# Servo Tech Middle East Co. Ltd.

## AC Servo Drives

# User's Manual

# SR , TSDA , SD Series

Jan.2006

# Contents

**For any information , please call <u>0098-21-33910719 , 33955239</u> , or FAX to us with <u>33955248 2</u>**

# 1. Introduction

Thank you for choosing SR series AC servo Drivers. SR series Drivers use the digital servo technology to provide high-precision and versatile functions for driving servo motors.

Many safety-related features have been built in the Driver design. However, erroneous operation may result in unpredictable accident and cause damage to the Driver or severe personal injury. It is highly recommended that the user is familiar with this manual and performs all setup and operations with caution.

This manual provides the information you need to install and configure SR series Driver. This manual is intended for use by vendors who are responsible for installing and setting up SR series Driver; consequently, it assumes a basic working knowledge of AC servo Motors.

In this manual, the installation related information such as **Dimensions and Specifications** are described in Chapter 1. **Wiring information** is shown in Chapter 2. Procedures for **Panel Operation** are described in Chapter 3. Finally, the **Alarm Codes** are given in Chapter 4.

## 1.1. Unpacking

After receiving the shipment from your supplier, please verify the following:
1. The motor (s) and driver(s) are the same as ordered.
2. The capacity of the driver matches with the motor to be driven. (Please see the Driver Specification for correct driver.)
3. No damage to the packaging material occurred during transportation.

## 1.2. Relocation

Please use the original packaging for driver relocation and handle with care.

## 1.3. Safety Precautions

1. Many high volume capacitors are used in the Driver circuit; these capacitors remain charged even if the unit power is been shut off. If it is necessary to touch the terminal or open the driver chassis, **please wait at least 10 minutes** before continuing.
2. While power on the Driver and/or motor, stand clear from the unit to prevent personal injury caused from erroneous operation.
3. Disconnect the power if the Driver/Motor unit is not used for a prolonged period.
4. To prevent electric leakage, connect the motor ground to the **FG** terminal of the Driver and connect this **FG** to Class 3 grounding. The machine, which the Driver and motor are installed must be **single-point grounded**.

## 1.4. Installation

### 1. Location

(1) If installed in a confined chassis, please provide necessary ventilation system to maintain the environmental temperature of the Driver below +55 deg. Celsius.

(2) Use rubber pad or shock absorber to insulate vibration if there is vibrating equipment nearby.

(3) The Driver shall not be installed in an environment where corrosive gases, excess dust, or metal powder is present. Insulation from water, water moist, or cutting fluid is required.

(4) If there is a big magnet switch or welding equipment, which may generate electronic noise, near the Driver installation, then a line filter is required. Recommend filter: For single-phase power source: DELTA 06DPCW5
For three-phase power source: DELTA 08TDS4W4

(5) If a line filter is not allowed for the reason of excess leakage current, then an insulating transformer is required at the input of the Driver.

### 2. Orientation

The Driver must be installed vertically.

### 3. Mounting Screw

Use four (4) M5 screws to mount the Driver securely.

### 4. Spacing

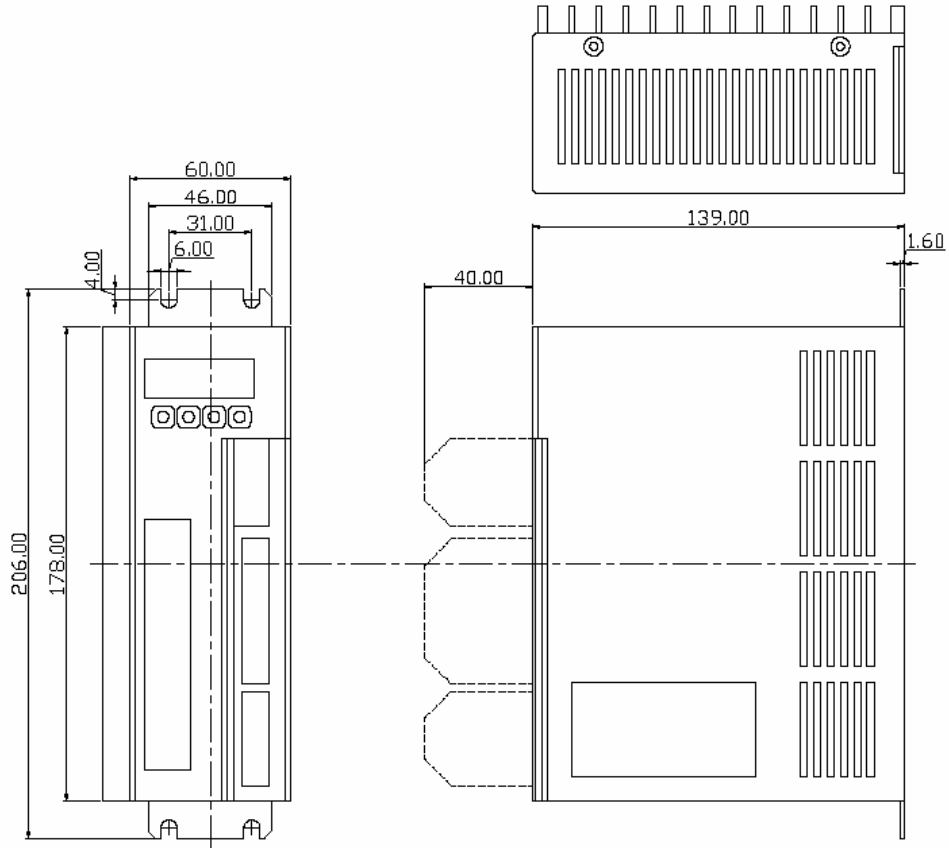Maintain **at lease 2 cm** spacing around the Driver unit.
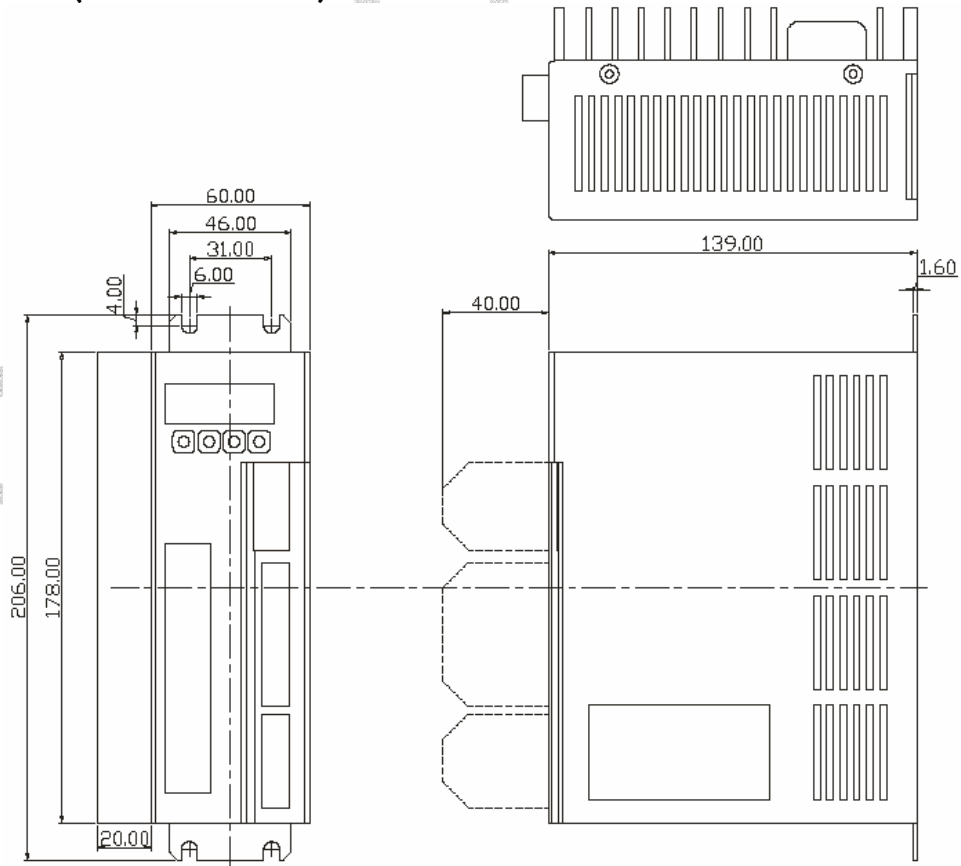
### 5. Foreign objects

