



**REFU**

**MACTROL-REFU PVT. LTD.**

# **MR-EcoS-220 Series Servo Drive User Manual**



## Notes

There are two types for **MR-EcoS-220** Series Drives such as **MR-EcoS-220-020-1A-3** / **MR-EcoS-220-030-1A-3**.

This manual is the simple one for **MR-EcoS-220** Series Drive, include simple wiring, parameters, trouble shooting and some cautions.

If you need detailed introductions about the parameters and performance, please contact your local **MR-EcoS-220** sales representative to send detailed paper or electronic manual to you.

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## **I Important Notice**

1. The power supply could be Three-phase AC 220V (-15%~10%), 50Hz~60Hz.
2. You need to change the motor code parameter PA1 for different motor model. Otherwise the vibration or some other trouble may occur.
3. Please set the electronic gear ratio correctly. You should to set PA12 and PA13 by referring to the manual.
4. Please choose the external pulse input type PA14 for the application. If the parameter PA14 is set incorrect, the motor couldn't run or rotate only in one direction.
5. The parameters mentioned above such as PA1, PA14 and PA35 could be effective after saving the parameters and restarting the drive.

## II Wiring

### 1. Appearance



### 2. Braking Unit

The BP and PI of the driver are externally connected to the braking resistor (the braking resistor has high voltage; please do not touch it by hand). if you use the built-in resistor, please short connect BP, D, if you use the external resistor, please remove the short connecting piece of BP, D .

**It's forbidden to connect terminal PI to BP directly by wire, which would damage the drive.**

### 3. Control power terminal

Terminal L1 and L2 are the control power connecting terminal, the power source should be Single-phase AC 220V. The users could connect the L1 and L2 with any 2 main power supply terminal of the R, S and T.

#### 4. Common DC bus supply terminals

PI Common DC bus positive. N Common DC bus negative

#### 5. Main power supply terminals

Terminals R, S and T should be connected to the 3-phase AC 220V main power supply.

#### 6. Servo motor output terminal

U, V and W are the servo motor output terminals of the drive, which should be connected to the servo motor correctly.

#### 7. Ground terminal

PE is the ground terminal. It's suggested that PE terminal, machine shell and shell of the CNC system should be connected, which is beneficial for personal security and EMC.

#### 8. Control Signal terminals

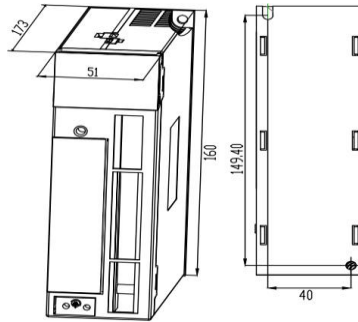
CN1 is encoder connector ,CN2 is I/O connector and CN3,CN4 is RS485 connector.

#### 9. Power level

The power level for the **MR-EcoS-220** series drives is shown as the following. Referring to the following table, you could choose the appropriate drive model which you need.

**Table 2.1** Power level for MR-EcoS-220 series drive

Servo Model	Power	Rated Current	voltage range	Size	Built-in resistance	External resistance
MR-EcoS-220-020-1A-3	750W	3.3A	AC220V	160*51*173	Yes	optional
MR-EcoS-220-030-1A-3	1.2KW	4.8A	AC220V	160*51*173	Yes	optional



MR-EcoS-220-020/030-1A-3

### III Motor code parameter

PA0 is the password parameter and PA1 is the motor code for different motor model.

Before setting the PA1, you should set PA0 to 302 which is only effective for PA1, or you could change the parameter PA1.

After setting PA1 by referring to the motor code list, you should save the parameters. (When EE-SET is displayed, please press the **Enter** key for 3 seconds, and then “FInIsh” would occur on the display, which means the saving operation is completed). For the detailed operation you can read the section 8.4 to know how to save the parameters. The PA1 could be effective after re-power the drive.

The specific motor code list for each drive model is shown as the following.

