# TD3200 Variable Speed Drive for Elevator Door Control User Manual

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Emerson Network Power provides customers with technical support. Users may contact the nearest Emerson local sales office or service center.



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## Preface

Thank you for using TD3200 series drive made by Emerson Network Power Co., Ltd.

TD3200 series drives are high performance vector control drives used for elevator door and various automatic door controls and other applications. Before operation, be sure to read this manual carefully to ensure correct operation and make full use of this drive's perfect functions. This manual is delivered as an accessory of the drive. Be sure to keep it properly after using. This manual is subject to changes without notification.

The development and design of this product is compliant with the national standards of Elevator Manufacturing and Installation Safety Rules (GB 7588-1995). Besides, when it is used with other controller to form a system, this system can also meet the requirements of the standards if used properly. Users must install and use the product according to the national standards as well as the directions of this manual, and Emerson Network Power bears no responsibility for any human injury or material loss due to incorrect use of this product.

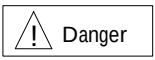
## Contents

The components, installation and wiring, daily application, fault-handling and maintenance of TD3200 series drive are described in detail in this manual.

## Readers

Drive installation personnel, engineering maintenance personnel and designers.

### Typographic Conventions:




Operations that are not performed in compliant with the requirements may cause death or severe hurt.

Operations which are not performed in compliant with the requirements may cause medium hurt or light hurt or material damage.

Note: The parts to which the operator should pay attention.

# Contents

# Chapter 1 Safety Rules

## 1.1 Cautions in Installation

| | |
|---|---|
| Danger | Do not install the drive in an environment with explosive gas, or with the risk of explosion.<br>Only qualified personnel are allowed to perform the wiring of the drive, or they might be at the risk of electric shock.<br>Make sure the mains is cut off before wiring.<br>The earth terminal of the drive must be earthed properly.<br>Maintenance should be done after the mains has been cut off for 5 minutes, and the charger indicator is off, and the bus voltage is under 36V, or there is danger of electric shock. |
| Attention | Do not leave screw, washer or other metal parts inside the drive, or there is danger of fire.<br>Please do not install or run the drive if it is damaged or lack of some parts.<br>Avoid exposure of the drive to direct sunshine.<br>Do not mis-connect input terminals (L, N), output terminals (U, V, W) and brake terminals (P(+), P(-), PB), or there is danger of explosion.<br>Do not connect control terminals, except TA, TB and TC, directly to 220V, otherwise, the drive might be damaged.<br>Bare part of cable lugs used in main circuit wiring must be bound with insulation tape.<br>Generally, remove the drive's cover and blow off the dust using proper tools every 1~3 months.<br>If the over-current protection acts after start, please check if the wiring is correct and then restart . |

## 1.2 Notes for Application

Pay attention to the following issues when using TD3200 Variable Speed Drive (the drive):

1. Product Configuration

The standard TD3200 drive has no operation keypad and display unit. You may choose them based on your needs.

2. Low Speed Running with Constant Torque

Driving a common motor at low speed for a long time, the motor's life will be reduced due to the deteriorating heat dissipation effect, so a special variable speed motor for this case.

3. Insulation of Motors

Before using the drive, please check the insulation ratings of the motors to avoid damage. When the environmental conditions are unfavorable to the motor, please check the insulation conditions at a regular interval to ensure the safety of the whole system.

4. Regenerating load

For the load to be elevated, it may bring regenerating torque. The drive will trip due to over-current and over-voltage. If the drive needs to drive such load, you should select brake resistor.

5. Do Not Install Varistors or Capacitors at Output

You must remove the capacitors or voltage sensitive devices installed at the output for improving power factor, because they will result in drive trip or other devices damaged. Besides, you'd better not install air-break switch or contactor. If you have to do so, you must ensure that when the switches act, the output current of the drive is zero. Please refer to Figure1-1.

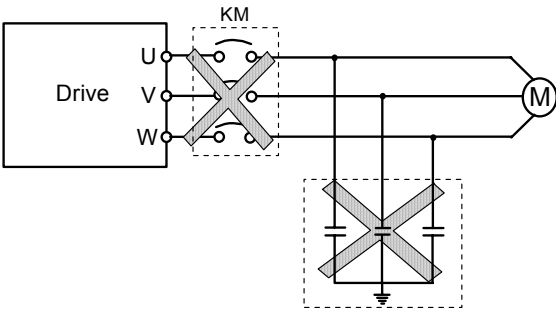



*Figure 1-1 Capacitors are prohibited to be connected at the drive's output*

6. Derating at Base Frequency

When the base frequency is set below the rated frequency, derate the drive to prevent the motor from being damaged due to overheat.

7. Altitude and derating

When the altitude is higher than 1000m, the cooling effect of the drive becomes worse because of the rareness of air, so the drive must be derated. Refer to Figure 1-2.

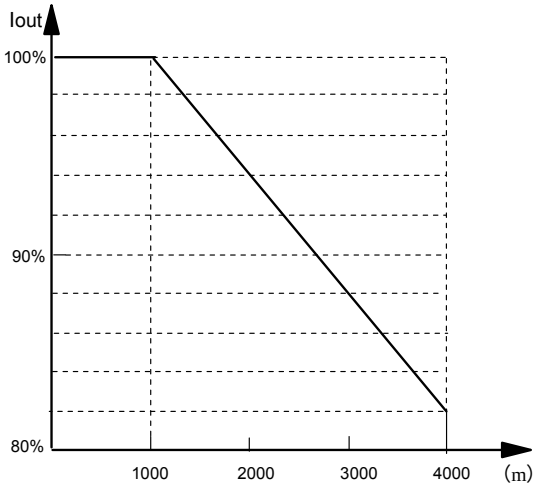



*Figure 1-2 Derating of drive's output current at different elevations*

8. About the protection level

The protection level of the TD3200 drive is IP20 when the display unit or the operation keypad is selected.

## 1.3 Disposing of Unwanted Drive

When disposing the Drive, pay attention to the following factors:

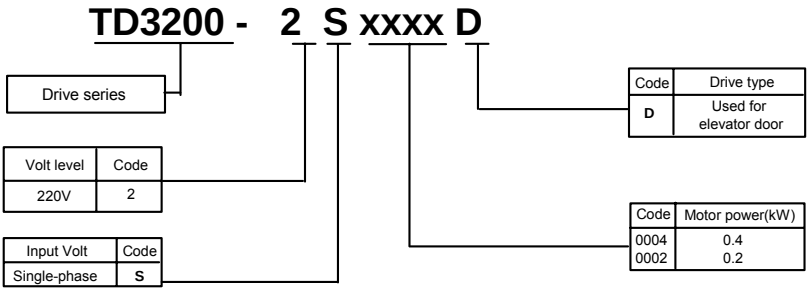
The capacitors may explode when they are burnt.

Poisonous gas may be generated when the plastic parts like front covers are burnt.

Disposing method: Please dispose the drive as industrial waste.

# Chapter 2 Product Introduction

## 2.1 Model Designation Rules




## 2.2 Nameplate of Drive

The Nameplate is on the bottom right of the front keypad of the drive, as shown in Figure 2-1.

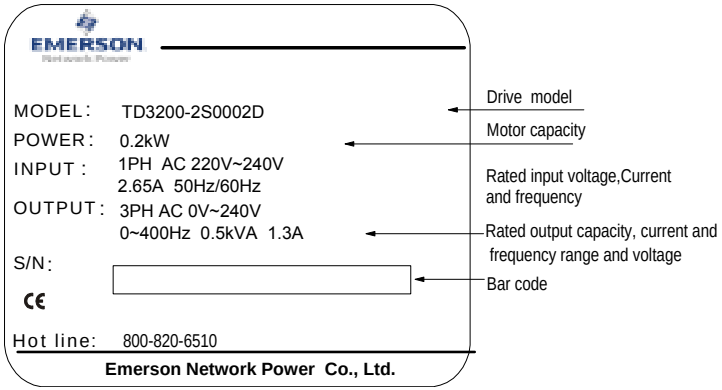



*Figure 2-1 Nameplate of drive*

## 2.3 Main Models of TD3200 Series Drive

| Drive's model constant-torque Load | Rated input current (A) | Rated capacity (kVA) | Rated output current (A) | Motor power (kW) |
|---|---|---|---|---|
| TD3200-2S0002D | 2.65 | 0.5 | 1.3 | 0.2 |
| TD3200-2S0004D | 5.3 | 1.0 | 2.5 | 0.4 |

## 2.4 Product Specifications

| Items | Subitems | Specifications |
|---|---|---|
| Input | Voltage range | Single-phase: 180V~264V |
| | Frequency range | 50Hz±5%, 60Hz±5% |
| Output | Voltage range | Three-phase: 0~220V |
| | Frequency range | 0Hz～400Hz |
| | Over load ability | 150% rated current for 1 minute, 180% rated current for 10 seconds; |
| Main control functions | Modulation mode | Optimized space voltage vector PWM modulation |
| | Control algorithm | Sensorless vector control, vector control with speed sensor |
| | Operation mode | Two modes: 1: The drive operates as a drive specially used for controlling the elevator door (elevator door control mode); 2: The drive operates as a general purpose drive |
| | Frequency resolution | Digital setting: 0.01Hz |
| | Auto learning | The drive operates at the auto-learnt speed, and operates in the logic procedure of close door (CD) →open door (OD)→CD→stop. After the auto-learning operation, the door width information is saved and the auto learning process is over. |
| | Auto tuning of motor's parameters | Purpose of auto tuning function of drive is to obtain the motor's parameters automatically and these parameters will be saved automatically after the tuning process is over. |

| Items | Subitems | Specifications |
|---|---|---|
| Main control functions | Auto operation testing upon start | In elevator door control mode, once the drive is switched on, the door will be closed automatically, after the door is closed completely, the drive will stop and the door stays in completely-closed status. |
| | Acc/Dec curve | Acc/Dec according to S curve, the Acc/Dec speed is selectable |
| Main control functions | Brake | Built-in braking unit, braking resistor connected externally, utility rate of braking: 0 ~100% |
| | Carrier frequency | 2~16kHz |
| | Multi-speed running | External terminals can be selected 8-level speed running |
| | Speed-adjusting range | Under rated load condition, 1:100 for vector control with speed sensor; 1:50 for sensorless vector control |
| | Speed accuracy | Under rated conditions, with speed sensor: 0.5% rated speed<br>Sensorless: 1% rated speed |
| | Start torque | 150% rated torque for control mode with speed sensor at 15~300 rpm (for 4-pole motor)<br>150% rated torque for sensorless control mode at 30~300 rpm (for 4-pole motor) |
| Operation Functions Display | Control mode | Terminal control mode; keypad control mode |
| | Frequency setting | Set the frequency via keypad; operate at multi-speed level |
| | Input signal | OD/CD command signal, CD/OD speed changing control signal, OD/CD location limiting signal, external reset signal; optical protection signal, MS speed control signal, OD prohibition protection signal, torque maintaining prohibition signal, low speed control signal, PG signal, door lock signal |
| | Output signal | 3 relay-output: 250VAC/2A($\cos\phi=1$), 250VAC/1A($\cos\phi=0.4$), 30VDC/1A |

| Items | Subitems | | Specifications |
|---|---|---|---|
| | 4-digit LED display (select TDP-LED02) | | Running frequency, reference frequency, output frequency, output voltage, bus voltage, output current, output torque, DC bus voltage, status of digital input terminals, status of digital output terminals, door-operating location (pulse number) |
| Protection function | | | Over current protection, over voltage protection, low voltage protection, over heat protection, overload protection, alarm for motor's parameters tuning, alarm for parameters setting error, OD width auto-learning error, OD/CD error, output phase failure protection, alarm for CPU error, parameter r/w error, and current detection circuit fault |
| Optional parts | | | Operation keypad, status display unit, braking resistors; cables of operation keypad, operation keypad base, cables for operation keypad |
| Environment | | Application environment | Inside, free from direct sunlight, dust, corrosive gas, combustible gas, oil mist, steam, water drop, etc. |
| | | Elevation | Lower than 1000m (deration required for elevation above 1000m) |
| | | Working temperature | －10℃～＋50℃ |
| | | Humidity | Less than 90%RH, no condensation |
| | | Vibration | Lower than 5.9m/s$^2$(0.6g) |
| | | Storage temperature | －40℃～＋70℃ |
| Structure | | Protection | IP20 (under conditions of using TDP-LED02 or TDP-LED03) |
| | | Cooling | Natural air cooling without fan |
| Mount modes | | Mounted on the wall or inside cabinet | |

# 2.5 Optional Parts

## 2.5.1 Operation Keypad

The TDP-LED02 operation keypad is a standard part produced by Emerson Network Power, as illustrated in Figure 2-2.

*Figure 2-2 Operation keypad*

*Figure 2-3 Status display unit*

## 2.5.2 Display Unit

TDP-LED03 display unit is shown in Figure 2-3.

In case that several TD3200 drives are used in one site, to lower the cost, you may use one operation keypad to set the parameters for all the drives. However, each drive should be equipped with one TDP-LED03. Under this condition, you can operate the drive only through control terminals, and check basic operation status (Power-on, Run, fault) of the drive through the display unit.

The dimensions of TDP-LED03 are the same with the operation keypad. The red, green and yellow LEDs on it are to indicate basic states of the drive.

## 2.5.3 Braking resistors

The drive has a built-in brake unit. If dynamic braking is required, please select the braking resistor with reference to the table below.

| Voltage | Motor's Rated Power | Braking resistors | Utility of braking unit | Braking torque | Maximum continuous running time |
|---|---|---|---|---|---|
| 220V | 0.2 kW | 200Ω/ 80W | 20(ED%) | 100% | 30s |
| | 0.4 kW | 200Ω/ 80W | 20(ED%) | 100% | 30s |

**Note**

Any special requirements for braking, please contact your supplier or Emerson Network Power.

## 2.5.4 Operation Keypad Pedestal and Cables

The operation keypad pedestal and connecting cables are optional.

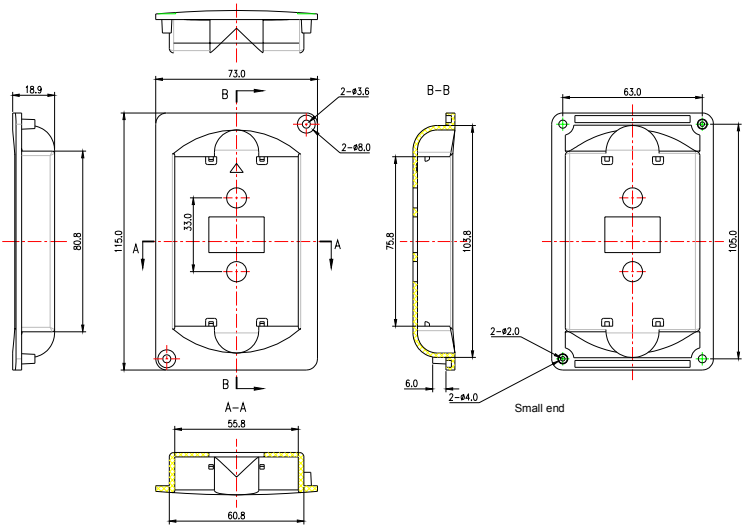



Figure 2-4 Operation keypad base

*Figure 2-5 Operation keypad cable*

Figure2-4 shows TDF-KB01 operation keypad pedestal.

There are three kinds of cables for operation keypad: TDC-CB0006A (0.6m), TDC-CB0015A (1.5m), TDC-CB0030A (3.0m). See Figure 2-5.

# Chapter 3 Installation and Wiring

## 3.1 Unpacking Inspection

Upon unpacking, please confirm the following:

- Any damage occurred during transportation;
- Check whether the rated values on the nameplate of the drive are in accordance with your order.
- If there is anything missed, please contact us or the your supplier.

## 3.2 Installation

The structure of TD3200 series drive is shown in Figure 3-1 and its dimensions are shown in Figure 3-2 and Table 3-1.

The drive should be installed vertically. The clearance requirements are shown in Figure 3-3 and Figure 3-4.

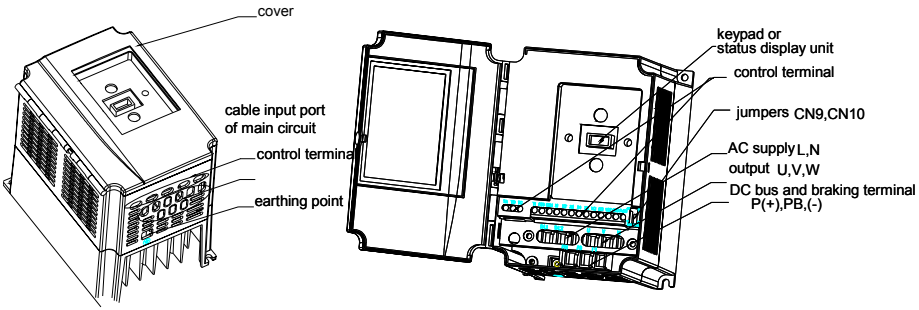



*Figure 3-1 Structure of the drive*

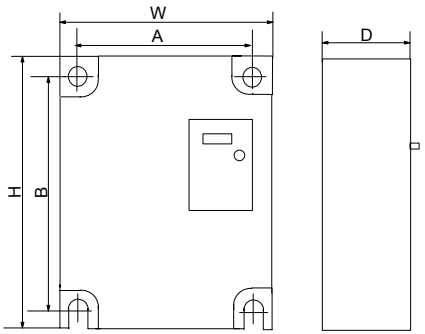



*Figure 3-2 Dimensions*

*Table 3-1 Outline & Dimensions*

| Drive's model | Motor power (kW) | Installation dimensions | | Outline dimensions | | | Diameter of mounting hole(mm) | Weight (kg) |
|---|---|---|---|---|---|---|---|---|
| | | A(mm) | B(mm) | H(mm) | W(mm) | D(mm) | | |
| TD3200-2S0002D | 0.2 | 91 | 137 | 145 | 101 | 130 | 4 | 1.2 |
| TD3200-2S0004D | 0.4 | | | | | | | |

**Note**

To attain IP20 protection level, you should select display unit or the operation keypad.

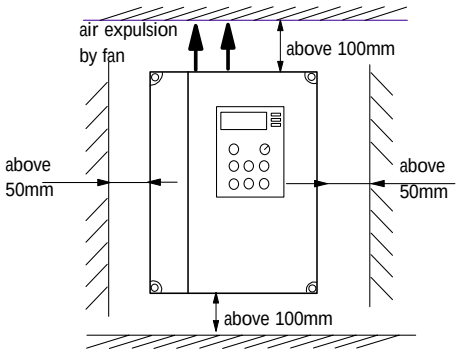



*Figure 3-3 Clearance*

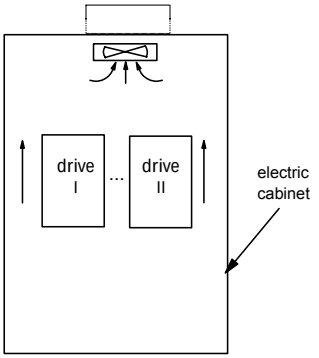


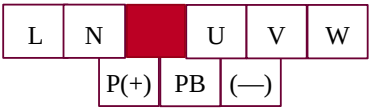

*Figure 3-4 Installing several drives together*

When TD3200 is used for controlling elevator 's door, it should be installed on the top of the elevator car (external surface). It's recommended to be installed vertically or placed obliquely, at 45 ° with the horizontal surface, with protective covering.

