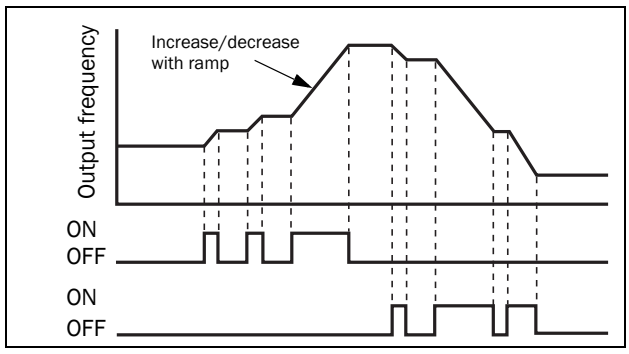
(2) Set 5-08=1, when the Run terminal is energised, the VSD operates from 0 Hz, the Function of Up/Down is the same as in the description above. When the Run signal is released, the VSD will ramp stop or stop output (determined by 1-05). And the VSD goes back to 0 Hz. The following operation will always begin from 0 Hz.

Step of Up/Down Function (Hz):

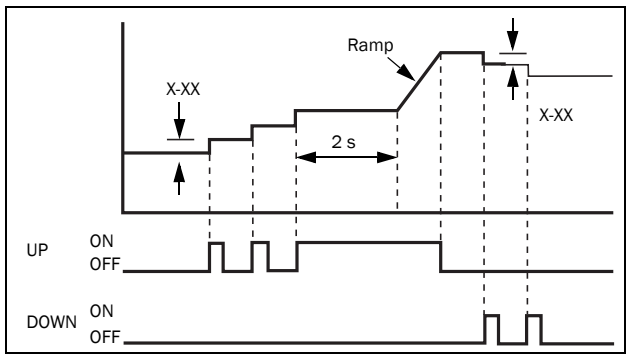
5-09: Up/Down (Hz) 0.00 to 5.00

There are two modes covered below:

(1) 5-09=0.00, the function is disable. The operation is just like the original one. When the UP terminal is ON, the frequency increases, and when the Down terminal is ON, the frequency decreases. (Refer to the following graph).




(2) 5-09=0.01 to 5.00, Up/ Down terminal ON, which is equivalent to increasing/decreasing the frequency of 5-09. If the held down for over 2 seconds, revive the original Up/ Down mode (Please refer to the following diagram).




Encoder Impulse Ratio:

5-10 Impulse input frequency time ratio

When frequency source 1-06 is set as 0005, the impulse signal frequency will be according to this parameter to decide the real internal frequency of the VSD.

The internal calculation formula: Frequency = S5 (impulse frequency)*5-10 (times ratio)

For example, when the S5 impulse is 1KZ1000, and 5-10 is set to 1.50 times, the VSD frequency command is 1000*1.5 = 1500 = 15.00Hz. The frequency accuracy of S5 is by based on 100; i.e. 1K (1000) present 10.00 Hz.

Reference Source 2:

5-11 Auxiliary frequency source can be selected

Example.

If the frequency source command is set as impulse command, (1-06=5).

If using master speed operation (5-00 to 5-06 set to 16 and the terminal is OFF), the frequency runs as impulse frequency.

If using auxiliary speed operation (5-00 to 5-06 set to 16 and the terminal is ON), the frequency should be decided by the 5-11 setting.

The action process is as follows:

5-11=0, frequency refer to 6-00.

5-11=1, frequency refer to the VR analogue signal on the keypad.

5-11=2, frequency refer to the VR analogue signal on TM2.

5-11= 3, frequency refer to the frequency value which is calculated by Up/Down on TM2.

5-11= 4, frequency refer to the input communication frequency..

| AI2 Function: |
|---|
| 5-12 Analog Input |

5-12=0020 : PID Feedback Signal AI2 (terminal AI2)

5-12=0021 : AI2 Bias Signal 1 Input (terminal AI2)

5-12=0022 : AI2 Bias Signal 2 Input (terminal AI2)

## 3.4.7 Parameter Group 6 - Jog and Preset (MFIT) Speed Setting on Keypad

| Jog and Preset (MFIT) Speed Setting on Keypad: |
|---|
| 6-00 to 08: Set Jog and preset speed with Keypad |

A. 5-00 to 06=2-4 (preset speed 1 to 3)

The external multifunction terminal = ON, the VSDVSD operates at preset speed. The operation time of the 8 stages is based on the ON time of the terminal. Please refer to the corresponding parameters list:

B. 5-00 to 06=5 (Jog terminal)

The external multifunction terminal = ON, the VSD operates in Jog acceleration time/ Jog decelerate time/ON.

| Function Code No. | Description | Range/Code |
|---|---|---|
| 6-00 | Keypad Frequency (Hz) | 0.00 to 650.00 |
| 6-01 | Jog Frequency (Hz) | 0.00 to 650.00 |
| 6-02 | Preset Speed #1 (Hz) | 0.00 to 650.00 |
| 6-03 | Preset Speed #2 (Hz) | 0.00 to 650.00 |
| 6-04 | Preset Speed #3 (Hz) | 0.00 to 650.00 |
| 6-05 | Preset Speed #4 (Hz) | 0.00 to 650.00 |
| 6-06 | Preset Speed #5 (Hz) | 0.00 to 650.00 |
| 6-07 | Preset Speed #6 (Hz) | 0.00 to 650.00 |
| 6-08 | Preset Speed #7 (Hz) | 0.00 to 650.00 |

Priority in reading the frequency: Jog > Preset speed > Keypad frequency or external frequency signal.

| Multifunction terminal3 Preset value=04 | Multifunction terminal 2 Preset value=03 | Multifunction terminal 1 Preset value=02 | Jog Command terminal Preset value=05 | Output frequency preset value |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 6-00 |
| X | X | X | 1 | 6-01 |
| 0 | 0 | 1 | 0 | 6-02 |
| 0 | 1 | 0 | 0 | 6-03 |
| 0 | 1 | 1 | 0 | 6-04 |
| 1 | 0 | 0 | 0 | 6-05 |
| 1 | 0 | 1 | 0 | 6-06 |
| 1 | 1 | 0 | 0 | 6-07 |
| 1 | 1 | 1 | 0 | 6-08 |

## 3.4.8 Parameter Group 7 - Analogue input signal operation mode

Analogue Input Signal Operation Mode: (The function is valid when 1-06==0002)

7-00: AIN Gain (%) 0 - 200

7-01: AIN Bias (%) 0 - 100

7-02: AIN Bias Selection:

0000: positive
0001: negative

7-03: AIN Slope:

0000: positive
0001: negative

7-04: AIN signal verification Scan Time (AIN, AI2) 1–100 (× 4ms)

7-05: AI2 Gain (%) (S6) 0 - 200

1. 7-02=0: 0V (0mA) corresponding to lower frequency limit. 10V (20mA) corresponding to upper frequency limit.
2. 7-02=1: 10V (20mA) corresponding to lower frequency limit 0V (0mA) corresponding to upper frequency limit.
3. 12-6=0: 0–10V (0–20mA)

   F = I*(3-00)/20 I> = 0SW2 = or F=V*(3-00)/10 V>=0SW2=V
   = 1: 2–10V (4–20mA)
   F=(I-4)*(3-00)/16 I>=4SW2=
   F=0 I<4
   F=(V-2)*(3-00)/8 V>=2SW2=V or
   F=0 V<2

The setting of figure 1:The setting of figure2:

| | 7-00 | 7-01 | 7-02 | 7-03 | 7-05 |
|---|---|---|---|---|---|
| A | 100 | 50% | 0 | 0 | 100% |
| B | 100 | 0% | 0 | 0 | 100% |

| | 7-00 | 7-01 | 7-02 | 7-03 | 7-05 |
|---|---|---|---|---|---|
| C | 100 | 50% | 0 | 1 | 100% |
| D | 100 | 0% | 0 | 1 | 100% |

Figure 1

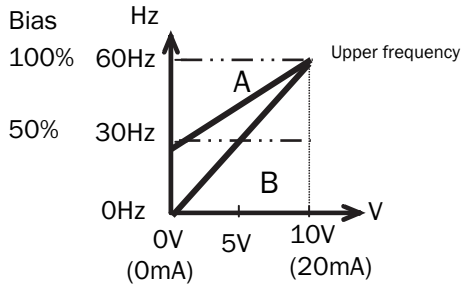
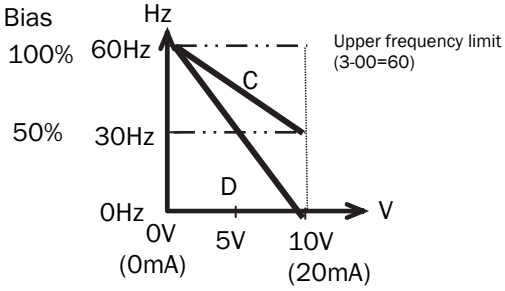



Figure 2




The setting of figure 3:

The setting of figure 4:

| | 7-00 | 7-01 | 7-02 | 7-03 | 7-05 |
|---|---|---|---|---|---|
| E | 100 | 20% | 1 | 0 | 100% |

| | 7-00 | 7-01 | 7-02 | 7-03 | 7-05 |
|---|---|---|---|---|---|
| F | 100 | 50% | | 1 | 100% |

Figure 3

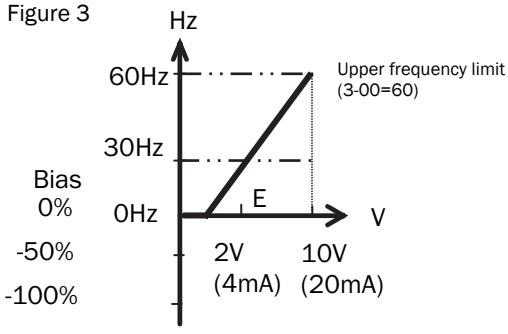
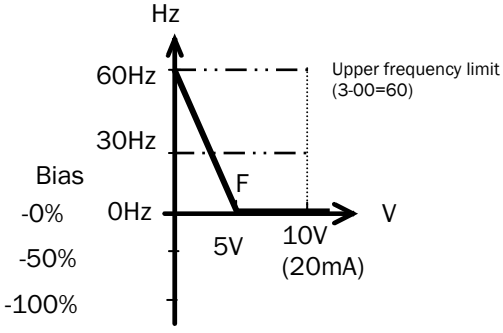



Figure 4



4. The VSD reads the average value of A/D signals once per (7-04×4 ms). Users can determine scan intervals according to noise in the environment. Increase 7-04 in noisy environment, but the response time will increase accordingly.

## 3.4.9 Parameter Group 8 - Multifunction output terminal and output signal operation mode

Multifunction analogue output control:

8-00: Analogue Output Voltage Mode:

0000: Output frequency
0001: Frequency Setting
0002: Output voltage
0003: DC Bus Voltage
0004: Motor current
0005: Feedback Signal of PID

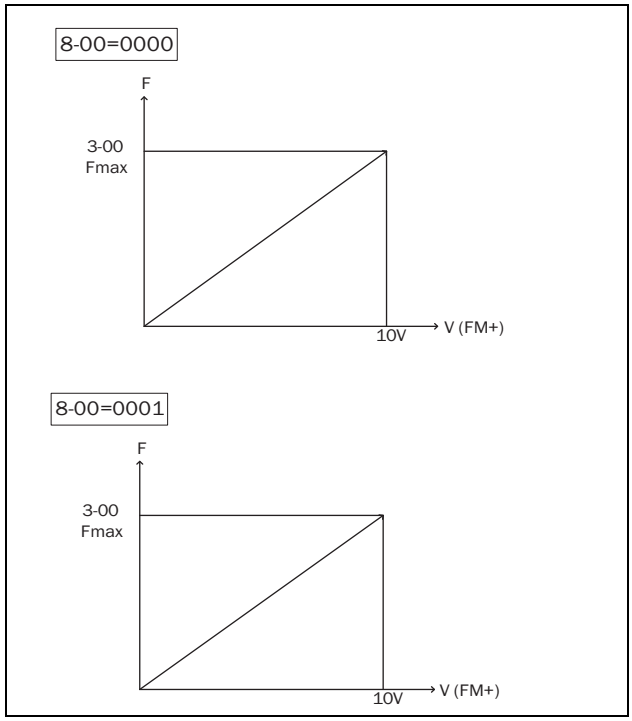
8-01: Analogue Output Gain=0 to 200%

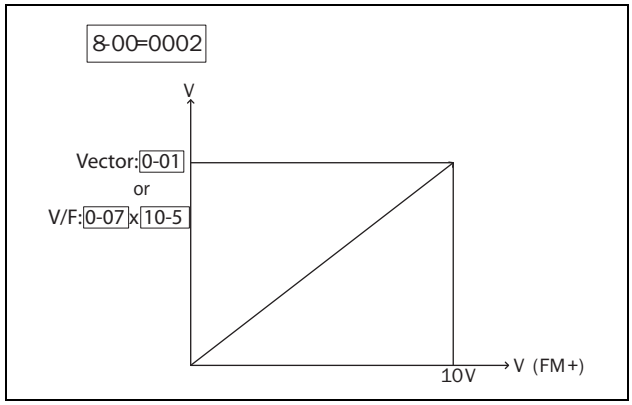
The multifunction analogue output terminal of the terminal block (TM2) is 0–10 VDC analogue output. The output type is determined by the setting 8-00. The function of 8-01 is: when there is tolerance for the external voltage meter and peripheral equipment, please regulate 8-01.

The feedback value of PID (i.e. the input voltage and current of AI2) outputs analogue value from the FM+ terminal. (Decides parameter 4-06). The value corresponds to the input signal 0–10V (0–20 mA) or 2–10V (4–20mA).

**Note: The max output voltage is 10V due to the circuit, even when the output voltage should be higher than 10 V.**

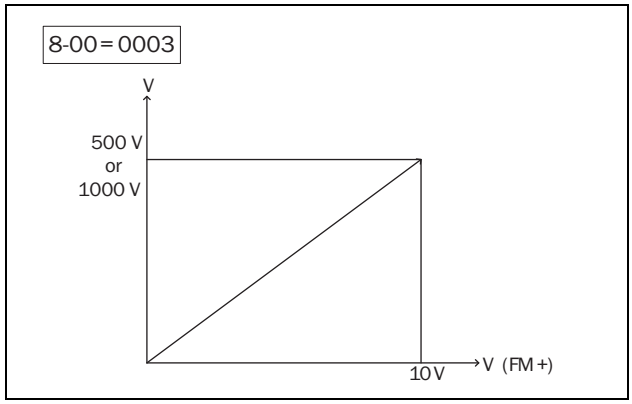
8-00 Multifunction analog output control:



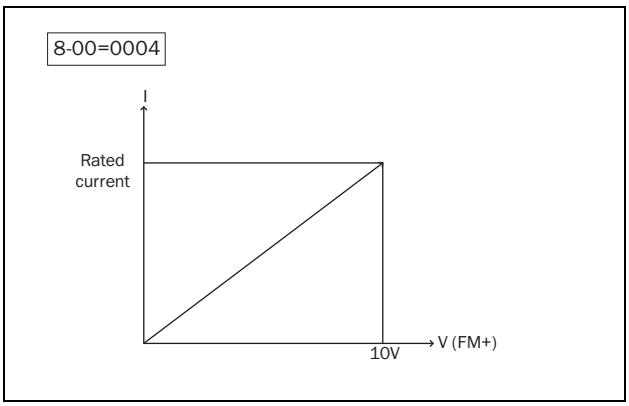

1. When 0-00=0 or 1 (vector) FM+ 0~10V corresponds to 0~ motor rated voltage (0-01)

2. When 0-00=2 (V/F) FM+ 0~10V corresponds to 0~AC line input voltage (0-07) x Max output frequency voltage ratio % (10-5).