**Table 3.1** Motor code list for MR-ECOS-220

Code	Motor model	Power (kw)	Torque (Nm)	Rated Speed (rpm)	Rated Current (A)	Rated Voltage (V)
523	80F-2-1.3NM-3000-17Bit	0.4	1.27	3000	2.93	220
525	80F-2-1.9NM-3000-17Bit	0.6	1.9	3000	3.5	220
533	80F-2-2D4NM-3000-17Bit	0.75	2.39	3000	3.8	220
535	80F-2-3D3NM-3000-17Bit	1	3.3	3000	4.5	220
561	130F-2-040NM-2500-17Bit	1	4	2500	4	220



567	130F-2-060NM-2500-17Bit	1.5	6	2500	6	220
570	130F-2-7D7NM-2500-17Bit	2	7.7	2500	7.5	220
573	130F-2-0100NM-2500-17Bit	1.5	10	1500	6	220

The motors mentioned above are all produced by Mactrol-Refu Pvt. Ltd. If the users want to use the motor produced by other manufacturer, please contact with your local Mactrol-Refu Pvt. Ltd. sales representative or Mactrol-Refu Pvt. Ltd. distributors.

## V Parameters

1. PA0 is the password parameter. The default password is 315 for users and general parameters. PA0 must be 315 when users want to set the parameters except PA1.
2. Generally the parameters which the users may set are PA1, PA4, PA5, PA9, PA12, PA13, PA14
3. PA1 is for the motor model code. PA1 could be set at PA0=302 and the PA1 could be effective after saving and re-powering.
4. PA4 is for the control mode selection.

The mode is position mode at PA4=0 and the drive could work by the pulse command of the CNC host system or PLC control system.

The speed mode would be selected at PA4=1 and the speed command could be set by analog voltage (-10V~+10V) or internal speed command.

The torque mode would be selected at PA4=2 and the torque command could be set by analog voltage (-10V~+10V).

The trial run control mode would be selected at PA4=3, which mode is for debugging.









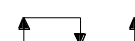



JOG mode would be selected at PA4=4.

The mode is for adjusting the zero of the encoder at PA4=5.

The default mode is the position mode, which is ready for CNC system.

5. PA5 and PA9 are set for stiffness and responsiveness of the the control loop. Please select the default values if there is no special application.
6. PA12 and PA13 are set for the electronic gear ratio. PA12 is the numerator of the gear ratio and PA13 is the denominator.
7. PA14 is set for selecting the external pulse input type.  
 PA14=0: pulse + direction.  
 PA14=1: CCW pulse + CW pulse.  
 PA14=2: AB phase pulse.  
 PA14 could be effective after saving and re-powering.

**Table 4.1** Type and waveform of the external input pulse

Pulse Type	Forward		Reverse	PA14
Pulse + Direction	PULS			0
	SIGN			
CCW + CW	PULS			1
	SIGN			
AB Phase Pulse	PULS			2
	SIGN			

## 8. Parameter summary

**Table 4.2** Parameter List

NO.	Function Description	Fault Description	Value Range
0	Password	1: Password is 315 2: motor type password is 302, you only need this when you are modifying PA1	1~1000
1	Motor type code	Select the motor type that you are using; in case you need to revise this number, input PA0 is 302, which is the password, finish off your parameters setting, power the drive off and on again then the changes will be effective.	20~200
2	Software Version	Software version read only, you can't change the details, A means the drive power level, B C D E means the different software versions.  A=3, 750W; A=4, 1.2KW; A=5, 1.8KW; A=6, 2.5KW;	0~99999
3	Initial display status	Select the display status when the drive has been powered on: 0: actual motor speed. 1: low data of the feedback position 2: high data of the feedback position 3: Low data of the position command 4: High data of the position command 5: Low data of the position error	0~19