## 3.3 Wiring

> 🕮 **Note**
>
> Refer to Chapter 7 Application Guidance if the drive is used for controlling the elevator door, in which the wiring methods, testing and parameter settings of several typical elevator door control applications are given.

### 3.3.1 Power Terminals of Main Circuit




> 🕮 **Note**
>
> Safety earthing cable should be connected to the screw marked with "⏚"

*Functions of Power Terminals*

| Terminal Name | Function |
|---|---|
| P(＋), PB, (—) | P(＋): "+" bus;<br>PB: terminal for connecting braking unit, (—): "-" bus; |
| L. N | Input terminals for single-phase 220Vac |
| U. V. W | Output terminals for motor |
| PE | Terminal for earthing |

### 3.3.2 Control Terminals

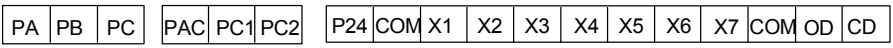


*Table of Control Terminals Functions*

| Terminal | Terminal Code | Terminal function description | Specification |
|---|---|---|---|
| Multi-function input terminal | X1～X7 | Functions are programmable (reference GND is COM) | 24V input, X1 and X2 can meet the input requirements of pulse signal with frequency below 40kHz |
| Terminals for inputting OD and CD commands | OD | OD command (reference GND is COM) | |
| | CD | CD command (reference GND is COM) | |
| Output terminals | P24 | 24V power supply (reference GND is COM) | +24V, maximum output current is 100mA |
| | PA, PB, PC | Programmable relay output 0 | Ratings of contacts: AC: 250V/2A; DC: 30V/1A |
| | PAC, PC1 | Programmable relay output 1 | |
| | PAC, PC2 | Programmable relay output 2 | |

### 3.3.3 Wiring of Drive

The basic wiring of drive's input/output terminals and external equipment are illustrated in Figure 3-5.

The control terminals in the Figure below are used for setting frequency, operation control and outputting the drive's status to external monitoring devices. Its wiring method depends on your application.

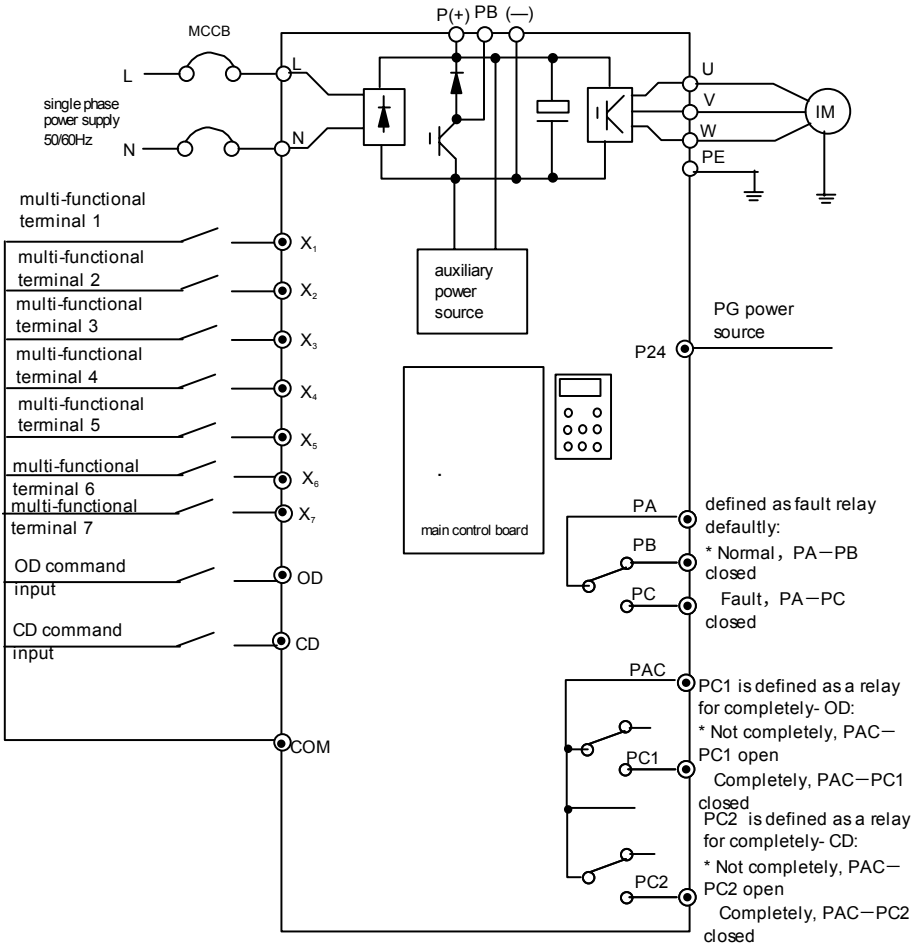



*Figure 3-5 Basic Wiring*

TD3200 can be fed two kinds of PG signal, and provide only 24V power supply to PG.

1. The wiring of the open-collector PG with 24V power supply is shown in Figure 3-6.

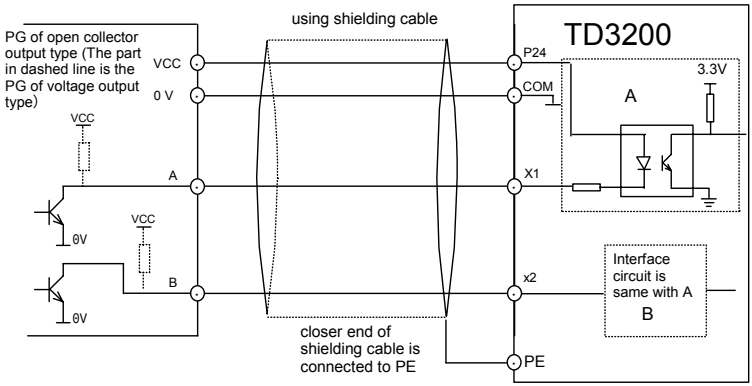



*Figure 3-6 Wiring of PG of open collector output type*

2. Wiring with 24V power supply (push-pull output type)

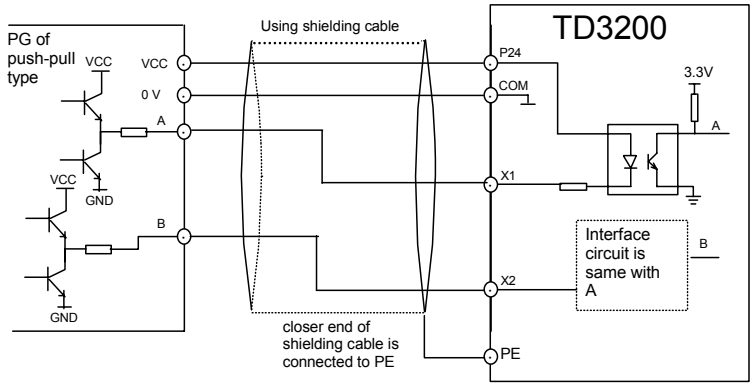



*Figure 3-7 Wiring of PG of push-pull output type*

If the signal is single-phase PG signal, then it must be input via terminal X1.

## 3.3.4 Wiring Requirements

1. MCCB used for overcurrent protection must be installed between AC power and the drive, and it must be fixed inside the cabinet;

2. The cable diameter and MCCB capacity should be selected according to the table below:

| Models | MCCB (A) | Mains ($mm^2$) | | | | Control cables ($mm^2$) |
|---|---|---|---|---|---|---|
| | | Input cables | Braking cables | Output cables | Earthing cables | |
| TD3200-2S0002D | 20 | 1.5 | 1.0 | 1.0 | 2.5 | 0.5 |
| TD3200-2S0004D | 20 | 1.5 | 1.0 | 1.0 | 2.5 | 0.5 |

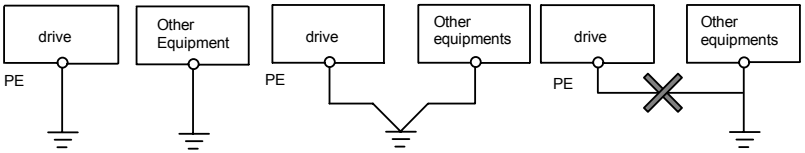
**Note**

1) The "0.5 $mm^2$" in the above table is the sectional area of a single strand of a multi-core control cables. If single-core cable is used as control cable and routed outside the cabinet, whose diameter should be no less than 1.0 $mm^2$.

2) Before wiring, the power switch must be in "OFF" position, and drive's charging indicator must be off (the charging indicator can be seen from the hole at the top left corner if the cover is removed);

3) It is forbidden to connect the AC source cables with U, V, W, P (+), PB, (-) and PE terminals;

4) Flat cable should be used as earthing cable, and the earthing resistance should be less than 10Ω. The most favorable method is that the drive should have its own earthing pole, the less favorable method is to use a common earthing pole, but don't share one earthing cable. The earthing cable should be as short as possible, that is, the earthing point should be as close to the drive as possible. Earthing cables should be as far away from the I/O cables of the equipment that is sensitive to noise, and also should be as short as possible.




Earthing via a special pole (best) Earthing to a common pole (OK) Share earthing cable (forbidden)

3. It is recommended to install a line filter at the drive's power input cables

The filter can reduce the interference caused by the drive on other equipment connected to the same mains.

The filter's enclosure must be well earthed.

The filter inside the cabinet should be placed closed to the input AC power supply and its power input cables inside the cabinet should be as short as possible. The distance between input and output cables of the filter should be as far as possible, otherwise the high frequency noise may be coupled between the cables and thus bypass the filter.

4. Motor cables should be as short as possible so as to reduce the leakage current to earth.

5. Selection of control cables

Generally, the control cables should be shielded and the shield must be connected to the metal enclosure of the drive by cable clamps at both ends.

6. Control cables, input power cables and motor cables should be installed separately

Adequate clearance should be left between the cables, especially when the cables are laid in parallel and long. If the signal cables have to cross over the power cables, keep them vertical to each other, as shown in Figure 3-8.

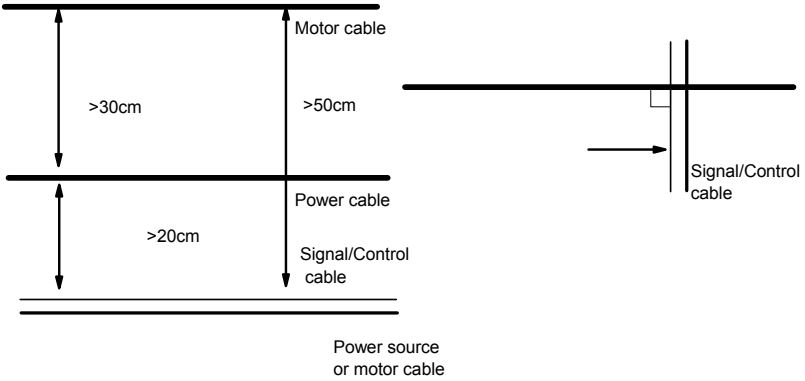



*Figure 3-8 Wiring requirements*

7. Installation requirements of relay, contactor and electro-magnetic braking kit, which may generate great noises, should be installed outside of the drive cabinet and installed with surge suppressors.

The suppressors are generally varistor, RC filter or diode as illustrated in Figure 3-9:

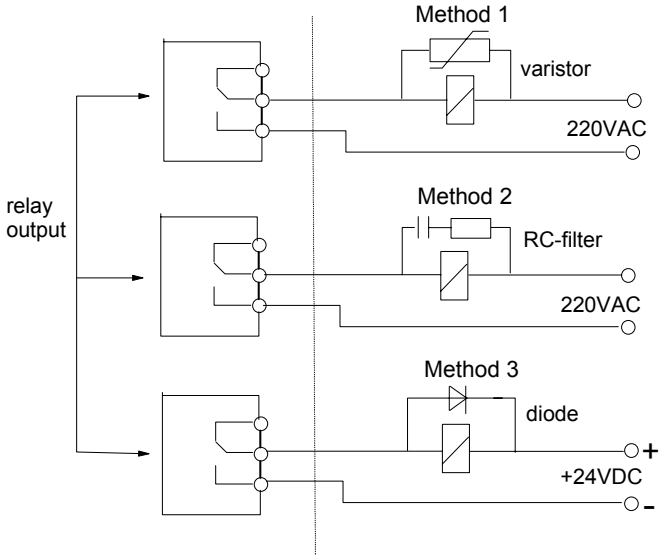



*Figure 3-9 Relay, Contactor and Brake Device*

## 3.4 Installation of Options

### 3.4.1 Installation of Operation Keypad

1. Installation

Install the keypad on the drive: Open the plastic cover of TD3200, hold the operational keypad and keep the face of the keypad upward, align the connector of the keypad and insert the keypad directly.

Install the keypad separated from the drive: use the cables you have ordered as option (see Chapter 2) to connect the keypad to the drive. Install the keypad on the keypad holder, which is fixed on the required place. Its dimensions are given as follows:

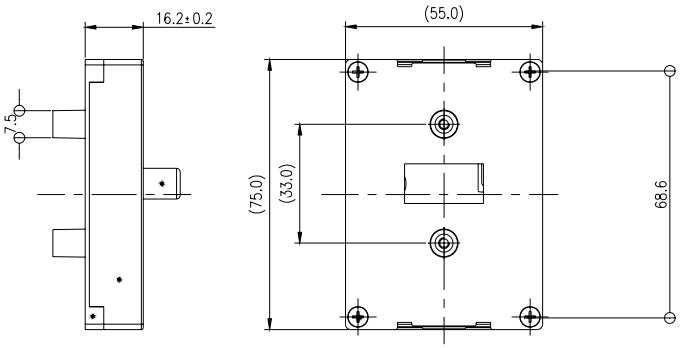



*Figure 3-10 Dimensions of Operation Keypad*

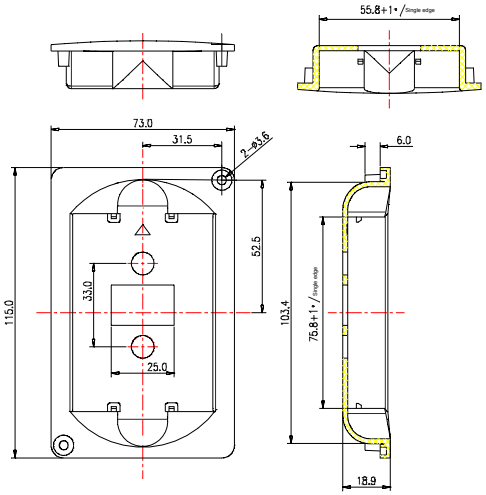



*Figure 3-11 Installation dimensions of operation keypad*

2. Notes in Installation

1) Do not connect the keypad cables alive.

2) The screws for fixing the cables is M3×6; its length must be shorter than 6mm to avoid short-circuit.

## 3.4.2 Installation of Status Display Unit

Status display unit is installed on the drive regardless of dimensions. The installation is the same with that of the keypad.

### 3.4.3 Installation of Braking Resistors

Connect braking resistor between "P (+)" and "PB" with cables of proper diameters, as shown in Figure 3-12.

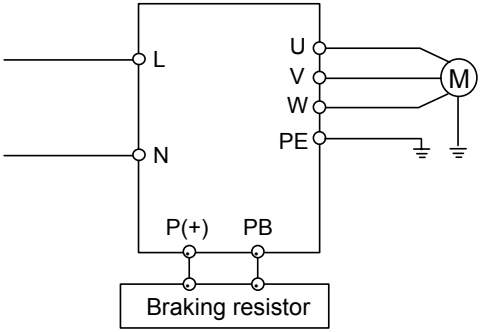



*Figure 3-12 Connection between braking resistor and drive*

# Chapter 4 Operation

## 4.1 Operation

### 4.1.1 Operation Keypad and Status Display Units

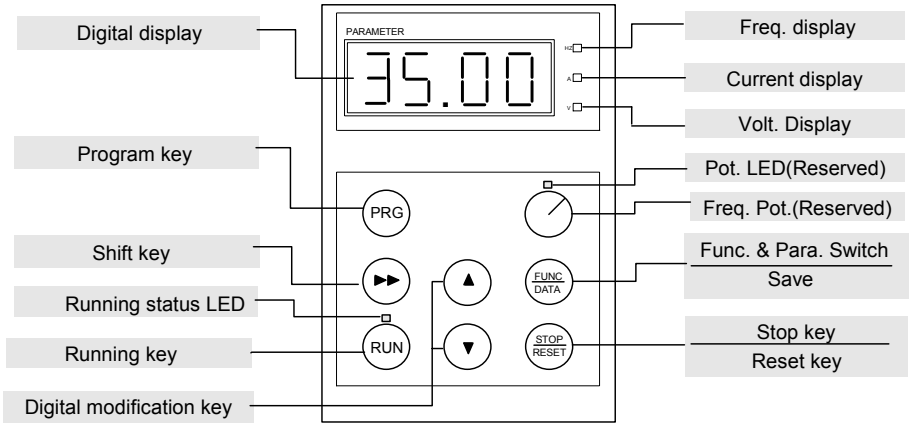



*Figure 4-1 Operation keypad*

*Operation Keypad Key Functions*

| Key | Name | Function |
|---|---|---|
| PRG | Programming | Switches between stopping status/operating status and programming state. |
| FUNC/DATA | Function /Data | Select data monitor mode and data input confirmation |
| ▲ | Up | Increase |
| ▼ | Down | Decrease |
| ▶▶ | Shift | In the status of RUN and STOP, press this key to select the parameters that you want to display on the screen; when setting data, press this key to select the digit you want to modify, or to switch to next function group. |

| Key | Name | Function |
|---|---|---|
| RUN | Run | In the keypad control mode, press this key to start. |
| STOP/RESET | Stop/Reset | In the keypad control mode, press this key to stop operating, or to reset and exit fault alarming status. |
| / | Frequency potentiometer | Reserved |

**Note**

In the manual tuning mode of elevator-door control, press RUN key and ▲ key at the same time to open the door, and press RUN key and ⬇ key at the same time to close the door.

Under general-purpose drive keypad mode, press RUN key and ▲ key at the same time to run forward, and RUN key and ▼ key at the same time to run reversely.

*LED Indicator's Implication*

| Description | LED color | Symbols |
|---|---|---|
| Frequency unit | Green | Hz |
| Current unit | Green | A |
| Voltage unit | Green | V |
| Operating status | Green | RUN |
| Potentiometer indicator (reserved) | Green | |

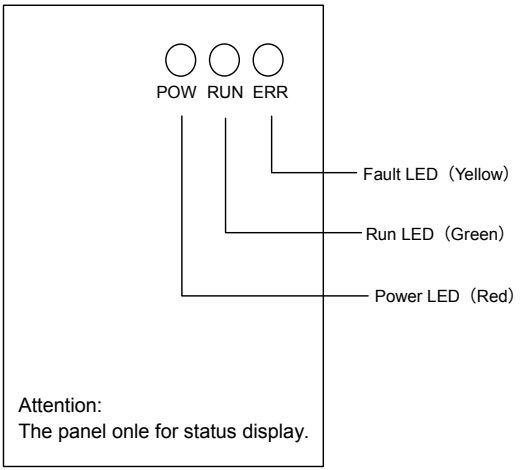



*Figure 4-2 Status display units*

**Note**

You cannot do any operation on the status display unit.

### 4.1.2 Drive's Operating Status Descriptions

A drive has 4 operating status.

Stopping status-The drive is switched on but without any operation.