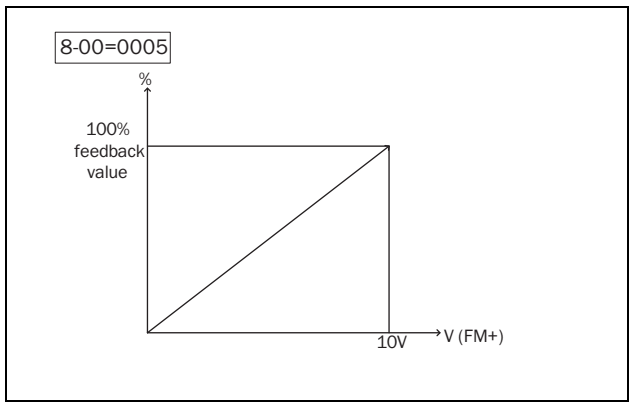



200V class: FM+ 0~10V corresponds to 0~500Vdc

400V class: FM+ 0~10V corresponds to 0~1000Vdc




Ex. The rated current of 201 is 4.5A, FM+ 0~10V corresponds to 0~4.5A

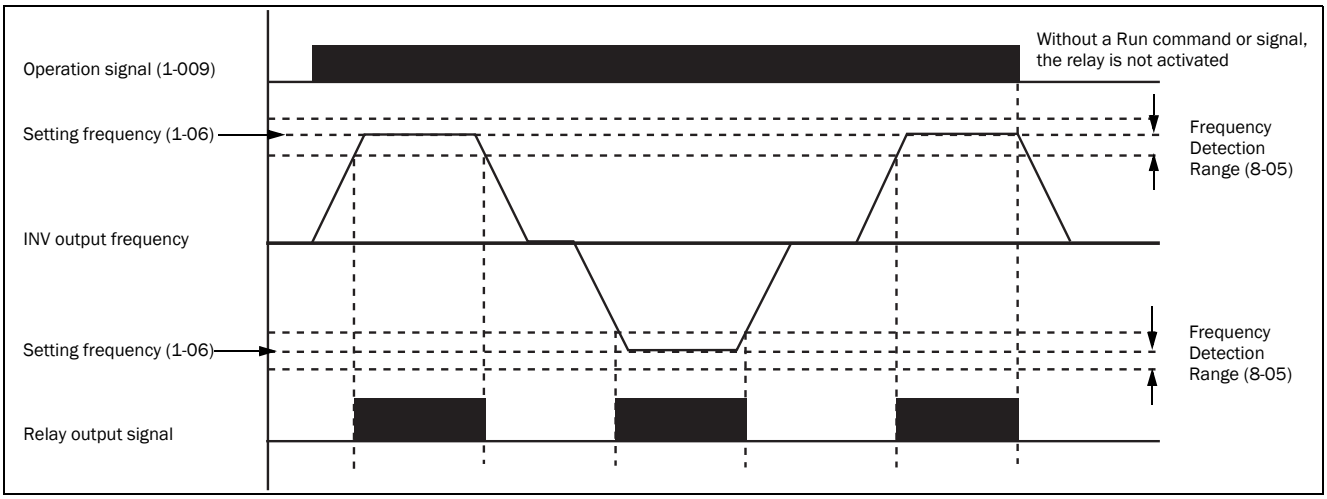



1. When 11-0≠0, FM+ 0~10V corresponds to 0~100% feedback value.

2. When 11-0=0 FM+ 0~10Vcorresponds to 0~10V or 0 ~ 20mA on AI2.

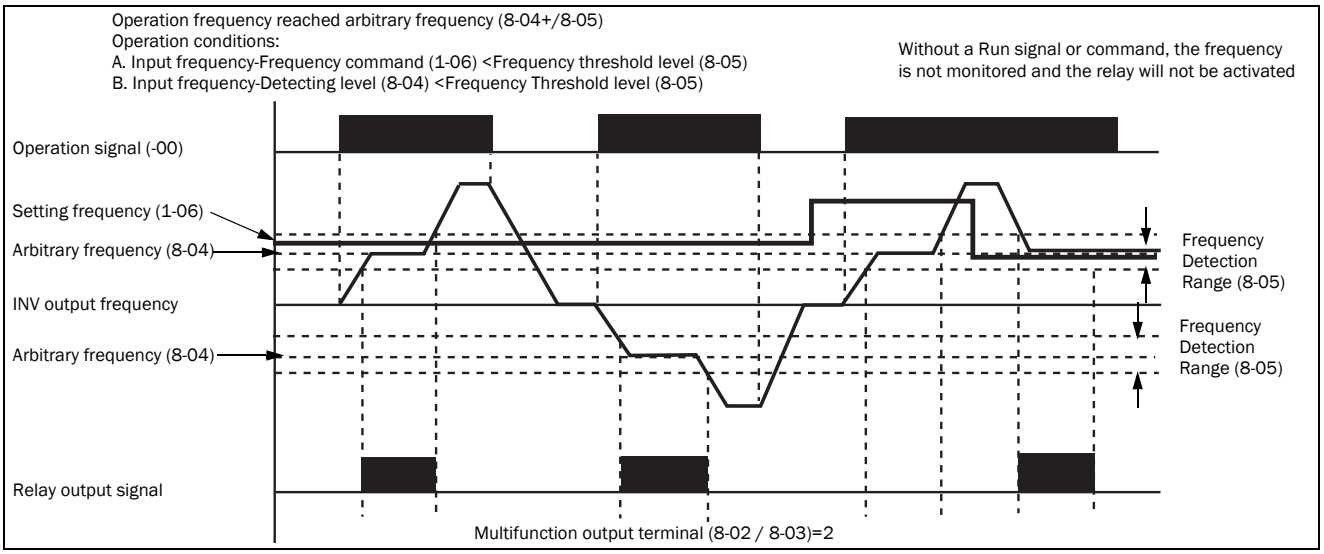
## 8-02/03=01:

The preset frequency is reached (±8-05)



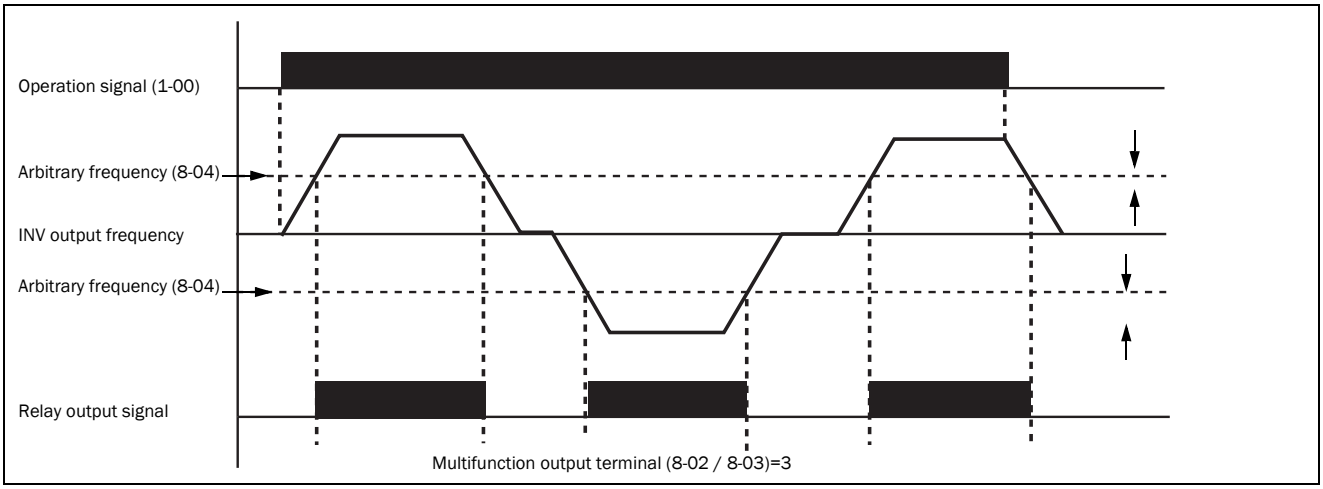

## 8-02/3=02:

Arbitrary frequency consistency $F_{OUT}$=8-04 ± 8-05



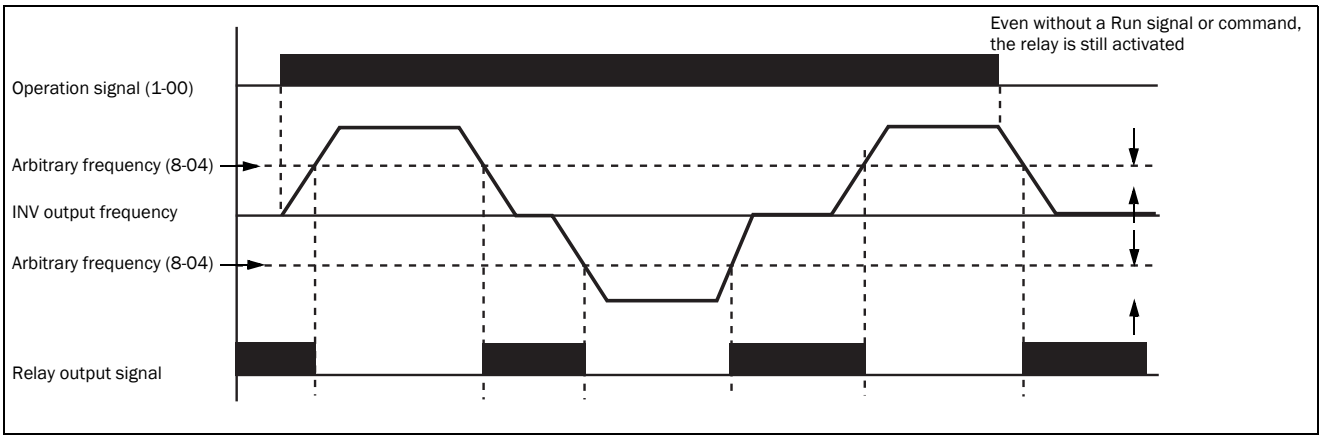
## 8-02/3=03:

Frequency detection $F_{OUT}$ > 8-04



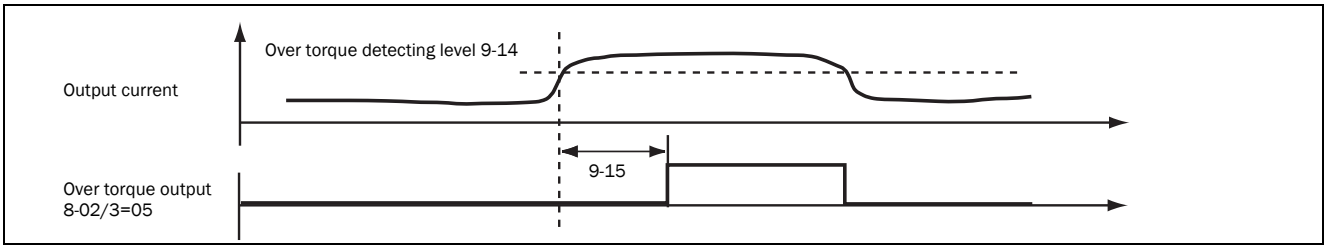

## 8-02/3=04:

Frequency detection $F_{OUT}$ < 8-04




## 8-02/3=05:

Over torque detection



## 3.4.10 Parameter Group 9 – Drive and Load Protection Modes

9-00: Trip Prevention Selection During Acceleration:

0000: Enable Trip Prevention During Acceleration
0001: Disable Trip Prevention During Acceleration

9-01: Trip Prevention Level During Acceleration: 50% to 300%

9-02: Trip Prevention Selection During Deceleration:

0000: Enable Trip Prevention During Deceleration
0001: Disable Trip Prevention During Deceleration

9-03: Trip Prevention Level During Deceleration: 50% to 300%

9-04: Trip Prevention Selection in Run Mode:

0000: Enable Trip Prevention in Run Mode
0001: Disable Trip Prevention in Run Mode

9-05: Trip Prevention Level in Run Mode: 50% to 300%

9-06: Trip Prevention Deceleration Time Selection in Run Mode:

0000: Trip Prevention Deceleration Time Set with 3-03
0001: Trip Prevention Deceleration Time Set with 9-07

9-07: Deceleration Time in Trip Prevention Mode (s): 0.1 to 3600.0

1. When accelerating, the VSD will delay the acceleration, if it is too short and this would result in over current, in order to prevent the VSD tripping.
2. When decelerating, the VSD will delay the deceleration, if it is too short and this would result in an over voltage of DC BUS, to prevent the VSD tripping with 'OV' displayed.
3. Some mechanical characteristics (such as pressure) or unusual breakdown (seizure due to insufficient lubrication, uneven operation, impurities in processed materials, etc.) will cause the VSD to trip, thus inconveniencing users. When the operating torque of the VSD exceeds the setting of 9-05, the VSD will lower the output frequency following the deceleration time set by 9-06, and return to the normal operation frequency after the torque stabilises.
4. When the VSD needs to stop immediately and the braking resistor is connected, set 9-02 to 1 to obtain greater braking capacity.

9-08: Electronic Motor Overload Protection Operation Mode:

0000: Enable Electronic Motor Overload Protection
0001: Disable Electronic Motor Overload Protection

9-09: Motor Type Selection:

0000: Electronic Motor Overload Protection Set for self ventilated Motor
0001: Electronic Motor Overload Protection Set for forced ventilated Motor

9-10: Motor Overload Protection Curve Selection:

0000: Constant Torque (OL=103%) (150%,1 minute)
0001: Variable Torque (OL=113%) (123%,1 minute)

9-11: Operation After Overload Protection is Activated:

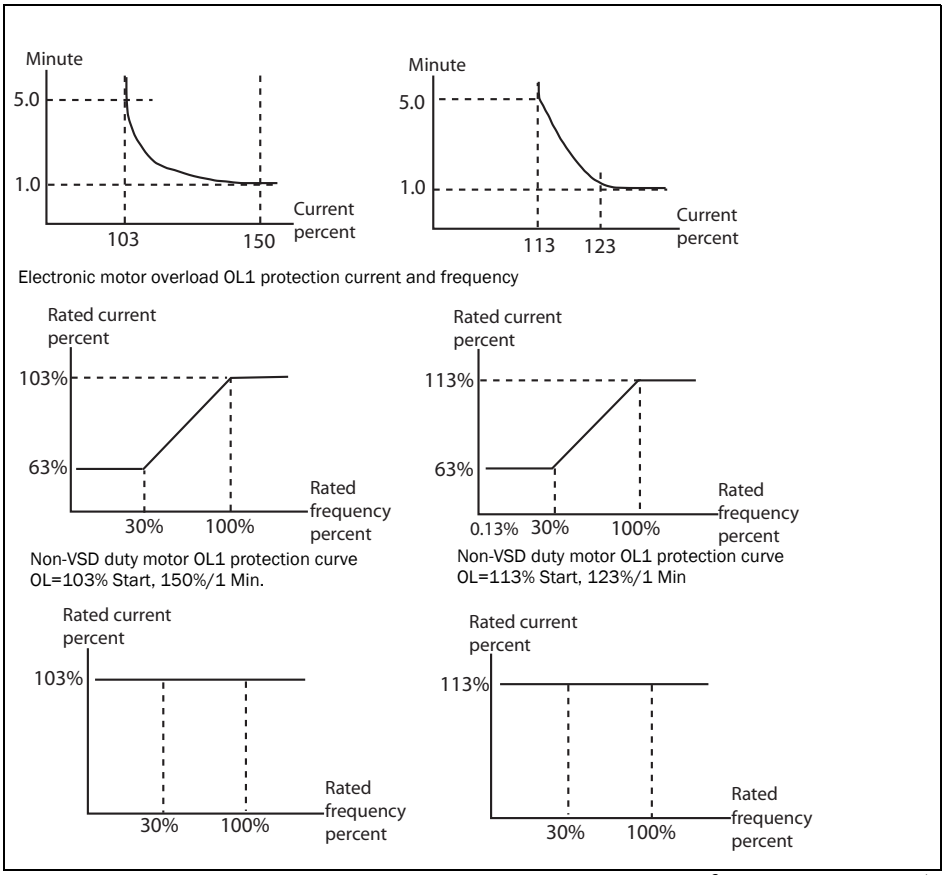
0000: Coast-to-Stop After Overload Protection is Activated
0001: Drive Will not Trip when Overload Protection is Activated (OL1)

Description of the thermal relay function:

1. 9-10=0000: protect the general mechanical load. If the load is less than 103% rated current, the motor continues to run. If the load is larger than 150% rated current, the motor will run for 1 minute. (Refer to following curve (1).

   = 0001: protects HVAC load (FAN, PUMP, etc.): If the load is less than 113% rated current, the motor continue to run. If the load is larger than 123% rated current, the motor will run for 1 minute.
2. The heat sinking function will decline when the motor runs at low speed. So the thermal relay action level will decline at the same time. (Curve 1 will change to curve 2).
3. 9-09=0000: sets 0-05 as the rated frequency for the motor.

   9-11=0000: the VSD coast to stop as the thermal relay acts and flashes OL1. Press 'reset' or the external reset terminal to continue running
   = 0001: the VSD continues to run as the thermal relay acts and flashes OL1. Until the current declines to 103% or 113%(determined by 9-10), OL1 will disappear.