		6: High data of the position error 7: motor torque 8: motor current(Q axis); 9: Reserved 10: control mode; 11: pulse frequency of position command 12: Speed command 13: Torque command 14: Motor feedback current -position. 15: D-axis current 16: Reserved 17: DC bus voltage 18: Drive operation status 19: Error/alarm code;	
4	Control Mode selection	Select the requested control mode by changing the following parameters: 0: Position control mode, controlling the position command pulse input and output; 1: Speed control mode. 2: Torque control mode 3: Speed trial run control mode, type in the numbers via keypad, users can test the drive and motor. 4: JOG control mode, enter the Jog control operation panel, press and hold the UP key, the motor will be running at a JOG speed, release the UP key, the motor stops with a zero speed; press and hold the DOWN key, the motor will be running at the JOG speed in a reverse direction, release the DOWN key, motor stops. 5: Zeroing encoder control mode, set PA4=5 will enter this mode directly.	0~8
5	Proportional Speed Loop	Generally speaking, increase this value can improve response performance and reduce the error. The default value is 170. The gain should be increased if	1~5000 Hz

	Gain	the load inertia is relatively high. Generally if the load inertia is greater, the value should be modified larger. You can increase the gain as much as possible without causing big noise and obvious vibration.	
6	Integral Time of Speed Control Loop	The value of the integral time has an effect on the response performance of the speed control loop. The lower the value is, the quicker the speed will be, however, when the value is too low, it may cause overshoot. Users need to adjust the value by the motor type and load inertia etc. Generally, having a big load inertia requires a bigger value setting.	1~1000 Ms
7	Speed Detection Filter time constant	1.the bigger this value is, the lower the cut-off frequency will be, less produced noise from the motor. If the load inertia is being very high, please increase this value considerably without causing major vibration and noise.  Decreasing the value can uplift the cut-off frequency, enhance the speed feedback response performance.	1~1000 ×0.1Ms
8	Differential coefficient of position	The larger the value, the faster the speed response. Excessive value may cause motor vibration.	1~1000 ×0.1Ms
9	Proportional Position Loop Gain	Increasing this value can improve the response performance and position precision. However excessive value will cause vibration and overshoot. The detailed value will be decided by the motor type, load inertia etc.	1~1000 /S
10	Position Feed Forward Gain	Increasing the value can reduce the position track error, set value 100% means the total position error is always zero under any frequency pulse. Increase this value can enhance the system response performance, but will make the position loop unstable and cause	0~100%

		possible vibration. Generally the set value is 0 unless users require very high response performance for specific applications.	
11	Smooth Constant for position feed forward	This parameter is used to set the time constant of low-pass filter for position feed forward gain. The function of this low-pass filter is to maintain the stability of position control.	0~1000 ×0.1ms
12	Electronic Gear Ratio (Numerator) N1	Under the control mode, users can matching different types of pulse commands and achieve their desired resolutions (angle/pulse) by adjusting PA12 & PA13. The electronic gear ratio can be calculated as the following : $N1/M1 = F2/(S1 \cdot P1)$  P1: Number of pulses corresponding to 1mm in the host controller  F2: Number of encoder pulses per circle (Default is 10000)  S1: Screw pitch of the mechanical transmission (mm)  The ideal range of the gear ratio is from 1/50 to 50.	1~ 30000
13	Electronic Gear Ratio (Denominator) M1	Refer to parameter PA12	1~ 30000
14	Position command Pulse Input Type	Note the revised parameters will only be effective after you turn the power off and on again in completion of the changes.  There are three different types of pulse input: 0: pulse + direction. 1: CCW pulse + CW pulse. 2: AB phase pulse.  Definitions of CCW and CW: face the motor, anti-clockwise direction is CCW(positive) while	0~2

		clockwise running direction is CW(negative).	
15	Position command Pulse Direction	0: Normal direction 1: Negative direction	0~1
16	Positioning Completed Range	In PT mode, this parameter is used to monitor the pulse range for the completion of the position controlling. The servo drive will need to use this value to judge whether or not the position control is completed.  In the position control mode, the COIN signal will be on when the leftover pulse of the position error is less than set value of PA16.	0~30000 pulse
17	Excessive Position Error Detection Range	Users can set position error detection range by adjusting this parameter. Under the position control mode, if the actual position error exceeds to the set value, the servo drive will send the alarm signal..	0~30000 ×100 pulse
18	E17 / E4 Control bit	bit0: E4 control bit bit0 = 0, E4 is valid; Bit0 = 1, E4 is invalid. bit1: E17 control bit bit1 = 0, E17 is valid; Bit1 = 1, E17 is invalid.	00~11
19	Smooth Constant of Position Command	This filter is used to smooth the position command pulse, value means the smooth constant. Command pulse going through the filter won't cause any pulse lose, but result in command delays. When the set value is 0, this means the filter is disabled. This filter will be used under the following circumstances: <ul style="list-style-type: none"> <li>• The host controller does not have a deceleration / acceleration function.</li> <li>• The electronic gear ratio is larger than 10.</li> <li>• The position frequency is low. ;</li> <li>• Step jumping and vibration occur when the motor is</li> </ul>	0~30000 ×0.1Ms