Programming state-Use operation keypad to modify and set function parameters

Operating status-The drive's U, V, W terminals have electricity outputs

Fault alarming status-When fault occurs either from external equipment, internal or wrong operation, the drive's LED will display the fault code and lock output

### 4.1.3 Operating Mode Descriptions

The drive has 4 operating modes: Speed control 1, Speed control 2 (multi-speed control application), Distance control 1, Distance control 2.

### 4.1.4 Parameter Classification

There are 124 parameters totally, which are divided into 12 groups according to their functions:

1. F000-F008: for basic operation function parameters' setting
2. F010-F024: for OD curve parameters
3. F027-F042: for CD curve parameters
4. F044-F054: for distance control parameters
5. F055-F062: for MS control
6. F063-F066: only for demo of operation
7. F068-F081: for motor's parameters
8. F082~F084: auxiliary parameter
9. F088~F095: vector control parameter
10. F097~F106: digital I/O parameter

11. F110~F121: display and monitoring

12. F124: for factory use, not open to users.

📖 **Note**

Function parameters in group 2~4, 7 and 9~11 are set by the manufacturer as NOT DISPLAY (parameters packed). If you want to display some of the above parameters, please set F009 (group 2), F026 (group 3), F043 (group 4), F067 (group 7), F087 (group 9), F096 (group 10) or F109 (group 11) to "1". Please refer to Chapter 5 and Chapter 6 for details.

### 4.1.5 Parameter Setting Method

Parameters can be set via the keypad only.

Look at the example below: modifying F005 (low-speed operating speed) from 3Hz to 4Hz.

1. Press PRG key - to enter programming state

The LED on the keypad will display current parameter code (e.g. F000)

2. Press ▲, ▼ key or SHIFT key - to search the parameter to be modified (F005)

📖 **Note**

If there is no continuous display of parameters, please unpack the parameter group.

3. Press FUNC/DATA key - to see the settings.

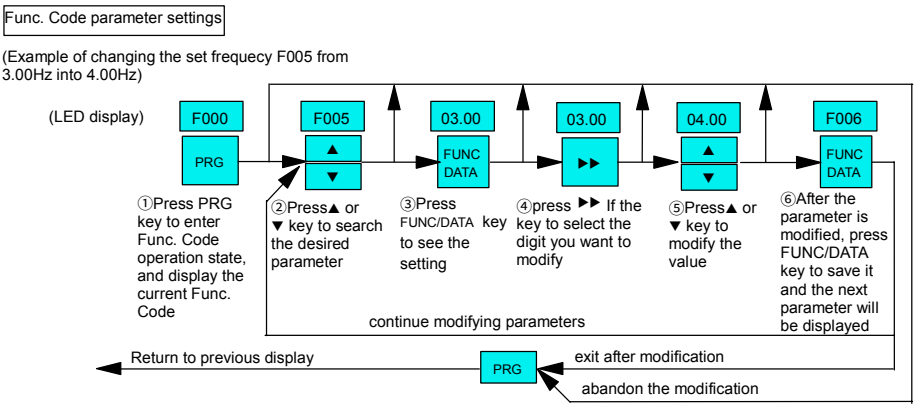
4. Press ▶▶ key to shift to the bit to be modified

5. Press ▲ or ▼ key - to change the setting

6, Press FUNC/DATA key - to save and auto-display next parameter (F006)

7, Press PRG key - to exit programming state

The application chart is as follows:




**Note**

When unable to modify the parameter, please refer to the following solutions:

1) The settings of some parameters are interrelated, you should set them by certain sequence. For example, F016~F017 first and then F097~F103.

2) Some parameters cannot be modified because they are fixed or actually detected, e.g. F112, F113

### 4.1.6 Display of Parameters

1. Define the displayed parameters during operation or at stopping state through F110~F111.

2. During operation, the defined parameters can be displayed one by one by pressing ▶▶ key on the keypad. Accordingly, certain unit indicator will turn on.

3. In stopping status, the parameter defined by F111 can be displayed one by one by pressing ▶▶ key on the keypad.

## 4.2 Basic Applications

### 4.2.1 Motor Parameter Tuning

TD3200 series drives are vector control drives. It is necessary to tune motor parameters before operating. Tuning can be started via operation keypad.

Before tuning, motor must be free of load; otherwise, the results will be inaccurate.

1. Press PRG key to enter programming state.

2. Set main parameters (Other parameters can use the defaults)

F069 ~ F073: Correctly input motor nameplate parameters (Please refer to Chapter 5, 6 for detailed explanation of parameters)

F075=1: Tuning allowed

3. Press PRG key to return

4. Press RUN key to start motor parameter tuning and the LED displays "TUNE". In the tuning state, the motor runs on a fixed mode, so you need not interfere. After the tuning is over, the drive stops automatically, F075 will resume to "0" and the settings of F076~F081 will be updated. If the tuning is obviously abnormal, press STOP key to stop it. Check the connections and motor ratings, then set F075=1 again. Press RUN key to start tuning.

5. A successful tuning can ensure correct control of the motor.

**Note**

If you have known the motor's parameters, you can input them into F076~F081 directly, no need to start the tuning.

### 4.2.2 Basic Operating Modes

1. Operating frequency settings, tuning and operating control can be done via operation keypad.

1) Press PRG key to enter programming state

2) Set main parameters (other parameters can use the defaults)

F055=5.00, MS frequency 0

F001=0, speed control 1 (sensorless vector control)

F002=0, in general keypad control mode

3) Press PRG key to return

4) Press RUN key and ▲ key together for FWD running. Press RUN key and ▼ key together for REV running

5) When modify operating frequency (here means MS frequency 0) in operating status, press PRG key to enter programming state; press ▲ key or SHIFT key to shift to F055; press FUNC/DATA key to enter the settings of parameter; press ▶▶ key to move to the digit you want to modify; press ▲ or ▼ key to set the desired value; Then press FUNC/DATA key to save and auto-display F056

6) In FWD running status, press RUN key and ▼ key together, the drive will run reversely; In REV running status, press RUN key and ▲ key together, the drive will run forward.

7) Press STOP key, the drive will stop (decelerate to stop)

8) Power-off

2. Frequencies can be set and modified via the keypad and operating control through control terminals

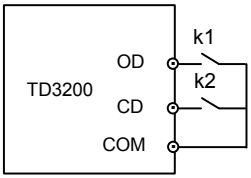



*Figure 4-3 Wiring*

Connect power cables according to Figure 4-3, and switch on after confirming the connection.

1) Press PRG key to enter programming state

2) Set main parameters (other Func.Codes can use the manufacturer's settings)

F055=5.00, MS frequency 0

F001=0, speed control 1 (sensorless vector control)

F002=4, in general terminal control mode, the operating command is given via the control terminal. OD controls FWD running and CD controls REV running

3) Press PRG to return to stopping status

4) Switch on K1, the drive runs forward

5) During operation, the operating frequency can be modified. See part one of this section.

6) Switch off K1 and switch on K2, the drive runs REV

7) Switch off K1, K2, the drive stops (Decelerate to stop)

8) Power-off

3. Multi-speed operating can be controlled via control terminals

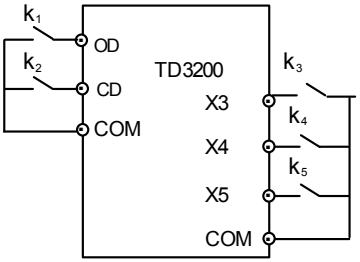



*Figure 4-4 Connection of multi-speed operation*

Connect power cables according to Figure 4-4, and switch on after confirming the connection.

1) Press PRG key to enter programming state

2) Set main parameters (other parameters can use the defaults)

F001=1, speed control 2 (sensorless vector control)

F002=4, in general terminal control mode, the operating command is given via the control terminal. OD controls FWD running and CD controls REV running.

F099=16, MS (multi-speed) terminal 1

F100=17, MS (multi-speed) terminal 2

F101=18, MS (multi-speed) terminal 3

3) Press PRG key to return to stopping status

4) Switch on K1 (K2), the drive runs FWD (REV)

5) Corresponding MS frequency can be selected according to the following table via the combinations of switch ON/OFF of K3, K4, K5.

| K5 | K4 | K3 | Operating frequency | Corresponding function parameters |
|---|---|---|---|---|
| OFF | OFF | OFF | MS frequency 0 | F055 |
| OFF | OFF | ON | MS frequency 1 | F056 |
| OFF | ON | OFF | MS frequency 2 | F057 |
| OFF | ON | ON | MS frequency 3 | F058 |
| ON | OFF | OFF | MS frequency 4 | F059 |
| ON | OFF | ON | MS frequency 5 | F060 |
| ON | ON | OFF | MS frequency 6 | F061 |
| ON | ON | ON | MS frequency 7 | F062 |

# Chapter 5 Parameters Table

In the "Mod." column of the tables,

"O" means that the parameter can be modified during operation

"×" means that the parameter can not be modified during operation

"*" means the actual measured or fixed parameters can not be modified

"—" means that it is set by the manufacturer and can not be modified by the user

Abbreviation in the table:

OD: opening door

CD: closing door

MS: multi-speed

## 5.1 Basic Operation Function Parameters

| Para. | Name | Range | Min.unit | Default | Mod. |
|---|---|---|---|---|---|
| F000 | User password | 0~9999 (0000 means no password) | 1 | 0 | ○ |
| F001 | Control mode | 0: Speed control 1<br>1: Speed control 2<br>2: Distance control 1<br>3: Distance control 2 | 1 | 0 | × |
| F002 | Control commands' selection | 0: Keypad control mode of universal drive<br>1: Terminal control mode of the drive used for controlling elevator door<br>2: Manual testing mode<br>3: Auto-demo mode<br>4: Terminal control mode of universal drive | 1 | 0 | × |
| F003 | Max.output frequency | 50.00Hz~400.0Hz | 0.01Hz | 50.00Hz | × |

| Para. | Name | Range | Min.unit | Default | Mod. |
|---|---|---|---|---|---|
| F004 | Operating direction selection | 0: Conformed to the pre-set direction<br>1: Reversed to the pre-set direction | 1 | 0 | × |
| F005 | Low-speed operation setting | 0.00~50.00Hz | 0.01Hz | 3.00Hz | × |
| F006 | Limit of CD or OD time | 0.1~3600s | 0.1s | 300.0s | × |
| F007 | Delay time for OD terminal command | 0~3600.0s | 0.1s | 0.0s | × |
| F008 | Delay time for CD terminal command | 0~3600.0s | 0.1s | 0.0s | × |

## 5.2 OD/CD Operating Parameters

| Para. | Name | Range | Min.unit | Default | Mod. |
|---|---|---|---|---|---|
| F009 | Display selection for F009~F025 | 0: Not display<br>1: Display | 1 | 0 | ○ |
| F010 | OD start torque | 0.0%~150%(motor rated torque) | 0.1% | 50.0% | × |
| F011 | OD startup Acc time | 0.1~3600s | 0.1s | 1.0s | ○ |
| F012 | Low speed setting in OD startup process | 0.00~50.00Hz | 0.01Hz | 10.0Hz | × |
| F013 | Low speed maintaining time at OD start | 0.1~3600s | 0.1s | 1.0s | ○ |
| F014 | OD reference frequency setting | 0~Max. frequency(Hz) | 0.01Hz | 35.00Hz | ○ |
| F015 | OD Acc time | 0.1~3600s | 0.1s | 2.0s | ○ |
| F016 | Initial time of "S" shape curve in OD Acc process | 10.0%~50.0%( Acc/Dec time)<br>F016+F017 ≤90% | 0.1% | 20.0% | × |
| F017 | Rising time of "S" shape curve in OD Acc process | 10.0%~80.0%( Acc/Dec time)<br>F016+F017 ≤90% | 0.1% | 60.0% | × |
| F018 | OD Dec time | 0.1~3600s | 0.1s | 2.0s | ○ |

| Para. | Name | Range | Min.unit | Default | Mod. |
|---|---|---|---|---|---|
| F019 | Initial time of "S" shape curve in OD Dec process | 10.0%~50.0%(Acc/ Dec time)<br>F019+F020 ≤90% | 0.1% | 20.0% | × |
| F020 | Dropping time of "S" shape curve in OD Dec process | 10.0%~80.0%(Acc/ Dec time)<br>F019+F020 ≤90% | 0.1% | 60.0% | × |
| F021 | Low speed setting in OD ending phase | 0.00~50.00Hz | 0.01Hz | 3.00Hz | × |
| F022 | Holding torque in complete OD status | 0.0%~150%(Motor rated torque) | 0.1% | 50.0% | × |
| F023 | Threshold setting for OD torque changing | 0.0%~150%(Motor rated torque) | 0.1% | 50.0% | × |
| F024 | Abnormal Dec time | 0.1~100s | 0.1s | 0.5s | ○ |
| F025 | Reserved | | | | |
| F026 | Display selection for F026~F042 | 0: No display of this function module<br>1: Display of this function module | 1 | 0 | ○ |
| F027 | Start torque for CD | 0.0%~150%(Motor rated torque) | 0.1% | 50.0% | × |
| F028 | CD startup Acc time | 0.1~3600s | 0.1s | 1.0s | ○ |
| F029 | Low speed setting in CD startup process | 0.00~50.00Hz | 0.01Hz | 8.00Hz | × |
| F030 | Low speed maintaining time at CD startup | 0.1~3600s | 0.1s | 1.0s | ○ |
| F031 | CD reference frequency setting | 0.00~Max. frequency(Hz) | 0.01Hz | 30.00Hz | ○ |
| F032 | CD Acc time | 0.1~3600s | 0.1s | 2.0s | ○ |
| F033 | Initial time of "S" curve in CD Acc process | 10.0%~50.0%(Acc/Dec time)<br>F033 +F034 ≤90% | 0.1% | 20.0% | × |
| F034 | Rising time of "S" curve in CD Acc process | 10.0%~80.0%(Acc/Dec time)<br>F033+F034 ≤90% | 0.1% | 60.0% | × |
| F035 | CD Dec time | 0.1~3600s | 0.1s | 2.0s | ○ |

| Para. | Name | Range | Min.unit | Default | Mod. |
|---|---|---|---|---|---|
| F036 | Initial time of "S" curve in CD Dec process | 10.0%~50.0%(Acc/Dec time)<br>F036+F037 ≤90% | 0.1% | 20.0% | × |
| F037 | Falling time of "S" curve in CD Dec process | 10.0%~80.0%(Acc/Dec time)<br>F036+F037 ≤90% | 0.1% | 60.0% | × |
| F038 | Low speed setting in CD ending phase | 0.00~50.00Hz | 0.01Hz | 2.00Hz | × |
| F039 | Holding torque in complete CD status | 0.0%~150%(Motor rated torque) | 0.1% | 50.0% | × |
| F040 | Hindering torque setting for CD high speed phase | 0.0%~150%(Motor rated torque) | 0.1% | 100.0% | × |
| F041 | Threshold setting for CD torque changing | 0.0%~150%(Motor rated torque) | 0.1% | 50.0% | × |
| F042 | Hindering torque setting for CD low speed end phase | 0.0%~150%(Motor rated torque) | 0.1% | 100.0% | × |

## 5.3 Distance Control Parameters

| Para. | Name | Setting Range | Min.unit | Default | Mod. |
|---|---|---|---|---|---|
| F043 | Display selection for F043~F066 | 0: Not display<br>1: Display | 1 | 0 | ○ |
| F044 | Number of pulse per revolution | 1~9999 | 1 | 128 | × |
| F045 | Number of phases of PG | 0: double phase<br>1: single phase | 1 | 0 | × |
| F046 | Direction of PG | 0: FWD<br>1: REV | 1 | 0 | × |
| F047 | Speed in door-width auto-learning | 0~50.00Hz | 0.01Hz | 5.00Hz | × |

| Para. | Name | Setting Range | Min.unit | Default | Mod. |
|---|---|---|---|---|---|
| F048 | Door-width auto-learning setting | 0, 1. From 0 → 1 to start door-width auto-learning, then auto turn to 0 after finishing. Auto-learning is effective in motor manual tuning mode | 1 | 0 | × |
| F049 | OD speed changing position under Distance control | 60.0%~90.0%(door-width ) | 0.1% | 70.0% | × |
| F050 | CD speed changing position under Distance control | 60.0%~90.0%(door-width) | 0.1% | 70.0% | × |
| F051 | Pulse setting for completely OD under Distance control | 80.0%~99.0%(door-width) | 0.1% | 95.0% | × |
| F052 | Pulse setting for completely CD under Distance control | 80.0%~99.0%(door-width) | 0.1% | 95.0% | × |
| F053 | Lower four digits of door-width pulse | 0~9999 | 1 | 0 | × |
| F054 | Higher four digits of door-width pulse | 0~9999(*10000) | 1 | 0 | × |

## 5.4 MS Speed Parameters

| Para. | Name | Range | Min.unit | Default | Mod. |
|---|---|---|---|---|---|
| F055 | MS frequency 0 | 0.00Hz~Max. frequency(Hz) | 0.01Hz | 50.00 | ○ |
| F056 | MS frequency 1 | 0.00Hz~Max. frequency(Hz) | 0.01Hz | 5.00 | ○ |
| F057 | MS frequency 2 | 0.00Hz~Max. frequency(Hz) | 0.01Hz | 10.00 | ○ |
| F058 | MS frequency 3 | 0.00Hz~Max. frequency(Hz) | 0.01Hz | 15.00 | ○ |
| F059 | MS frequency 4 | 0.00Hz~Max. frequency(Hz) | 0.01Hz | 20.00 | ○ |
| F060 | MS frequency 5 | 0.00Hz~Max. frequency(Hz) | 0.01Hz | 30.00 | ○ |
| F061 | MS frequency 6 | 0.00Hz~Max. frequency(Hz) | 0.01Hz | 40.00 | ○ |
| F062 | MS frequency 7 | 0.00Hz~Max. frequency(Hz) | 0.01Hz | 50.00 | ○ |

## 5.5 Demo Parameters

| Para. | Name | Range | Min.unit | Default | Mod. |
|---|---|---|---|---|---|
| F063 | Holding time for completely OD in demo mode | 1~3600s | 0.1s | 2.0s | ○ |
| F064 | Holding time for completely CD in demo mode | 1~3600s | 0.1s | 2.0s | ○ |
| F065 | CD/OD times in demo mode | 0~9999 | 1 | 0 | × |
| F066 | Preset CD/OD times in demo mode | 0~9999 | 1 | 0 | × |

## 5.6 Motor's Parameters

| Para. | Name | Range | Min.unit | Default | Mod. |
|---|---|---|---|---|---|
| F067 | Display selection F067 ~F086 | 0: Not display<br>1: Display | 1 | 0 | ○ |
| F068 | Motor type selection | 0: Asynchronous motor<br>(1, 2: Reserved) | 1 | 0 | × |
| F069 | Motor rated power | 0~750W | 1W | 370W | × |
| F070 | Motor rated voltage | 0~380V | 1V | 220V | × |
| F071 | Motor rated current | 0.10A~9.90A | 0.01A | 1.94 | × |
| F072 | Motor rated frequency | 1.00Hz~400.0Hz | 0.01Hz | 50.00Hz | × |
| F073 | Motor rated speed | 1~9999rpm | 1rpm | 1400rpm | × |
| F074 | Reserved | | | | |
| F075 | Auto-tuning for getting motor's parameters | 0: tuning disabled<br>1: tuning enabled<br>F075 will turn to "0" automatically after tuning finished. effective in keypad control mode | 1 | 0 | × |
| F076 | Stator resistance | 00.00~99.99Ω | 0.01Ω | 7.73 Ω | × |
| F077 | Stator inductance | 0~9999mH | 1mH | 357mH | × |
| F078 | Rotator resistance | 00.00~99.99Ω | 0.01Ω | 5.23 Ω | × |

| Para. | Name | Range | Min.unit | Default | Mod. |
|---|---|---|---|---|---|
| F079 | Rotator inductance | 0~9999mH | 1mH | 357mH | × |
| F080 | Mutual inductance | 0~9999mH | 1mH | 325mH | × |
| F081 | Magnetising current without load | 0.00~99.99A | 0.01A | 1.08A | × |