9-12: Over Torque Detection Selection:

= 0000: Disable Over Torque Operation
= 0001: Enable Over Torque Operation Only if at Set Frequency
= 0002: Enable Over Torque Operation while the Drive is in Run Mode

9-13: Operation After Over Torque Detection is Activated:

= 0000: Drive will Continue to Operate After Over Torque is Activated
= 0001: Coast-to-Stop After Over Torque is Activated

9-14: Over Torque Threshold Level (%): 30-200%

9-15: Over Torque Activation Delay Time (s): 0.0-25.0

The over torque is defined as: the output torque is inside parameter 9-15, the voltage level (the VSD rated torque is 100%) is over 9-14 parameter.

9-13=0000: If there is over torque, the VSD can continue to run and flashes OL3 till the output torque is less than the 9-14 setting value.

= 0001: If there is over torque, the VSD coasts to stop and flashes OL3. it is necessary to press 'RESET' or external terminal to continue to run.

If parameter 8-02,03 (Multifunction output terminal) = 05, the output terminal is output over torque signal.

**NOTE: Over torque output signal will be output when the parameter 9-12=0001 or 0002 when the level and time are above the range.**

## 3.4.11 Parameter Group 10 – Volts / Hz Pattern Operation Mode

V/F pattern Selection

10-0: V/F pattern Selection = 0 to 18

10-1: Torque boost gain (V/F pattern modulation)% = 0.0 to 30.0%

10-2: Motor no load current (Amps AC) ----------

10-3: Motor rated slip compensation (%) = 0.0 to 100.0%

10-4: Max output frequency (Hz) = 0.20 to 650.0 Hz

10-5: Max output frequency voltage ratio (%) = 0.0 to 100.0%

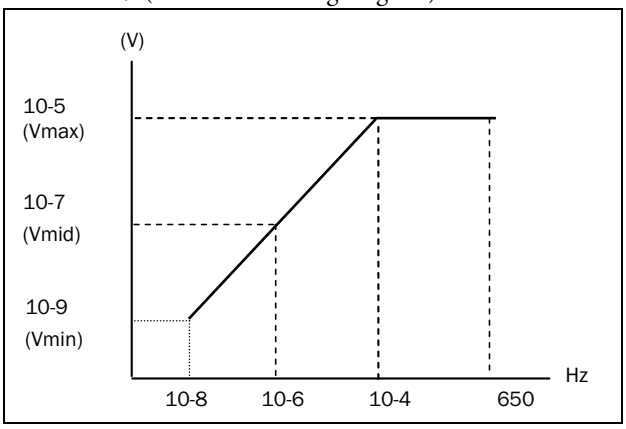
10-6: Medium frequency (Hz) = 0.10 to 650.0 Hz

10-7: Medium output frequency voltage ratio (%) = 0.0 to 100.0%

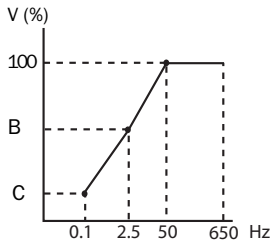
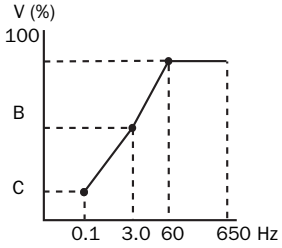
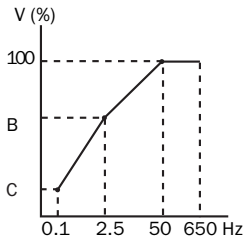
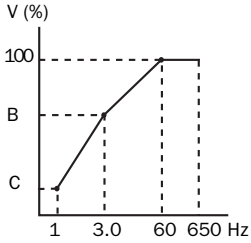
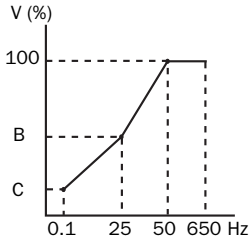
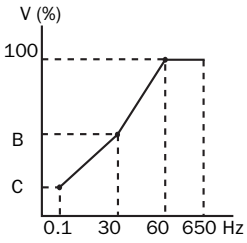
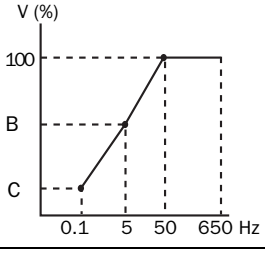
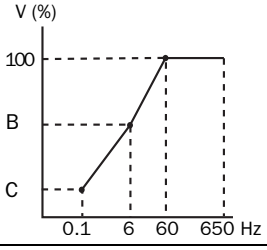
10-8: Min output frequency (Hz) = 0.10 to 650.0 Hz

10-9: Min output frequency voltage ratio (%) = 0.0 to 100.0%

1. 10-0=18, sets the V/F pattern freely complying with 10-4 to 10-9 (Refer to following diagram)

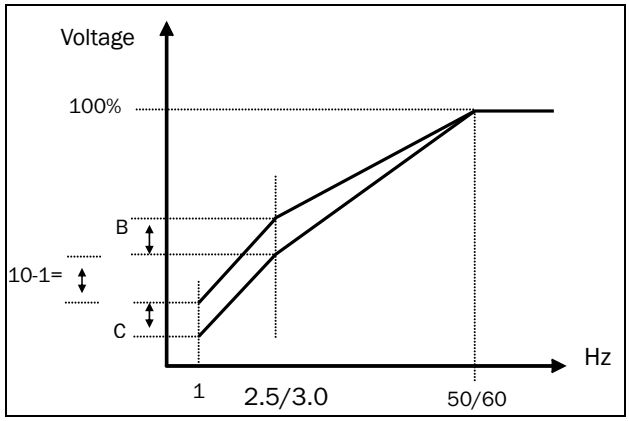



2. 10-0=0 to 17 V/F pattern (Refer to following list) C

| Type | Function | 10-0 | V/F pattern | Type | Function | 10-0 | V/F pattern |
|---|---|---|---|---|---|---|---|
| 50 Hz | General use | 0 |  | 60 Hz | General use | 9 |  |
| | High start torque | 1 |  | | High start torque | 10 |  |
| | | 2 | | | | 11 | |
| | | 3 | | | | 12 | |
| | Decreasing torque | 4 |  | | Decreasing torque | 13 |  |
| | | 5 | | | | 14 | |
| | Constant torque | 6 |  | | Constant torque | 15 |  |
| | | 7 | | | | 16 | |
| | | 8 | | | | 17 | |

| 10-0 | B | C |
|---|---|---|
| 0 / 9 | 50.0% | 1.0% |
| 1 / 10 | 60.0% | 1.0% |
| 2 / 11 | 65.0% | 1.0% |
| 3 / 12 | 70.0% | 1.0% |
| 4 / 13 | 40.0% | 1.0% |
| 5 / 14 | 35.0% | 1.0% |
| 6 / 15 | 45.0% | 1.0% |
| 7 / 16 | 55.0% | 1.0% |
| 8 / 17 | 65.0% | 1.0% |

3. The VSD will output the value in B, C and voltage (refer to 10-0) plus 10-1 V/F pattern setting. The start torque will also be raised.




4. When the induction motor is running, there must be slip due to the load. Boost is necessary to improve the precision of the speed.

$$\text{Slip frequency boost} = \frac{\text{Output Current-(10-2)}}{\text{(0-02)-(10-2)}} \times (10\text{-}3)$$

Note: 0-02 = motor rated current 10-2 = motor no load current

10-3 rough value = (Motor synchronization speed– Rated speed) / Motor synchronization speed

Marked on the motor nameplate

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

$$\text{e.g.: 4-pole 60 Hz induction motor synchronization speed} = \frac{120}{4} \text{ X } 60 = 1800 \text{ RPM}$$

**Note: Motor with no load current (10-2) differs from the VSD capacities in 15-0 (refer to 0-02 note). It should be regulated according to the actual condition.**

## 3.4.12 Parameter group 11 - PID operation mode

| 11-0: PID Operation Selection |
|---|
| 0000: PID disable<br>0001: PID enable (deviation is D-controlled)<br>0002: PID feedback D-controlled<br>0003: PID D reverse characteristic controlled<br>0004: PID feedback D characteristic controlled<br>0005: PID frequency command + D controlled<br>0006: PID frequency command + feedback D controlled<br>0007: PID frequency command + D reverse characteristic controlled.<br>0008: PID frequency command + feedback D reverse characteristic controlled. |

11-0 =1, D is the deviation of (target value – detected value) in the unit time (11-4).

=2, D is the deviation of the detected values in unit time (11-4).

=3, D is the deviation of (target value – detected value) in the unit time (11-4). If the deviation is positive, the output frequency decreases, and vice versa.

=4, D is the deviation of detected value in unit time (11-4). When the deviation is positive, the frequency decreases, and vice versa.

=5, D is equal to the deviation of (target value – detected value) in unit time (11-4) + Frequency command.

=6, D is equal to the deviation of detected values in unit time + Frequency command.

=7, D is equal to the deviation of (target value – detected value) in unit time + Frequency command. If the deviation is positive, the output frequency decreases, and vice versa.

=8, D is equal to the deviation of detected values in unit time + Frequency command. When the deviation is positive, the frequency decreases, and vice versa.

| 11-1: Feedback Calibration Gain (%): 0.00 to 10.00 |
|---|

11-1 is the calibration gain which can be used to increases the accuracy of the PID controller when low feedback signal are used. Deviation = Feedback signal × 11-1.

Example: When PID Feedback signal is 30 and 11-1 setting is 2, the internal used feedback signal becomes 30*2=60

| 11-2: Proportion Gain (%): 0.00 to 10.00 |
|---|

11-2: Proportion gain for P control.

| 11-3: Integrate Time (s): 0.0 to 100.0 |
|---|

11-3: Integrate time for I control.

| 11-4: Differential Time (s): 0.00 to 10.00 |
|---|

11-4: Differential time for D control.

| 11-5: PID Offset:<br>0000: Positive Direction<br>0001: Negative Direction<br>11-6: PID Offset Adjust (%): -109% to +109% of rated motor speed |
|---|

11-5/11-6: PID output is compensated with the PID Offset according to setting of 11-6. This is done by adding: PID Offset Adjust (11-6) x motor rated speed to the actual speed. The sign of PID Offset Adjust is changed if Negative Direction (11-5=0001).

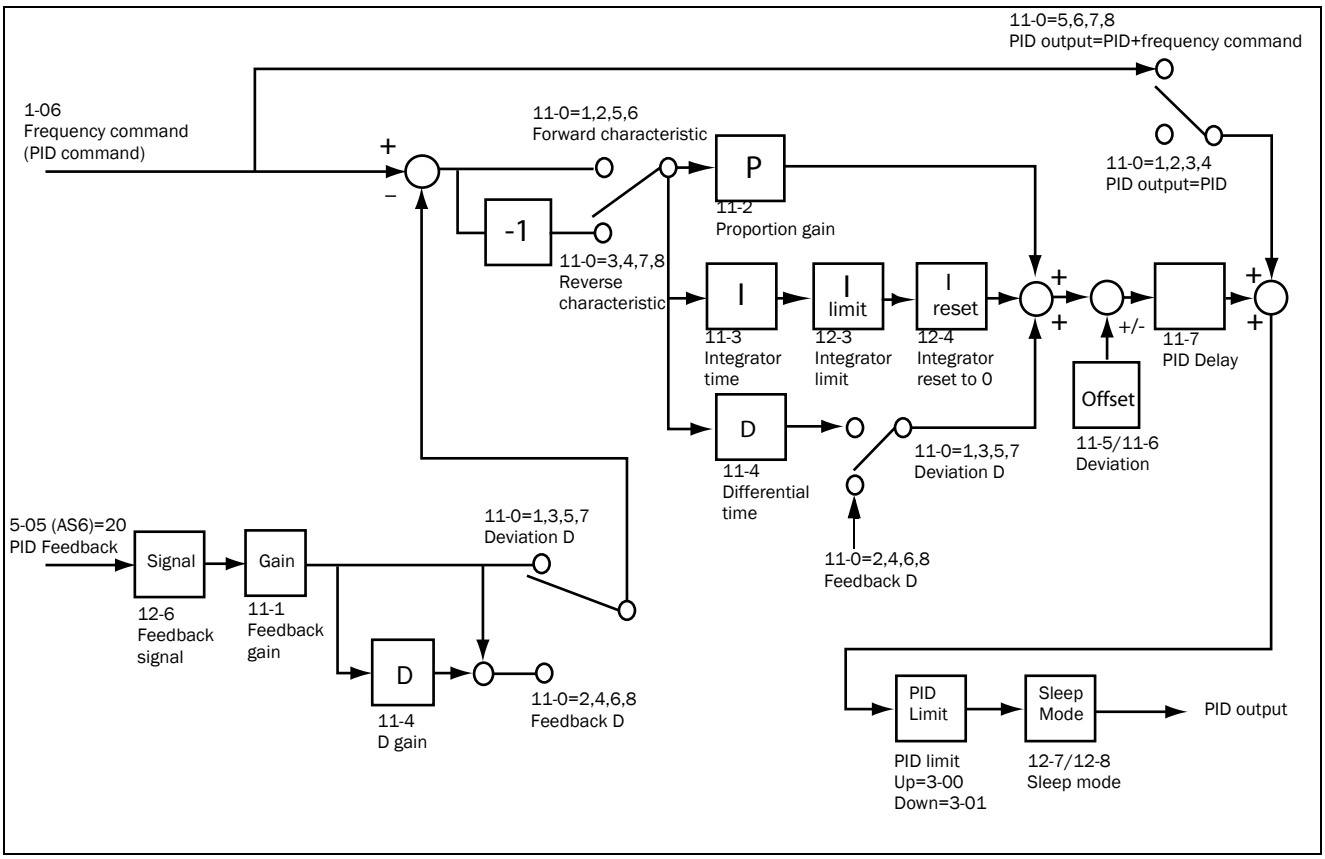
Example: The PID control uses this PID Offset, 11-5 = 0000, and the rated motor speed is 60Hz.

The PID process value result is an output frequency of 30Hz. With adjusting the PID Offset 11-6= 10%, the output frequency will become 30 Hz + (motor rated speed *10%) = 36Hz.

| 11-7: Output Lag Filter Time (s): 0.0 to 2.5 |
|---|

11-7: Updates time for output frequency; ; the output frequency will each time be updated to the actual PID output signal value when the set time in 11-7 is reached..

**NOTE: PID Function is available for controlling the output flow, external fan flow and temperature. The controlling flow is as follows:**




1. For performing PID control, set 5-05=20, AI2 (S6) on TM2 as PID feedback signal.
2. The target value of above diagram is the 1-06 input frequency.
3. There are two ways to see the PID feedback signal, one is using the keypad switch display (4-06 must be set as 1); the other is using analogue output FM+ (8-00 must be set as 5).

## 3.4.13 Parameter Group 12 - PID "Limits" and "Out of Range" Mode

| 12-0: Feedback Loss Detection Mode:<br>0000: Disable<br>0001: Enable – Drive Continues to Operate After Feedback Loss<br>0002: Enable – Drive "STOPS" After Feedback Loss |
|---|

12-0=0: Disable; 12-0=1: detection for running and display PDER12-0=2: detection for stopping and display PDER.

| 12-1: Feedback Loss Detection Mode (%): 0 to 100 |
|---|

12-1 is the level for signal loss. Deviation = Command value – Feedback value. While the deviation is larger than the loss level, the feedback signal is lost.

| 12-2: Feedback Loss Detection Delay Time (s): 0.0 to 25.5 |
|---|

12-2: The action delay time if the feedback signal is lost.

| 12-3: Integrate Limit Value (%): 0 to 109 of rated motor speed |
|---|

12-3: The Limiter prevents PID saturation and set the I-control limit as a percentage of the rated motor speed.

| 12-4: Integrator Reset to 0 when Feedback Signal Equals the Intended Value:<br>0000: Disable<br>0001: 1 second<br>0030: 30 seconds |
|---|

12-4=0: When PID feedback value reaches the Frequency command value, the PID controller will keep active.