During and after installation, any foreign object such as cutting chips, small screw, or washer which may fall into the opening of the Driver unit must be prevented.
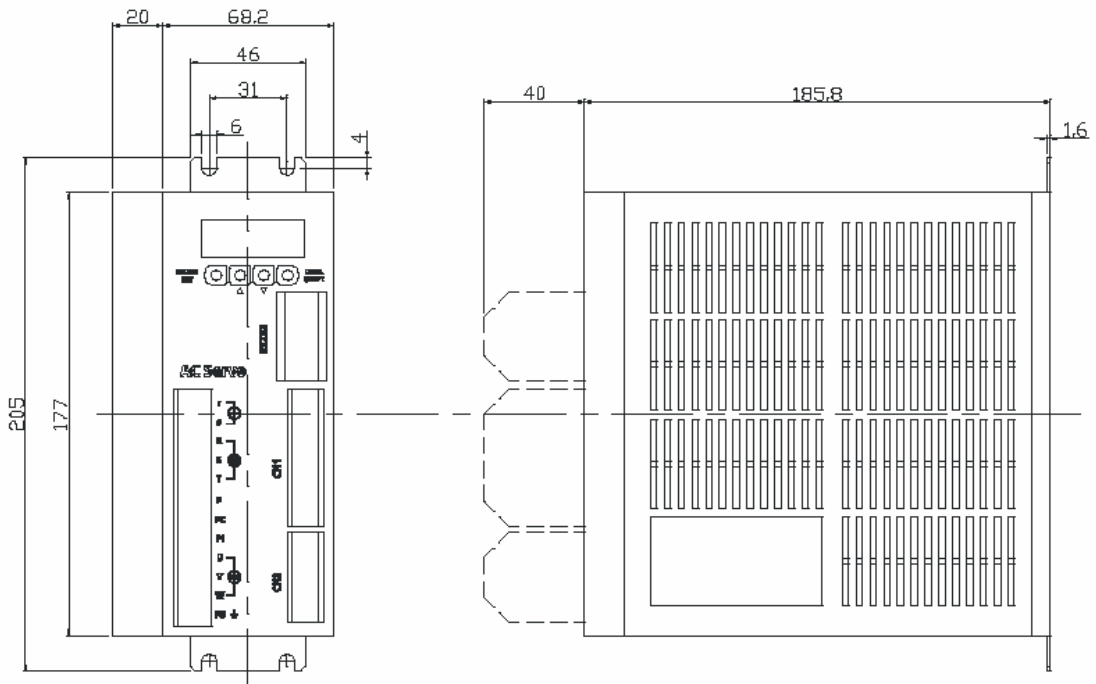
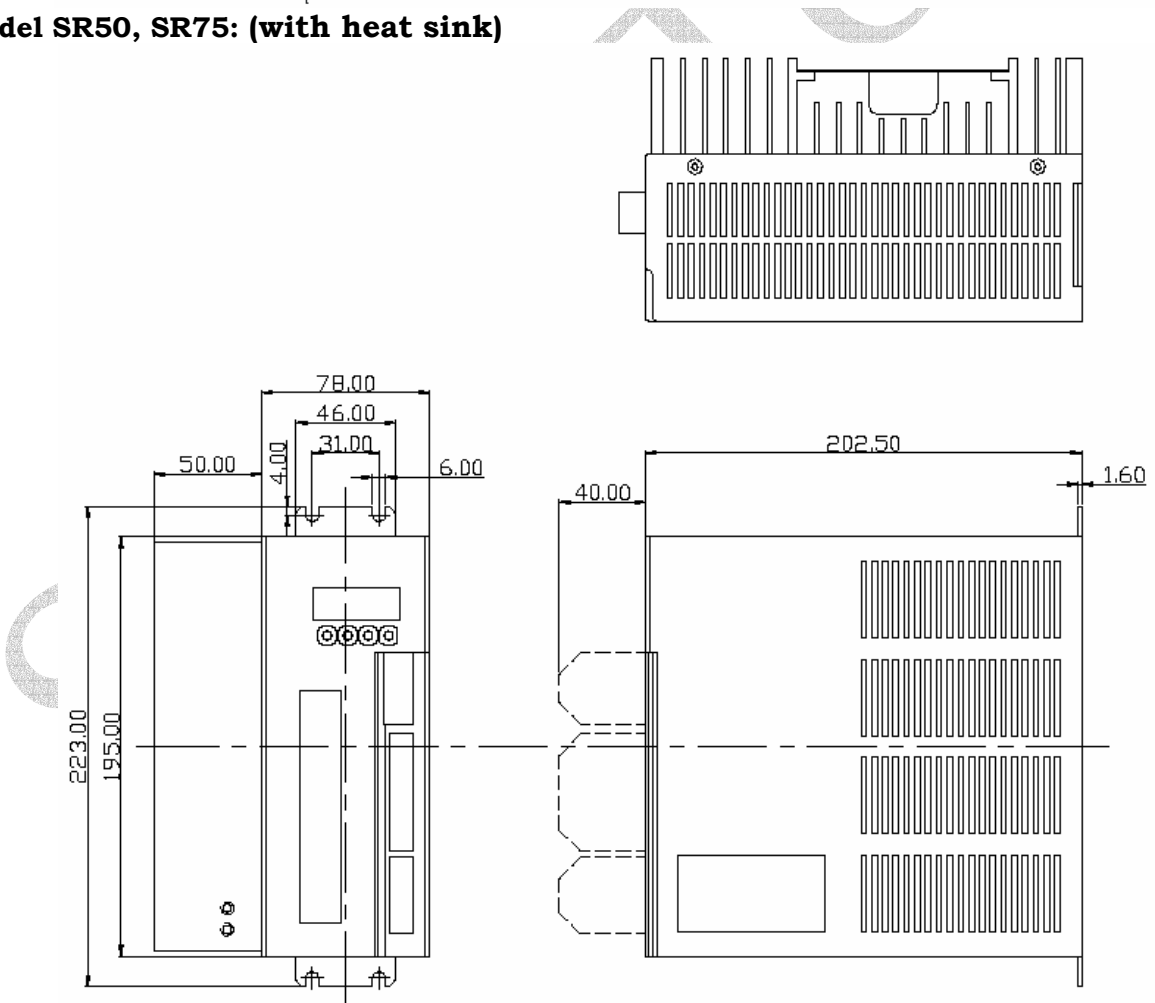## 1.5. Dimensions
### Model SR15B: (with heat sink)



### Model SR20B: (with heat sink)

## Model SR30C: (with heat sink)



## Model SR50, SR75: (with heat sink)

## 1.6. Technical Specifications

| Item | Description | | | | |
|---|---|---|---|---|---|
| Model No. | SD15 B | SD20 B | SD30 C | SD50 C | SD75 C |
| Maximum Peak Current (A) | 8.4A | 11.4A | 17.0A | 28.2A | 42.3A |
| Input supply | AC180V ~ 240V Single-Phase 50 / 60 Hz | | AC180V ~ 240V Three-Phase 50 / 60 Hz | | |
| Encoder | Incremental type | | | | |
| Environment Temperature | Operation: 0 ~ 50°C , Storage: -20 ~ 80°C | | | | |
| Humidity | Operation/Storage: < 85% RH | | | | |
| Vibration | < 0.5G | | | | |
| Manual Operation | Defined by User's Parameter. | | | | |
| Error Message | 10 error messages are stored. | | | | |
| Over-Travel inhibit | Positive or Negative Over-Travel inhibit (If over-travel is occurred, the servo power is disabled or put on hold.) | | | | |
| Analog Monitoring Output | Speed and Torque (-10V ~ +10V) | | | | |
| Encoder Output | A, B, Z Phase line driver output | | | | |
| Encoder dividing Ratio | 1/N : N = 1 ~ 16 | | | | |
| Display | 5-digit LED display , 4 button | | | | |
| Digital Inputs | Servo ON , Reset , Reverse Inhibit , Control Mode , External Torque Limit , Emergency Stop, Pulse Input Inhibit , etc. | | | | |
| Digital Outputs | Servo Ready, Error, In Position, Zero Speed, Encoder Output. | | | | |
| Communication | RS-232C for User's Parameter setting and status monitoring | | | | |
| **Control Mode** | Position / Speed / Torque | | | | |
| *__Position__* | Input type: | | A&B phase pulse , Up-Down pulse ( 2 pulse ) , Direction & pulse (1 pulse). | | |
| Max. Input Freq. | 500kpps | | | | |
| Electronic Gear Ratio | 1/50 < A/B < 50 (A&B : 1 ~ 10000) | | | | |
| Input Ripple Filtering | Time Constant = 0 ~ 10000ms | | | | |
| In position range | 0 ~ 32767 Pulses. | | | | |
| *__Speed__* | Input type: | | 0 ~ ±10V (Looking at the motor shaft, +V = CCW) | | |
| Preset speeds | Three preset speeds available through defining User's Parameter. | | | | |
| Linear Acceleration / Deceleration | Enable/Disable: defined by Parameter. When enabled, the slope is defined by User's Parameter between 10ms ~ 10000ms. | | | | |
| Zero Speed determination | 0 ~ 255rpm. | | | | |
| Specified speed reached | Specified by User's Parameter, (0 ~ Rated Speed). | | | | |
| Servo Lock | Enable/Disable: may be defined by User's Parameter. | | | | |
| Torque output | 0 ~ 300% rated torque of motor. | | | | |
| *__Torque__* | Input type: | | 0 ~ ±10V (Positive voltage for positive torque). | | |
| Input Ripple Filtering | Time Constant : 0 ~ 10000ms | | | | |
| Speed Limit ( External ) | Externally adjustable by POT | | 0 ~ 10V (Max. Rated Speed) | | |
| Speed Limit ( Internal ) | 0 ~ Rated Speed (adjusted by Parameters). | | | | |