## 5.7 Auxiliary Parameters

| Para. | Name | Range | Min.unit | Default | Mod. |
|---|---|---|---|---|---|
| F082 | Carrier frequency | 2.0kHz~16.0kHz | 0.1kHz | 8.0kHz | × |
| F083 | Auto reset times upon fault | 0~100, 0 means without auto reset function (reset interval time :2s) | 1 | 0 | × |
| F084 | Utility rate of braking | 0: Without dynamic braking 1: 2.0%<br>2: 5.0%<br>3: 10.0%<br>4: 20.0%<br>5: 50.0%<br>6: 80.0%<br>7: 100.0% | 1 | 7 | ○ |
| F085 | Reserved | | | | |
| F086 | Reserved | | | | |

## 5.8 Vector Control Parameters

| Para. | Name | Range | Min.unit | Default | Mod. |
|---|---|---|---|---|---|
| F087 | Display selection F087 ~F095 | 0: Not display<br>1: Display | 1 | 0 | ○ |
| F088 | ASR proportional gain 1 | 0.000~6.000 | 0.001 | 1.000 | × |
| F089 | ASR integral time 1 | 0 (no action), 0.032~32.00s | 0.001s | 1.000s | × |
| F090 | ASR proportional gain 2 | 0.000~6.000 | 0.001 | 1.200 | × |

| Para. | Name | Range | Min.unit | Default | Mod. |
|---|---|---|---|---|---|
| F091 | ASR integral time 2 | 0(no action),<br>0.032~32.00s | 0.001s | 0.400s | × |
| F092 | ASR switching frequency | 0.00~400.0Hz | 0.01Hz | 5.00Hz | × |
| F093 | Slip compensation gain | 0 (reserved function),<br>50.0%~250.0%(for accounting the slip value) | 0.1% | 100.0% | × |
| F094 | Motoring torque limiting | 0.0~200.0%(rated current) | 0.1% | 100.0% | × |
| F095 | Braking torque limiting | 0.0~200.0%( rated current) | 0.1% | 100.0% | × |

## 5.9 Digital I/O Function Parameters

| Para. | Name | Range | Min. unit | Default | Mod. |
|---|---|---|---|---|---|
| F096 | Display selection F096~ F108 | 0: Not display<br>1: Display | 1 | 0 | ○ |
| F097 | Function of X1 | 0: No function (can be selected again)<br>1: External reset(RESET)input<br>2: Normally open input for optic signal<br>3: Normally closed input for optic signal<br>4: Normally open input for touching board<br>5: Normally closed input for touching board<br>6: OD position control signal normally open input<br>7: OD position control signal normally closed input<br>8: CD position control signal normally open input<br>9: CD position control signal normally closed input<br>10: PG A-phase signal input(X1,X2)<br>11: PG B-phase signal input(X1,X2)<br>12: OD speed-shift contact normally open | 1 | 0 | × |
| F098 | Function of X2 | | | | |
| F099 | Function of X3 | | | | |
| F100 | Function of X4 | | | | |

| Para. | Name | Range | Min. unit | Default | Mod. |
|---|---|---|---|---|---|
| F101 | Function of X5 | input<br>13: OD speed-shift contact normally closed input<br>14: CD speed-shift contact normally open input<br>15: CD speed-shift contact normally closed input<br>16: MS terminal 1<br>17: MS terminal 2<br>18: MS speed terminal 3<br>19: OD prohibiting terminal input<br>20: Torque maitaining prohibiting terminal input<br>21: Low speed OD/CD enabling input<br>22: Locking signal permanent ON input<br>23: Locking signal permenant OFF input<br>24: Operation enabling signal input (valid only for X7) | 1 | 0 | × |
| F102 | Function of X6 | | | | |
| F103 | Function of X7 | | | | |
| F104 | Function of programmable relay output PA/PB/PC | 0: Output signal 0 for completely OD<br>1: Output signal 0 for completely CD<br>2: Output signal 1 for completely OD<br>3: Output signal 1 for completely CD<br>4: Fault relay output 1(POFF state excluded)<br>5: Fault relay output 2(POFF state included)<br>6: Output signal 2 for completely OD<br>17: Output signal 2 for completely CD<br>8: Locking signal output<br>9: Door re-opening signal output | 1 | 4 | × |
| F105 | Function of programmable relay output PAC/PC1 | | | 0 | × |
| F106 | Function of programmable relay output PAC/PC2 | | | 1 | × |
| F107 | Definition of relay PC1 and PC2 contacts | 0~3 | 0 | 1 | × |
| F108 | OD priority function setting | 0~1 | 1 | 0 | × |

## 5.10 Display and Monitoring Parameters

| Para. | Name | Range | Min. unit | Default | Mod. |
|---|---|---|---|---|---|
| F109 | Display selection F109 ~F122 | 0: Not display<br>1: Display | 1 | 0 | ○ |
| F110 | Parameters displayed by LED during operation | Setting of the bit:<br>0: not display<br>1: display<br><br>BIT0: operating frequency (Hz)<br>BIT1: reference frequency (Hz)<br>BIT2: output voltage (V-RMS)<br>BIT3: output current (A-RMS)<br>BIT4: output torque (%)<br>BIT5: DC bus voltage (V-AVE)<br>BIT6: status of idgital input terminal(no unit)<br>BIT7: status of idgital output terminal(no unit)<br>BIT8: low bit of pulse number of door location(0~9999)<br>BIT9: high bit of pulse number of door location(0~9999)<br>Note: all the values F110 chooses to monitor can be displayed by pressing ▶▶ key during operating, | 1 | 31(00011111B) | ○ |

| Para. | Name | Range | Min. unit | Default | Mod. |
|---|---|---|---|---|---|
| F111 | Parameters displayed by LED in stopping status | 0: Preset OD frequency (Hz)<br>1: Preset CD frequency (Hz)<br>2: Status of digital input terminal(no unit)<br>3: Status of digital output terminal(no unit)<br>4: DC bus voltage (V-AVE)<br>5: MS frequency 0(Hz)<br>6: Low bit of pulse of door location(0~9999)<br>7: High bit of pulse of door location(0~9999) | 1 | 0 | ○ |
| F112 | Type of 1st fault | 0: No abnormal record(clear abnormal record)<br>1: Acc over current (E001)<br>2: Dec over current (E002)<br>3: Constant speed over current (E003)<br>4: Acc over voltage (E004)<br>5: Dec over voltage (E005)<br>6: Constant speed over voltage (E006)<br>7~8: Reserved<br>9: Output side phase loss(E009)<br>10: Reserved<br>11: Heatsink overheat(E011)<br>12,14,15: Reserved<br>13: Drive overload | 1 | 0 | × |
| F113 | Type of 2nd fault | | | | |

| Para. | Name | Range | Min. unit | Default | Mod. |
|---|---|---|---|---|---|
| F114 | Type of 3rd fault | 16: EEPROM R/W fault(E016)<br>17~18: Reserved<br>19: Current detection circuit fault(E019)<br>20: CPU fault<br>21~23: Reserved<br>24: Tuning fault(E024)<br>25~27: Reserved<br>28: Parameters setting fault(E028)<br>29: Door-width auto-learning fault(E029)<br>30: OD/CD operation fault(E030) | 1 | 0 | × |
| F115 | DC bus voltage (V) at the latest fault | 0~999V | 1V | 0V | × |
| F116 | Output current (A) at the latest fault | 0.00~99.99A | 0.01A | 0.00A | × |
| F117 | Output frequency at the latest fault | 0.00Hz~400.0Hz | 0.01Hz | 0.00Hz | × |
| F118 | Status of input terminal at the latest fault | 0~1023 (0: OFF; 1: ON)<br>CD/OD/X7/X6/X5/X4/X3/X2/X1 | 1 | 0 | × |
| F119 | Status of output terminal at the latest fault | 0~15 (0: OFF; 1: ON)<br>PR0/PR1/PR2 | 1 | 0 | × |
| F120 | Total operation time | 0~65535 hour | 1 | 0 | × |
| F121 | Temperature codes used in factory testing | 0~9999 | 1 | 0 | × |
| F122 | Sofware version No. | 32.XX | - | - | - |

| Para. | Name | Range | Min. unit | Default | Mod. |
|---|---|---|---|---|---|
| F123 | Parameter initialization | 0: no operation<br>1: Clear memory information<br>2: Resume factory setting | 1 | 0 | × |
| F124 | Factory password | **** | — | — | — |

# Chapter 6 Parameter Descriptions

**Note**

Reference frequency: Target frequency at which the drive operates stably.

Operating frequency: The drive's actual output frequency during operation.

The parameters in " 【】 " are defaults.

| | |
|---|---|
| ⚠Danger | Only qualified personnel is allowed to test this product, otherwise, accidents might occur;<br>Make sure that the mechanical system and electrical connections of elevator door are correct, accidents might occur;<br>All the parameters must be set properly according to relevant industrial standards, otherwise, accidents might occur;<br>Don't walk to the area where the door is under testing, otherwise, personal injuries might occur. |

## 6.1 Basic Operation Parameters

| F000 User Password | Range: 0~9999 【0】 |
|---|---|

Set up any non- zero number as user's password to enable the password protection function.

0000: no password, the access of parameter is not protected.

**Attention**

Once user's password is set, you can only read the parameters but not set or modify them if you don't input the correct password.

| F001 Control mode | Range: 0~3 【0】 |
|---|---|

0: Speed control 1

The drive operates in sensorless vector control mode. When the drive is used to control an elevator door, the speed can be changed by connecting different speed contacts, and the complete CD or OD can is controlled by a limit switch.

1: Speed control 2

The drive operates in sensorless vector control mode. The reference frequency can be determined by the logic combinations of multi-speed terminals. When the drive controls an elevator door, the complete CD or OD is controlled by a limit switch.

2: Distance control 1

The drive operates in vector control mode with speed sensor. The PG parameters must be set correctly, otherwise the accuracy of control and door width cannot be ensured. When the drive controls an elevator door, the door width should be obtained by auto-learning, and the result will be saved. Besides, the distance control parameters (F049~F052) should be set correctly. During operation, the pulse count value will be compared with the preset value to achieve varied speed and complete CD or OD. In this mode, PG must be connected to the motor's shaft.

3: Distance control 2

The drive operates in vector control mode without speed sensor. When the drive operates as a drive controls elevator door, the PG parameters must be set correctly, otherwise the accuracy of door width cannot be ensured. The door width should be obtained via auto-learning, and the door width information should be saved after auto-learning. Besides, the distance control parameters (F049~F052) should be set correctly. During operation, the pulse count will be compared with the preset value varied speed and complete CD or OD.

In this mode, PG may not be connected to the motor's shaft.

| F002 | Control commands selection | Range: 0~4 【0】 |
|---|---|---|

0: Keypad control mode of general-purpose drive

The starting and stopping of the drive is controlled through the keypad of the drive (if the keypad is selected). The drive runs forward if RUN and ▲ are pressed at the same time, and reversely if RUN and ▼ are pressed at the same time, and stops if STOP is pressed. In this control mode, the drive operates as a general-purpose drive and will not follow the command for elevator door control. Besides, the motor parameters tuning is only active in keypad control mode.

1: Terminal control mode for controlling elevator door

The drive sends OD and CD commands via control system to realize door opening or closing. The operating logic is shown in Figure 6-1.

| $K_1$ | $K_2$ | operating command |
|---|---|---|
| 0 | 0 | stop |
| 1 | 0 | OD |
| 0 | 1 | CD |
| 1 | 1 | OD |

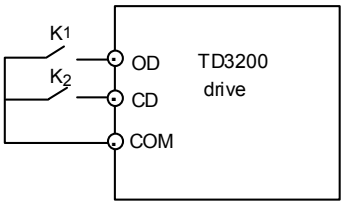



*Figure 6-1 Terminal control logic*

2: Manual testing mode

In this mode, you can test the door operation and set the CD and OD control signal as well as all the relevant parameters of CD and OD operation curves. Press RUN and ▲ together to open door, press RUN and ▼ together to close door, and press STOP to stop the drive.

**Attention**

Door width auto-learning is only valid in manual testing mode. Pressing RUN can start the auto-learning.

3: Auto-demo mode

Auto-demo mode is used for demonstrating the operation or commissioning of the drive in the factory, no need to be controlled by the control system. The auto-demo mode can be set after the drive's operation curve is set in manual testing mode. Press RUN to start the demonstration of OD and CD repetitively, and the interval between CD and OD can be set by F063 and F064. Pressing STOP to stop the demo.

4: Terminal control mode of general-purpose drive

The starting and stopping of the motor can be controlled via OD and CD terminals. The operation logic is shown in Figure 6-2. In this control mode, the drive will not perform the functions of elevator door control.

| K1 | K2 | operation command |
|---|---|---|
| 0 | 0 | stop |
| 1 | 0 | run forward |
| 0 | 1 | run reverse |
| 1 | 1 | run forward |

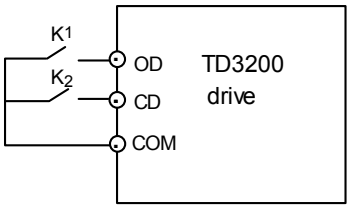



*Figure 6-2 Terminal control mode of general-purpose drive*

| F003 | Max. output frequency | Range: 50.00~400.00Hz 【50.00】 |
|---|---|---|

Max. output frequency is the highest frequency output from the drive, see fmax in Figure 6-3;

Rated frequency (also called base frequency) is the minimum output frequency at the rated voltage, see fb in Figure 6-3. If the base frequency is set too low, motor overheat may occur or even be damaged when operating at it for a long time;

Generally, rated voltage is set at the motor's rated voltage.

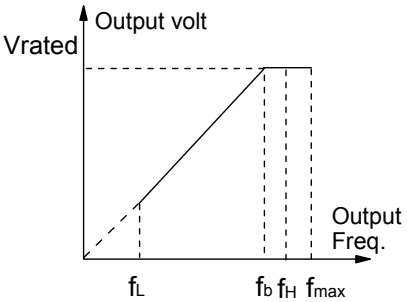



*Figure 6-3 Illustration of characteristic parameters*

| F004 | Running direction selection | Range: 0、1 【0】 |
|---|---|---|

Motor's running direction can be changed by setting F004. The motor's running direction is determined after the motor is wired correctly. You can change the setting of F004 to change the direction without rewiring the motor.

0: Same with preset direction

1: Reverse to preset direction

| F005 Low-speed operation setting | Range: 0.00~50.00Hz 【3.00】 |
|---|---|

F005 is to set the speed of low speed operation including the auto-testing at start-up, and the operation when the low speed running command is effective.

**Note**

Auto-testing at start-up: If the drive is set in elevator-door control mode, when it is powered on, it will conduct low-speed CD at first. If it is interrupted during closing the door, it will open it again, and close it after the door is opened completely. After that, the drive stops and the auto-testing is over.

| F006 CD or OD time limit | Range: 0.1~3600s 【300.0】 |
|---|---|

F006 is used to set the maximum time of CD and OD operation. You should set it properly according to the actual conditions. The settings must be bigger or equal to the sum of all the settings of CD or OD (parameter group of CD and OD curve), otherwise error may occur (E028). Setting F006 correctly can protect the system against abnormal operation of elevator door. The normal operation time will not exceed F006, but when the CD or OD position limit is invalid, which may cause the door cannot be opened or closed to the position, the operation time may exceed F006, CD or OD error (E030) will be activated.

**Note**

1) OD time: The duration from the drive receiving OD command until the door is opened completely.

2) CD time: The duration from the drive receiving CD command until the door is closed completely.

3) When the drive operates as a general-purpose drive, this parameter is invalid.

| F007 Delay time for OD terminal command | Range: 0~3600.0s 【0.0s】 |
|---|---|

F007 is to set the time interval from the OD command becoming invalid to the end of holding time of complete OD state. If the holding time is equal or greater than F007, the drive will stop. If the door is not opened to the position completely and OD command is cancelled at that time, the drive will stop immediately and the delay function is invalid.

If F007 is set to 3600s, the OD delay, once triggered, will be maintained endlessly. If F007 is set to 3599 or anything below, the OD delay will be maintained as per the actual setting of F007.

| F008 Delay time for CD terminal command | Range: 0~3600.0s 【0.0s】 |
|---|---|

F008 is to set the time interval from the CD command becoming invalid to the end of holding time of complete CD state. If the holding time is equal or greater than F008, the drive will stop. If the door is not closed to the position completely and CD command is cancelled at that time, the drive will stop immediately and the delay function is invalid.

If F008 is set to 3600s, the CD delay, once triggered, will be maintained endlessly. If F008 is set to 3599 or anything below, the CD delay will be maintained as per the actual setting of F008.

## 6.2 CD and OD Parameters

Let's take speed control 1 for example to explain the process of OD and CD.

The locations of various control contacts (operating switches) are shown in Figure 6-4.

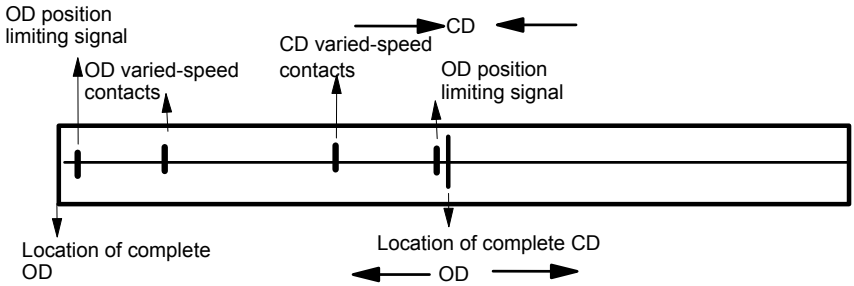



*Figure 6-4 Varied-speed contacts for speed control 1*

Set the function parameters from F010 to F040. Define the varied-speed contacts and position limiting signal accurately. Operating curve is illustrated in Figure 6-5 and Figure 6-6.

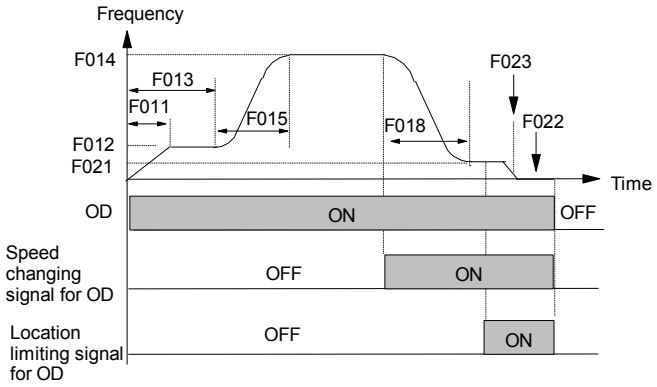



*Figure 6-5 Illustrations of OD operating curve for speed control 1*

Notes for OD process of speed control 1:

① When the OD command is active, the elevator door starts with start torque for OD (F010), and accelerates to Low speed in OD startup process (F012) according to OD startup Acc time (F011), and then operates at constant speed in low-speed section.