12-4=1 to 30: When PID feedback value reaches the Frequency command value, and this will stay stable for the set time in 12-4, the PID output will become 0 and stops to control the output speed, until there is a deviation (target

speed - feedback) which is above the set integration Error Margin in 12-5..

| 12-5: Allowable Integration Error Margin (Unit Value) (1 Unit = 1/8192): 0 to 100 |
|---|

**Note: when 12-4 = 0000, the setting of 12-5 has no effect.**

12-5=0 to 100% unit value: will re-activate the PID control when the deviation is greater then the set unit value.

| 12-6: AIN and AI2 Signal Type: 0-10V (0-20mA) or 2-10V (4-20mA) |
|---|

12-6:AIN and AI2 Signal Type:

12-6=0: AIN=0-10V or 0-20mA, AI2=0-10V or 0-20mA (signal V or I is decided by SW2 & SW3)
12-6=1: AIN=0-10V or 0-20mA, AI2=2-10V or 4-20mA (signal V or I is decided by SW2 & SW3)
12-6=2: AIN=2-10V or 4-20mA, AI2=0-10V or 0-20mA (signal V or I is decided by SW2 & SW3)
12-6=3: AIN=2-10V or 4-20mA, AI2=2-10V or 4-20mA (signal V or I is decided by SW2 & SW3).

| 12-7, 12-8: PID Sleep Mode |
|---|

PID Sleep Mode:

11-0=1 (PID Enable)

5-05=20 (PID Feedback Enable)

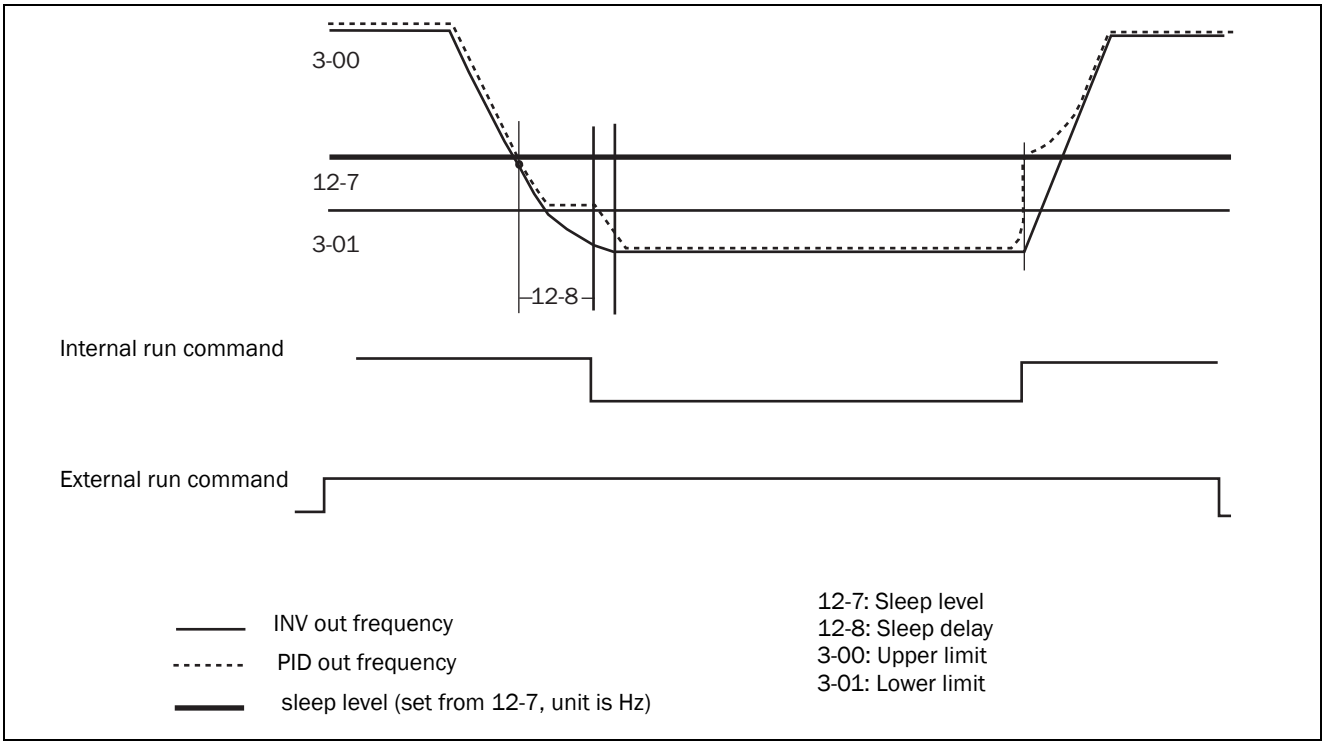
1-06 = PID setting frequency source (Target Value)

12-7 Sets the frequency for sleep start, Unit: Hz

12-8 Sets the Time for sleep delay, Unit: sec

When PID output frequency is less than the frequency for sleep start and it reaches the time of sleep delay, the VSD will decelerate to 0 and enter PID sleep mode.

When PID output frequency is larger than the frequency for sleep start the VSD will be woken and enter PID awake mode. The time diagram is as follows:



## 3.4.14 Parameter Group 13 - Communication mode

| 13-0: Assigned Communication Station Number: 1 - 254 |
|---|

13-0: Sets the communication station codes which are suitable for driving the situations of more than one VSD.

| 13-1: Baud Rate setting (bps): 0000: 4800<br>0001: 9600<br>0002: 19200<br>0003: 38400<br>13-2: Stop Bit Selection:<br>0000: 1 stop bit<br>0001: 2 stop bit<br>13-3: Parity Selection: 0000: no parity<br>0001: even parity<br>0002: odd parity<br>13-4: Data Format Selection: 0000: 8 bit data<br>0001: 7 bit data |
|---|

1. RS-485 Communication:

   (1)1 vs. 1 Control: controlling one VSD with a PC, PLC or controller. (Set 13-0=1 to 254)
   (2)1 vs. more Control: controlling more than one VSD with PC, PLC or controller. (The max. number of VSDs is 254. Set 13-0=1 to 254). When the VSD receives the communication station code = 0, the communication control is acceptable regardless of the set value for 13-0.
2. RS-232 communication: (RS232 interface is required) 1 vs. 1 control: controlling one VSD with a PC, PLC or controller. (Set 13-0=1 to 254).

**NOTE: a. The BAUD RATE (13-1) of the PC (or PLC or controller) and of the VSD should be set to the same level. Communication format (13-2/13-3/13-4) should be set to the same one.**

**b. The VSD will confirm the parameter co-efficient when the PC modifies the parameter of the VSD.**

**c. Please refer to the VSC Communication PROTOCOL.**

| 13-5/13-6: Communication time-out detection time / Communication time-out operation |
|---|

1. Time-out operation selection:

000: Deceleration to stop (3-03: Deceleration time 1).
001: Free run to stop.
002: Deceleration to stop (3-07: Deceleration time 2).
003: Continue operating.

Default=000

Reset method:

a. Push the "Reset" button directly.

b. Receive correct Modbus data from Master.

After communication time-out, the motor decelerates to stop (13-5 = 000, 001, 002). And the motor does not run automatic after reset, the inverter must set the run command again to restart.

*Cannot be modified during communication.

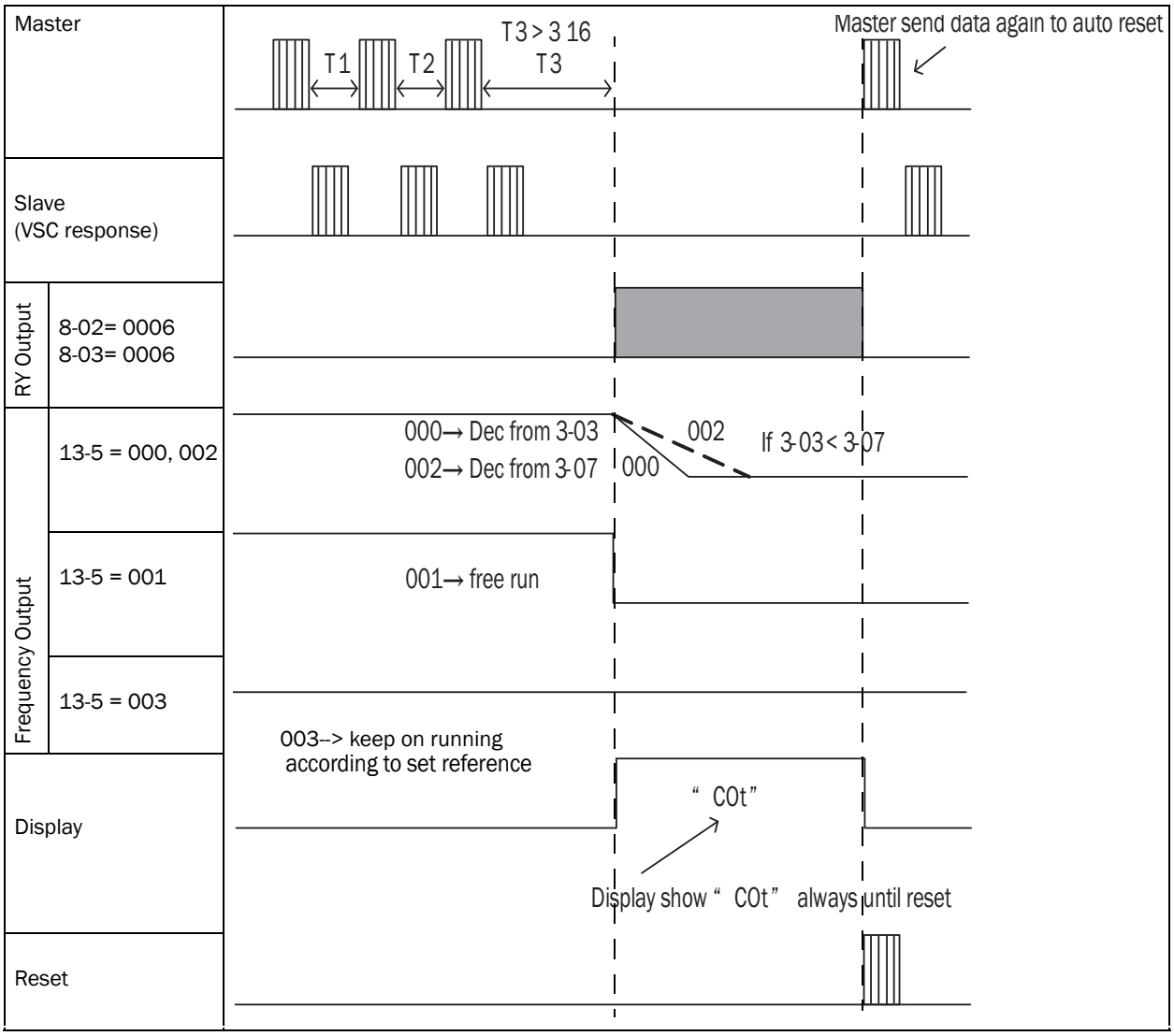
*Detail list please see figure on next page.

2. Time-out detection time: 00.0~25.5sec; setting 00.0 sec: disable time-out function.

Default: 00.0sec

Communication time-out detection enable or not is according to 13-6?not relationship with Run/Frequency command.

*Cannot be modified during communication.


Master
T1
T2
T3 > 3 16
T3
Master send data again to auto reset
Slave
(VSC response)
RY Output
8-02= 0006
8-03= 0006
Frequency Output
13-5 = 000, 002
000→ Dec from 3-03
002→ Dec from 3-07
002
000
If 3-03< 3-07
13-5 = 001
001→ free run
13-5 = 003
003--> keep on running
according to set reference
Display
“ COt”
Display show “ COt” always until reset
Reset

## 3.4.15 Parameter Group 14 - Autotuning

| |
|---|
| 14-0: Stator Resistance (Ohms) Gain |
| 14-1: Rotator Resistance (Ohms) Gain |
| 14-2: Equivalent Inductance (mH) Gain |
| 14-3: Magnetized Current (Amps AC) Gain |
| 14-4: Ferrite Loss Conduction (gm) Gain |

1. If 0-00=0 or 1 (vector mode) is selected, when power ON, set 0-06=1, the motor will run as the VSD performs autotuning. When the motor stops, it means that autotuning is finished. The VSD will write the internal parameter of the motor to 14-0 to 14-4, and auto reset the 0-06 back to 0.
2. Autotuning must be carried out if the motor has been changed. If the internal parameters are known already, they can be entered to 14-0 to 14-4 directly.
3. 0-06=1to perform autotuning. When finished, 0-06 is auto reset to 0, the Keypad displays END.
4. The parameter group only affects the Vector mode.

## 3.4.16 Parameter Group 15 - Operation Status and Function Reset

| |
|---|
| 15-0: Drive Horsepower Code |

| 15-0 | VSD Model | |
|---|---|---|
| 405 | VSC48 | 009 |
| 408 | | 013 |
| 410 | | 018 |

| |
|---|
| 15-1: Software Version |

| |
|---|
| 15-2: Fault JogLatest 3 times |

1. When the VSD doesn't work normally, the previous fault log stored in 2.xxxx will be transferred to 3.xxxx and then the one in 1.xxxx to 2.xxxx. The present fault will be stored in the blank 1.xxxx. Thus the fault stored in 3.xxxx is the earliest one of the three, while the one 1.xxxx is the latest.
2. Enter 15-2, the fault 1.xxxx will be displayed first, press – . Now you can read 2.xxx3.xxx1.xxx, whereas with – , the order is 3.xxx2.xxx1.xxx3.xxx.
3. Enter 15-2, the three fault log will be cleared once the reset key is pressed. The log content will be changed to 1.---2.---3.---.
4. E.g. if the fault log content is '1.OCC', which indicates the latest fault is OC-C, etc.

| |
|---|
| 15-3: Accumulated Operation Time 1 (hours): 0 – 9999 |
| 15-4: Accumulated Operation Time 2 (hours X 10000): 0 - 27 |
| 15-5: Accumulated Operation Time Mode: 0000: Power on time |
| 0001: Operation time |

1. When the operation time goes up to 9999 this set operation duration 1. The next hour will be carried to operation duration 2. Meanwhile, the recorded value will be cleared to 0000, and the recorded value of operation duration 2 will be 01.
2. Description of operation time selection:

| Preset value | Description |
|---|---|
| 0 | Power on, counts the accumulated time. |
| 1 | VSD operation, counts the accumulated operation time |

| |
|---|
| 15-6: Reset the factory setting: |
| 1110: Reset the 50Hz factory setting<br>1111: Reset the 60Hz factory setting<br>1112: Reset PLC program |

If 15-6 is set to 1111, the parameter will be reset to factory setting. The max output voltage will comply with the voltage and frequency (0-01/0-05) on the nameplate of the motor. The output frequency is 60 Hz if the upper frequency limit is not set.

**NOTE: In V/F control mode, motor parameters (14-0 to 14-4) will be modified when resetting factory setting.**

**However, in vector control mode, motor parameters (14-0 to 14-4) will not be modified when resetting factory setting.**

# 4. Troubleshooting and Maintenance

## 4.1 Error display and remedying errors

### 4.1.1 Errors which cannot be recovered manually

| Display | Error | Cause | Remedy |
|---|---|---|---|
| CPF | Program problem | External noise interference | Connect a parallel RC burst absorber across the magnetizing coil of the magnetic contactor that causes interference |
| EPR | EEPROM problem | Faulty EEPROM | Replace EEPROM |
| -CV- | Voltage too high during stop | Detection circuit malfunction | Send the VSDVSD back to be repaired |
| -LV- | Voltage too low during stop | 1. Power voltage too low<br>2. Restraining resistor or fuse burnt out.<br>3. Detection circuit malfunctions | 1. Check if the power voltage was correct or not<br>2. Replace the restraining resistor or the fuse<br>3. Send the VSD back to be repaired |
| -OH- | The VSD is overheated during stop | 1. Detection circuit malfunctions<br>2. Ambient temperature too high or bad ventilation | 1. Send the VSD back to be repaired<br>2. Improve ventilation conditions |
| CTER | Current Sensor detecting error | Current sensor error or circuit malfunction | Send the VSD back to be repaired |

Note @ the failure contact does not function.