		running.	
20	Inhibition Function Selection	<ul style="list-style-type: none"> <li>· PA20 = 0, the external DI is allowed to disable CCW and CW; that is, when the FSTP or RSTP input is at an active level, CCW or CW is disabled. If FSTP and RSTP are valid at the same time, an alarm ERR7 for inhibiting input is generated.</li> <li>· PA20 = 1, CCW prohibition is valid. That is, when the FSTP input is at an active level, CCW is disabled. CW cannot be prohibited at this time.</li> <li>· PA20 = 2, CW prohibition is valid. That is, when the RSTP input is at an active level, CW is disabled. CCW cannot be prohibited at this time.</li> <li>· PA20 = 3, CCW and CW prohibition are invalid.</li> </ul>	0~3
21	JOG Operation Command	Set the operation speed command for JOG control mode.	-3600~3600 r/min
22	Torque filtering time constant	<p>*Set the characteristics of torque instruction filter;            *Used to suppress resonance generated by torque;            *If the moment of inertia of the load is very large, PA22 can be increased appropriately. If the value is too large, the response will slow down, which may cause oscillation.</p> <p>*The smaller the value, the higher the cutoff frequency and the faster the response. If a higher torque response is required, the set value can be reduced appropriately.</p>	0~1000 *0.1ms
23	Speed Command selection	0: External analog input( analog voltage between AS+,AS- to control the speed) 1:select the 1 <sup>st</sup> speed command(determined by PA24) 2: select the 2 <sup>nd</sup> speed command(determined by PA25) 3: select the 3 <sup>rd</sup> speed command(determined by PA26) 4: select the 4 <sup>th</sup> speed command(determined by PA27)	0~5

		5:select the speed command via SC2, SC1 SC2=0, SC1=0, select the 1 <sup>st</sup> speed command SC2=0, SC1=1, select the 2 <sup>nd</sup> speed command SC2=1, SC1=0, select the 3 <sup>rd</sup> speed command SC2=1, SC1=1, select the 4 <sup>th</sup> speed command	
24	1 <sup>st</sup> Speed Command	Set inner speed 1	-3600 ~3600 r/min
25	2 <sup>nd</sup> Speed Command	Set inner speed 2	-3600 ~3600 r/min
26	3 <sup>rd</sup> Speed Command	Set inner speed 3	-3600 ~3600 r/min
27	4 <sup>th</sup> Speed Command	Set inner speed 4	-3600 ~3600 r/min
28	Target Motor Speed	1.this parameter is used to set the targeted speed value; 2.Under the non position control mode, if the detected motor speed is over the set value, the SCMP will be ON, otherwise, the SCMP is OFF. 3.There is no need to use this parameter under position control mode  The motor speed has nothing to do with the rotating directions.	0~3600 r/min
29	Analog Torque Command Gain	Set the proportional relationship between analog input voltage and the value of torque command. This function is effective only under the torque control mode (PA4=2). The unit is 0.1V/100%.  The default is 50, which means it will produce 100% rated torque by inputting 5v voltage.	10~100 (0.1V/100 %)