② Start timing when the OD starts, when the time is counted to low-speed holding time of OD startup (F013), the elevator door starts to operate at OD reference frequency (F014), and accelerates according to OD Acc time (F015), and then operates at high speed after the acceleration.

③When the OD speed changing signal is active, the elevator door decelerates according to OD Dec time (F018), and then operates at low speed with low speed setting in OD ending phase.

④When OD location limiting signal is active, the elevator door continues to run at OD low speed, and the drive judge the output torque. If the torque is bigger or equal to the threshold of OD torque changing (F023), the drive will keep the OD torque of F022, thus the whole OD process is over.

⑤When OD command is cancelled, the drive will not maintain the OD torque any more.

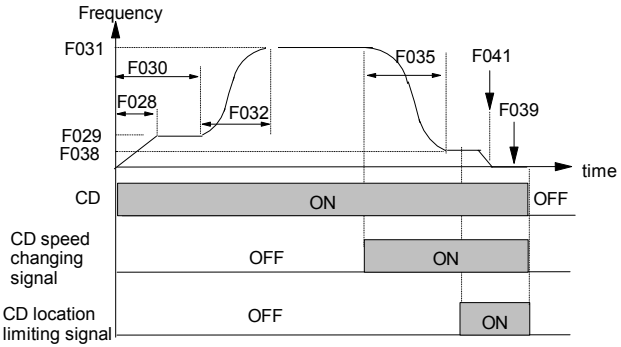



*Figure 6-6 Illustrations of CD operating curve of speed control 1*

Notes for CD process of speed control 1:

① When the CD command is active, the elevator door starts with start torque for CD (F027), and accelerates to Low speed in CD startup process (F029) according to CD startup Acc time (F028), and then operates at constant speed in low-speed section.

② Start timing when the CD starts, when the time is counted to low-speed holding time at CD startup (F030), the elevator door starts to operate at CD reference frequency setting (F031), and accelerates according to CD Acc time (F032), and then run at high speed after the acceleration.

③When the CD speed changing signal is active, the elevator door decelerates according to CD Dec time (F035), and then runs at low speed with low speed setting in CD ending phase (F038) as the target speed.

④When CD location limiting signal is active, the elevator door continues to run at CD low speed, and the drive judge the output torque. If the torque is bigger or equal to the threshold for CD torque changing (F041), the door will maintain its torque at F039, thus the whole CD process is over.

⑤When CD command is disabled, the drive exits the CD torque maintaining status.

See distance control parameters for distance control operating curve.

| F009 Display selection for F009~F025 | Range: 0、1 【0】 |
|---|---|

F009 decides whether to display the parameter group (F010~F025).

0: Not display

1: Display

**Note**

In parameters displaying status, press ▶▶ to scroll through the parameters that are allowed to display. The parameter of "Display selection for xxx~xxx" will be displayed first.

| F010 | OD start torque | Range: 0.0%~150.0%【50.0】 |
|---|---|---|

F010 is used to set the start torque when the drive starts to open the door to ensure smooth operation. The value of the torque is the product of F010 and the rated torque.

| F011 | OD startup Acc time | Range: 0.1s~3600s 【1.0】 |
|---|---|---|

F011 is to set the time taken for accelerating from zero speed to low speed in OD startup process.

**Note**

1. Acc time is the time taken for the drive to accelerate from 0Hz (zero speed) to the maximum frequency (maximum speed).

2. Dec time is the time taken for the drive to decelerate from maximum frequency (maximum speed) to 0Hz (zero speed).

| F012 | Low speed in OD startup process | Range: 0~50.00Hz 【10.00】 |
|---|---|---|

F012 is used to set the low operating frequency (speed) in OD process.

| F013 | Low-speed maintaining time at OD startup | Range: 0.1s~3600s 【1.0】 |
|---|---|---|

F013 is used to set the low-speed operating time including the Acc time and constant speed operating time in OD startup process.

| F014 | OD reference frequency setting | Range: 0~Maximum frequency【35.00】 |
|---|---|---|

F014 is used to set the high operating frequency (speed) in OD process.

| F015 | OD Acc time | Range: 0.1s~3600s 【2.0】 |
|---|---|---|

F015 is used to set the time taken for the elevator door to accelerate from the OD startup low speed to the OD frequency in OD process.

| F016 Initial time of "S" -shape curve in OD Acc process | Range: 10.0%~50.0%【20.0%】 |
|---|---|

F016 defines the ratio of the initial time("①" of T1 in Figure 6-7) of "s"-shape curve to the whole Acc time, as shown in Figure 6-7, which is "①" of T1.

TD3200 drive accelerates and decelerates according to the "S"-shape curve shown in Figure 6-7. Descriptions of "S"-shape curve: In drive's Acc/Dec process, the output frequency decreases or increases with the Acc/Dec time according to the "S"-shape curve, as shown in Figure 6-7.

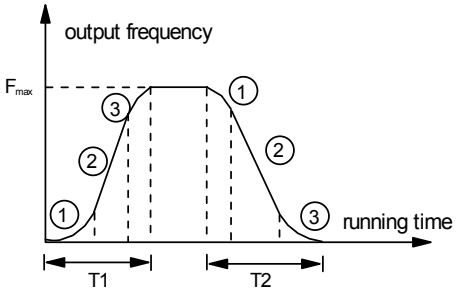



*Figure 6-7 S curve Acc and Dec*

| F017 Rising time of "S" -shape curve in OD Acc process | Range: 10.0%~80.0%【60.0%】 |
|---|---|

F017 defines the ratio of the rising time("②" of T1 in Figure 6-7) of "s"-shape curve to the whole Acc time, as shown in Figure 6-7, which is "②" of T1.

| F018 OD Dec time | Range: 0.1s~3600s 【2.0】 |
|---|---|

F018 defines time taken for the elevator door to decelerate from the OD frequency (high speed) to the low speed in OD ending status in OD process.

| F019 Initial time of "S"-shape curve in OD Dec process | Range: 10.0%~50.0%【20.0%】 |
|---|---|

F019 defines the ratio of the initial time("①" of T2 in Figure 6-7) of "s"-shape curve to the whole Dec time, as shown in Figure 6-7, which is "①" of T2.

| F020 Dropping time of "S" -shape curve in OD Dec process | Range: 10.0%~80.0%【60.0%】 |
|---|---|

F020 defines the ratio of the dropping time("②" of T2 in Figure 6-7) of "s"-shape curve to the whole Dec time, as shown in Figure 6-7, which is "②" of T2.

| F021 low speed setting in OD ending phase | Range: 0~50.00Hz 【3.00】 |
|---|---|

F021 defines the motor's low operating frequency (speed) after the OD speed changing signal is active in OD process.

| F022 Holding torque in complete OD status | Range: 0.0%~150.0%【50.0%】 |
|---|---|

When the motor is in OD operating process, the OD location limiting function is enabled. When the torque of catching spinning motor is bigger or equal to the setting of F023, and in the mean time the torque-holding-prohibition function is disabled, the elevator door maintains at complete OD status with the holding torque of the product of F022 and motor's rated torque.

| F023 Threshold for OD torque changing | Range: 0.0%~150.0%【50.0%】 |
|---|---|

In OD process, if the OD location limiting signal is active or the pulse count for distance control reaches the product of F051 and the door width, the elevator door continues to run at low speed in the ending phase of OD. When the door reaches the limited location, the motor is caught. When the motor catching torque is bigger or equal to the product of F023 and motor's rated torque, the door is in complete OD status and maintaining the current torque until the door opens again or stops.

| F024 Abnormal Dec time | Range: 0.0~100s 【0.5s】 |
|---|---|

If re-OD command is active, F024 defines the time taken for the elevator door decelerates from CD operating frequency to zero.

Under the condition of ensuring no over-current in Dec process, F024 should be set as small as possible so as to ensure the fast return of the door.

| F025 Reserved |
|---|

F025 is reserved and not open to users. If operation keypad is used, after entering the reserved unit, the keypad LEDs will display " HoLd".

| F026 Display selection for F026~F042 | Range: 0, 1 【0】 |
|---|---|

F026 decides whether F027~F042 can be displayed or not.

0: Not display

1: Display

| F027 Start torque for CD | Range: 0.0%~150.0%【50.0%】 |
|---|---|

F027 is used to set the start torque when the elevator door starts to close the door so as to ensure good CD effects. The value of the torque is the product by multiplying the setting of F027 by the rated torque.

| | | |
|---|---|---|
| F028 | CD startup Acc time | Range: 0.1s~3600s 【1.0】 |

F028 is used to set the time taken for the elevator door to accelerate from zero speed to low speed in CD startup process.

| | | |
|---|---|---|
| F029 | Low speed in CD startup process | Range: 0~50.00Hz 【8.00】 |

F029 is used to set the target frequency (speed) of low operation speed in CD process.

| | | |
|---|---|---|
| F030 | Low-speed maintaining time at CD startup | Range: 0.1s~3600s 【1.0】 |

F030 is used to set the low-speed operating time including the Acc time and constant speed operating time in CD startup process.

| | | |
|---|---|---|
| F031 | CD reference frequency | Range: 0~Maximum frequency【30.00】 |

F031 is used to set the high operating frequency (speed) in CD process.

| | | |
|---|---|---|
| F032 | CD Acc time | Range: 0.1s~3600s 【2.0】 |

F032 is used to set the time taken for the drive to accelerate from the CD startup low speed to the CD reference frequency in CD process.

| | | |
|---|---|---|
| F033 | Initial time of S curve in CD Acc process | Range: 10.0%~50.0% 【20.0%】 |

F033 defines the ratio of the initial time of S curve (① of T1 in Figure 6-7 ) to the whole Acc time T1. See Figure 6-7.

| | | |
|---|---|---|
| F034 | Rising time of S curve in CD Acc process | Range: 10.0%~80.0%【60.0%】 |

F034 defines the ratio of the rising time(② of T1 in Figure 6-7) of S curve to the whole Acc time T1. See Figure 6-7.

| | | |
|---|---|---|
| F035 | CD Dec time | Range: 0.1s~3600s 【2.0】 |

F035 defines time taken for the drive to decelerate from the CD reference frequency (high speed) to the low speed in CD ending status.

| | | |
|---|---|---|
| F036 | Initial time of S curve in CD Dec process | Range: 10.0%~50.0% 【20.0%】 |

F036 defines the ratio of the initial time(① of T2 in Figure 6-7) of S curve to the whole Dec time, as shown in Figure 6-7.

| F037 Falling time of S curve in CD Dec process | Range: 10.0%~50.0%【60.0%】 |
|---|---|

F037 defines the ratio of the falling time(② of T2 in Figure 6-7) of S curve to the whole Dec time, as shown in Figure 6-7.

| F038 Low speed in CD ending phase | Range: 0~50.00Hz 【2.00】 |
|---|---|

F038 defines the drive's low operating frequency (speed) after the CD speed changing signal is active in CD process.

| F039 Holding torque in complete CD status | Range: 0.0%~150.0%【50.0%】 |
|---|---|

When the drive is in CD process, the CD position limiting function is enabled, and the drive torque is bigger or equal to the setting of F041. In the mean time the torque-holding-prohibition function is disabled, then the drive keep the elevator door in complete CD status with the holding torque of the product of F039 and motor's rated torque.

| F040 Hindering torque for CD high speed phase | Range: 0.0%~200.0%【100.0%】 |
|---|---|

During CD high speed running, the drive's output torque is detected, and if the torque is bigger or equal to the product of F040 and motor's rated torque, the door will be re-opened to complete OD status. During the OD process, the drive will not response to the CD command.

| F041 Threshold for CD torque changing | Range: 0.0%~150.0%【50.0%】 |
|---|---|

In CD process, if the CD position limiting signal is active or the pulse count for distance control equals to the product of F052 and the door width, the drive will run at F038. When the door closes to position, the drive torque will increase. Once it catches the product of F041 and motor's rated torque, the elevator door will enter and maintain complete CD status until the drive runs reversely or stops.

| F042 Hindering torque for CD low speed end phase | Range: 0.0%~200.0%【100.0%】 |
|---|---|

In CD low speed end process, the drive's output torque is detected, and if the torque is bigger or equal to the product of F042 and motor's rated torque, the door is re-opened to the complete OD status. During the OD process, the drive will not response to the CD command.

## 6.3 Distance Control Parameters

In distance control mode, based on the door width acquired from auto-learning, in CD/OD process, the pulse is counted in real time, which is compared with the preset pulse to change speed during CD or OD. The control process is shown in Figure 6-8.

Distance control includes distance control 1 and distance control 2, and their control logics and operating curve are exactly the same. In distance control 1, the PG information is used both in control and pulse counting, and under this condition, the PG must be connected to the shaft of the motor. In distance control 2, the PG information is only used in pulse counting, and under this condition, the PG needs not to be connected to the shaft of the motor.

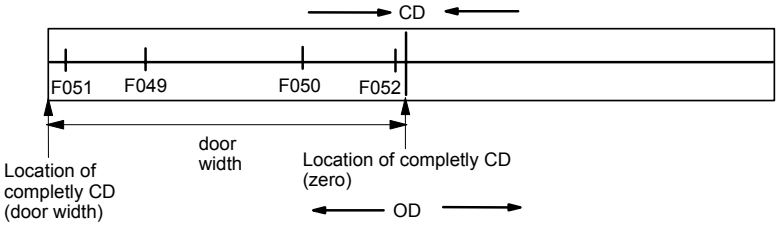



*Figure 6-8 Illustration of distance control*

In distance control, besides F010 ~F040, the parameters F044~F052 also needs to be set.

Door width auto-learning should be implemented before distance control. The speed curves of distance control are illustrated by Figure 6-9 and Figure 6-10.

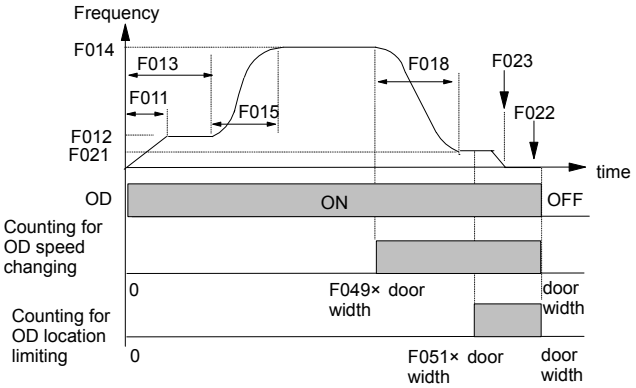



*Figure 6-9 OD operating curve for distance control*

OD process for distance control:

① When the OD command is active, the elevator door starts with OD start torque (F010), and accelerates to low speed (F012) within OD startup Acc time (F011), and then operates at constant speed in low-speed section.

② Start timing when the OD starts, when F013 (low-speed maintaining) arrives, the elevator door starts to operate at OD reference frequency setting (F014), and accelerates within OD Acc time (F015), and then operates at high speed after the acceleration.

③When the pulse counted in OD process ≥F049×door width, the elevator door decelerates to F021 within OD Dec time (F018), and then operates at constant low speed in OD ending phase.

④When pulse counted in OD process≥F051×door width, the elevator door continues to run at OD low speed in OD ending phase. If the output torque is bigger or equal to the threshold of OD torque changing (F023), the elevator door will maintain the torque of F022, thus the whole OD process is over.

⑤When OD command is disabled, the drive exits the OD torque maintaining status.

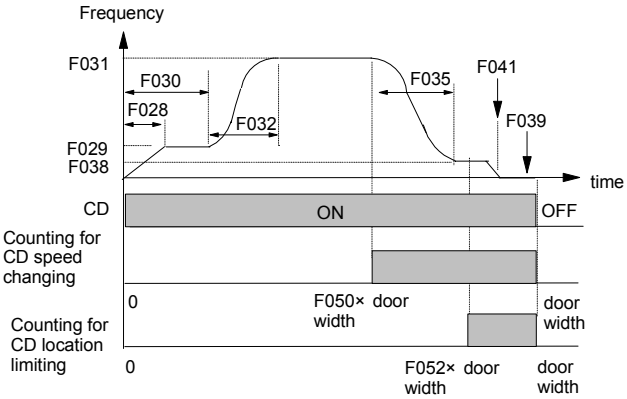



*Figure 6-10 CD operating curve for distance control*

CD process for distance control:

① When the CD command is active, the elevator door starts with start torque for CD (F027), and accelerates to "low speed in CD startup process" (F029) with in F028, and then operates at constant speed in low-speed section.

② Start timing when the CD operation starts, when F030 (low-speed maintaining at CD startup) arrives, the elevator door starts to accelerate within F032 (Acc time), and then maintain the speed after the acceleration (F031).

③When pulse counted in CD process ≥F050 ×door width, the elevator door decelerates with (F035), and then maintain the speed after the deceleration (F038).

④When pulse counted in CD process ≥F052 ×door width, the elevator door continues to run at CD low speed in CD ending phase. If the torque is bigger or equal to the threshold of CD torque changing (F041), the drive will maintain at the torque of F039. The whole CD process is over.

⑤When CD command is disabled, the drive exits the CD torque maintaining status.

It is recommended to restart the drive after the auto-learning is over.

After restarting the drive, the drive tests the running automatically, and stop after the door is closed completely. The drive is then in the initial position (zero). At this time, OD/CD is under distance control.

In single-phase PG mode, if the location in stopping status is not changed, when the drive runs again, it will control the door to OD or CD according to the curve shown in Figure 6-9 and Figure 6-10. If the location in stopping status is changed and the changing exceeds 12.5% of the door width, when the drive runs again, it will control the door to CD or OD completely according to the setting of F005. After that, the drive will operate according to the curve shown in Figure 6-9 and Figure 6-10.

| F043 Display selection for F043~F066 | Range: 0, 1 【0】 |
|---|---|

F043 decides whether to display F044~F066.

0: Not display

1: Display

| F044 Number of pulse per revolution | Range: 1~9999 【128】 |
|---|---|
| F045 PG phase | Range: 0, 1 【0】 |
| F046 Direction of PG | Range: 0, 1 【0】 |

TD3200 drive adopts vector control mode. Relevant parameters of PG must be set if close loop vector control mode is adopted.

In distance control mode, relevant parameters of PG should also be set correctly so as to ensure the control effects.

TD3200 can use both two-phase PG and single-phase PG.

**Note**

1) Two phase PG signals are input via terminal X1 and X2, while single phase PG signal must be input via X1.

2) TD3200 drive only provides 24V power supply, so please use 24V PG.

3) Use the PG with open collector output or push-pull output.

| F047 Speed during door width auto-learning | Range: 0.00~50.00Hz 【5.00】 |
|---|---|

F047 defines the operating frequency in door width auto-learning process.

In order to reduce the door width error, F047 must not be too big so as to avoid the shock when the door is in complete OD or CD status.

**Note**

Before the auto-learning, if speed control 1 (F001=0) is selected, the auto-learning can be successful only if location limiting signal is input. If speed control 1 (F001≠0) is not selected, the auto-learning can be done without location limiting signal.

| F048 Selection of door-width auto-learning | Range: 0, 1 【0】 |
|---|---|

0: disabled

1: enabled

Set F048 to 1, press RUN, and the drive will begin door-width auto-learning automatically.

After the auto-learning, setting of F048 will resume to 0 automatically.