### 4.1.2 Errors which can be recovered manually and automatically

| Display | Error | Cause | Remedy |
|---|---|---|---|
| OC-S | Over-current at start | The motor wind and enclosure short circuit<br>The motor contacts and earth short circuit<br>The IGBT module is damaged | Inspect the motor<br>Inspect the wire<br>Replace the transistor module |
| OC-D | Over-current at deceleration | The preset deceleration time is too short | Set a longer deceleration time |
| OC-A | Over-current at acceleration | 1. Acceleration time too short<br>2. The capacity of the motor higher than the capacity of the VSD<br>3. Short circuit between the motor coil and the shell<br>4. Short circuit between motor wiring and earth<br>5. IGBT module is damaged | 1. Set a longer acceleration time<br>2. Replace a VSD with the same capacity as that of the motor<br>3. Check the motor<br>4. Check the wiring<br>5. Replace the IGBT module |

| | | | |
|---|---|---|---|
| OC-C | Over-current at fixed speed | 1. Transient load change<br>2. Transient power change | 1. Increase the capacity of the VSD<br>2. Rerun parameter autotuning (0-06=1)<br>3. Reduce stator resistance (14-0) if the above remedies are helpless |
| OV-C | Voltage too high during operation/deceleration | 1. Deceleration time setting too short or large load inertia<br>2. Power voltage varies widely | 1. Set a longer deceleration time<br>2. Add a brake resistor or brake module<br>3. Add a reactor at the power input side<br>4. Increase VSD capacity |
| Err4 | Illegal interrupt of CPU | Outside noise interference | Send back to be repaired if it happens repeatedly |
| OVSP | Over speed during operation | Motor load too great or VSD capacity too small<br>Mother parameter error (vector mode)<br>The gain is too great during vector mode operation<br>The current detect circuit is faulty | 1. Increase acceleration / deceleration time (3-02/3-03)<br>2. Input correct motor Parameter<br>3. Change stator Resistance gain and Rotator resistance gain (14-0/14-1). Recommended decrease 50~100, until 0<br>4. Send back to Emotron |

### 4.1.3 Errors which can be recovered manually but not automatically

| Display | Error | Cause | Remedy |
|---|---|---|---|
| OC | Over-current during stop | 1. Detection circuit malfunction<br>2. Bad connection for CT signal cable | 1. Check the noise between Power line and motor line<br>2. Send the VSD back to be repaired |
| OL1 | Motor overload | 1. Heavy load<br>2. Inappropriate settings of 0-02, 9-08~11 | 1. Increase the motor capacity<br>2. Set 0-02, 9-08~11 properly |
| OL2 | VSD overload | Heavy load | Increase the VSD capacity |
| OL3 | Over torque | 1. Heavy load<br>2. Insufficient settings of 9-14, 9-15 | 1. Increase the VSD capacity<br>2. Set 9-14, 9-15 properly |
| LV-C | Voltage too low during operation | Power voltage too low<br>2. Power voltage varies widely | Improve power quality or increase the value of 2-01<br>Set a longer acceleration time<br>Increase VSD capacitor<br>Add a reactor at the power input side |
| OH-C | Heatsink temperature too high during operation | 1. Heavy load<br>2. Ambient temperature too high or bad ventilation | 1. Check if there are any problems with the load<br>2. Increase VSD capacity<br>3. Improve ventilation conditions |

### 4.1.4 Special conditions

| Display | Error | Description |
|---|---|---|
| STP0 | Zero speed stop | Happens when preset frequency <0.1Hz |
| STP1 | Fail to start directly | 1. If the VSD is set to external terminal control mode (1-00=1) and direct start is disabled (2-04=0001), the VSD cannot be started and will flash STP1 when the operation switch is turned to ON after applying power (refer to descriptions for 2-04).<br>2. Direct start is possible when 2-04=0001. |
| STP2 | Keypad emergency stop | 1. If the VSD is set to external control mode (1-00=0001) and Stop key is enabled (1-03=0000), the VSD will stop according to the setting of 1-05 when the Stop key is pressed. STP2 flashes after stop. Turn the operation switch to OFF and then ON again to restart the VSD.<br>2. If the VSD is in communication mode and the Stop key is enabled (1-03=0000), the VSD will stop in the way set by 1-05 when the Stop key is pressed during operation and then flashes STP2. The PC has to send a Stop command then a Run command to the VSD for it to be restarted.<br>3. The Stop key cannot perform emergency stop when 1-03=0001 |
| E.S. | External emergency stop | The VSD will ramp stop and then flash E.S., when it receives external emergency stop signal via the multifunctional input terminal (refer to descriptions of 5-00~5-06). |
| b.b. | External base block | The VSD stops immediately and then flashes b.b., when external base block is input through the multifunctional input terminal (refer to descriptions of 5-00~5-06). |
| ATER | Autotuning faults | 1. Motor data error resulting in for autotuning failure<br>2. Stops the VSD during Autotuning |
| PDER | PID feedback loss | PID feedback loss detect |

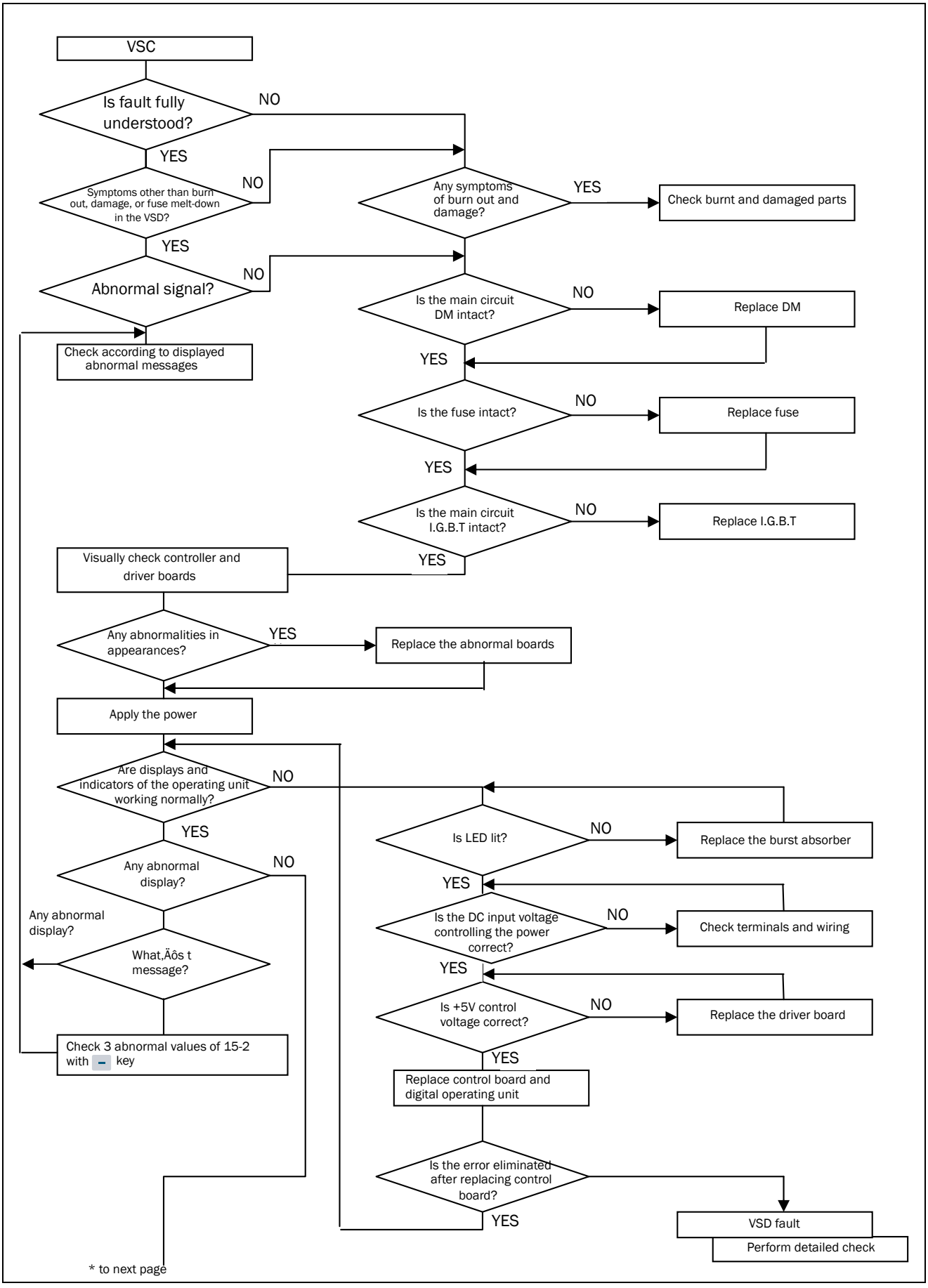
### 4.1.5 Operation errors

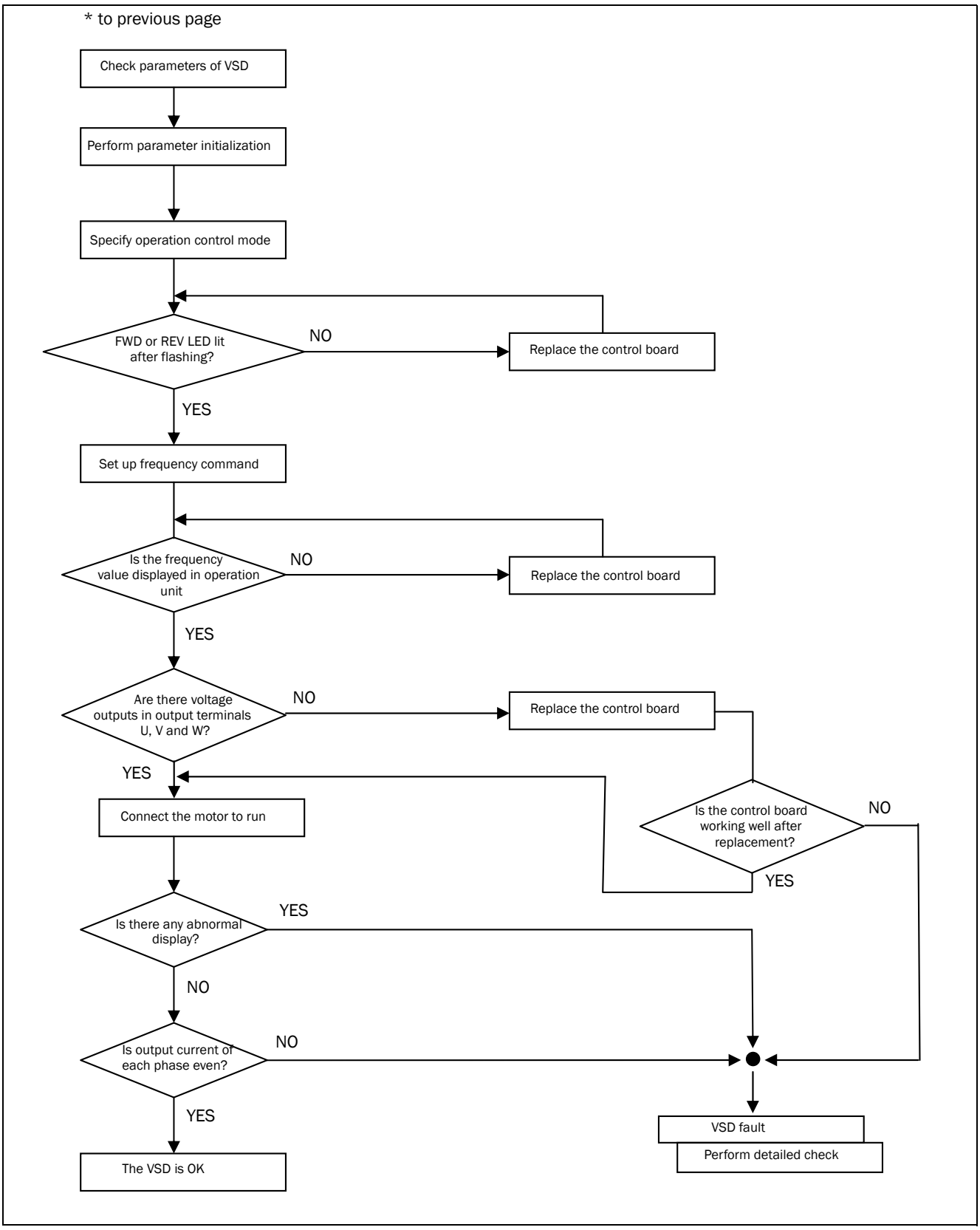
| Display | Error | Cause | Remedy |
|---|---|---|---|
| LOC | Parameter and frequency reverse already locked | 1. Attempt to modify frequency /parameter while 3-17>0000<br>2. Attempt to reverse while 1-02=0001 | 1. Set 3-17=0000<br>2. Set 1-02=0000 |
| Err1 | Key operation error | 1. Press + or − while 1-06>0 or running at preset speed.<br>2. Attempt to modify the parameter cannot be modified during operation (refer to the parameter list). | 1. The + or − is available for modifying the parameter only when 1-06=0<br>2. Modify the parameter during STOP |
| Err2 | Parameter setting error | 1. 3-01in the range of 3-13 ± 3-16 or 3-14 ± 3-16 or 3-15 ± 3-16<br>2. 3-003-01<br>3.The setting error as per performing autotuning (e.g. 1-00 = 0, 1-06=0 | 1. Modify 3-13~3-15 or 3-16 3-00>3-01<br>2. Set 1-00=0, 1-06=0 during autotuning |
| Err5 | Modification of parameter is not available in communication | 1. Issue a control command during communication disabled<br>2. Modify the function 13-1~13-4 during communication | 1. Issue enable command before communication<br>2. Set the specific parameter of the function before communication |
| Err6 | Communication failed | 1. Wiring error<br>2. Communication parameter setting error<br>3. Sum-check error<br>4. Incorrect communication protocol | 1. Check hardware and wiring<br>2. Check functions 13-1~13-4 |
| Err7 | Parameter conflict | Attempt to modify the function 15-0 or 15-7<br>Voltage and current detection circuit is abnormal | If Reset VSD is not available, please send the VSD back to be repaired |
| Err8 | Factory setting error | When PLC is running, perform factory setting | Please perform factory setting before PLC stops. |
| EPr1 | Parameter setting error copy unit failed | 1.Set 3-18=1.2 without connecting copy unit.<br>2. Copy unit failed | 1. Modify 3-18<br>2. Replace copy unit |
| EPr2 | Parameter does not match | Copy the parameter to VSD to verify the parameter does not match. | 1. Rewrite again<br>2. Replace copy unit |

## 4.2 General troubleshooting

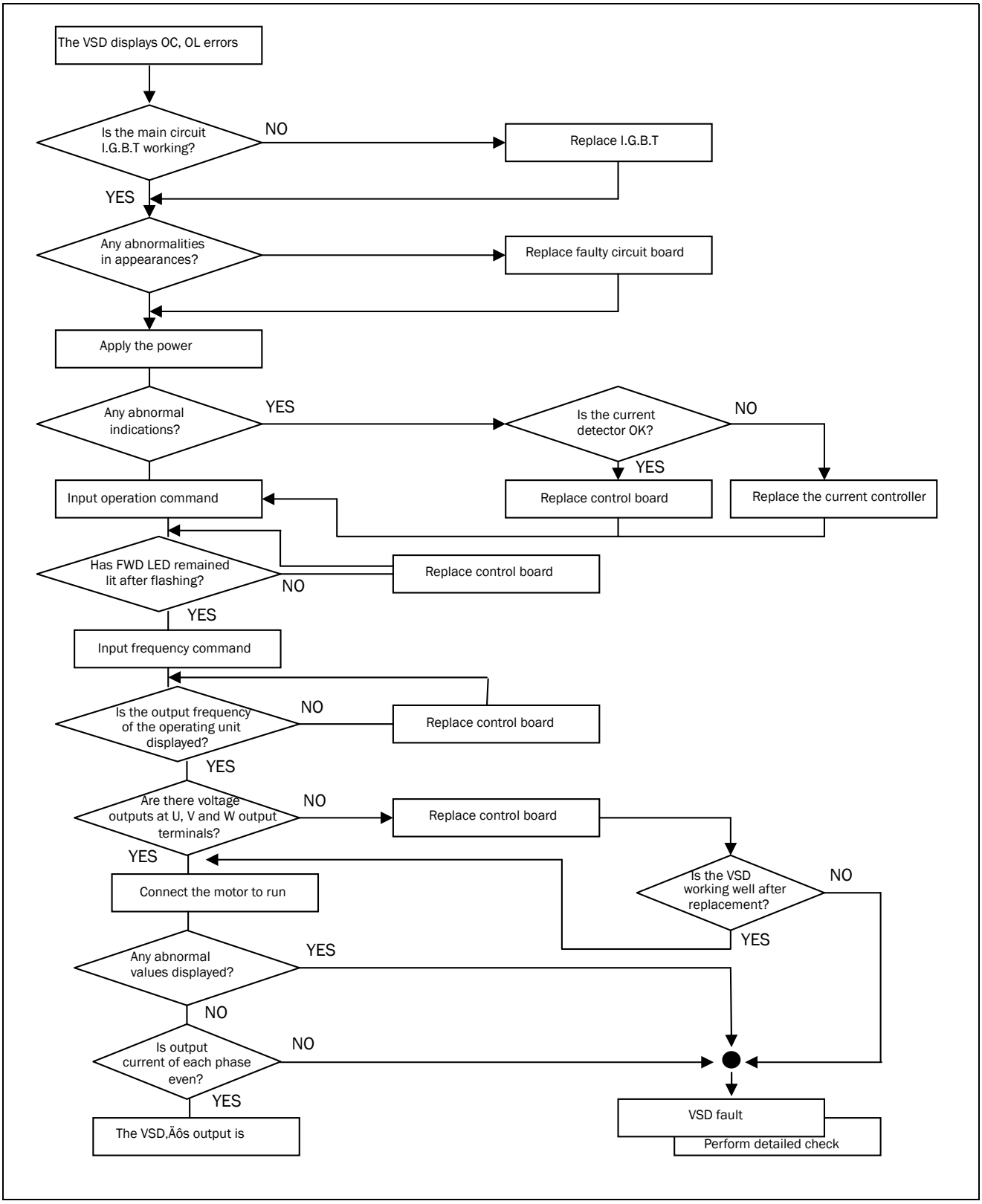
| Status | Checking point | Remedy |
|---|---|---|
| Motor cannot run | Is power applied to L1, L2, and L3 terminals (is the charging indicator lit)? | Is the power applied?<br>Turn the power OFF and then ON again.<br>Make sure the power voltage is correct.<br>Make sure screws are secured firmly. |
| | Is there voltage across the output terminals T1, T2, and T3? | Turn the power OFF and then ON again. |
| | Is overload causing the motor to be blocked? | Reduce the load to let the motor run. |
| | Are there any abnormalities in the VSD? | See error descriptions to check wiring and correct if necessary. |
| | Has a forward or reverse running command been issued? | |
| | Has analogue frequency signal been entered? | Is analogue frequency input signal wiring correct?<br>Is voltage of frequency input correct? |
| | Is operation mode setting correct? | Carry out operations via the digital panel. |
| Motor runs inversely | Is wiring for output terminals T1, T2, and T3 correct? | Wiring must match the motor's U, V, and W terminals. |
| | Is wiring for forward and reverse signals correct? | If necessary, check wiring is correct. |
| The motor speed cannot be regulated. | Is wiring for analogue frequency inputs correct? | If necessary, check wiring is correct. |
| | Is the operation mode correctly set? | Check the operation mode of the operator. |
| | Is the load too heavy? | Reduce the load. |
| Motor running speed too high or too low | Are the motor specifications (poles, voltage...) correct? | Confirm the motor's specifications. |
| | Is the gear ratio correct? | Confirm the gear ratio. |
| | Is the setting of the highest output frequency correct? | Confirm the highest output frequency. |
| Motor speed varies unusually | Is the load too heavy? | Reduce the load. |
| | Does the load vary largely? | Minimize the variation of the load.<br>Increase capacities of the VSD and the motor. |
| | Is the input power lack of phase? | Add an AC reactor at the power input side if using single-phase power.<br>Check wiring if using three-phase power. |