## 2. System Wiring

## 2.1. Unit Overview

## 2.2. CN1 Connector

| Pin no | Name | Symbol | I/O* | Mode | Function |
|---|---|---|---|---|---|
| 1 | Servo on | SON | Di-1 | A | **SON** connects to **DG** means servo "ON" or servo system ready, open circuit means servo "OFF". |
| 2 | Alarm reset | ALRS | Di-1 | A | If **ALRS** is short to **DG**, then the alarm signal is cleared. However, the alarm persists if the reason, which caused the alarm, is not resolved. |
| 3 | P/PI switch | PCNT | Di-1 | PS | Connect to **DG** will switch the control mode from "proportional + integral" mode to "pure proportional" mode |
| 4 | CCW inhibit | FSTP | Di-1 | A | Connect to a **CCW** over-travel sensor / switch / detector. (Normally closed contact) |
| 5 | CW inhibit | RSTP | Di-1 | A | Connect to a **CW** over-travel sensor / switch / detector. (Normally closed contact) |
| 6 | **External** torque limit | TLMT | Di-1 | PS | Connect this signal to **DG** will limit the torque output in the range of **NIC** to **PIC.** |
| | **External** speed limit | | | T | Connect this signal to **DG** will limit the motor speed below the speed read from **PIC (PIN 27).** |
| 7 | Clear error counter | CLR | Di-1 | P | Clear error counter |
| | Servo lock | LOK | | S | Lock the last position if speed command is lower than 23 RPM. |
| 8 | Reserved | | | | (Do not use.) |
| 9 | Emergency stop | EMC | Di-1 | A | Servo "OFF" if **EMC** connect to **DG**. |
| 10 | Internal speed 1 | SPD1 | Di-1 | ST | **Effective ONLY if PN 12-4 is 1** |
| 11 | Internal speed 2 | SPD2 | | | |
| 12 | Control mode | MDC | Di-1 | A | **Please refer to PN10-1** |
| 13 | Command pulse inhibit | INH | Di-1 | P | Ignores the input command pulses, if connected to **DG**. |
| 14 | **Pulse +** | PP | Di-2 | P | |
| 15 | **Pulse -** | /PN | | | |
| 16 | **Direction +** | DP | | | |
| 17 | **Direction -** | /DN | | | |
| 18 | Servo ready | REDY | Do-1 | A | **REDY** connects to **DG** if Power source is in normal condition and no alarm. |
| 19 | Alarm | ALM | Do-1 | A | **ALM** connects to **DG** normally; it is opened when any abnormal condition is detected. |
| 20 | Zero speed | ZS | Do-1 | S | **ZSP** connects to **DG** if **PN11- 4 is 0** , and the motor speed is lower than the speed set in **PN7**. |
| | Brake | BI | | | This signal is used as a control signal for external brake if **PN11- 4 is 1**. **BI** connects to **DG** to release the brake at servo "ON", and opened at servo "OFF". The timing can be adjusted by the value set in **PN32**. |
| 21 | In position | INP | Do-1 | P | When the pulses difference between the command pulses and the feedback pulses is less than the value set in the **PN20,** The **INP** signal connects to **DG**. |
| | Speed reached | INS | | S | When the motor speed exceeds the RPM value set in **PN8**, the **INS** signal connects to **DG**. |
| 22 | alarm bit 0 | | Do-1 | PS | Binary representation of the alarm codes. The alarm code output from these ports is the same as the code shown on the 7-segment display. |
| 23 | alarm bit 1 | | | | |
| 24 | alarm bit 2 | | | | |
| 25 | alarm bit 3 | | | | |
| 26 | Speed / torque command | SIN | Ai | ST | A **+10V to −10V** speed-command input or torque-command input. **PN3** is used to scale the input value. If the rated speed is **3000RPM** and PN3 is **8**, that means an **8 V** speed command input is interpreted as a **3000 rpm** speed command. Please refer to **PN10-3** which is used to change the direction. |
| 27 | Speed limit | PIC | Ai | T | **0 ~ +10V** External speed limit. **+10V** gives a speed limit the same as rated speed |
| | CCW torque limit | | | PS | **0 ~ +10V** External torque limit. **+10V** input voltage gives a **3** times rated torque limit in positive direction. |
| 28 | CW torque limit | NIC | Ai | PS | **0 ~ -10V** External torque limit, **-10V** input voltage gives a **3** time rated torque limit in negative direction. |

Additional detail within Pin 10/11 row:

| SPD1 | SPD2 | **Speed mode** | **Torque mode** |
|---|---|---|---|
| 0 | 0 | **SIN (pin 26)** | **PIC (pin 27)** |
| 1 | 0 | Internal speed 1 | Speed limit 1 |
| 0 | 1 | Internal speed 2 | Speed limit 2 |
| 1 | 1 | Internal speed 3 | Speed limit 3 |

Additional detail within Pin 14–17 row:

| **PN10-2 value** | **Pin 14,15** | **Pin 16,17** |
|---|---|---|
| 0 | CW Pulse | CCW Pulse |
| 1 | Pulse | Direction |
| 2 | Phase A | Phase B |

| Pin no | Name | Symbol | I/O* | Mode | Function |
|--------|------|--------|------|------|----------|
| 30 | Speed monitor | TG | Ao | PS | $\pm$**10V** represent $\pm$**4500rpm**, offset can be adjusted from **PN34**. |
| 31 | Torque monitor | CUR | Ao | PS | $\pm$**10V** represent $\pm$**3.5** times of rated torque output. The offset can be adjusted from **PN35**. |
| 29 | Analog ground | AG | Ao | PS | Analog ground |
| 32 | | | | | |
| 33 | Voltage out | +15 | | A | **+15V** DC, **10mA** MAX out. power source for **SIN, PIC, NIC** test. |
| 34 | Voltage out | -15 | | A | **- 15V** DC, **10mA** MAX out. power source for **SIN, PIC, NIC** test. |
| 35 | Encoder phase **A** output | PA | D0-2 | PS | |
| 36 | Encoder phase /**A** output | /PA | D0-2 | PS | Encoder output pulses after frequency division with **PN0**. When **PN10-3 is 1**, the motor rotation direction is **CCW**, and phase **A** lead phase **B** by **90** degree. |
| 37 | Encoder phase **B** output | PB | D0-2 | PS | |
| 38 | Encoder phase /**B** output | /PB | D0-2 | PS | Output is by line driver. |
| 39 | Encoder phase **Z** output | PZ | D0-2 | PS | |
| 40 | Encoder phase /**Z** output | /PZ | D0-2 | PS | Transfer the **Z and** /**Z** pulses of the encoder of the motor to line driver output. |
| 41 | Reserved | | | | (Do not use) |
| 42 | Reserved | | | | (Do not use) |
| 43 | Encoder phase **Z** output | Zo | D0-1 | PS | An open collector output for encoder phase **Z.** |
| 44 | **Encoder ground** | **EG** | | **PS** | **Encoder ground** |
| 45 | 24V External Voltage | +24V | | A | Connect to external **+24V (300mA)** for **I/O** use. Regulated power supply is recommended. |
| 46 | Digital ground | **DG** | | PS | Ground for digital input and output ports. |
| 47 | | | | | |
| 48 | | | | | |
| 49 | | | | | |
| 50 | Shielding | **FG** | | PS | Connect to the shielding of the cable. |

* **In mode column, 'P' means for <u>POSITION</u> mode, 'S' means for <u>SPEED</u> mode, 'T' means for <u>TORQUE</u> mode, 'A' means for <u>ALL</u> modes.**

*<b>Di-1~3 are input pins, Do-1~2 are output pins, Ai and Ao are analog input and analog output respectively. All the circuits are listed in the following charts.</b>

## 2.3. CN2 encoder connector

| Pin no | Name | Symbol | I/0* | ENCODER WIRE COLOR | ENCODER TERMINAL NO. | Function |
|--------|------|--------|------|------------|--------------|----------|
| **1,2** | 5V | + 5V | | white | **B** | If the wire length for the encoder is longer than **20m**, please use **double wire** to minimize voltage drop. If longer than **30m**, please consult with your supplier . |
| **3,4** | 0V | 0V | | black | **I** | |
| **5** | A | A | | Green | **A** | Encoder phase **A** |
| **6** | /A | /A | | Blue | **C** | Encoder phase **/A** |
| **7** | B | B | Di-3 | Red | **H** | Encoder phase **B** |
| **8** | /B | /B | | Pink | **D** | Encoder phase **/B** |
| **9** | Z | Z | | Yellow | **G** | Encoder phase **Z** |
| **10** | /Z | /Z | | Orange | **E** | Encoder phase **/Z** |
| **11~19** | Reserved | | | | | Not used. |
| **20** | Shielding | **FG** | | Shielding | **F** | Connect to the shielding of cable. |