Process of door-width auto-learning: After auto-learning is started, the door will be closed, opened and then close. After the door is completely closed, the door width information will be saved automatically.

**Note**

1) Relevant parameters of PG must be input correctly before the auto-learning.

2) Auto-learning is active in manual testing mode (F002=2) only,

3) During auto-learning process, the rail on which the door slide on must be free from obstructions.

4) If two-phase PG is used, the door width information can be obtained manually without starting the motor. Set F054 as 9999. First, record the pulse number P1 when the door is complete closed, and then pull the door open completely, record the pulse number P2 at this time. The P1 and P2 can be displayed as stopping parameters, refer to F110 and F111.

Door width=|P2 - P1|. Input the results in F053 and F054 manually.

| F049 OD speed changing location under distance control | Range: 60.0%~90.0%(door width) 【70.0%】 |
|---|---|

In the OD process under distance control, the pulse number is recorded in real time. When the pulse number is bigger or equal to the product of F049 and the door width, the elevator door will enter the OD ending phase and operating at low speed.

| F050 CD speed changing location under distance control | Range: 60.0%~90.0%(door width) 【70.0%】 |
|---|---|

In the CD process under distance control, the pulse number is recorded in real time. When the pulse number is bigger or equal to the product of F050 and door width, the elevator door will enter the CD ending phase and operating at low speed.

| | |
|---|---|
| F051 Pulse setting for complete OD under distance control | Range: 80.0%~99.0%(door width) 【95.0%】 |

In the OD process under distance control, the pulse number is recorded in real time. When the pulse number is bigger or equal to the product of F051 and door width, the drive will take actions complete OD.

| | |
|---|---|
| F052 Pulse setting for complete CD under distance control | Range: 80.0%~99.0% (door width) 【95.0%】 |

In the CD process under distance control, the pulse number is recorded in real time. When the pulse number is bigger or equal to the product of F052 and door width, the drive will take actions for complete CD.

| | |
|---|---|
| F053 Lower digits of pulse count | Range: 0~ 9999【0】 |

The parameter is to save the low four digits of pulse count obtained by door width auto-learning (max: four digits).

| | |
|---|---|
| F054 Higher digits of pulse count | Range: 0~ 9999【0】 |

The parameter is to save the higher digits of pulse count obtained by door width auto-learning.

door width=F054×10000+F053

Pulse number of door width, which is obtained by auto-learning, can be changed via operation keypad.

## 6.4 MS Speed

| | |
|---|---|
| F055 MS frequency 0 | Range: 0.0Hz~Maximum frequency【50.00】 |
| F056 MS frequency 1 | Range: 0.0Hz~Maximum frequency【5.00】 |
| F057 MS frequency 2 | Range: 0.0Hz~Maximum frequency【10.00】 |
| F058 MS frequency 3 | Range: 0.0Hz~Maximum frequency【15.00】 |
| F059 MS frequency 4 | Range: 0.0Hz~Maximum frequency【20.00】 |
| F060 MS frequency 5 | Range: 0.0Hz~Maximum frequency【30.00】 |

| | | |
|---|---|---|
| F061 | MS frequency 6 | Range: 0.0Hz~Maximum frequency【40.00】 |
| F062 | MS frequency 7 | Range: 0.0Hz~Maximum frequency【50.00】 |

F055~F062 defines the MS frequency for multi-speed operation.

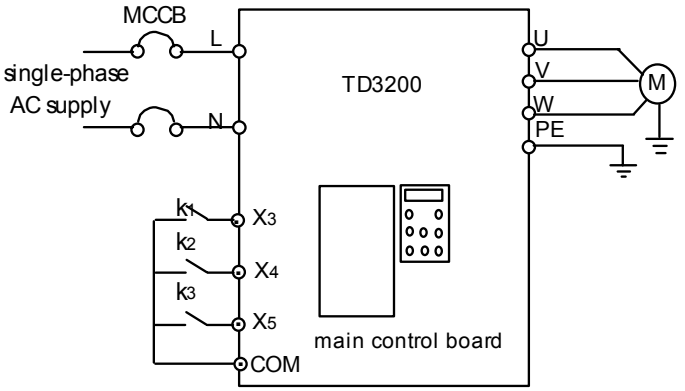



*Figure 6-11 Wiring for MS speed operation*

In Figure 6-11, X3, X4 and X5 are MS terminals 1, 2, and 3 respectively. Through the different logic combinations of K1, K2 and K3, the drive can operate at 0~7 speed, see Table 6-1.

*Table 6-1 Multi-speed Setthing*

| K3 | K2 | K1 | Frequency setting |
|---|---|---|---|
| OFF | OFF | OFF | MS frequency 0 |
| OFF | OFF | ON | MSfrequency 1 |
| OFF | ON | OFF | MS frequency 2 |
| OFF | ON | ON | MS frequency 3 |
| ON | OFF | OFF | MS frequency 4 |
| ON | OFF | ON | MS frequency 5 |
| ON | ON | OFF | MS frequency 6 |
| ON | ON | ON | MS frequency 7 |

## 6.5 Demo Functions

Demo mode is a cyclic operation of OD and CD. Press RUN key to start the demo. The door is opened according to the operation curve. The drive starts timing after the door is opened completely. When the time reaches the setting

of F063, the drive starts reverse running, and door is closed. The drive starts timing after the door is closed completely. When the time reaches the setting of F064, the door is opened again. The door is thus opened and closed repeatedly. Press STOP key to end the demo.

Demo can be under both speed control and distance control. It can be used for demonstration and burning test.

| F063 | Holding time for complete OD in demo mode | Range: 1~3600s 【2.0】 |
|---|---|---|

F063 defines the interval from complete OD to CD in demo mode, and can be set according to the actual needs of demo.

| F064 | Holding time for complete CD in demo mode | Range: 1~3600s 【2.0】 |
|---|---|---|

F064 defines the interval from complete CD to OD in demo mode, and can be set according to the actual needs of demo.

| F065 | CD/OD times record in demo mode | Range: 0~9999 【0】 |
|---|---|---|

F065 records the operation times in demo mode. The setting is saved upon power off. The operation times is counted and added to the previous setting F065 when the drive is repowered. The number is added by one if the door is opened or closed once.

| F066 | Preset CD/OD times in demo mode | Range: 0~9999 【0】 |
|---|---|---|

F066 is used to set the operation times in demo mode. When the actual operation times is bigger than the setting of F066, the demo is ended automatically.

If F066=0, this function is disabled and demo will not be ended automatically.

## 6.6 Motor's Parameters

| F067 | Display selection for F067~F086 | Range: 0, 1 【0】 |
|---|---|---|

F067 decides whether to display F068~F086 or not.

0: Not display

1: Display

| F068 | Motor type selection | Range: 0 【0】 |
|---|---|---|

0: Asynchronous motor

| | | |
|---|---|---|
| F069 | Rated power | Range: 0~750W 【370】 |
| F070 | Motor rated voltage | Range: 0~380V 【220】 |
| F071 | Motor rated current | Range: 0.10 ~9.90A 【1.94】 |
| F072 | Motor rated frequency | Range: 1.00~400.00Hz 【50.00】 |
| F073 | Motor rated speed | Range: 1~9999rpm 【1400】 |

Set the parameters of motor according to the nameplate.

**Note**

1) Relevant parameters of motor (F068~F073) must be input correctly before the auto-tuning.

2) The motor power should match that of the drive, that is, the setting of F069 can be only one grade higher or two grades lower than standard motor capacity, to ensure the performance.

| | |
|---|---|
| F074 | Reserved |

| | | |
|---|---|---|
| F075 | Motor's parameters auto-tuning | Range: 0, 1 【0】 |

0: disabled

1: enabled

Enter the motor parameters according to the nameplate (F069~F073) before tuning. First set F075 to 1, press RUN on the operation keypad, the drive will execute auto-tuning function.

After tuning completed, setting of F075 will resume to 0 automatically.

**Note**

1) Do not start tuning with load on motor;

2) Make sure the motor is in stopping status before tuning, otherwise, the tuning can not be processed normally;

3) Tuning can be performed in keypad control mode only (F002=0, factory default value);

4) If you already know the motor's parameters, just input the motor parameters directly, no need to auto-tuning.

| | | |
|---|---|---|
| F076 | Stator resistance | Range: 0.00~99.99Ω 【7.73】 |
| F077 | Stator inductance | Range: 0~9999mH 【357】 |
| F078 | Rotor resistance | Range: 0.00~99.99Ω 【5.23】 |

| | |
|---|---|
| F079 Rotor inductance | Range: 0~9999mH 【357】 |
| F080 Mutual inductance | Range: 0~9999mH 【325】 |
| F081 Exciting current with no load | Range: 0.00~99.99A 【1.08】 |

After auto-tuning, settings of F076~F081 will be updated.

Each time after changing the parameters on the motor's nameplate, the settings of F076~F081 will be restored to defaults automatically.

Motor's parameters are illustrated in Figure 6-12.

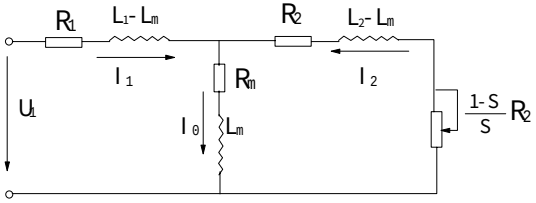



*Figure 6-12 Steady-state equivalent circuit of asynchronous motor*

In Figure 6-12, $R_1$, $L_1$, $R_2$, $L_2$, $L_M$, $I_0$ represent stator resistance, stator inductance, rotor resistance, rotor inductance, mutual inductance and exciting current respectively.

## 6.7 Auxiliary Parameters

| | |
|---|---|
| F082 Carrier frequency | Range: 2.0~16.0kHz 【8.0】 |

F082 defines the carrier frequency of PWM output by the drive.

**Note**

The carrier frequency will affect the motor noise. In the case of silent running, the carrier frequency should be generally set above 8kHz.

| | |
|---|---|
| F083 Auto reset times upon fault | Range: 0 ~100 【0】 |

When fault occurs while the drive is operating, the drive stops its output. After 2s interval, it resets automatically and continue to run. The maximum reset times for a continuous running is 3. If the parameter is set at "0", it means the drive will not reset automatically.

**Note**

The drive will not reset automatically when E024, E028, E029 and E030 faults occur.

| F084 Utility rate of braking | Range: 0~7 【7】 |
|---|---|

Relationship of settings and utility rate is shown below.

| Setting | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|
| Meaning | No dynamic braking | 2% | 5% | 10% | 20% | 50% | 80% | 100% |

| F085 Reserved |
|---|
| F086 Reserved |

## 6.8 Vector Control Parameters

| F087 Display selection for F087~F095 | Range: 0, 1 【0】 |
|---|---|

F087 decides whether to display F088~F095.

0: Not display

1: Display

| F088 Speed regulator's proportional gain 1 | Range: 0.000~6.000 【1.000】 |
|---|---|
| F089 Speed regulator's integral time 1 | Range: 0, 0.032~32.00s 【1.000】 |
| F090 Speed regulator's proportional gain 2 | Range: 0.000~6.000 【1.200】 |
| F091 Speed regulator's integral time 2 | Range: 0, 0.032~32.00s 【0.400】 |
| F092 Speed regulator's changing frequency | Range: 0.00~400.00Hz 【5.00】 |

Speed regulator's proportional gain P and integral time I can be set via F088 ～F092 to change the speed response of vector control.

1. Structure of speed regulator (ASR) is shown in Figure 6-13, where $K_P$ is proportional gain P, and $K_I$ is integral time I.

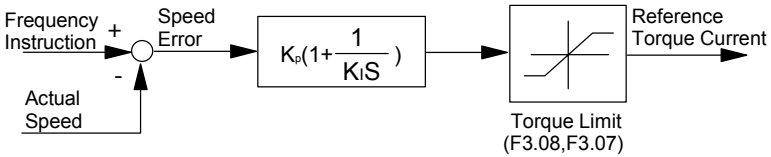



*Figure 6-13 Simplified speed regulator diagram*

If the integral time is set at 0 (F089=0, F091=0), which means integral function is disabled, and the speed loop is simply a proportion regulator.

2. Adjustment of proportional gain P and integral time I for speed regulator

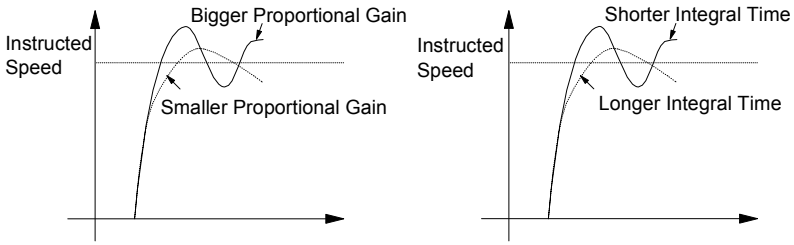



*Figure 6-14 Relationship of speed regulator's step response to values of P and I*

Increasing P will fasten system transient response, but system oscillation may occur given too big P.

Decreasing I will fasten transient response, but system oscillation and overshoot may occur given too small.

Normally, you may tune P first, increase its value as long as no system oscillation occurs; then adjust I, ensuring fast response without overshoot. Figure 6-15 shows better speed step response if P, I are set properly.

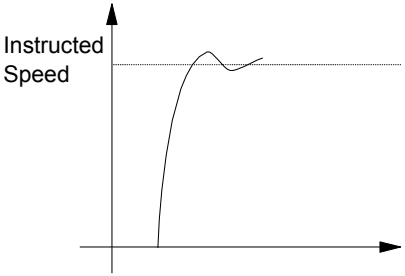



*Figure 6-15 Step response with better dynamic performance*

3. Speed regulator's P, I Settings in High/Low Speed Applications

If the system is required to respond quickly both in low and high frequency operation with load and, then the user may set speed regulator's switching frequency in F092. Normally, when the system runs at low frequency, the transient response performance can be improved by increasing P and decreasing I.

Adjust speed regulator's parameters following the procedures below:

Set appropriate switching frequency F092.

First tune P (F088) and I (F089) for high-speed application, ensuring no oscillation and short response time.

Next, tune P (F090) and I (F091) for low-speed application, ensure no oscillation and good response performance at low frequency.

| | | |
|---|---|---|
| F093 | Slip compensation gain | Range: 0, 50.0%~250.0%【100.0%】 |

F093 is used in calculating slip frequency. The setting 100% means rated slip frequency corresponds to rated torque current. The user may decrease/increase the settings of F093 to adjust the speed control's difference accurately.

| | | |
|---|---|---|
| F094 | Motoring torque limit | Range: 0.0%~200.0%【100.0%】 |
| F095 | Braking torque limit | Range: 0.0%~200.0%【100.0%】 |

Torque limiting is used to limit the speed regulator's output torque current.

Torque limit is the percentage of the drive's rated current; If the torque limit is 100%, then the torque current limit is the drive's rated current. F094 and F095 limit the output torque in motorizing state and braking state respectively, as shown in Figure 6-16.

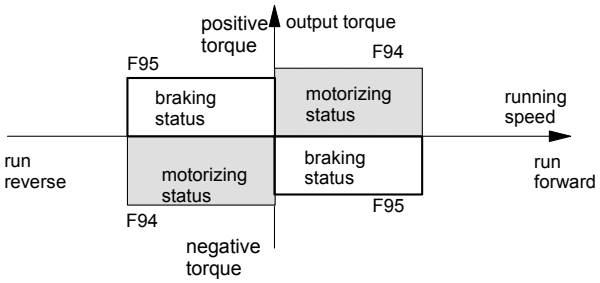



*Figure 6-16 Torque limiting function*

**Note**

When operating in regeneration state, adjust braking torque limit (F095) if necessary. Given large braking torque, it is required to connect braking unit on DC bus bar, otherwise bus bar overvoltage fault may occur.

## 6.9 Digital I/O

| F096 | Display selection for F096~F108 | Range: 0, 1 【0】 |
|---|---|---|

F096 decides whether to display F097~F0108.

0: Not display

1: Display

Function and parameters of control terminal X1~X7 are defined by the following parameters.

| F097 | Function selection for control terminal X1 | Range: 0~23 【0】 |
|---|---|---|
| F098 | Function selection for control terminal X2 | Range: 0~23 【0】 |
| F099 | Function selection for control terminal X3 | Range: 0~23 【0】 |
| F100 | Function selection for control terminal X4 | Range: 0~23 【0】 |
| F101 | Function selection for control terminal X5 | Range: 0~23 【0】 |
| F102 | Function selection for control terminal X6 | Range: 0~23 【0】 |
| F103 | Function selection for control terminal X7 | Range: 0~24 【0】 |

Control terminals X1~X7 are programmable input terminals, and their functions can be defined by F097~F103. The functions are listed in Table 6-2.

*Table 6-2 Function selection for multi-function inputs*

| Settings | Functions | Settings | Functions |
|---|---|---|---|
| 0 | No functions | 12 | Normally open input contacts for OD speed changing |
| 1 | External reset (RESET) signal input | 13 | Normally closed input contacts for OD speed changing |
| 2 | Normally open input contacts for optical signal | 14 | Normally open input contacts for CD speed changing |
| 3 | Normally closed input contacts for optical signal | 15 | Normally closed input contacts for CD speed changing |
| 4 | Normally open input contacts for touching board | 16 | MS speed terminal 1 |
| 5 | Normally closed input contacts for touching board | 17 | MS speed terminal 2 |
| 6 | Normally open input for OD location limiting | 18 | MS speed terminal 3 |

| Settings | Functions | Settings | Functions |
|---|---|---|---|
| 7 | Normally closed input for OD location limiting | 19 | Terminal for inputting OD prohibition signal |
| 8 | Normally open input for CD location limiting | 20 | Terminal for inputting torque-maintaining prohibition signal |
| 9 | Normally closed input for OD location limiting | 21 | Low speed OD/CD enabling signal input |
| 10 | Phase A PG signal input (only X1 and X2) | 22 | Normally open input for locking signal |
| 11 | Phase B PG signal input (only X1 and X2) | 23 | Normally closed input for locking signal |
| | | 24 | Operation enabling signal input |

**Note**

Programmable digital input terminal can be disabled by setting F097~F110 at 0.

0: No function

1: External reset (RESET) signal input

When a fault occurs, the drive can be reset via this terminal. This function is enabled at the rising edge of the pulse, and its function is the same with that of the RESET key on the keypad.

2, 3: Normally open/closed input contacts for optical signal

In CD process, if this terminal is activated, then the OD command is re-executed for protection, after the door is re-opened completely, then next CD command can be executed. During the re-opening process, the drive will not response to CD command.

If the door has reached the CD location limit, this protection signal is ineffective.

4, 5: Normally open/closed input contacts for touch board

In CD process, if this terminal is activated, then the OD command is re-executed for protection, after the door is re-opened completely, then next CD command can be executed. During the re-opening process, the drive will not response to CD command.

If the door has reached the CD location limit, this protection signal is ineffective.

6, 7: Normally open/closed input for OD location limiting

In OD process under speed control, the drive will take actions of OD location limiting after this signal is enabled.

8, 9: Normally open/closed input for CD location limiting

In CD process under speed control, the drive will take actions of CD location limiting after this signal is enabled.

10, 11: Phase A/B PG signal input (only X1 and X2)

Enable the terminal as inputting PG signal to achieve close loop vector control or distance control. Only F097 and F098 can be set so.

12,13: Normally open/closed input for OD speed changing

In OD process under speed control 1, the elevator door starts low speed operation in ending phase after the normally open/closed input for OD speed changing is enabled.