# 4.3 Quick troubleshooting of VSC

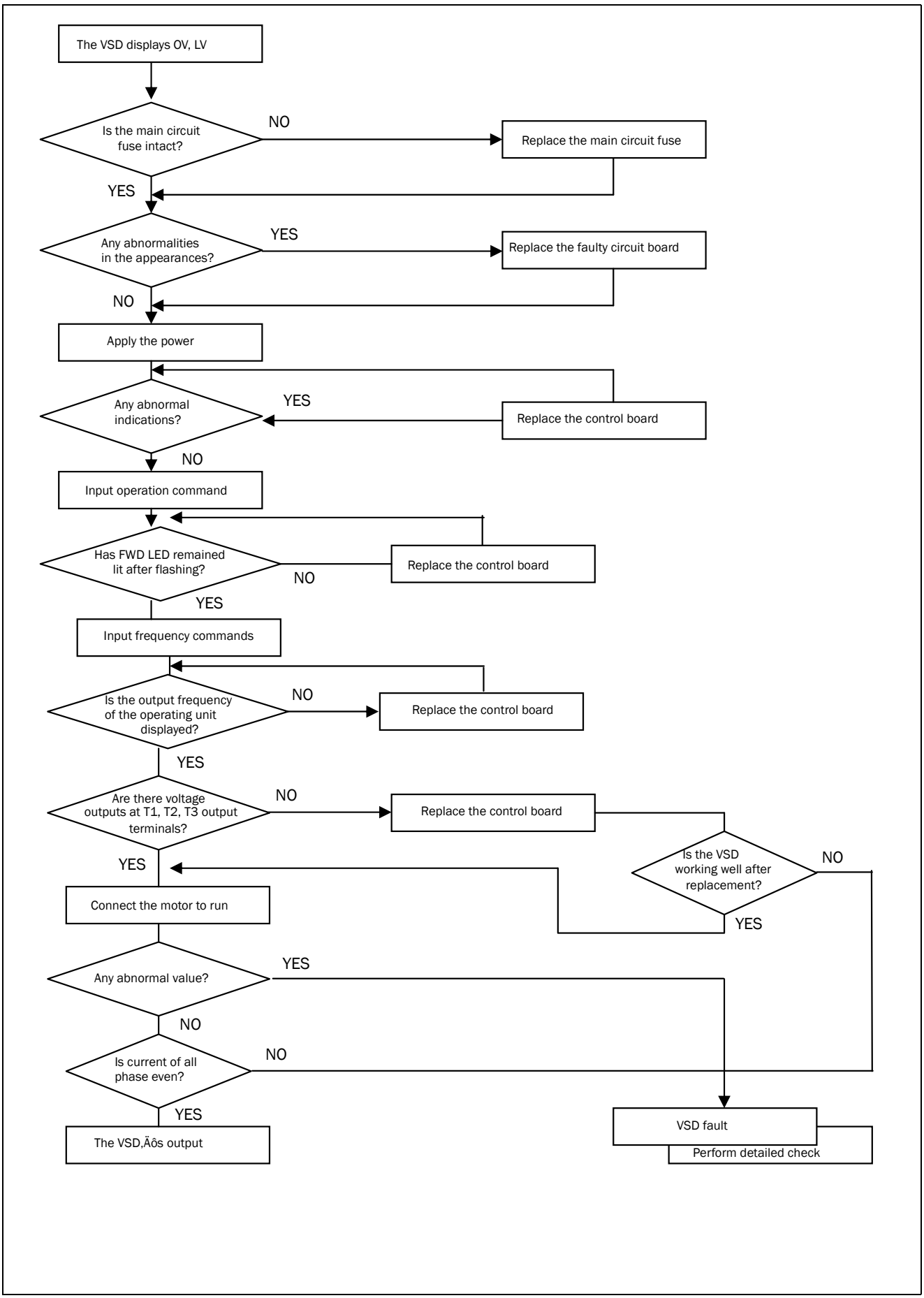



* to previous page
Check parameters of VSD
Perform parameter initialization
Specify operation control mode
FWD or REV LED lit after flashing?
NO
Replace the control board
YES
Set up frequency command
Is the frequency value displayed in operation unit
NO
Replace the control board
YES
Are there voltage outputs in output terminals U, V and W?
NO
Replace the control board
YES
Connect the motor to run
Is the control board working well after replacement?
NO
YES
Is there any abnormal display?
YES
NO
Is output current of each phase even?
NO
YES
The VSD is OK
VSD fault
Perform detailed check

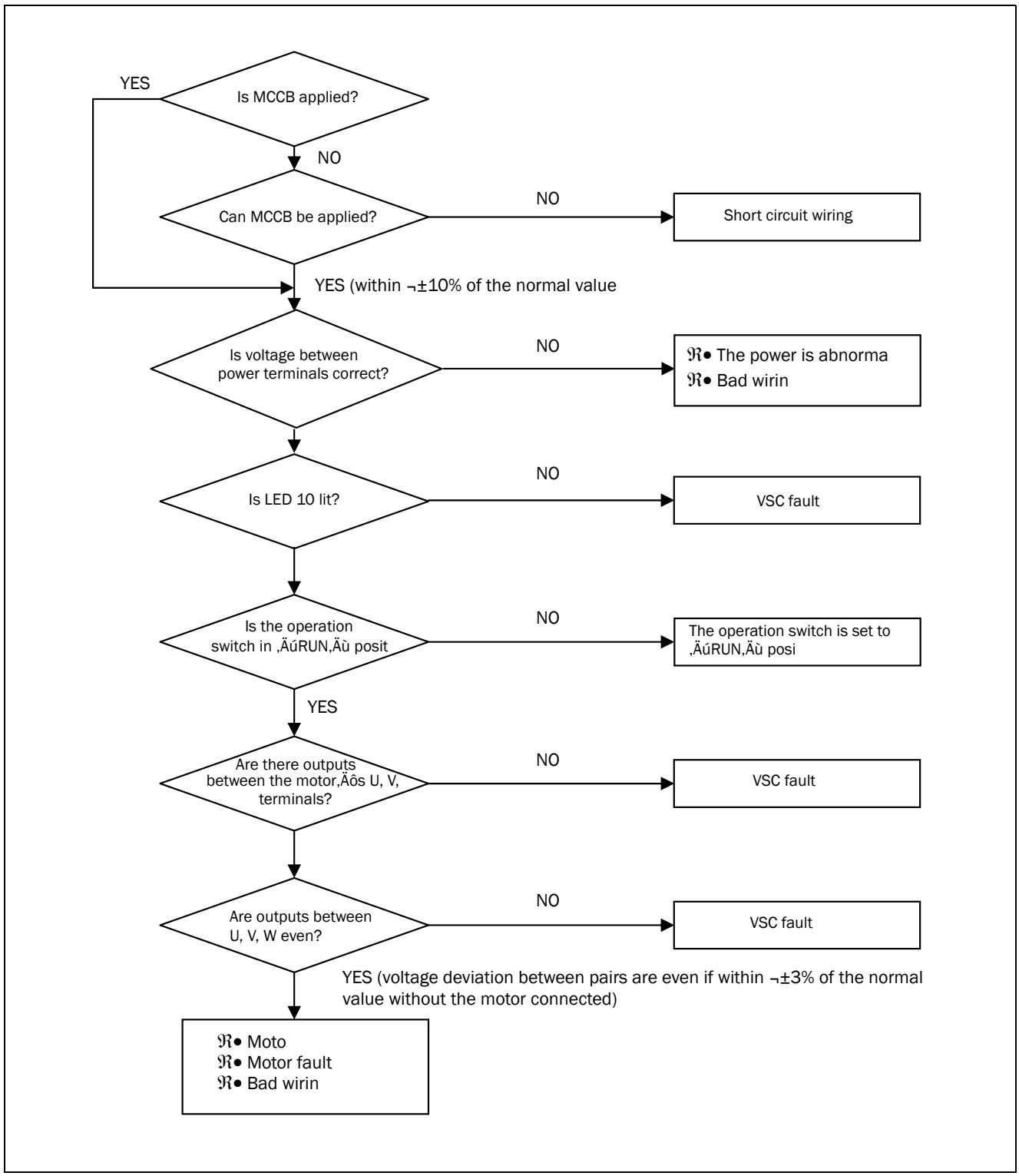
# Troubleshooting for OC, OL error displays



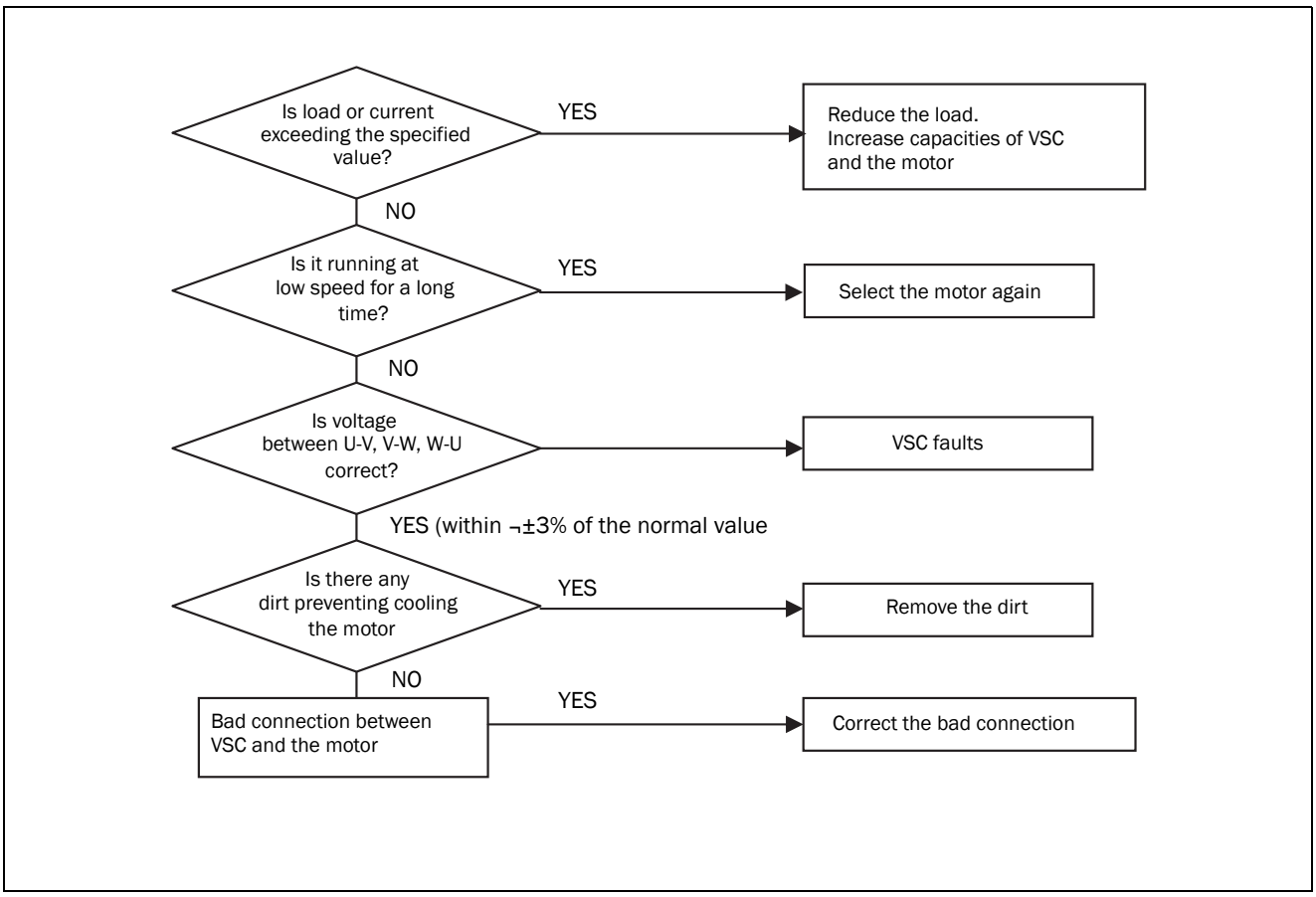
# Troubleshooting for OV, LV error



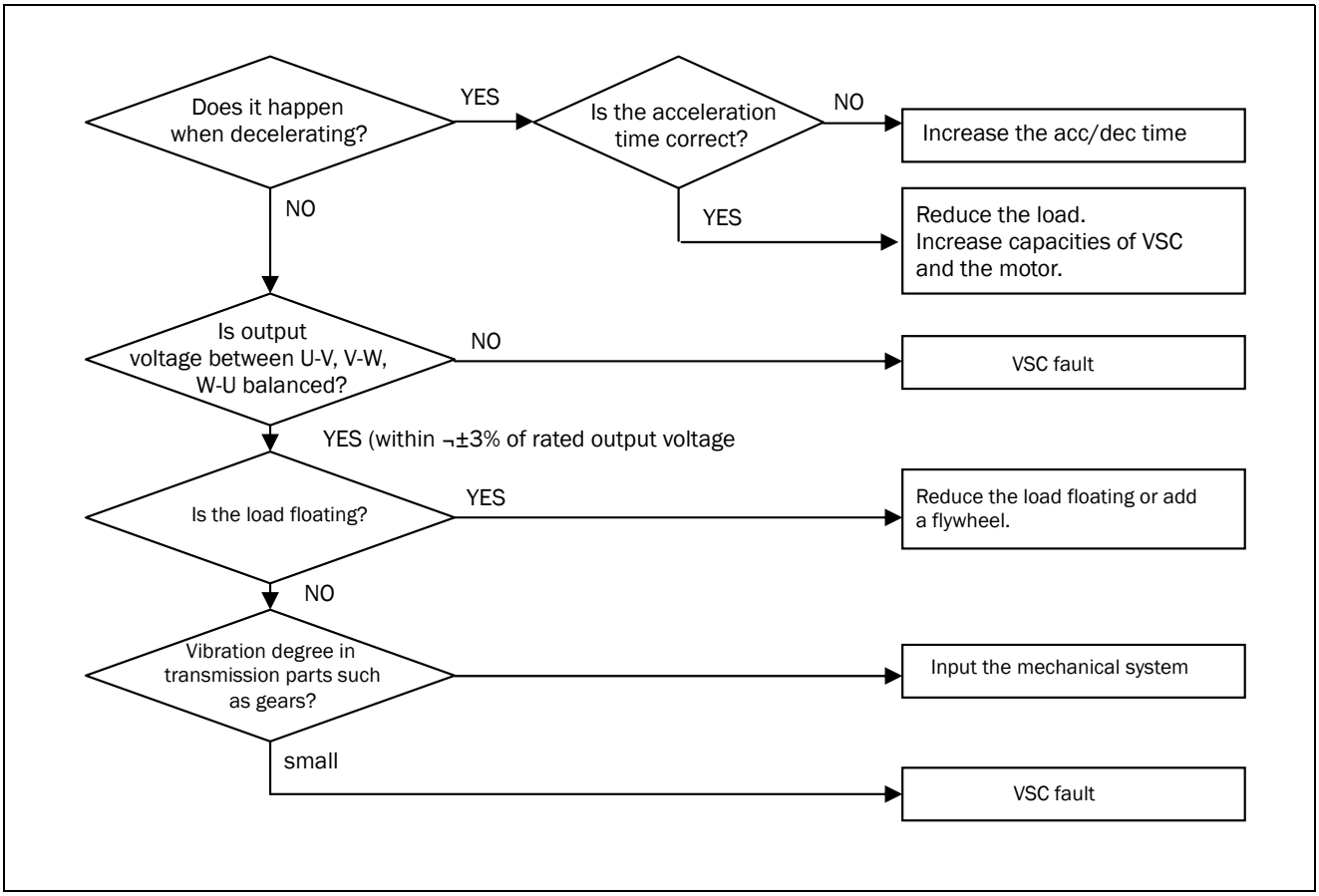
## The motor cannot run



## The motor is overheated




## Motor runs unevenly



## 4.4 Routine inspection and periodical inspection

To ensure stable and safe operations, check and maintain the VSD regularly and periodically.