**\* Note: Please see the chart shown on Page 9 for <u>Di-3</u> characteristics.**

## 2.4. Position mode :
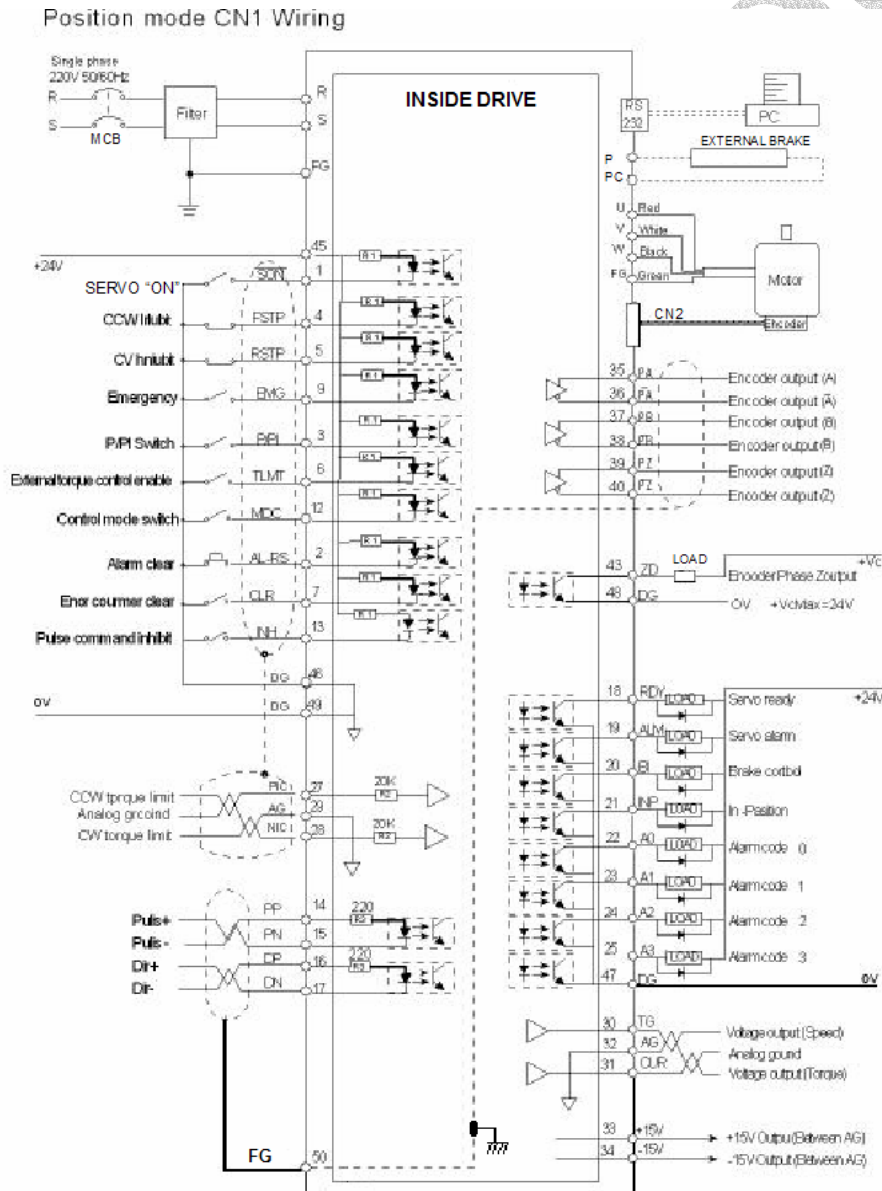


Position mode CN1 Wiring

## 2.5. Speed mode :



SPEED MODE CN1 WIRING
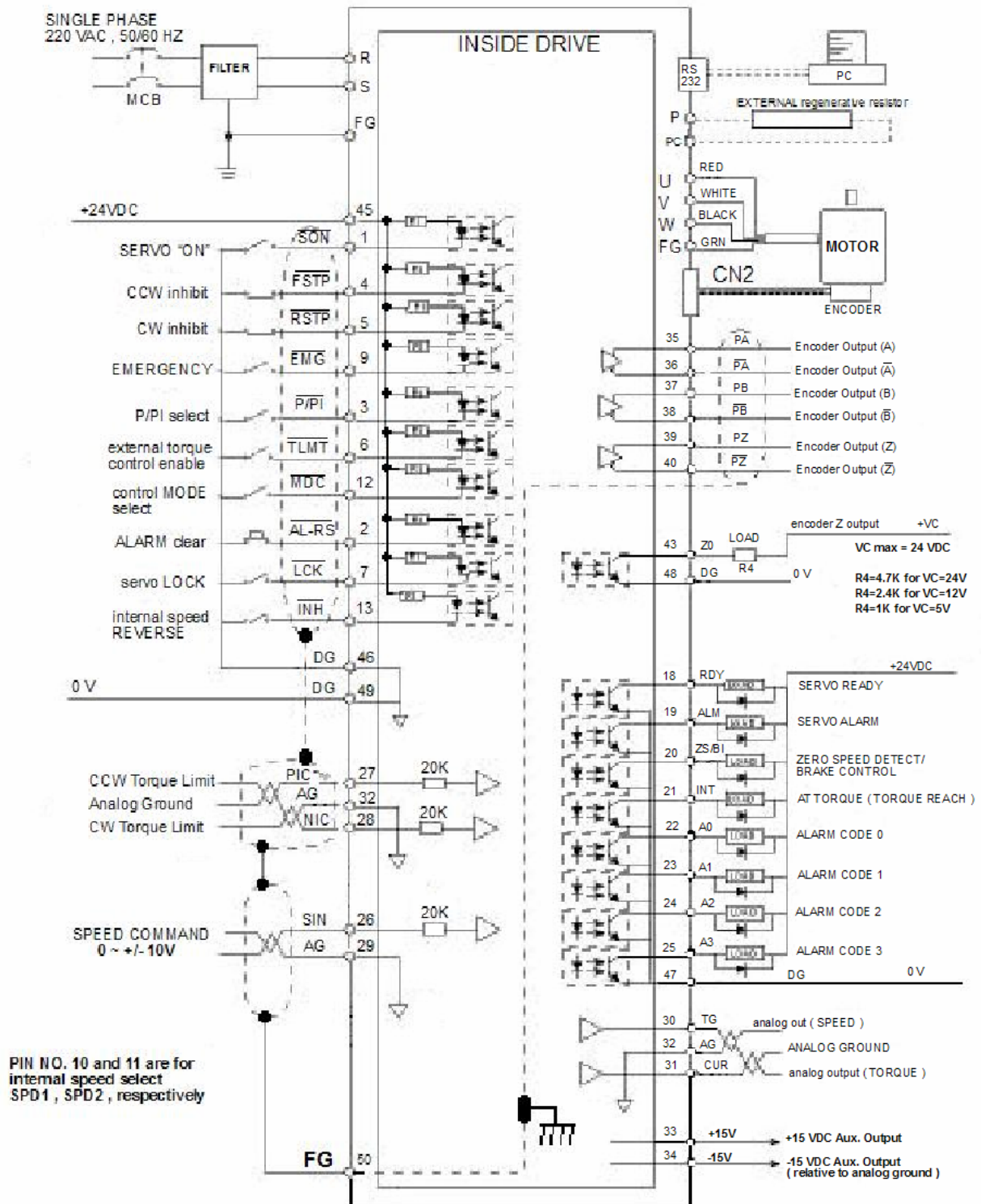
## 2.6. Torque mode :
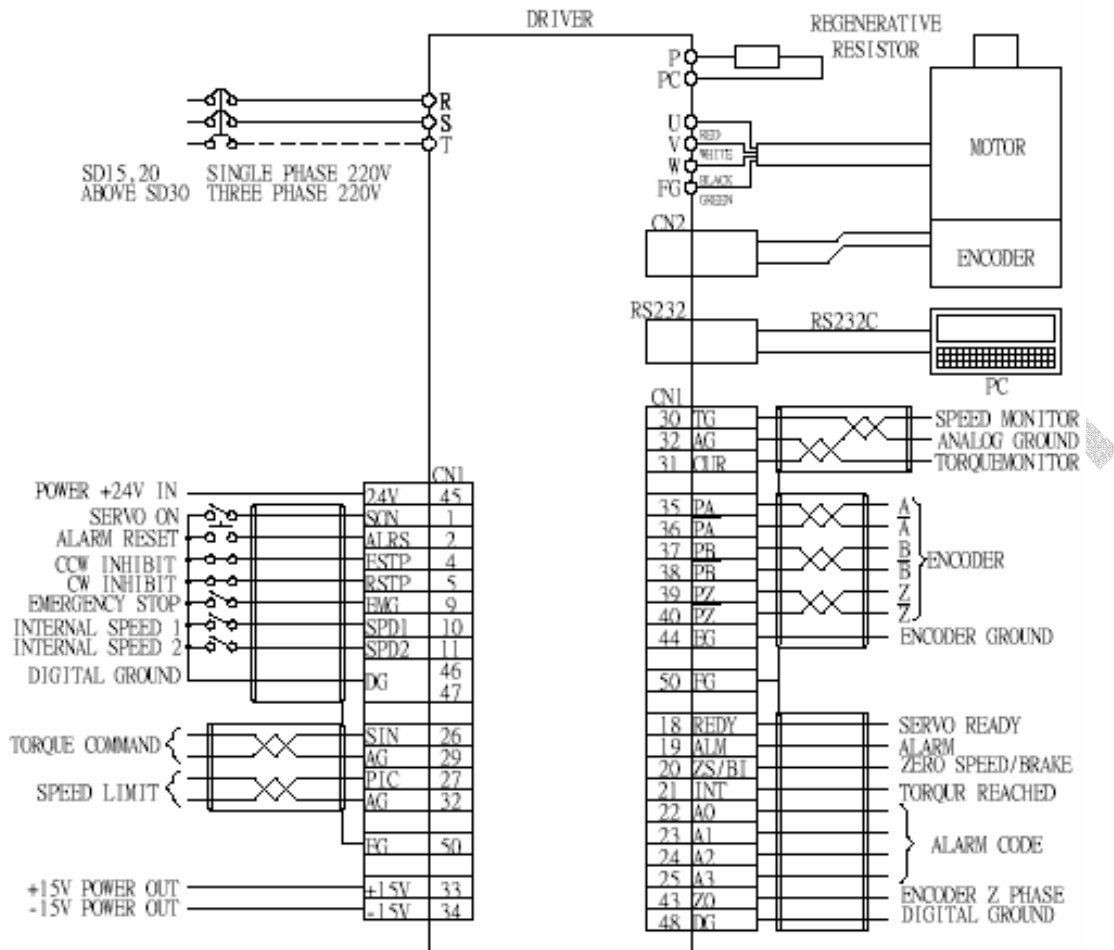


## 2.7. Power and motor diagram :

**FOR SR 15 B, SR 20 B :**
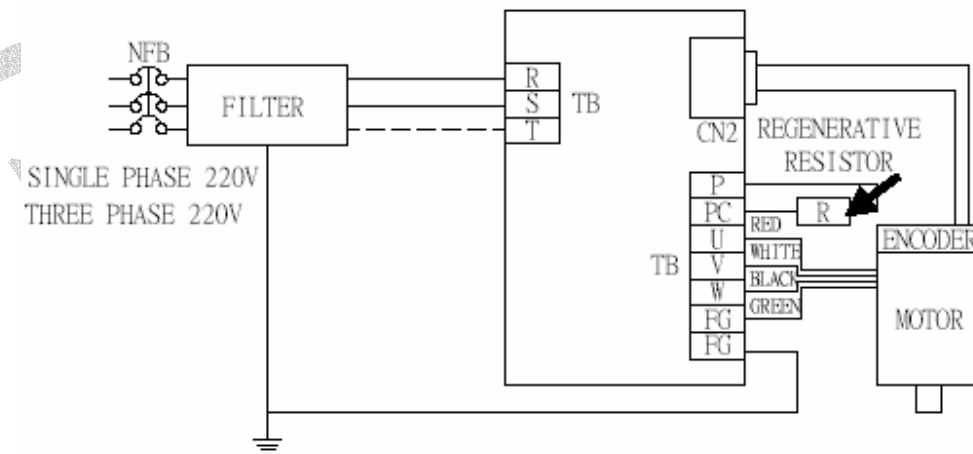
## FOR SR 30 C, SR 50 C, SR 75 C:



**Recommended line filter:**
**15A , 20A**: DELTA 06DPCW5 ,     **30A**: DELTA 08TDS4W4 ,  **50A**: DELTA 16TDS4W4  ,  **75A**: DELTA 24TDS4W4