14, 15: Normally open/closed input for CD speed changing

In CD process under speed control, the elevator door starts low speed operation in ending phase after the normally open/closed input for CD speed changing is enabled.

16~18: Terminal for inputting MS speed operation signal

Through the ON/OFF combination of the terminals, up to 8 levels of speed can be defined, and these speed levels can be set by F055~F062 respectively.

19: Terminal for inputting OD prohibition signal

OD command will not be executed if this signal is enabled.

20: Terminal for inputting torque-maintaining prohibition signal

In CD/OD torque-maintaining process, the drive will maintain the 0 torque if this signal is enabled.

21: Low speed OD/CD enabling signal input

If this signal is enabled, the motor operates at low speed according to the speed set by F005.

22, 23: Normally open/closed input for locking signal

24: In the terminal control mode of the drive (F002 = 1), when X7 is not set to 24, the door is controlled by the external door control signals. When set to 24, the X7 is defined as the operation enabling signal input terminal, and the external door control is enabled only when X7 signal is valid. If X7 signal is invalid, the inverter will stop immediately when in the operation state, or does not respond when in the stopping state.

| | | |
|---|---|---|
| F104 | Function of programmable relay output PA/PB/PC | Range: 0~9 【4】 |
| F105 | Function of programmable relay output PAC/PC1 | Range: 0~9 【0】 |
| F106 | Function of programmable relay output PAC/PC2 | Range: 0~9 【1】 |

Functions of programmable relay are shown in Table 6-3.

*Table 6-3 Relay output functions*

| Settings | Functions | Settings | Functions |
|---|---|---|---|
| 0 | Output signal 0 for complete OD | 5 | Fault relay output 2 |
| 1 | Output signal 0 for complete CD | 6 | Output signal 2 for complete OD |
| 2 | Output signal 1 for complete OD | 7 | Output signal 2 for complete CD |
| 3 | Output signal 1 for complete CD | 8 | Locking signal output |
| 4 | Fault relay output 1 | 9 | Re-opening signal output |

Notes about the functions:

0: Output signal 0 for complete OD

In OD process, when the drive receives OD location limiting signal or when the pulse count number reaches the OD location limiting value, the drive will output "0" for complete OD.

Complete OD signal is disabled in demo mode, general-purpose drive operation mode and CD process.

1: Output signal 0 for complete CD

In CD process, when the drive receives CD location limiting signal or when the pulse count number reaches the CD location limiting value, the drive will output "0" for complete CD.

The complete CD signal is disabled in demo mode, general-purpose drive operation mode and OD process.

2: Output signal 1 for complete OD

In OD process, when the drive receives OD location limiting signal or when the pulse count number reaches the OD location limiting value, and at the same time the drive torque reaches the setting of F023, the drive will output signal 1 for complete OD.

The complete OD signal is disabled in demo mode, general-purpose drive operation mode and CD process.

3: Output signal 1 for complete CD

In CD process, when the drive receives CD location limiting signal or when the pulse count number reaches the CD location limiting value, and at the same time the drive torque reaches the setting of F041, the drive will output signal 1 for complete CD.

The complete CD signal is disabled in demo mode, general-purpose drive operation mode and OD process.

4: Fault relay output 1

When the drive has fault, it will output fault relay output signal 1. But when parameter setting error (E028) occurs, the drive only displays the alarm information and will not output fault relay output signal 1.

5: Fault relay output 2

When the drive has fault or the drive's DC bus voltage is low (LED displays "P.oFF"), it will output fault relay output signal 2. But when parameter setting error (E028) occurs, the drive only displays the alarm information and will not output fault relay output signal 2.

6: Output signal 2 for complete OD

In OD process, when the drive receives OD location limiting signal or when the pulse count ed reaches the OD location limiting value, locking signal is invalid and at the same time the drive torque reaches the setting of F023, the drive will output signal 2 for complete OD.

The complete OD signal is disabled in demo mode, general-purpose drive operation mode and CD process.

7: Output signal 2 for complete CD

In CD process, when the drive receives CD location limiting signal or when the pulse count ed reaches the CD location limiting value, locking signal is disabled and at the same time the catching torque reaches the setting of F041, the drive will output signal 2 for complete CD.

The complete CD signal is disabled in demo mode, general-purpose drive operation mode and OD process.

8: Locking signal output

Synchronously input/output locking signal

9: Door re-opening signal output

In door re-opening process, the drive outputs the door re-opening signal.

| F107 | Relay PC1 and PC2 contacts definition | Range: 0~3 |
|---|---|---|

0: Neither PC1 or PC2 undergone NOT operation

1: NOT operation to PC1

2: NOT operation to PC2

3: NOT operation to both PC1 and PC2

If F107 is set at "0", both PA/PC1 and PA/PC2 are used as normally open contacts

If F107 is set at "1", the relay PA/PC1 is used as normally closed contacts and PA/PC2 normally open contacts

If F107 is set at "2", the relay PA/PC1 is used as normally open contacts and PA/PC2 normally closed contacts

If F107 is set at "2", both PA/PC1 and PA/PC2 are normally closed contacts

| F108 | OD Priority Setting | Range: 0~1 |
|---|---|---|

OD priority function setting

0: OD priority function enabled.

1: OD priority function disabled.

## 6.10 Display and Monitoring Functions

| F109 | Display selection for F109~F122 | Range: 0, 1 【0】 |
|---|---|---|

F0109 decides whether to display F110~F122.

0: Not display

1: Display

F109~F122 is to set parameters to be displayed on the LED and memorized.

| F110 Parameters displayed by LED | Range: 1~1023 【31】 |
|---|---|

F110 is to set the parameters that can be displayed on LED. For parameters that have been selected by F110, you may scroll through them by pressing ▶▶ on the keypad. The display of each parameter is controlled by a binary bit, "1" for display, "0" for not display. Therefore whether these 10 parameters can be displayed is determined by 10-bit binary code. For example, Bit0 controls whether to display operating frequency, if Bit0=0, the frequency will not be displayed, if Bit0=1, the frequency will be displayed. The representation of each bit is shown below:

Bit1: reference frequency (Hz)

Bit2: output voltage (V/rms)

Bit3: output current (A/rms)

Bit4: output torque (%)

Bit5: DC bus voltage (V)

Bit6: Status of digital input terminal (No unit)

Bit7: Status of digital output terminal (No unit)

Bit8: Low digits of pulse of door location (0~9999)

Bit9: High digits of pulse of door location (0~9999)

Door location = High digits of pulse counted for door location×10000+Low digits of pulse counted for door location

Notes for digital terminal input status: Digital terminal input status is represented by a 10-bit binary code. Each bit represents ON/OFF state of an input terminal. The bit is "1" if the drive detects the terminal is on, and is "0" if the drive detects the terminal is off. We define the relation of bits and terminals as follows:

| BIT | bit8 | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |
|---|---|---|---|---|---|---|---|---|---|
| Input terminal | CD | OD | X7 | X6 | X5 | X4 | X3 | X2 | X1 |

The number displayed by LED is the decimal number of the corresponding binary code.

Notes for digital terminal output status: Digital terminal input status is represented by a 4-bit binary code. Each bit represents ON/OFF state of an input terminal. The bit is "1" if the drive detects the terminal is activated, and is "0" if the drive detects the terminal is not activated. We define the relationship of bits of the binary code and terminals as follows:

| BIT | bit2 | bit1 | bit0 |
|---|---|---|---|
| Input terminal | PR0 | PR1 | PR2 |

The number displayed by LED is the decimal number of the corresponding binary code.

**How to set the values**

To determine what you want to display first and then set the corresponding bit to "1".

For example, if the factory setting is 00011111, corresponding parameters controlled by Bit0~Bit4 are displayed. The other parameters are not displayed.

To convert the binary code into the decimal code, the calculation formula is $\sum_{i=0}^{7} bit_i \cdot 2^i$, where, i: 0~7

As mentioned above, to convert the binary code into decimal code: $1\times2^0 +1\times2^1 +1\times2^2 +1\times2^3 +1\times2^4 = 31$

Therefore, this parameter is set at 31.

| F111 Selection of parameters displayed by LED in stopping status | Range: 0~7 【0】 |
|---|---|

0: Preset OD frequency (Hz)

1: Preset CD frequency (Hz)

2: Status of digital input terminal (No unit)

3: Status of digital output terminal (No unit)

4: DC bus voltage (V)

5: MS frequency 0 (Hz)

6: Lower digits of pulse counted for door location (0~9999)

7: Higher digits of pulse counted for door location (0~9999)

Door location = Higher digits of pulse counted for door location×10000+ Lower digits of pulse counted for door location

**Note**

LED will display the parameter set in F111 as default upon power on, e.g., F111 =5, MS frequency 0 will be displayed when the drive is powered on. Other parameters at stopping status can be scrolled through by pressing ▶▶.

| | | |
|---|---|---|
| F112 | Type of latest fault | Range: 0~30 【0】 |
| F113 | Type of second lastest fault | Range: 0~30 【0】 |
| F114 | Type of third lastest fault | Range: 0~30 【0】 |
| F115 | DC Bus Voltage (V) at the latest fault | Range: 0V~999V 【0】 |
| F116 | Output current (A) at the latest fault | Range: 0.00A~99.99A 【0.00】 |
| F117 | Frequency at the latest fault (Hz) | Range: 0.00Hz~400.0Hz 【0.00】 |
| F118 | Status of input terminal at the latest fault | Range: 0~1023 【0】 |
| F119 | Status of output terminal at the latest fault | Range: 0~15 【0】 |

TD3200 series drive can diagnose 15 kinds of faults intelligently and can memorize the types of the latest 3 faults (F112, F113 and F114), and also the voltage, current, frequency and the terminal status at the latest fault (F115~F119) for your reference.

Refer to chapter 8 for details.

| | | |
|---|---|---|
| F120 | Total operation time | Range: 0~65535 hours【】 |

The maximum value is 65535 hours. Once the operation time exceeds 65535 hours, the drive will time from 0.

| | |
|---|---|
| F121 Temperature codes used by manufacturer in test | Range: 0~9999 【0】 |

F121 is used by manufacturer in test. You need not change it.

| | | |
|---|---|---|
| F122 | Software version No. | Range: 32.XX |

The software version No. available to users for enquiry.

The two digits before the decimal point stand for product series, while the two digits after the decimal point stand for the software version No.

For example, “32.23” refers to the software of TD3200 series inverter whose version No. is 1.23.

| F123 | Parameter initialization | Range: 0, 1, 2 【0】 |
|---|---|---|

0: Parameter modification enabled

In this status, the parameter can be read and revised.

1: Clear the information

Clear the information in F112~F119.

2: Recover the factory setting

To recover the factory settings of F000~F052, F055~F67 and F082~F111 according to drive's model.

| F124 | Factory password |
|---|---|

For manufacturer use only.

# Chapter 7 Application Guidance

This chapter introduces the basic procedures and parameter setting methods for the elevator door control system using TD3200 series drive. Applications of speed control 1 and distance control are introduced below, including the system Configuration and parameter settings.

## 7.1 Speed control 1

### 7.1.1 System Wiring Diagram

In speed control 1, speed changing contacts are used to change the speed, and the location limiting signal is used to judge whether the door is opened or closed completely. System wiring diagram for speed control 1 is shown in Figure 7-1.

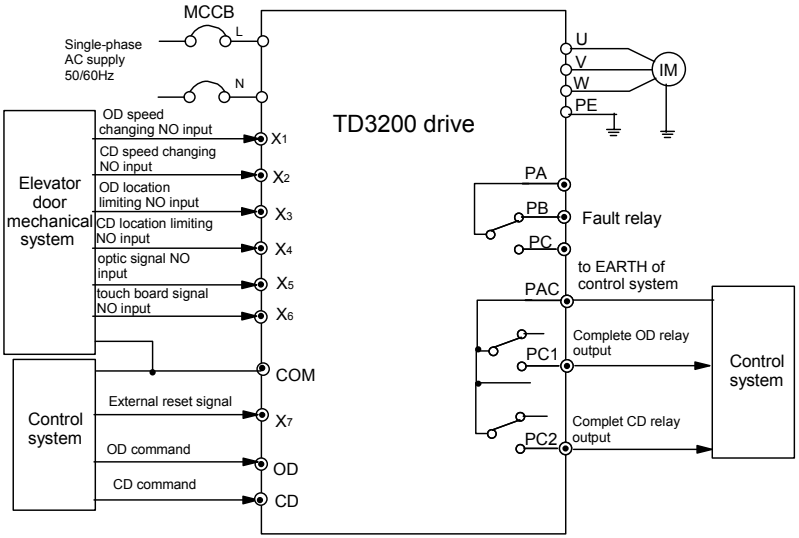



*Figure 7-1 System wiring diagram for speed control 1*

Note: "NO" in Figure7-1 stands for "normally open" .

### 7.1.2 Testing Procedures

1) Wiring according to Figure 7-1;

2) Switch on the drive, set F123 to "2", resume the factory settings. Refer to section 4.1 for parameter setting;

3) Make sure F002 is set to 0 (keypad control for general-purpose drive), remove the load, and input the values on motor's nameplate to F069~F073 (refer to relevant parts in Chapter 5 & 6) Set F075 to "1", press RUN to start tuning for getting motor parameters until the tuning process is over. In the tuning process, the keypad will display "TUNE". The parameters will be saved automatically after tuning.

> 🕮 **Note**
>
> Motor load should be removed during tuning, otherwise the motor parameters obtained will be inaccurate or the tuning unsuccessful.
>
> For the motor of same model and made by same manufacturer, just input the motor parameters with reference to the previous motor parameters to set F076~F081, unnecessary to start auto-tuning.

4) Set F002 to "2" (manual testing mode), set the parameters according to table 7-1, press RUN and ▲ (or ▼) to start the operation. If bumping or unsmooth operation occurs in the process, adjust the CD or OD curves according to the OD curve for speed control 1 shown in Figure 6-5 and CD curve for speed control 1 shown in Figure 6-6.

> 🕮 **Attention**
>
> If the actual operation is reverse to OD/CD command, please change the setting of F004 or change the phase connection of motor.

5) After testing, set F002 to "1" (terminal control mode), and the drive will begin to work normally.

### 7.1.3 Parameters Setting

Please refer to Figure 7-1.

*Table 7-1 Parameter settings for Speed control*

| Functions | Name | Setting | Remark |
|---|---|---|---|
| F001 | Control mode | 0 | Speed control |
| F097 | Function of digital input terminal X1 | 12 | Normally open input for OD speed changing |
| F098 | Function of digital input terminal X2 | 14 | Normally open input for CD speed changing |
| F099 | Function of digital input terminal X3 | 6 | Normally open input for OD location limiting |
| F100 | Function of digital input terminal X4 | 8 | Normally open input for CD location limiting |
| F101 | Function of digital input terminal X5 | 2 | Normally open input contacts for optic signal |
| F102 | Function of digital input terminal X6 | 4 | Normally open input contacts for touching board |
| F103 | Function of digital input terminal X7 | 1 | External reset (RESET) signal input |
| F105 | Programmable relay PAC/PC1 | 2 | Output type 1 signal for complete OD |
| F106 | Programmable relay PAC/PC2 | 3 | Output type 1 signal for complete CD |
| F010 | Start torque for OD | 50.0% | Parameters in the table are factory settings, adjust the OD parameters according to the actual OD operating conditions. |
| F011 | OD startup Acc time | 1.0s | |
| F012 | Low speed in OD startup process | 10Hz | |
| F013 | Low-speed maintaining time at OD startup | 1.0s | |
| F014 | OD reference frequency setting | 35Hz | |
| F015 | OD Acc time | 2.0s | |
| F016 | Initial time of S curve in OD Acc process | 20.0% | |
| F017 | Rising time of S curve in OD Acc process | 60.0% | |
| F018 | OD Dec time | 2.0s | |
| F019 | Initial time of S curve in OD Dec process | 20.0% | |

| Functions | Name | Setting | Remark |
|---|---|---|---|
| F020 | Falling time of S curve in OD Dec process | 60.0% | |
| F021 | Low speed setting in OD ending phase | 3Hz | |
| F022 | Holding torque in complete OD status | 50.0% | |
| F023 | Threshold setting for torque holding | 50.0% | |
| F024 | Abnormal Dec time | 0.5s | |
| F027 | Start torque for CD | 50.0% | Parameters in the table are factory settings, adjust the CD parameters according to the actual CD operating conditions. |
| F028 | CD startup Acc time | 1.0s | |
| F029 | Low speed in CD startup process | 8Hz | |
| F030 | Low-speed maintaining time at CD startup | 1.0s | |
| F031 | CD reference frequency setting | 30Hz | |
| F032 | CD Acc time | 2.0s | |
| F033 | Initial time of S curve in CD Acc process | 20.0% | |
| F034 | Rising time of S curve in CD Acc process | 60.0% | |
| F035 | CD Dec time | 2.0s | |
| F036 | Initial time of S curve in CD Dec process | 20.0% | |
| F037 | Dropping time of S curve in CD Dec process | 60.0% | |
| F038 | Low speed setting in CD ending phase | 2Hz | |
| F039 | Holding torque for complete CD | 50.0% | |
| F040 | Hindering torque for CD | 100.0 % | |
| F041 | Threshold of CD torque changing | 50.0% | |

| Functions | Name | Setting | Remark |
|---|---|---|---|
| F082 | Carrier frequency adjustment | 8k | Set according to system requirements |
| F084 | Utility rate of braking | 7 | Set properly according to braking condition |

**Attention**

F006 must be set bigger than the sum of time in all phases of CD or OD curve.

## 7.2 Distance Control 1

### 7.2.1 System Wiring Diagram

For distance control 1, PG should be installed on the motor's shaft. In distance control, the speed changing and complete CD and OD judgments are made according to the actual number of pulses counted. System wiring diagram for distance control is shown in Figure 7-2.

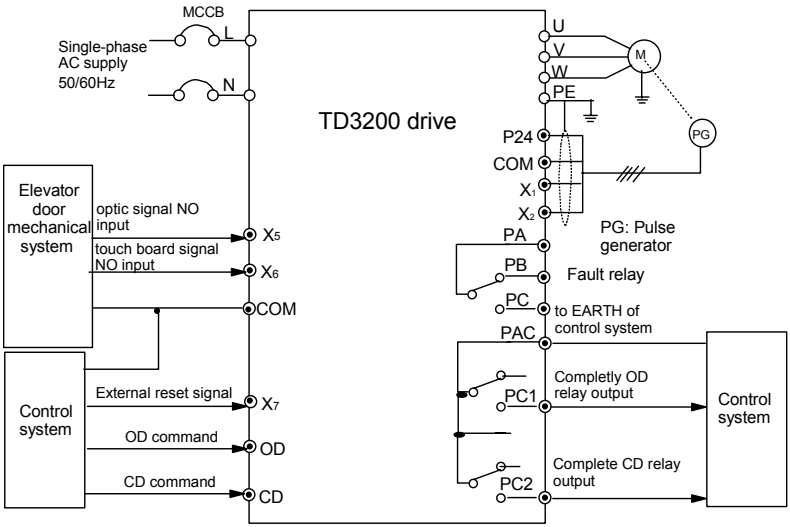



*Figure 7-2 System wiring diagram for distance control*

## 7.2.2 Testing Procedures

1) Wiring according to Figure 7-2 (refer to Figure 3-6 or Figure 3-7 for PG wiring);

2) Switch on the drive, set F123 to "2", resume the factory settings. Refer to section 4.1 for parameter setting;

3) Make sure F002 is set to "0" (keypad control for general-purpose drive), remove the load, and input the values on motor's nameplate to F069~F073 (refer to relevant parts in Chapter 5 & 6). Set F075 to "1", press RUN to start tuning to obtain motor parameters. In the tuning process, the keypad will display "TUNE". The parameters will be saved automatically after tuning.