The table below lists the items to be checked to ensure stable and safe operations.

Check these items 5 minutes after the "Charge" indicator goes out to prevent service personnel from being injured by residual electric power.

| Items | Details | Checking period | | Methods | Criteria | Remedies |
|---|---|---|---|---|---|---|
| | | Daily | Annually | | | |
| Ambient conditions around the machine | Confirm the temperature and humidity around the machine | O | | Measure with thermometer and hygrometer according to installation notices. | Temperature: -10 to 40°C Humidity: Below 95% RH | Improve the circumstances |
| | Are there inflammable piled up around? | O | | Visual check | No foreign matters | |
| Installation and grounding of the VSD | Any unusual vibration from the machine | O | | Visual, hearing | No foreign matters | Secure screws |
| | Is the grounding resistance correct? | | O | Measure the resistance with a multi-tester | 200V series: below 100<br>400V series: below 10 | Improve the grounding |
| Input power voltage | Is the voltage of the main circuit correct? | O | | Measure the voltage with a multi-tester | Voltage must conform to the specifications | Improve input voltage |
| External terminals and internal mounting screws of the VSD | Are secure parts loose? | | O | Visual check<br>Check with a screwdriver | No abnormalities | Secure or send back for repair |
| | Is the terminal base damaged? | | O | | | |
| | Obvious rust stains | | O | | | |
| Internal wiring of the VSD | Deformed or crooked | | O | Visual check | No abnormalities | Replace or send back for repair |
| | Any damage of the wrapping of the conducting wire | | O | | | |
| Heat sink | Heap of dust or mingled trifles | O | | Visual check | No abnormalities | Clean up heaped dust |
| Printed circuit board | Heap of conductive metal or oil sludge | | O | Visual check | No abnormalities | Clean up or replace the circuit board |
| | Discoloured, overheated, or burned parts | | O | | | |
| Cooling fan | Unusual vibration and noise | | O | Visual or hearing check | No abnormalities | Replace the cooling fan |
| | Heap of dust or mingled trifles | O | | Visual check | | Clean up |
| Power component | Heap of dust or mingled trifles | | O | Visual check | No abnormalities | Clean up |
| | Check resistance between each terminals | | O | Measure with a multi-tester | No short circuit or broken circuit in three-phase output | Replace power component or VSD |
| Capacitor | Any unusual odour or leakage | O | | Visual check | No abnormalities | Replace capacitor or VSD |
| | Any inflation or protrusion | O | | | | |

## 4.5 Maintenance and inspection

The VSD does not require daily inspection and maintenance.

To ensure long-term reliability, follow the instructions below when performing regular inspection. Turn the power off and wait for the charge indicator (LED101) to go out before inspection to avoid receiving an electric shock possibly caused by charges resides in high-capacity capacitors.

(1) Clean up the accumulation of muck inside the VSD.

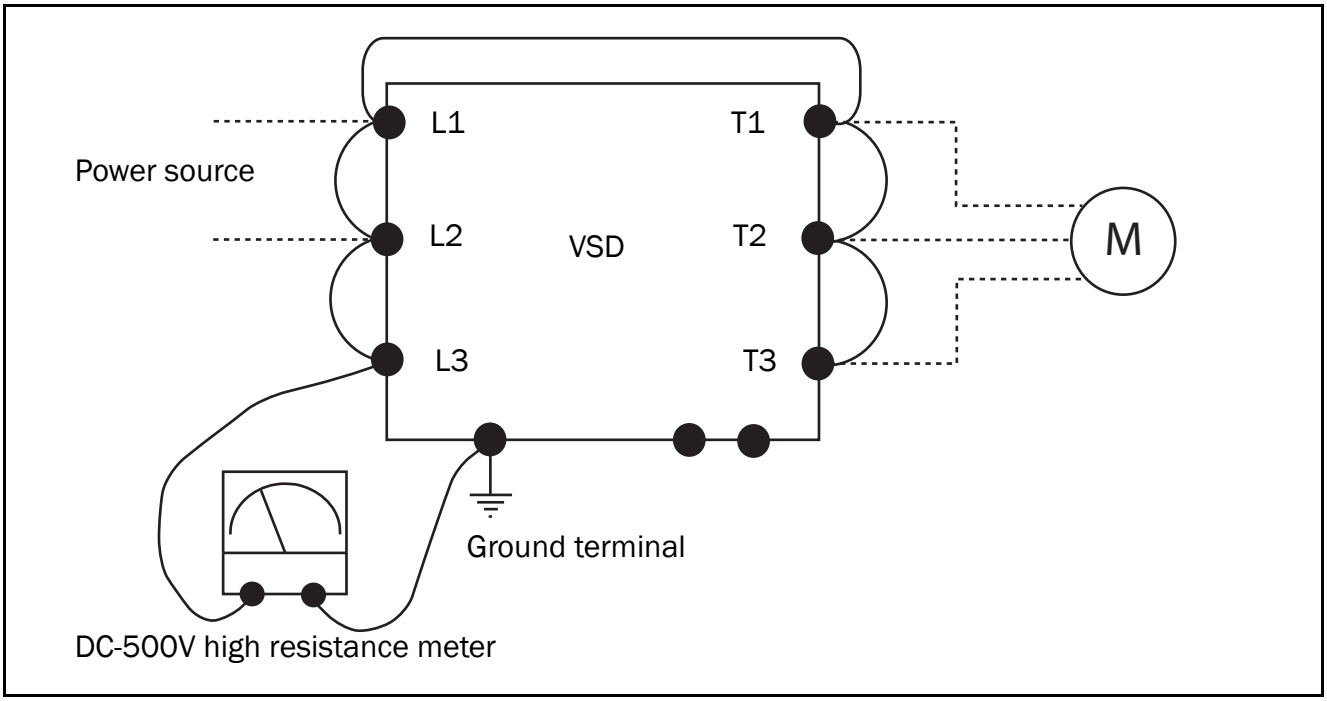
(2) Check if there are any loose terminal screws and securing screws. Tighten all loose screws.

(3) Insulation tests

(a) Disconnect all leads connecting T-VERTER to the external circuit when performing insulation tests against external circuit.

(b) An internal insulation test should be only be performed against the main circuit of the T-VERTER body. Use a high resistance DC 500V meter with insulating resistance higher than 5M.

**Caution: Do not perform this test against the control circuit.**



# 5. Peripheral Components

## 5.1 Reactor specification for input side

| Model | | AC inductance on input side | |
|---|---|---|---|
| | | Current (A) | Inductance (mH) |
| VSC48- | 009 | 10.0 | 2.2 |
| | 013 | 15.0 | 1.42 |
| | 018 | 20.0 | 1.06 |

## 5.2 Reactor specification on DC side

| Model | | DC inductance for input side | |
|---|---|---|---|
| | | Current (A) | Inductance (mH) |
| VSC48- | 009 | 8.8 | 3.98 |
| | 013 | 13 | 2.69 |
| | 018 | 17.5 | 2.00 |

## 5.3 Braking unit and braking resistor

VSC series braking current calculation

| VSD Model | Braking Unit | | Braking Resistor per braking unit | Suitable Motor Capacity (HP) | Suitable Motor Capacity (KW) | Braking resistor Specification | | Braking resistor ED(%) | Braking torque (%) | Resistor dimension (L*W*H) mm |
|---|---|---|---|---|---|---|---|---|---|---|
| | Model | Number used | Type | | | (W) | (Ω) | | | |
| VSC48-009 | - | - | JNBR-400W150- | 5 | 3.7 | 400 | 150 | 10 | 126 | 395*34*78 |
| VSC48-013 | - | - | JNBR-600W130- | 7.5 | 5.5 | 600 | 130 | 10 | 102 | 470*50*100 |
| VSC48-018 | - | - | JNBR-800W100 | 10 | 7.5 | 800 | 100 | 10 | 99 | 535*50*110 |

Formula for braking resistor:
W= (Vpnb * Vpnb) * ED% / R

1. W: braking resistor consumption power
2. Vpnb: braking voltage (440V=760VDC)
3. ED%: braking effective period
4. R: used braking resistor

For detailed information, please contact your supplier.

## 5.4 EMC Filter

The VSD adopts rapid switching components to improve the efficiency of the motor and to reduce the motor noise. Using the EMC filter allows the EMI (Electromagnetic Interference) and RFI (Radio Frequency interference) to be controlled within a certain range.

### EMC Directive

The VSD with built-in filter complies with the EMC Directive 89/336/EEC, limiting the environmental EMI and RFI. Independent tests have demonstrated compliance to the following standards when the optional filters are used.

EMI radio standard °BEMS immunity standard

EN 61800-3 1996/A11: 2000: First Environment Restricted Distribution

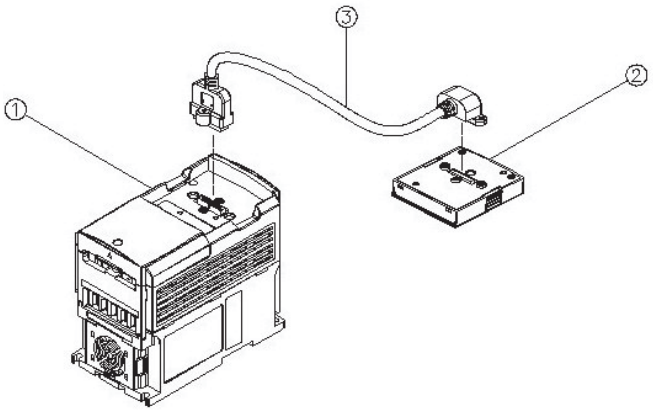
### Filter Selection

| VSD Model | | Rating (INPUT) | Filter Model | |
|---|---|---|---|---|
| | | | First Environment Restricted Distribution | First Environment Unrestricted Distribution |
| VSC48 | 009 | 3 ϕ 323~528 V | Built-in | Contact supplier |
| | 013 | 3 ϕ 323~528 V | Built-in | Contact supplier |
| | 018 | 3 ϕ 323~528 V | Built-in | Contact supplier |

## 5.5 Digital operator and extension cable

A.Remote Keypad Cable Kit

| Inverter Model | Extension Cable Kit | Cable Length (Meter) |
|---|---|---|
| All models | VSC Remote Keypad cable | 2.0 |




B. Content

1. Inverter
2. LED Keypad
3. REMOTE Cable for Keypad

C. Operation procedure:

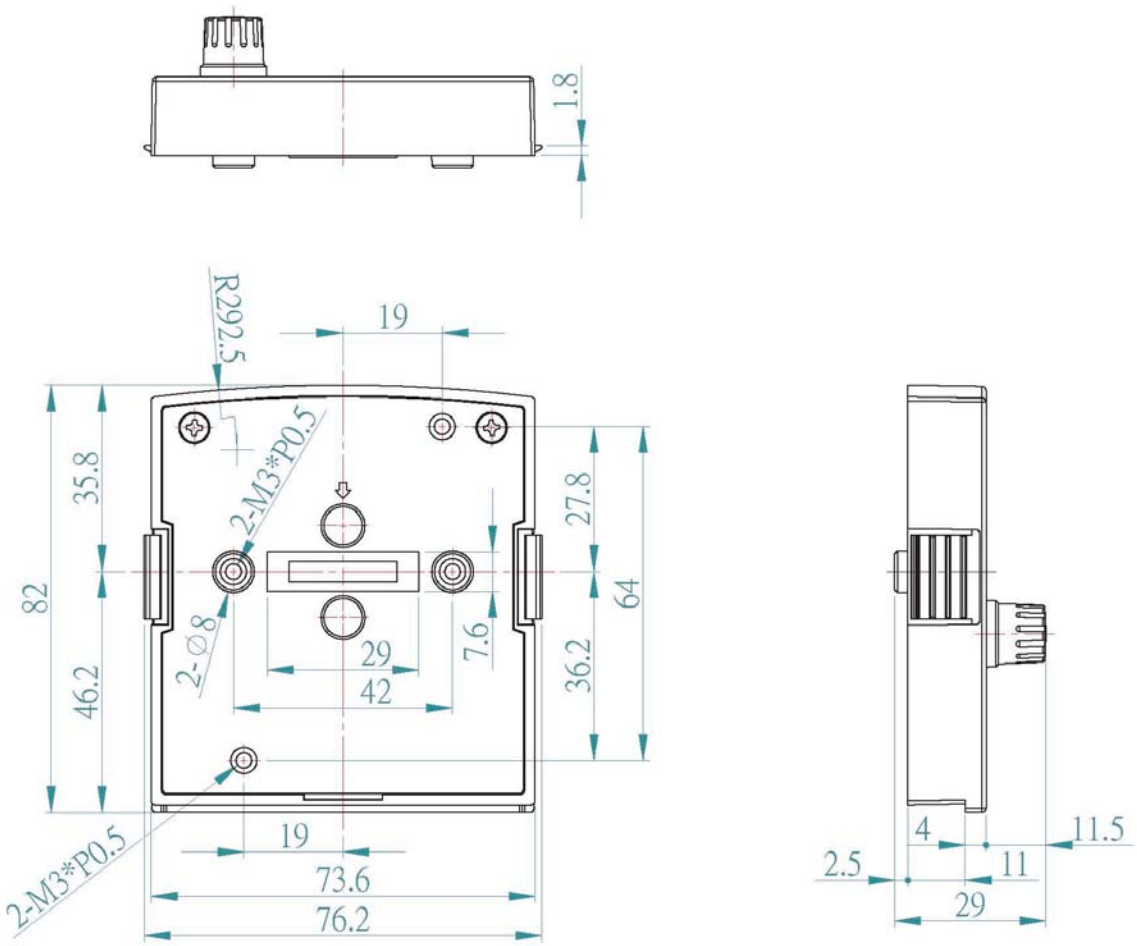
**Warning: Turn OFF the power supply. The following procedures should be performed after there is no display on the keypad.**

1. Remove the keypad from the Inverter.
2. Please refer to Diagram before mounting the keypad to your machine or Panel.
3. Connect the inverter and the keypad with the remote cable in accordance with the above Diagram.

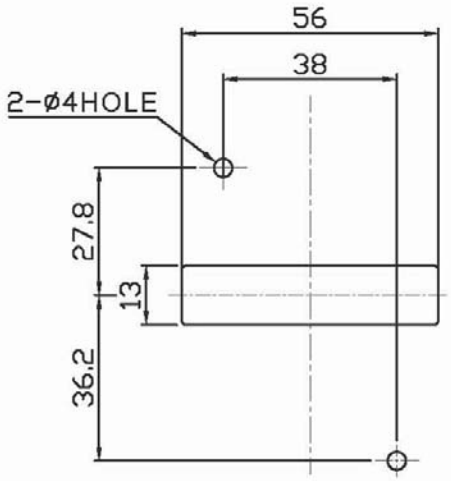
Supply the power to operate ONLY after all elements are securely fixed.