**EXTERNAL Regenerative Resister:**
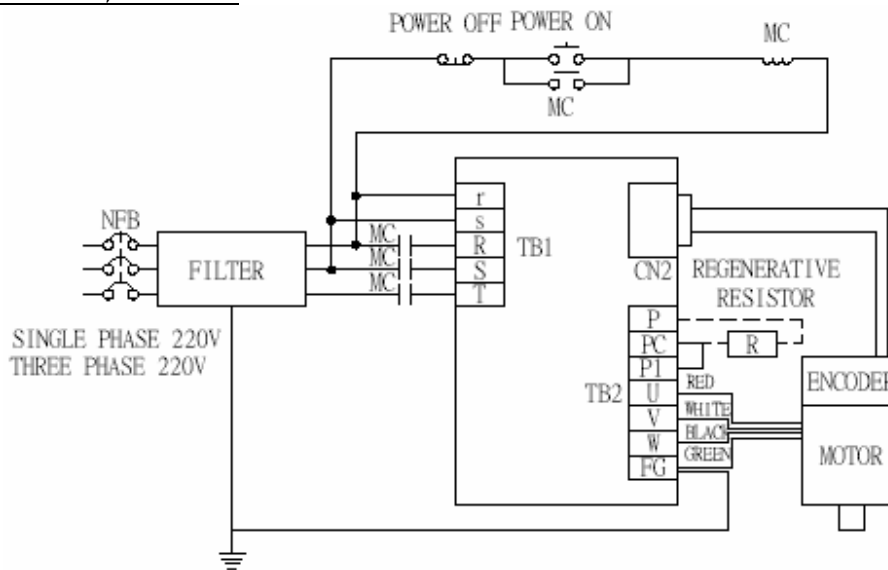   When the inertia presented on the motor is heavy, a regenerative resister is required. The value of the resister may be obtained by dividing the wattage of the motor from 2500. For example, a 50 Ohm resister may be used for a 50W motor. If **"error02"** (Chapter4) persists, then adjusting the regeneration duty cycle is also required (**Pn40, Section 3.3**). Select suitable wattage for the resistor, forced cooling (by fan) may be required for proper heat dissipation.

## 2.8. RS232
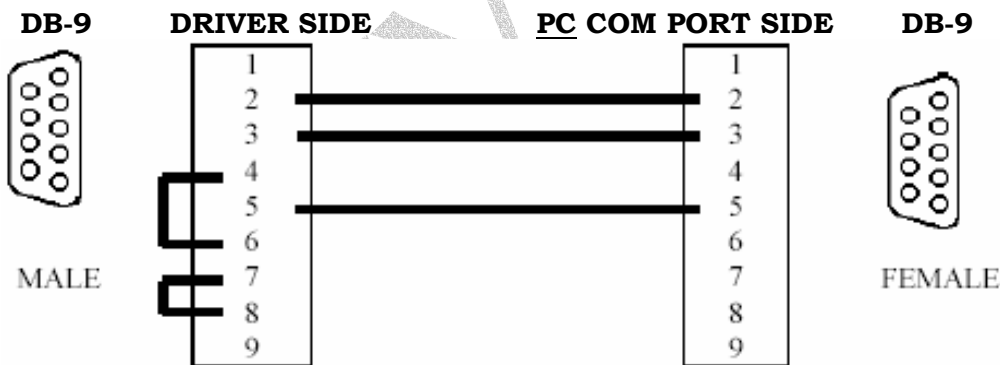


**Please use the cable described above to connect the servo driver to a PC for retrieving the system data and setting up the operation parameter.**

## 2.8.1. PC Communication port setting

Baud rate: **9600** bps ,
Parity: **None ,**
Data bit: **8 ,**
Stop bit: **1 ,**
Flow Control: **None .**

### 2.8.2. Read data from driver

⇨ **To read a SINGLE-WORD from driver**
Syntax: **R5XxSs**
The read command must be started with "R5" and the command string length must be "6".
Where: R5 = This is a single-word read command.
      Xx = the address of the data to be read.
      Ss = Check Sum = 'R'+'5'+'X'+'x'

Example :
Read the data stored in 30H.
Check Sum = 52H + 35H + 33H + 30H = EAH
           R     5     3     0
   Thus, the reading command is "R530EA" : R(52H) , 5(35H) , 3(33H) , 0(30H) , E(45H) , A(41H).

⇨ **Drive's response**: **%XxYySs**

Where:  % = This is a response.
Xx = High word of data
Yy = Low word of data
Ss = Check Sum = '%'+'X'+'x'+'Y'+'y'
If the data stored in the address 30H is 0008H, then
Check Sum = 25H + 30H + 30H + 30H + 38H = EDH
           %     0     0     0     8
Thus, the driver's response is
" %0008ED" = %(25H) , 0(30H) , 0(30H) , 0(30H) , 8(38H) , E(45H) , D(44H).
If there is a Check Sum error in the read command, then the driver returns "! (21H)"

⇨ **To read a DOUBLE-WORD from driver**

Syntax : **L5NnSs**
The read command must be started with "L5" and the command string length must be "6".
Where: L5 = This is a double-word read command.
      Nn = the address of the data to be read.
      Ss = Check Sum = 'L'+'5'+'N'+'n'
⇨ Driver's response : **%XxYyAaBbSs**

Where: % = This is a response.
    XxYy = data stored in Nn+1
   AaBb = data stored in Nn
    Ss='%'+'X'+'x'+'Y'+'y'+'A'+'a'+'B'+'b'
If there is a Check Sum error in the read command, then the driver returns "! (21H)"

# 2.8.3. Write data to driver

⇨ **To write a SINGLE-WORD to driver**

Syntax : **W5XxYyZzSs**
The write command must be started with "W5" and the command string length must be "8".
Where: W5 = This is a single-word write command.
      Xx = the address of the data to be written.
      Yy = The high word of the data
      Zz = The low word of the data
      Ss = 'W'+'5'+'X'+'x'+'Y'+'y'+'Z'+'z'

Example:
Write "8" to address "30H".
Check Sum = 57H + 35H + 33H + 30H + 30H + 30H + 30H + 38H = 1B7H
              W    5    3    0    0    0    0    8

  Thus, the write command is
  W5300008B7:
  W(57H) , 5(35H) , 3(33H) , 0(30H) , 0(30H) , 0(30H) , 0(30H) , 8(38H) , B(42H) , 7(37H)
  Please note that only the last two digits of the Check Sum are used.

#### ⇨ **Driver's response: %(25H)**

If there is a Check Sum error in the read command, then the driver returns "! (21H)" .

For Monitor Mode Address 128(80H) ~ 157(9DH), the data sent to the driver is the number of times, which the driver will respond with the content stored in the specified address.
**For example :** Sending a string of **"W5800008BC"** will cause the driver to respond with the content stored in address 80H for **eight times.** The format of the response string is the same as "R5" read command.
This function can be used to monitor a certain data *such as speed or torque continuously*.
Writing a "zero" to one of these addresses will clear the content store at that address.

#### ⇨ **To write a DOUBLE-WORD to driver**

Syntax : **M5NnXxYyAaBbSs**
The write command must be started with "M5" and the command string length must be "14".
Where : M5 = This is a double-word write command.
Nn = the address of the data to be written.
Xx = The high word of the data to stored in Nn+1
Yy = The Low word of the data to stored in Nn+1
Aa = The high word of the data to stored in Nn
Bb = The Low word of the data to stored in Nn
Ss = 'M'+'5'+'N'+'n'+'X'+'x'+'Y'+'y'+'A'+'a'+'B'+'b'

#### ⇨ **Driver's response: %(25H)**

If there is a Check Sum error in the read command, then the driver returns "! (21H)" .