**Note**

The motor load should be removed in tuning process, otherwise the obtained motor parameters will be inaccurate or the tuning unsuccessful.

For the motor of same model and made by same manufacturer, just input the motor parameters with reference to the previous motor parameters to set F076~F081, unnecessary to start auto-tuning.

4) Set F002 to 2 (manual testing mode), set F044 and F045(0－double phase, 1－single phase) and F046 (0: run forward, 1: run reverse) correctly. After exiting the programming status, press RUN and ▲ (or ▼) to start the operation in keypad control mode. If over current or over load or the output current exceeding the motor's rated current, restart the drive after changing the settings of F046 to ensure the correct PG parameter settings.

5) Switch off the drive, connect the elevator door mechanical system and switch on the drive again.

6) Set F002 to "2" (manual testing mode), select auto-learning speed properly via F047, set F048 to "1", press RUN to start door-width auto learning, and the motor operates according to the procedures of CD→OD→CD. The drive stops after the last motor catching. The door width information will be saved automatically after auto-learning.

**Note**

If the actual operation is reverse to OD/CD command, please change the setting of F004 and change the setting of F046 accordingly.

7) Switch on the drive again, it will operate according to the preset speed of F005, and the drive will be in stopping status after the door is completely closed.

8) Set relevant parameters according to table 7-2, and the CD/OD parameters can be set according to the OD operation curve shown in Figure 6-9 and the CD operation curve shown in Figure 6-10.

9) After testing, set F002 to "1" (terminal control mode), and the drive can work normally.

### 7.2.3 Parameters Setting

Please refer to Table 7-2.

*Table 7-2 Parameter settings for Speed control*

| Functions | Name | Setting | Remark |
|---|---|---|---|
| F001 | Control mode | 2 | Distance control 1 |
| F097 | Function of digital input terminal X1 | 10 | Phase A PG signal input |
| F098 | Function of digital input terminal X2 | 11 | Phase B PG signal input |
| F101 | Function of digital input terminal X5 | 2 | Normally open input contacts for optic signal |
| F102 | Function of digital input terminal X6 | 4 | Normally open input contacts for touch board |
| F103 | Function of digital input terminal X7 | 1 | External reset (RESET) signal input |
| F105 | Programmable relay PAC/PC1 | 2 | Output signal for complete OD1 |
| F106 | Programmable relay PAC/PC2 | 3 | Output signal for complete CD1 |

| Functions | Name | Setting | Remark |
|---|---|---|---|
| F010 | Start torque for OD | 50.0% | Parameters in the table are factory settings, adjust the OD parameters according to the actual OD operating conditions. |
| F011 | OD startup Acc time | 1.0s | |
| F012 | Low speed in OD startup process | 10Hz | |
| F013 | Low-speed maintaining time at OD startup | 1.0s | |
| F014 | OD reference frequency setting | 35Hz | |
| F015 | OD Acc time | 2.0s | |
| F016 | Initial time of S curve in OD Acc process | 20.0% | |
| F017 | Rising time of S curve in OD Acc process | 60.0% | |
| F018 | OD Dec time | 2.0s | |
| F019 | Initial time of S curve in OD Dec process | 20.0% | |
| F020 | Dropping time of S curve in OD Dec process | 60.0% | |
| F021 | Low speed setting in OD ending phase | 3Hz | |
| F022 | Holding torque in complete OD status | 50.0% | |
| F023 | Threshold for torque maintaining | 50.0% | |
| F024 | Abnormal Dec time | 0.5s | |

| Functions | Name | Setting | Remark |
|---|---|---|---|
| F027 | CD start torque | 50.0% | Parameters in the table are factory settings, adjust the CD parameters according to the actual CD operating conditions. |
| F028 | CD startup Acc time | 1.0s | |
| F029 | Low speed in CD startup process | 8Hz | |
| F030 | Low-speed maintaining time at CD startup | 1.0s | |
| F031 | CD reference frequency setting | 30Hz | |
| F032 | CD Acc time | 2.0s | |
| F033 | Initial time of "S" shape curve in CD Acc process | 20.0% | |
| F034 | Rising time of "S" shape curve in CD Acc process | 60.0% | |
| F035 | CD Dec time | 2.0s | |
| F036 | Initial time of "S" shape curve in CD Dec process | 20.0% | |
| F037 | Dropping time of "S" shape curve in CD Dec process | 60.0% | |
| F038 | Low speed setting in CD ending phase | 2Hz | |
| F039 | Holding torque for complete CD | 50.0% | |
| F040 | Hindering torque for CD | 100.0 % | |
| F041 | Threshold setting for CD torque changing | 50.0% | |
| F049 | OD speed changing location under distance control | 70.0% | Set according to actual operating effects. |
| F050 | CD speed changing location under distance control | 70.0% | |
| F051 | Pulse setting for complete OD under distance control | 90.0% | |
| F052 | Pulse setting for complete CD under distance control | 90.0% | |

| Functions | Name | Setting | Remark |
|---|---|---|---|
| F082 | Carrier frequency adjustment | 8K | Set according to system requirements |
| F084 | Utility rate of braking | 7 | Set properly according to braking condition |

**Attention**

Setting of F006 must be bigger than the sum of time in all phases of CD or OD curve.

## 7.3 Distance control 2

In distance control 2, refer to Figure 7-2 for system configuration, and the PG need not be connected to the shaft of the motor.

In distance control 2, except F001 set "3" (distance control 2), other parameters are the same with those of distance control 1. Refer to 7.2.2 for the testing procedures.

# Chapter 8 Troubleshooting

TD3200 can detect 16 types of faults. When fault occurs, you can get the information of fault codes, DC bus voltage, output current, operating frequency and terminal status by reviewing the values of F112~F119. You can check the faults according to the following table and note down the detailed fault phenomena before seeking technical service.

| Fault code | Type of faults | Possible fault reasons | Troubleshooting |
|---|---|---|---|
| E001 | Over-current in Acc process | 1) Acc time is too short.<br>2) Restart the motor in motion when momentary stop occurs.<br>3) Incorrect external wiring<br>4) Incorrect wiring of PG | 1) Prolong the Acc time;<br>2) Start the motor after it stops.<br>3) Wiring correctly<br>4) Change the setting of F046 or the wiring of PG |
| E002 | Dec overcurrent | Dec time is too short. | Please prolong Dec time<br>Adjust PI parameters |
| E003 | Overcurrent at constant speed operation | 1) Sudden change of load<br>2) Abnormal load | 1) Adjust PI parameters<br>2) Check load |
| E004 | Overvoltage in Acc process | 1) Abnormal input voltage<br>2) Unsuitable setting of PI parameters<br>3) Big load inertia | 1) Please check input power source.<br>2) Please Adjust PI parameters<br>3) Connect external braking resistor |
| E005 | Overvoltage in Dec process | 1) Dec time is short<br>2) Unsuitable selection of braking resistor<br>3) Abnormal input voltage<br>4) Unsuitable setting of PI parameters | 1) Prolong Dec time<br>2) Re-select the braking resistor<br>3) Check input voltage<br>4) Adjust PI parameters |

| Fault code | Type of faults | Possible fault reasons | Troubleshooting |
|---|---|---|---|
| E006 | Overvoltage at constant speed operation | 1) Abnormal change of input voltage<br>2) Energy regenerated by negative torque load | 1) Mount input reactor<br>2) Connect external braking resistor |
| E007<br>E008 | Reserved | | |
| E009 | Output phase loss | The output cables of the drive are broken, phase failure or 3-phase loads are severely unbalanced. | Check the 3-phase output cables of the drive and check if the 3-phase loads are balanced. |
| E010 | Reserved | | |
| E011 | Overheat of heatsink | (1) Air duct blocked<br>(2) IGBT abnormal | (1) Clear the air duct<br>(2)Seek service |
| E012 | Reserved | | |
| E013 | Drive overload | 1) Heavy load<br>2) Low mains voltage<br>3) PG error | 1) Select drives with bigger ratings<br>2) Check mains voltage<br>3) Check the PG wiring or replace the PG |
| E014<br>E015 | Reserved | | |
| | | | |
| E016 | EEPROM read or write fault | Fault occurs during the read-write of control parameters | Seek service |
| E017<br>E018 | Reserved | | |
| E019 | Current detecting circuit fault | (1) Current detecting circuit fails<br>(2) Power source fails | Seek service |
| E020 | CPU fault | (1) Severe interference<br>(2) Fault in read-write of CPU of control board | Seek service |
| E021<br>E022E023 | Reserved | | |

| Fault code | Type of faults | Possible fault reasons | Troubleshooting |
|---|---|---|---|
| E024 | Motor-parameters tuning error | (1)Motor's parameters setting error<br>(2)Tuning overtime | (1)Set the motor parameters correctly according to the motor nameplate<br>(2)Check if the motor is broken away from its load and check the motor's cables |
| E026<br>E027 | Reserved | | |
| E028 | Parameters setting error | (1)OD width auto-learning is not set as manual testing mode<br>(2)General keypad operating mode is not used in motor parameter tuning process<br>(3)CD and OD time is set shorter than all the settings of CD and OD time | (1)Set F002 to 2 in OD width auto-learning<br>(2)Set F002 to 0 in motor parameters tuning<br>(3)Set the OD and CD time to a bigger value and ensure the setting of F006 is bigger than all the settings of CD and OD time. |
| E029 | OD width auto-learning error | (1)The OD width obtained from the auto-learning process is 0.<br>(2)The OD width obtained from the auto-learning process is out of the limits. | (1)Check the PG wiring and relevant parameters<br>(2)Check the mechanical system of the elevator door |
| E030 | OD/CD error | (1)The motor's running direction is reverse to the definition of CD and OD<br>(2)OD/CD contacts error or setting error<br>(3)PG cable is broken<br>(4)OD width auto-learning overtime | (1)Change the phase rotation of the motor or set F004 to 1<br>(2)Check OD/CD contacts signal<br>(3)Check PG cable<br>(4)Check the mechanical system of elevator door |

# Chapter 9 Maintenance

Lots of factors such as ambient temperature, humidity, acid/alkali substances, dust, vibration, internal component aging and wearing may raise the chance of the occurrence of potential faults. Therefore, it is quite necessary to conduct daily checking and periodical maintenance to the drives that are operated or stored.

If the drive is transported from a distant place, routine inspections such as integrity of components and tightening of screws must be done before using the drive.

During normal operation, clean the dust inside the drive periodically, and check if the screws become loose.

If the drive has not been used for a long time, it is recommended to energize it every six months for more than half an hour to keep the internal electronic elements in good conditions.

**Danger**

- For the drive that has been stored for more than two years, when supplying AC power to the drive, use a voltage regulator to raise the input voltage to rated input voltage gradually, otherwise the drive may be damaged

**Danger**

- During drive's operation, the voltage is very high. Misoperation may result in serious personal injuries.
- Within a certain period of time after the power is cut off, dangerous high voltage still exsit inside the drive.
- Maintenance of drive shall only be done by qualified, trained professionals.
- Before maintenance, maintenance personnel must take off personal metal articles such as: watches, rings. Working uniforms and tools used during the operation must satisfy insulation requirements to avoid electric shock.

**Attention**

Before check and maintenance, please confirm the following items first. Otherwise, there is the hazard of electric shock:

- The inverter has been switched off;
- The charging LED lamp in the inverter is off.
- Use a volt-meter to test the voltage between terminals P(+) and P(-) and the voltage should be below 36V.

## 9.1 Daily Maintenance

Daily maintenance is required when using the drive so as to ensure the good operating environment. Besides, the daily operating data, parameter settings, parameter modification, etc. should be recorded, and filed.

Through daily maintenance and checking, various abnormal phenomena and the reasons for them can be found in time so as to eliminate the potential faults, ensure the normal operation of the drive and prolong the drive's life.

Refer to Table 9-1 for daily checking items.

*Table 9-1 Table of Routine Check Cues*

| Check guide | | | Criteria for judgment |
|---|---|---|---|
| Check items | Period | Check method | |
| 1) Temperature, humidity<br>2) Dust, water and drip<br>3) Gas | Anytime | 1)Thermometer, humidiometer<br>2) Visual inspection; measurement<br>3) Visual inspection | 1)<40℃. Remove the top cover if above 40 ℃<br>2) Be careful of dripping<br>3) No abnormal smell |
| 1) Vibration heat<br>2)Noise | Anytime | 1) Touching<br>2) Hearing | 1) Stable vibration, proper ventilation and temperature<br>2) Whether there is abnormal noise |
| 1) Heat<br>2) Noise | Anytime | 1) Touching<br>2) Hearing | 1) Whether the temperature is normal.<br>2) Whether the noise is even. |
| 1) Output current<br>2) Output voltage<br>3) Internal temperature | Anytime | 1) Voltmeter<br>2) Ammeter<br>3) Thermometer | 1),2) Within the specified range.<br>3) Temperature rise less than 35℃ |

## 9.2 Periodical Maintenance

You should check the drive every 3～6 months according to the actual environment so as to eliminate the potential faults and ensure the performance of the drive and prolong its life.

**Attention**

- Only trained personnel is allowed maintaining the drive;
- Never leave metal parts like screws or pads in the drive, otherwise the drive may be damaged;
- Do not reform the drive by yourself, otherwise the drive might become malfunctioned.

**Notes**

Some IC components on the control board are sensitive to ESD, so please don't touch these components by hand.

General Inspection:

1. Check if screws of control terminals are loose. If so, tighten them with a screwdriver;

2. Check if the main circuit terminals are properly connected, and check if the connection points of mains cables or buses, or screws are over heated;

3. Check if the power cables and control cables are damaged, especially the skin of the cables;

4. Check if the insulating tapes around the cable lugs are stripped or the connection between the cable and cable lugs is loose;

5. Clean the dust on PCBs and air ducts with a vacuum cleaner;

6. Before the insulation test of the motor, the motor must be disconnected from the drive. Otherwise, the drive might be damaged.

**Notes**

Dielectric test of the drive has already been done in the factory. It is not necessary for the user to do dielectric test again in order to avoid potential damage of its internal components.

## 9.3 Replacing Wiring Parts

Components that are easily damaged are: cooling fan and electrolyte capacitors of filters. Their lifetime depends largely on their application environment and maintenance.

Normally, lifetime of electrolyte capacitor is: 4 ~ 5 0,000 hours.

You can decide the time when the components should be replaced according to their life and the drive's total service time.

Abnormal components found during checking should be replaced immediately.

The model and parameters of the new component should be the same or very similar with the old component.

**Notes**

The drive may be damaged if the new component's model and parameters are different with those of the exchanged component.

Possible cause of damages of electrolyte capacitor: high ambient temperature, aging of electrolyte and big pulse current.

Criteria: Check if over-current or over-voltage failures occur frequently during drive startup with load, or if there is any leakage of liquids, or if the safety valve protrudes. Measure static capacitance and insulation resistance.

## 9.4 Storage

1. The following points must be followed for the temporary and long-term storage of drive:

*Table 9-2 Storage environment*

| Environment | Requirements | Remark | |
|---|---|---|---|
| Ambient temperature | -40 ℃~70℃ | Long-time storage temperature should be less than 30 ℃ to avoid the deterioration of the capacitor. | Condensation and frozen caused by sharp temperature change should be avoided. |
| Relative humidity | 20~90% | Use plastic film to seal the drive and desiccant, etc. | |
| Storage environment | Store in locations free of direct sun shine, dust, corrosive or combustible gases, oil mist, vapor, water drop, vibration and salt. | | |

2. Long-time storage will cause the deterioration of electrolytic capacitors. Therefore, the drive must be powered on periodically. For the drive that has been stored for a long time, it should be powered on without driving a motor for at least half an hour every half a year.

## 9.5 Warranty

Emerson Network Power will offer warranty service if the drive has faults in the following situations:

1. There are 18 months defects liability period as of the date of manufacture for the drive, providing that the drive is used as required in this user manual. After the 18 months, servicing will be charged properly;

2. Even within the 18 months, servicing will be charged in case of the following situations:

- Damages incurred to the drive due to mis-operations which are not in compliance with the User Manual;
- Damages incurred to the drive due to wrong wire connections;

- Damages incurred to the drive due to fire, flood, abnormal voltage and so on;
- Damages incurred to the drive due to the improper application of the drive.

3. The service will be charged based on the costs. If there are any contracts, the contracts prevail.

Emerson Network Power Co., Ltd.

# Maintenance Record

| | |
|---|---|
| Customer's Company: | |
| Address: | |
| Post code: | Contact person: |
| Tel: | Fax: |
| SN: | |
| Power: | Model: |
| Contract No.: | Date of purchase: |
| Service provider: | |
| Contact person: | Tel: |
| Servicing person: | Tel: |
| Date of servicing: | |
| Customer's opinion about the service:<br>☐Excellent ☐Satisfactory ☐ Acceptable ☐ Unsatisfactory<br>Other comments:<br>Signature： DD MM YYYY | |
| Customer Service Center Visit Record：<br>☐by phone call ☐by questionnaire<br>Others:<br>Signature: DD MM YYYY | |

Note: The form becomes invalid if the customer cannot be revisited.

# Warranty Agreement

1. The scope of warranty is confined to the drive only.

2. Warranty period is 18 months. Emerson Network Power conducts free maintenance and repair services to the drive that has fault or damage under the normal operation conditions.

3. The warranty period starts from the date the product is delivered, and the user, distributor and the manufacturer should negotiate under special conditions.

4. Even within 18 months, maintenance should also be charged in case of the following situations:

- Damages incurred to the drive due to mis-operations which are not in compliance with the User Manual;
- Damages to the drive due to fire, flood, abnormal voltage, etc;
- Damages incurred to the drive due to the improper use of drive functions.

5.The service fee will be charged according to the actual costs. If there are any maintenance contracts, priority will be put to the contract.

6.Please keep this paper and show this paper to the maintenance unit when the product needs to be repaired.

7. If you have any other question, please contact the distributor or Emerson Network Power directly.

**ENP Services China**

**Emerson Network Power Co., Ltd.**

Address: NO.6 Keyuan Road, 3F.SSIP Building. Shenzhen Science & Industry Park, Nanshan District, 518057, Shenzhen, PRC

Customer Service Hotline: 800-820-6510, (86) 21-23017141, (86) 755-86010800

**To Customers：**

Thank you for choosing our products.

We are ever trying to improve the product's quality and provide you with better service. Any comments or suggestions from you are much appreciated! Could you please fill in the form after the product has been operated for 1 month, and then mail or fax it to the Customer Service Center of Emerson Network Power Co. Ltd?  We will send you an exquisite souvenir upon receiving the completed Product Quality Feedback Form. Furthermore, if you can give us some advices on improving the product and service quality, you will be given a special award. Thank you very much!

**Emerson Network Power Co., Ltd.**

**Product Quality Feedback Form**

| | | | |
|---|---|---|---|
| Customer name | | Tel | |
| Address | | Zip code | |
| Model | | Date of use | |
| Machine SN | | | |
| Appearance or structure | | | |
| Performance | | | |
| Package | | | |
| Material | | | |
| Quality problem during usage | | | |
| Suggestion | | | |