### 5.5.1 LED Keypad Mounting

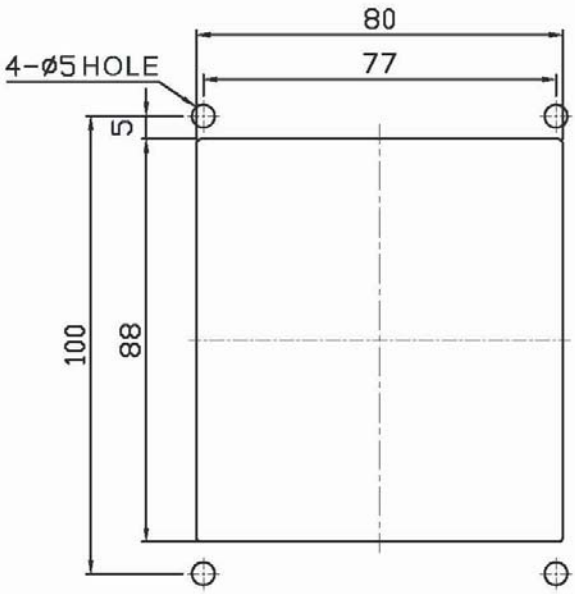
Dimensions Unit : mm


1.8
R2.5
19
2-M3*P0.5
35.8
82
46.2
27.8
64
36.2
2-Ø8
29
42
7.6
19
73.6
76.2
2-M3*P0.5
4
11.5
2.5
11
29

### 5.5.2 Keypad Installation Dimension



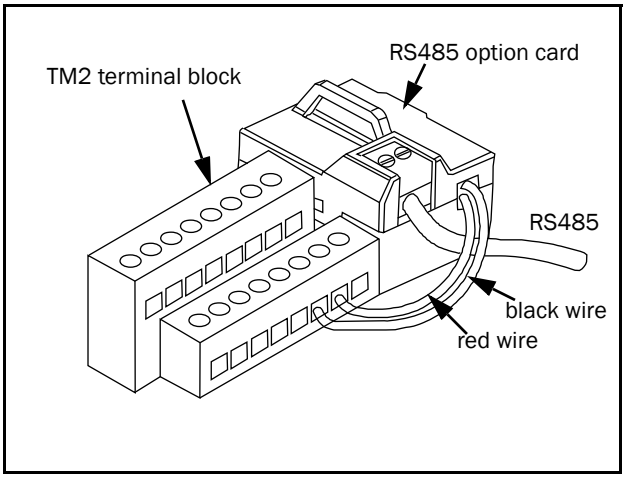

Dimensions for mounting remote keypad direct to control panel




Dimensions for mounting keypad with additional mounting-frame to control panel.

## 5.6 Interface Card

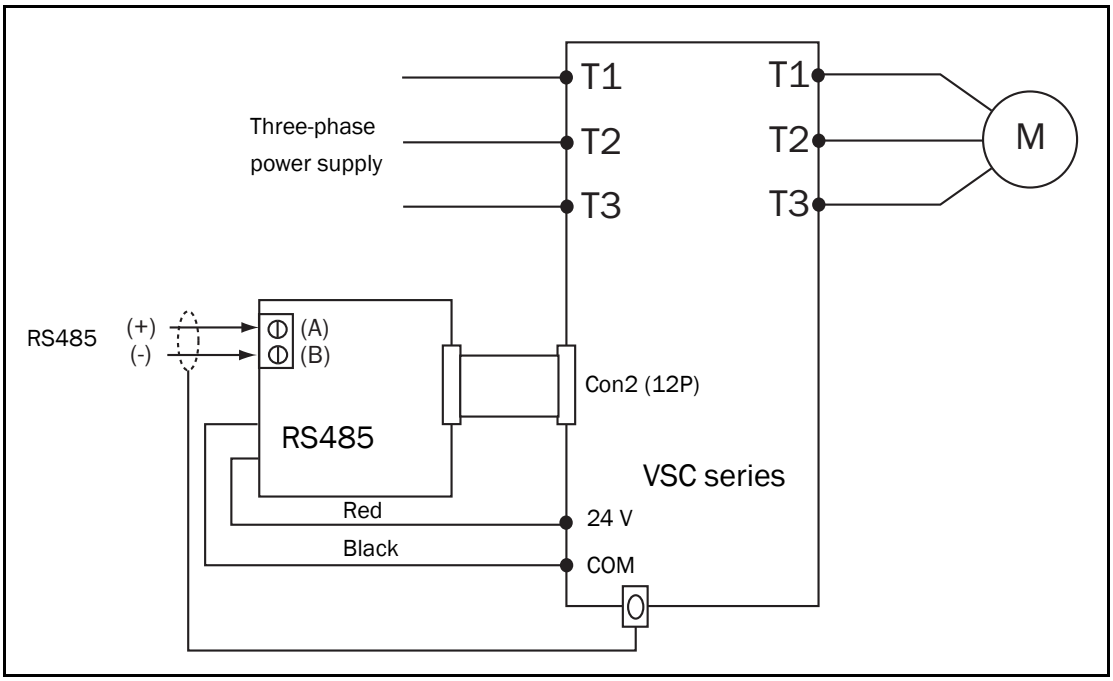
### 5.6.1 RS485 Interface Card




**NOTE:**
**1. Connect the black wire to the "com" terminal of TM2.**

**2. Connect the red wire to the "24V" terminal of TM2.**

RS485 Wiring Diagram:

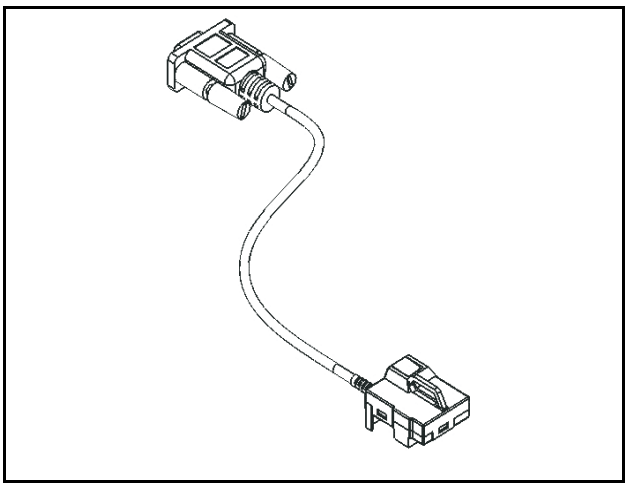



**NOTE:**

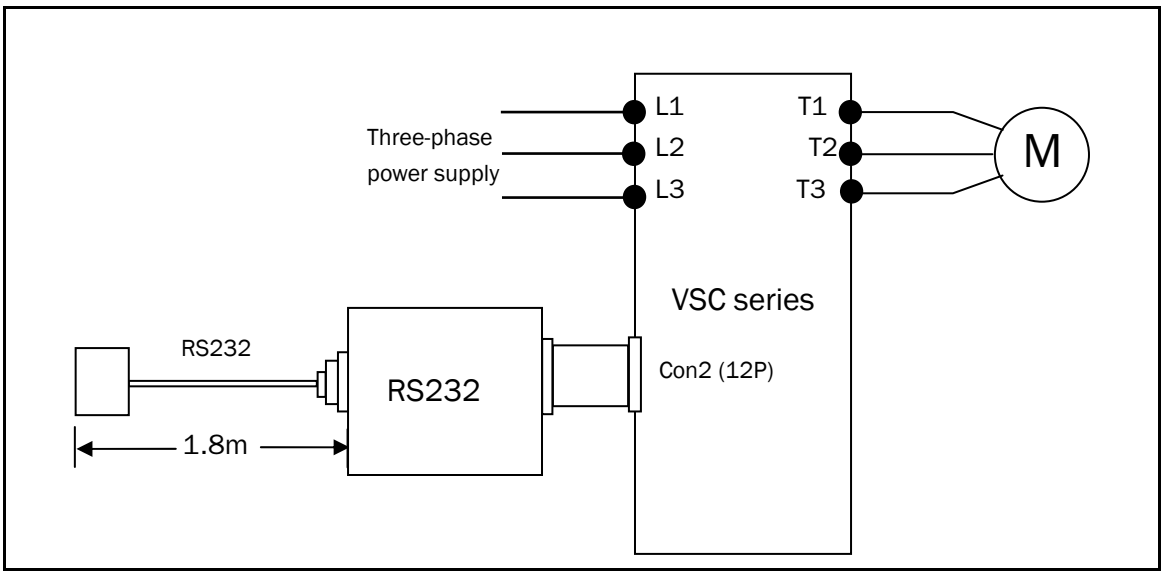
**Please put on the VSD cover to avoid the Interface card being disturbed by outside static electricity.**

**Please use isolated RS232/RS485 converter to link PC and interface card to avoid damaging equipment.**

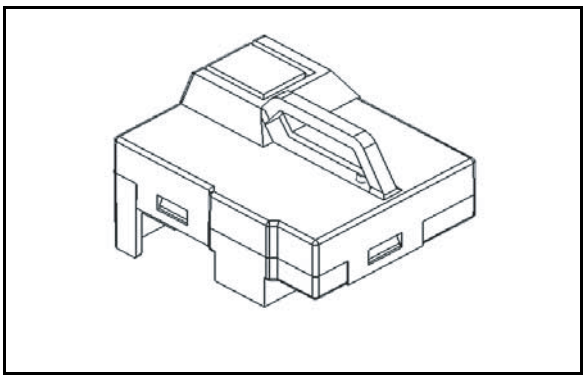
## 5.6.2 RS232 Interface Card



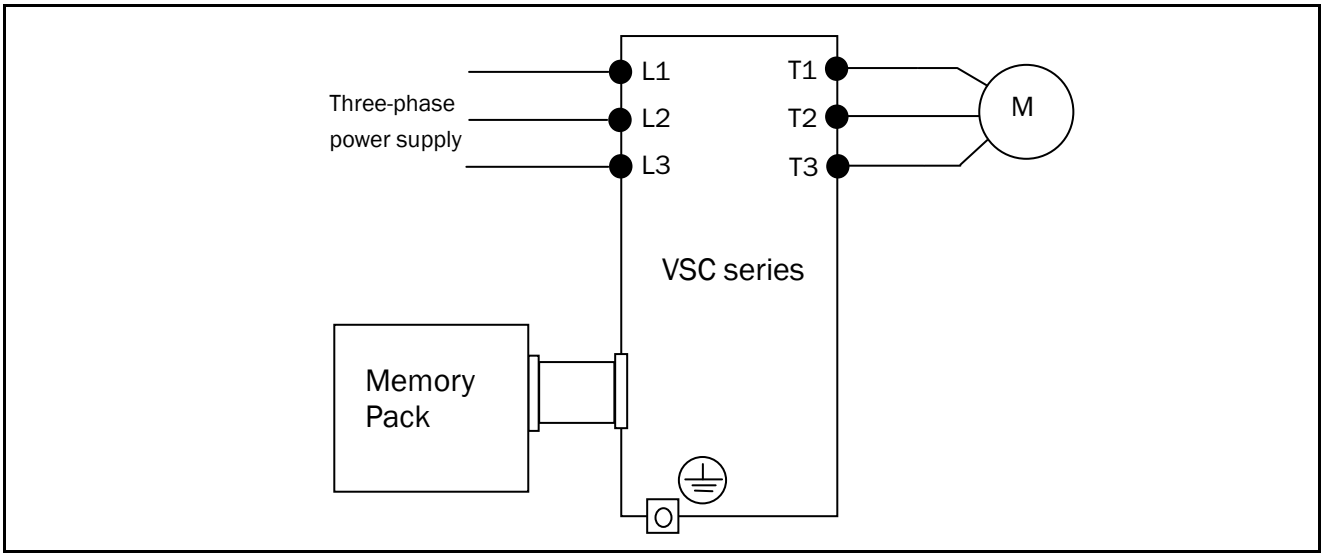
RS232 Wiring Diagram



### 5.6.3 Program Copy Unit



Memory Pack Wiring Diagram



# Appendix 1: List of internal parameters for VSC motor

Factory settings for the motor's internal parameters.

| Parameter Model | | 14-0 (Stator Resistance) | 14-1 (Rotor Resistance) | 14-2 (Equivalent Inductance) | 14-3 (Magnetization Current) | 14-4 (Iron Loss Conductance) |
|---|---|---|---|---|---|---|
| VSC 48- | 009 | 260 | 200 | 800 | 7200 | 0 |
| | 013 | 240 | 160 | | | |
| | 018 | 220 | 150 | | | |

**NOTE: 1. The above parameters are idle in V/F Control Mode. These parameters can be enabled in vector control mode.**

**2. The motor parameters (14-0~14-4) cannot be modified when factory settings are in vector mode. The internal parameters will be maintained after autotuning (refer to Autotuning and Description of motor's internal parameters).**

**3: The motor parameters (14-0~14-4) will be completely modified to factory settings in any operation mode.**

# Appendix 2:
# VSC parameter setting list

| Customer | | | | VSD Model | | | |
|---|---|---|---|---|---|---|---|
| Using Site | | | | Contact Phone | | | |
| Address | | | | | | | |
| Parameter Code | Setting Content | Parameter Code | Setting Content | Parameter Code | Setting Content | Parameter Code | Setting Content |
| 0-00 | | 3-16 | | 6-05 | | 10-8 | |
| 0-01 | | 3-17 | | 6-06 | | 10-9 | |
| 0-02 | | 3-18 | | 6-07 | | 11-0 | |
| 0-03 | | 3-19 | | 6-08 | | 11-1 | |
| 0-04 | | 3-20 | | 7-00 | | 11-2 | |
| 0-05 | | 3-21 | | 7-01 | | 11-3 | |
| 0-06 | | 3-22 | | 7-02 | | 11-4 | |
| 0-07 | | 3-23 | | 7-03 | | 11-5 | |
| 0-08 | | 3-24 | | 7-04 | | 11-6 | |
| 1-00 | | 3-25 | | 7-05 | | 11-7 | |
| 1-01 | | 3-26 | | 8-00 | | 12-0 | |
| 1-02 | | 3-27 | | 8-01 | | 12-1 | |
| 1-03 | | 3-28 | | 8-02 | | 12-2 | |
| 1-04 | | 3-29 | | 8-03 | | 12-3 | |
| 1-05 | | 3-30 | | 8-04 | | 12-4 | |
| 1-06 | | 4-00 | | 8-05 | | 12-5 | |
| 1-07 | | 4-01 | | 9-00 | | 12-6 | |
| 2-00 | | 4-02 | | 9-01 | | 12-7 | |
| 2-01 | | 4-03 | | 9-02 | | 12-8 | |
| 2-02 | | 4-04 | | 9-03 | | 13-0 | |
| 2-03 | | 4-05 | | 9-04 | | 13-1 | |
| 2-04 | | 4-06 | | 9-05 | | 13-2 | |
| 2-05 | | 5-00 | | 9-06 | | 13-3 | |
| 2-06 | | 5-01 | | 9-07 | | 13-4 | |
| 3-00 | | 5-02 | | 9-08 | | 13-5 | |
| 3-01 | | 5-03 | | 9-09 | | 13-6 | |
| 3-02 | | 5-04 | | 9-10 | | 14-0 | |
| 3-03 | | 5-05 | | 9-11 | | 14-1 | |
| 3-04 | | 5-06 | | 9-12 | | 14-2 | |
| 3-05 | | 5-07 | | 9-13 | | 14-3 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3-06 | | 5-08 | | 9-14 | | 14-4 | |
| 3-07 | | 5-09 | | 9-15 | | 15-0 | |
| 3-08 | | 5-10 | | 10-0 | | 15-1 | |
| 3-09 | | 5-11 | | 10-1 | | 15-2 | |
| 3-10 | | 5-12 | | 10-2 | | 15-3 | |
| 3-11 | | 6-00 | | 10-3 | | 15-4 | |
| 3-12 | | 6-01 | | 10-4 | | 15-5 | |
| 3-13 | | 6-02 | | 10-5 | | 15-6 | |
| 3-14 | | 6-03 | | 10-6 | | | |
| 3-15 | | 6-04 | | 10-7 | | | |

emotron®

DEDICATED DRIVE

**Emotron AB, Mörsaregatan 12, SE-250 24 Helsingborg, Sweden**
**Tel: +46 42 16 99 00, Fax: +46 42 16 99 49**
**E-mail: info@emotron.se**
**Internet: www.emotron.com**

Emotron AB 01-3992-01r3 2009-07-15