For Monitor Mode Address 128(80H) ~ 157(9DH), the data sent to the driver is the number of times, which the driver will respond with the content stored in the specified address.
**For example :** Sending a string of "M58000080008Ss" will cause the driver to respond with the content stored in address 81H and 80H for **eight times.**
The format of the response string is the same as "L5" read command.
This function can be used to monitor a double-word data *such as accumulated pulses continuously*.
Writing a "zero" to one of these addresses will clear the content store at that address.
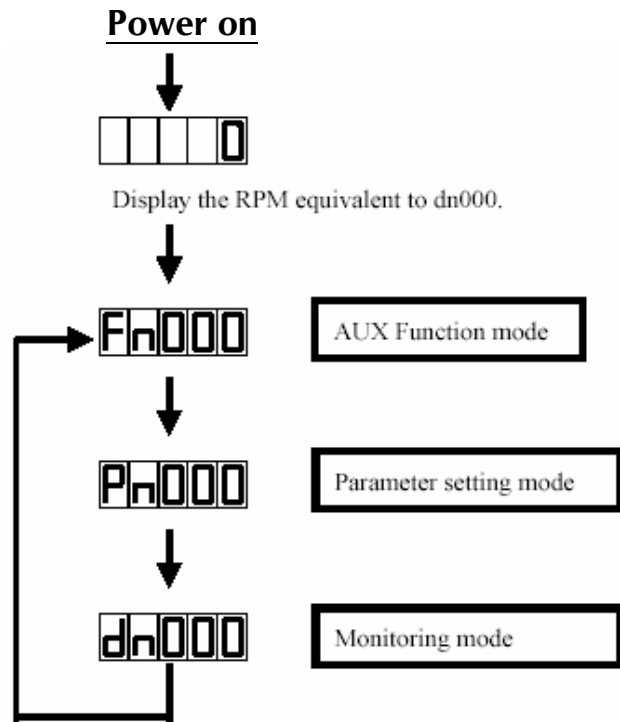
## 2.8.4. Memory map

| Address | Descriptions |
|---|---|
| 0~9 | Historical alarm codes (no.0~no.9) |
| 10 | Address of the last alarm (0~9) |
| 11 | User parameter check sum (no.0~no.51, XOR) |
| 12~63 | User parameter (no.0~no.51), read/write, unsigned. |
| 64~79 | Reserved for user as the motor model |
| 80~93 | Reserved |
| 94 | Backup copy of address 11 |
| 95~127 | Default values for user parameters (no.32~no.0) |
| 128~147 | Monitor mode (no.0~no.19), read only, signed. |
| 148~157 | Monitor mode data area. See section 2.8.3 for detailed information. |
| 158`191 | Reserved |
| 192(C0H) | 1. address 11 is the check sum of address 12~63 . any value change in address 12~63 will cause address 11 to be changed accordingly. 2. writing a "0" to this address (192) will disable the updating function of the address 11. writing a "1" to this address (192) will enable the updating function. The system default is "enable". 3. during the "disable" state , writing any value to address 11 will cause the check sum to be regenerated. 4. if there are many user parameters need to be changed, disabling the check sum updating function is highly recommended to prevent excessive writing of EEPROM. After changing all the user parameters, a write operation to address 11 may then be executed. |
| 193(C1H) | Clear historical alarm codes, the content in address 0~10 are cleared. |
| 194(C2H) | Writing a "1" to this address will initialize the driver with the setting stored in the address 12~63; the block, where a user is not allowed to change , is excluded. |
| 195(C3H) | Firmware version. The format is similar to that of Fn003. for the numbering of year , 0~9 stands for year 2000~2009; A~Z stands for year 2010~2035, respectively. |
| 196(C4H) | RESET |
| 197(C5H) | Input status, the description of each bit is shown in section 3.2.6. |
| 198(C6H) | Output status, the description of each bit is shown in section 3.2.7. |
| 199(C7H) | Current alarm code, "0" means no alarm. |

## 3. Panel operation

| Name | Function |
|---|---|
| MODE | Mode selection, press this key for more than 1 second to confirm the flashing function. |
| ^ | Increase the flashing digit by 1. |
| v | Decrease the flashing digit by 1.  Press (^) and (v) simultaneously to clear the alarm. |
| DATA | Shift the cursor (the flashing digit) left by 1 position. Press this key for more than 1 second to select or store the data into the **EEPROM (PN).** |

### 3.1. Mode selection:
There are **3** modes to select from: **Auxiliary function, Parameter setting, and Monitoring**. Press the MODE key repeatedly to cause the displays to scroll in the following sequence:

**Power on**



Display the RPM equivalent to dn000.

| | |
|---|---|
| Fn000 | AUX Function mode |
| Pn000 | Parameter setting mode |
| dn000 | Monitoring mode |

## 3.2. Auxiliary functions

Press the MODE key repeatedly until the following pattern is displayed. **Fn000**

## 3.2.1. Historical alarm code

The last 10 alarm codes are stored in the EEPROM.
Use the following procedures to retrieve the stored alarm codes.

1. Select the auxiliary function mode. **Fn000**

2. Press the DATA key for more than 1 second. **0-A00**

3. Press the (^) key or the (v) key to scroll up and down among the previous alarm codes. The leftmost number is the alarm sequence, where "9" means the oldest.

4. Press the DATA key for more than 1 second to return to the auxiliary function mode. **Fn000**

## 3.2.2. Clear the historical alarm codes

1. Press the (^) key or the (v) key to select function 1. **Fn001**

2. Press the DATA key for more than 1 second until the following message appears. **ErcLr**

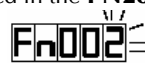3. Press the MODE key to clear the memory. **donEr** Flash for 1 second : → **ErcLr**

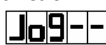4. Press the DATA key more than 1 second to return to the auxiliary function mode. **Fn001**

## 3.2.3. Jog

Jog uses the speed specified in the **PN29** and the acceleration time specified in the **PN28**.

1. Press the (^) key or the (v) key to select the jog function **"Fn002".** **Fn002**

2. Press the DATA key for more than 1 second. **Jog--**

3. Press the (^) key or the (v) key to jog in positive or negative direction.
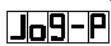
**Jog-P** For Jog in positive direction. **Jog-n** For Jog in negative direction. **Jog--** For Hold.

4. Press the DATA key for more than 1 second to return to the auxiliary function mode and close the jog function.
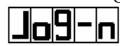
**Fn002**

**17**

### 3.2.4. Firmware version

1. Press the (^) key or the (v) key to select the function 3.   `Fn003`

2. Press the DATA key for more than 1 second to display the firmware release date: `00 126` represents the date: **26 JAN 2000 .**

   Counting from left to right, the first and second digit represents **YEAR**. The third digit represents the month. **1, 2, 3, 4, 5, 6, 7, 8, 9, A, b, c,** represent **JAN** to **DEC** respectively. The figures are shown as following:

   `123456789Abc` The fourth and fifth digits represent the **Date**.

4. Press the DATA key for more than 1 second to return to the auxiliary function mode.   `Fn003`

### 3.2.5. *Reset – Warm start*

**1. Press the (^) key or the (v) key to select the function 4.**   `Fn004`

**2. Press the DATA key for more than 1 second, and the following pattern is displayed.**   `RESEt`
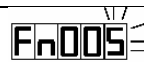**3. Press the MODE key to confirm the reset. Press the DATA key for more than 1 second to abort the reset.**
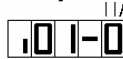
### 3.2.6. Input ports status ( address : 197(C5H) )

| PIN Number | Bit number | Definition |
|---|---|---|
| 1 | 9 | Servo on |
| 2 | 10 | Alarm reset |
| 3 | 2 | P/PI switching |
| 4 | 3 | CCW inhibit |
| 5 | 4 | CW inhibit |
| 6 | 5 | External torque limit |
| 7 | 1 | Clear error counter |
| 8 | 11 | Reserve |
| 9 | 8 | Emergence stop |
| 10 | 6 | Internal speed 1 |
| 11 | 7 | Internal speed 2 |
| 12 | 0 | Control mode |
| 13 | 12 | Pulse command inhibit |

1. Press the (^) key or the (v) key to select the function 5.   `Fn005`

2. Press the DATA key for more than 1 second, the display will show the pin number in **left 3 characters** and show the status in rightmost digit. *If the status digit is 1, which means the pin is* <u>connected to DG or 0V or close</u>. *If the status digit is 0, which means the pin is* <u>connected to 24V or open</u>.   `01 1-0`

3. Press the (^) key or the (v) key to scroll up and down to view all the input ports.
4. Press the DATA key for more than 1 second to return to the auxiliary function mode.

### 3.2.7. Output ports status ( address : 198(C6H) )

| PIN Number | Bit number | Definition |
|---|---|---|
| 18 | 3 | Ready |
| 19 | 0 | Alarm |
| 20 | 1 | Zero speed |
| 21 | 2 | In Position |
| 22 | 4 | Alarm code bit0 |
| 23 | 5 | Alarm code bit1 |
| 24 | 6 | Alarm code bit2 |
| 25 | 7 | Alarm code bit3 |

1. Press the (^) key or the (v) key to select the function 6.  `Fn006`

2. Press the DATA key for more than 1 second, then the display will show the pin number in the **left 3 characters** and show the status in **rightmost digit**. If the *status digit is 1, which means the pin is* <u>connected to DG or 0V or close</u>*. If the status digit is 0, which means the pin* <u>connect to 24V or open</u>.  `o20-1`

3. Press the (^) key or the (v) key to scroll up and down to view all output ports.

4. Press the DATA key for more than 1 second to return to the auxiliary function mode.

## 3.2.8. Scaling the positive speed input :

This is a special function for final calibration.
**Please don't perform this action without a precision Voltage generator.**
<u>**Procedure of this function : Fn010 -> Fn007 -> Fn008.**</u>
1. Press the (^) key or the (v) key to select the function 7 ( Fn007 ).
2. Press DATA for more than 1 second. The driver will ask you to present a **+2 Volt** signal in the speed reference input pin.
3. Press MODE key to indicate that a **+2 volt** signal is connected.
While scaling, **2 End** is flashing.
This function is locked to prevent unintentionally activation. If this function was activated before unlocking, a **Loc** message is displayed.
If this function is done successfully, a **donE** message flashes for 1 second before the confirmation. After confirmation, **in 2** is displayed and indicating that the result has been written into the EEPROM.
4.Press the DATA key for more than 1 second to return to the auxiliary function mode ( Fn007 ).
Unless a "donE" is displayed, the result is stored in the memory temporary to wait for negative data.

## 3.2.9. Scaling the negative speed input :

This is a special function for final calibration.
**Please don't perform this action without a precision Voltage generator.**
<u>**Procedure of this function : Fn010 -> Fn008 -> Fn007.**</u>
1. Press the (^) key or the (v) key to select the function 8 ( Fn008 ).
2. Press DATA for more than 1 second. The driver will ask you to present a **-2 Volt** signal in the speed reference input pin.
3. Press MODE key to indicate that a **-2 volt** signal is connected.
While scaling, **-2 End** is flashing.
This function is locked to prevent unintentionally activation. If this function was activated before unlocking, a **Loc** message is displayed.
If this function is done successfully, a **donE** message flashes for 1 second before the confirmation. After confirmation, **in -2** is displayed and indicating that the result has been written into the EEPROM.
4.Press the DATA key for more than 1 second to return to the auxiliary function mode ( Fn008 ).
Unless a "donE" is displayed, the result is stored in the memory temporary to wait for positive data.

## 3.2.10. Reload the <u>default</u> values *( Factory SETTING Reload )*
<u>**Function:**</u> reload the default values for **Pn0 ~ Pn32**
**Procedure of this function: Fn010 → Fn009.**

1. Press the (^) key or the (v) key to select the function 9.  `Fn009`

2. Press the DATA key for more than 1 second to request for a parameter initialization function.  `P init`
3. Press the MODE key to confirm the request.
`P init` flashes while reloading. → `donE` flashes for 1 Sec. → `P init`
This function is **locked** to prevent unintentionally activation. If this function was activated before unlocking, a `Loc` message is displayed.

4. Press the DATA key for more than 1 second to return to the auxiliary function mode.  `Fn009`

### 3.2.11. Lock & Unlock

Functions 7, 8 and 9 are locked normally to prevent unintentionally activation. The following procedures can be used to unlock these functions.
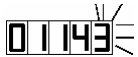
1. Press the (^) key or the (v) key to select the function 10. `FnO 10`

2. Press the DATA key for more than 1 second to request the unlock function. `UnLoc`

3. Press the MODE key to confirm the request

`UnLoc` flashes while unlocking → `donE` Flashes for 1 second → `Loc`

Press the MODE key again will lock the function again.

4. Press the DATA key for more than 1 second to return to the auxiliary function mode. `FnO 10`

After unlocking, the function 9 or the function 7 and 8 can only executed once.

***Functions 7, 8 and 9 will be locked after execution.***

## 3.3. User Parameters

1. Press the MODE key repeatedly until **PN000** is displayed. `Pn000`
press the (^) key or the (v) key to get the desired parameter number.

2. Press the DATA key for more than 1 second to retrieve the content of the listed parameter number.

`0 1 143`

***If there is a leading 'H', then it is a Hexadecimal number.***

3. To edit the number, press the DATA key to shift the flashing digit left. Press the (^) key or the (v) key to increase or decrease the flashing digit.

4. Press the DATA key for more than 1 second to store the new data into the **EEPROM**. The number entered will

flash for 1 second while recording. `0 1 145`

5. Press the DATA key for more than 1 second to return to the parameter setting mode. `Pn000`

# User Parameter Table

| No. | Definition | Range | Unit | Default | Mode | Activation | PC r/w address |
|---|---|---|---|---|---|---|---|
| **0** | MPG(Manual Pulse Generator) multiplying ratio | 1~16 | | 1 | A | reset | 12 |
| **1** | Speed loop proportional gain | 5~500 | | 40 | A | **enter** | 13 |
| **2** | Speed loop integration time (integral gain) | 1~1000 | msec | 100 | A | **enter** | 14 |
| **3** | Speed scale. The motor speed at SIN pin = 10V. | 200~3000 | rpm | 3000 | S | reset | 15 |
| **4** | Speed reference offset | ±63 | rpm | 0 | S | reset | 16 |
| **5** | Positive torque limit | 0~300 | % | 300 | A | reset | 17 |
| **6** | Negative torque limit | 0~300 | % | 300 | A | reset | 18 |
| **7** | Zero speed detection. Bellow this speed, pin20 will be connected to **DG**. Also refer to Parameter 11-4, 12-2. | 0~255 | rpm | 20 | S | **enter** | 19 |
| **8** | Reach the specified speed. If the current speed is greater than the specified speed, pin21 will be connected to **DG**. | 0~rated speed | rpm | Rated speed | S | **enter** | 20 |
| **9** | PWM sampling time | 90~125 | µs | 100 | A | reset | 21 |
| **10-1** | Hxxx**n**, <table><tr><td>**n**</td><td>**Pin 12 open**</td><td>**Pin 12 short**</td></tr><tr><td>0</td><td>speed</td><td>speed</td></tr><tr><td>1</td><td>position</td><td>position</td></tr><tr><td>2</td><td>torque</td><td>torque</td></tr><tr><td>3</td><td>speed</td><td>position</td></tr><tr><td>4</td><td>position</td><td>torque</td></tr><tr><td>5</td><td>torque</td><td>speed</td></tr></table> | 0~5 | | 1 | A | reset | 22-1 |
| **10-2** | Hxx**n**x, **n = 0**: pulse / direction , **n = 1**: CW / CCW , **n = 2**: A / B phase pulse input. | 0~2 | | 1 | P | reset | 22-2 |
| **10-3** | Hx**n**xx, **n = 0**: CCW for positive command, **n = 1**: CW for positive command. | 0,1 | | 0 | A | reset | 22-3 |
| **10-4** | H**n**xxx, **n = 0**: automatic current feedback , **n = 1**: current feedback offset to 0 . | 0,1 | | 0 | A | reset | 22-4 |
| **11-1** | Hxxx**n**, **n = 0**: dynamic brake "ON" while servo "OFF", **n = 1**: dynamic brake "OFF" while servo "OFF". Dynamic brake always "ON" while power "OFF". | 0,1 | | 0 | A | reset | 23-1 |
| **11-2** | Hxx**n**x, **n = 0**: increase the MAX. speed by 10~20% , **n = 1**: normal mode. | 0,1 | | 1 | A | reset | 23-2 |
| **11-3** | Hx**n**xx, for External inhibit signal from input ports. **n = 0**: disables positive inhibit signal , **n = 1**: enables positive inhibit signal , **n = 2**: enables negative inhibit signal , **n = 3**: inhibits both signals. Please refer to parameter 12-3 for more information. | 0~3 | | 3 | A | reset | 23-3 |
| **11-4** | H**n**xxx, **n = 0**: output signal 'ZSP/BI' means zero speed. **n = 1**: output signal 'ZSP/BI' is used to control an external brake. | 0~1 | | 0 | A | reset | 23-4 |
| **12-1** | Hxxx**n**, Acceleration and Deceleration time for speed mode. **n = 0**: time =0; **n = 1**: linear acceleration. Acceleration and deceleration time is set in parameter number 28. **n = 3**: deceleration time is set in the parameter number 27, Acceleration time is set in the parameter number 28. **n = 4**: Smoothing Acceleration. Acceleration and Deceleration time is set in Parameter number 28. | 0,1,3,4 | | 1 | S | reset | 24-1 |
| **12-2** | Hxx**n**x, **n = 0**: speed command is NOT influenced by ZSP output. **n = 1**: speed command is clamped to 0 while ZSP signal is "ON". | 0,1 | | 0 | S | reset | 24-2 |
| **12-3** | Hx**n**xx, **n = 0**: Servo keeps "ON" while external inhibit activated, **n = 1**: Servo "OFF" while external inhibit is activated. Please also refer to parameter number 11-3. | 0,1 | | 0 | A | reset | 24-3 |
| **12-4** | H**n**xxx, **n = 0**: internal speeds not effective, **n = 1**: internal speeds effective. One of the 3 internal speeds is selected from input port. Speeds are defined in parameters 29~31. | 0,1 | | 1 | S | reset | 24-4 |
| **14** | Torque command smoothing time | 0~10000 | ms | 0 | T | reset | 26 |
| **15** | Torque command gain, e.g. 300 means 300% rated torque output when torque command is 10 Volts. 100 means 100% rated torque output when torque command is 10V. | 30~300 | % | 300 | T | reset | 27 |
| **16** | Torque command offset, e.g. if offset is 100(1V), a 2.5V command from input port is executed only as a 1.5V command input. | -1000 ~ +1000 | 0.01V | 0 | T | reset | 28 |

| No. | Definition | Range | Unit | Default | Mode | Activation | PC r/w address |
|---|---|---|---|---|---|---|---|
| 17 | Speed Limit 1. Activated while the pin 10 of the CN1 is connected to **DG**, and the pin 11 of the CN1 is open. | 0 ~ rated speed | rpm | 0 | T | **enter** | 29 |
| 18 | Speed Limit 2. Activated while the pin 10 of the CN1 is open, and the pin 11 of the CN1 is connected to **DG**. | 0 ~ rated speed | rpm | 0 | T | **enter** | 30 |
| 19 | Speed Limit 3. Activated while the pin 10 and the pin 11 of the CN1 are both connected to **DG**. | 0 ~ rated speed | rpm | 0 | T | **enter** | 31 |
| 20 | In Position. Sets range of positioning completion signal output (INP). | 0 ~ 32767 | pulse | 4 | P | reset | 32 |
| 21 | Molecule of electronic gear ratio. Indicates the number of encoder pulses per reference unit. The input pulses will multiply this number to form an actual calculation number. 1/50 < **[21]** / **[22]** < 50. | 1 ~ 10000 | | 1 | P | reset | 33 |
| 22 | Denominator of electronic gear ratio. Indicates the number of encoder pulses per reference unit. The input pulses will divide this number to form an actual calculation number. 1/50 < **[21]** / **[22]** < 50. If encoder pulse of the motor is 2000ppr and **[21]** / **[22]** = 1, motor needs 8000 pulses to be input to drive, for one complete revolution. | 1 ~ 10000 | | 1 | P | reset | 34 |
| 23 | Positioning proportional gain | 10 ~ 500 | 1/sec | 30 | P | **enter** | 35 |
| 24 | Positioning smoothing time (integral gain) | 0 ~ 10000 | msec | 10 | P | Servo on | 36 |
| 25 | Error counter length | 1 ~ 500 | kpulse | 50 | P | reset | 37 |
| 26 | Feed forward gain | 0 ~ 100 | % | 0 | P | reset | 38 |
| 27 | Deceleration time. The time elapsed from rated speed to stop. Parameter number 12-1 is used to disable or enable this function. | 10 ~ 10000 | msec | 100 | S | Servo on | 39 |
| 28 | Acceleration time and deceleration time. The time elapsed from standstill to rated speed or from rated speed to standstill. Parameter number 12-1 is used to disable or enable this function. | 10 ~ 10000 | msec | 100 | S | Servo on | 40 |
| 29 | Internal speed 1. Activated while pin10 of the CN1 is connected to **DG**, and pin11 of the CN1 is open. | ± rated speed | rpm | 0 | S | **enter** | 41 |
| 30 | Internal speed 2. Activated while pin10 of the CN1 is open, and pin 11 of the CN1 is connected to **DG**. | ± rated speed | rpm | 0 | S | **enter** | 42 |
| 31 | Internal speed 3. Activated while both pin10 and pin 11 of the CN1 are connected to **DG**. | ± rated speed | rpm | 0 | S | **enter** | 43 |
| 32 | Brake timing. Waiting time or delay time around servo "ON" and servo "OFF". Brake will be released before servo "ON", and held after servo "OFF" if this constant is negative, servo "ON" command will be postponed. Brake will be released after servo "ON", and held before servo "OFF" if this constant is positive, servo "OFF" command is postponed. | ± 2000 | msec | 0 | A | reset | 44 |
| 34 | Speed monitor offset | -10 ~ +10 | 0.02V | 0 | A | **enter** | 46 |
| 35 | Torque monitor offset | -10 ~ +10 | 0.02V | 0 | A | **enter** | 47 |
| 36 | Speed command offset | -199 ~ +199 | 0.02V | 0 | ST | reset | 48 |
| 37 | Speed command scale | 10000 ~ 20000 | 1/16384 | 16384 | ST | reset | 49 |
| 38 | Speed command offset (4 times precision) | -199 ~ +199 | 5mV | 0 | S | reset | 50 |
| 39 | Speed command scale (4 times precision) | 10000 ~ 20000 | 1/16384 | 16384 | S | reset | 51 |
| 40 | Regeneration duty cycle. (default = 4) It means that if the voltage exceed 360V, there is 0.04 sec regeneration in every 10 second. Internal regeneration resistor : 15A driver 200R/10W , 20A driver 50R/10W , 30A driver 108R/10W , 50A driver 50R/10W , 75A driver 25R/10W . If Error # 2 exists, connect an external resistor, and observe the DN8 in Monitor Mode, if the value of DN8 gets divergent, then this parameter needs to be increased. The maximum value is resistance of the resistor (Ohm) times power dissipation (Watt) /134, (i.e: Max.**[40]** = R x P / 134). _Warning: To avoid burnout the driver, please watch the temperature raise of the heat sink._ External and internal resistors are in parallel, the minimum resistor: For 50A driver: 33R, and for Others: 25R. | 0 ~ 250 | 0.1% | 4 | A | reset | 52 |
| 41 | Current loop proportional gain | 0 ~ 10 | | 4 | A | reset | 53 |
| 42 | Inductance | 0 ~ 400 | % | 200 | A | reset | 54 |
| 43 | Feedback gain | 0 ~ 300 | | 100 | A | reset | 55 |
| 44 ~ 50 | Reserved | | | | | PC | |

### Remarks:
1. _Reset_ means the number is effective after reset from panel, CN1 or power off -on.
2. _Enter_ means effective after value set.
3. _PC_ means the value must be transferred in from of the RS232 communication port.
4. Mode(A): effective for all control modes.    (P): effective in position mode, only. (S): effective in speed mode, only.   (T): effective in torque mode, only.
5. Default value of Pn0 ~ Pn32 can be reload by function 9.  Pn 33 ~ Pn 43 can be set from panel or from communication port.

Pn50 and up, can only be set from the RS232 communication port.

## 3.4. Monitor mode

1. Press the MODE key repeatedly until the monitor mode is reached. **dn000**
2. Press the **(^)** key or the **(v)** key to get the desired parameter number.
3. Press the DATA key for more than 1 second to display the content of the DN.
4. Press the DATA key again for more than 1 second to return to the monitor mode.

### The monitor mode information list

| DN Number | Mode | Definition | PC r/w address |
|---|---|---|---|
| **0** | PST | **Speed (rpm), 120** means current motor speed is **120** rpm , this value is the average rpm in **0.1** second. | 128 |
| **1** | PST | **Torque:** the value is the percentage of the rated torque of the motor. **120** means that the current torque output is **120%** of the rated torque of the motor. | 129 |
| **2** | PST | **Actual load:** the value is the average torque output percentage in **26** seconds. | 130 |
| **3** | PST | **Maximum load:** the value is the maximum value appeared in **DN2.** | 131 |
| **4** | P | **Error:** the difference between command pulses and encoder feedback pulses. The command pulses are input pulse number multiplied by electronic gear ratio. The display value is clamped between **−9999 ~ +9999**. | 132 |
| **5** | S | **PIC:** torque limit for positive direction in percent. | 133 |
| **6** | S | **NIC:** torque limit for negative direction in percent. | 134 |
| **7** | T | **PIC: speed limit (rpm),** A value of **4** indicates **4** rpm. A value of **3000** indicates **3000** rpm. | 135 |
| **8** | PST | **Regeneration rate, 100** represents **1 %**. | 136 |
| **9** | PST | **Maximum regeneration rate, 100** represents **1 %**. | 137 |
| **10** | PST | **Maximum torque,** the maximum torque output since power on. | 138 |
| **11** | PST | **Driver capacity: 150** means **15A, 200** means **20A, 300** means **30A**. | 139 |
| **12** | PST | **Speed command, 4** means **1** rpm, **12000** means **3000** rpm. | 140 |
| **13** | ST | Voltage detected in AD0, **975** means **10V, 97** means **1V**. | 141 |
| **14** | S | Voltage detected in AD1, **975** means **2.5V**. | 142 |
| **15** | PST | **Motor type ( ID NUMBER )**. | 143 |
| **16** | PST | **Servo status: "0"** means **"servo on", "1"** means **"servo off".** | 144 |
| **17** | PST | **Current control mode: "0"** means **"speed mode", "1"** means **"position mode", "2"** means **"torque mode".** | 145 |
| **X** | P | Low word of error counter, the **32** bit counter has a range from **−500,000** to **500,000**. | 148 |
| **X** | P | High word of error counter. | 149 |
| **X** | P | Low word of accumulated input pulse. | 150 |
| **X** | P | High word of accumulated input pulse. | 151 |
| **X** | P | Low word of accumulated encoder feedback pulses. | 152 |
| **X** | P | High word of accumulated encoder feedback pulses. | 153 |
| **X** | PST | **RPM: 4** means **1 RPM. 480** means current motor speed is **120** rpm, this is a sampled value in **1** of **50** samples taken in **10 milliseconds.** | 154 |
| **X** | PST | **Torque:** output percentage of the rated torque. **120** means the torque output now is **120%** of the rated torque. This is a sampled value in **1** of **50** samples taken in **10 milliseconds.** | 155 |

**DN number X :  these values can only be read / written via the RS232 communication port.**

## 4. Alarm code

A message such as  EH-01  is indicating that an error has occurred. The message will stay until any key is pressed.

| Error code | To remove | Definition |
|:---:|:---:|:---|
| 1 | reset | **Low voltage** (DC voltage below **224V**, or AC voltage below **160V**, see note **1, 2**). |
| 2 | reset | **Over voltage** (DC voltage over **390V**, note **1, 2**), in most cases is happened on a large inertia. Please check **DN9** while running. If this value becomes bigger and never return to **0**, please add an external resistor for regeneration.<br>Please refer to **PN40**.The alarm also happens on high AC line voltage. |
| 3 | reset | **Over load**, a **200%** rated load can last for about **10** seconds, a **300%** load can last for about **4** seconds. |
| 4 | Power off | **IPM error**, due to high temperature, short-circuit, over current or low control voltage in IPM, the device which provides power to the motor. |
| 5 | reset | **Encoder error**, the signal from encoder is erroneous, please check connection or encoder. |
| 6 | reset | An abnormal value was read from the current sensors during power on. |
| 7 | reset | **Parameter error**, the electronic gear rate is not in the range **(0.02 ~ 50).** |
| 8 | reset | **Parameter checksum error**, The data stored in EEPROM may be corrupted. |
| 9 | reset | **Emergency stop**. |
| 10 | reset | **1) Over current** (**300%** rated current), please check the motor connection. Or,<br>**2) Specify a longer** acceleration/deceleration time. |
| 11 | reset | **Error-counter overflow**, (the difference of command pulses and feedback pulses is larger than the range of error-counter, which is defined in **PN25**. |
| 12 | reset | **Over speed**, the speed exceeds the value defined in the **PN46**. |
| 13 | reset | Peak input pulse exceeds **600kpps**. |
| 14 | reset | **Pin 3 and pin 4 of CN1 open simultaneously**. Normally both pins must be connected to **DG**. |
| 15 | reset | Due to the setting in **PN 12-3**, one of the **2** over travel switches (**pin3 OR pin4**) is activated and cause "servo OFF". |
| 16 | reset | **CPU error**, watch dog time out. The CPU already lost control. To prevent H/W damage, CPU reset is automatically issued. |

Note 1: Due to the accuracy of the resistor, the voltage detected has a maximum error of **2.02%.**

Note 2: If the rated voltage of the motor is **100 V**, the voltage level to alarm will be half of the value listed (DC**112V** for low voltage, DC**195V** for over voltage).

Note 3: There are **3** methods to reset the driver**.**

1) **Power cycle (Power off then on),**

2) **Fn004,**

3) **Send an input signal from pin2 of CN1.** However, the cause of alarm must be resolved first.