30	Direction of Analog Torque Command	0: The direction of the torque is CCW 1: The direction of the torque is CW	0~1
31	Zero-offset Compensation for Torque Command	The value is the offset compensation for the analog signal of torque command.	-2000 ~2000
32	Max speed Limit under torque mode	In torque control mode, this setting will limit the max running speed of the servo motor.	0~3600 r/min
33	DO status monitoring	1.monitoring the output level status for the 3 DO ports 2.Bit0 corresponds to DO1; Bit1 corresponds to DO2; Bit2 corresponds to DO3;Under the default parameters setting status: bit0=ALR ; bit1=coin; bit2=BRK 3.When Bitx=1,it means the related DO port output high level When Bitx=0, it means the related DO port output low level.	111
34	DI status monitoring	1.Monitoring the input level status for the 4 DI ports 2.Bit0 corresponds to DI1; Bit1 corresponds to DI2; Bit2 corresponds to DI3;Bit3 corresponds to DI4. Under the default parameter setting status, bit0=SON; bit1=CLE/SC1; bit2=SC2; bit3=ALRS 3.When Bitx=1,it means the related DI port input high level When Bitx=0, it means the related DI port input low level.	1111

35	Max speed limit of motor	Limit the max speed of motor, when you've done the parameter settings, turn the power off and on again to enable the changes.	0~3600 r/min
36	Internal torque limit	Control the drive torque output, $T_{max}=PA36 \times T_{rated} \times 1\%$ .	5~400%
37	Negative torque arrived set point	When negative torque arrived at the set point, the TRQL signal output is active. But this value should not be considered as the limited negative torque set point, the torque limit should be set by PA36.	5~300%
38	Positive torque arrived set point/ Maximum torque limit in test run and JOG mode	1. Under the position control mode, PA38 is set as the positive torque arrived at the set point, the TRQL signal output is active. But this value should not be considered as the limited positive torque set point. 2. Under the trial run (PA4=3) and Jog mode (PA4=4), PA38 is the limit parameter of the max torque output. And the max drive output torque will be the lower value between PA36 & PA38.	5~300%
39	Min speed limit for Analog speed control mode	PA4=1 means it's in analog speed control mode, this parameter is used to control the min speed of the motor.	0~1000 r/min
40	Acceleration Time	1. Set value indicates the acceleration time for the motor to reach the speed from 0 to 1000r/min. 2. It has a linear feature. 3. Only used under the speed control mode. 4. If the drive is being used together with the external position loop, please set PA40=0. This parameter is effective when PA4=1 or PA4=4.	0~10000 Ms

41	Deceleration Time	<p>1.set value indicates the acceleration time for the motor to reach the speed from 0 to 1000r/min.</p> <p>2.It has a linear feature.</p> <p>3.Only used under the speed control mode.</p> <p>4.If the drive is being used together with the external position loop, please set PA40=0.</p> <p>5.This parameter is effective when PA4=1 or PA4=4.</p>	0~10000 Ms
42	Acc/Dec S-curve	Stabilize the motor start-up and stop, set the S-curve continuous time for acceleration or deceleration. This parameter is effective when PA4=1 or PA4=4.	0~10000 Ms
43	Analog Speed Command Gain	<p>Set the proportional relationship between analog input voltage and the speed command.</p> <p>Only when PA4=1 and PA23=0, or PA4=2, the function is active.</p>	10~3000 r/min/V
44	Direction of analog Speed input Command	<p>Select the direction for the external speed command.</p> <p>0: When analog speed command is positive, the speed direction is CCW.</p> <p>1: When analog speed command is negative, the speed direction is CW.</p>	0~1
45	Zero-offset Compensation for Analog Speed Command	This is the analog speed command zero speed clamp value.	-2000 ~2000
46	Low-pass Filter for Analog Command	<p>1.this is a low-pass filter working on analog input.</p> <p>2.Increase the set value will down grade the response performance but eliminate the noise impact to the signal.</p> <p>3.this parameter is only active under the following conditions.</p> <p>1. PA4=1 and PA23=0</p> <p>2. PA4=2.</p>	0~1000 ms

47	Enable Delay time of the electromag netic Brake	Set the delay time between output terminal(BRK) ON to OFF and the actual current cut-off.  This value shall not be lower than the mechanical brake delay time.	0~300 ×10Ms
48	Disable Delay Time of the electromag netic Brake	Set the delay time between current cut-off and output terminal(BRK) OFF to ON. When the motor is running at a very high speed, wait until it slows down and enable the brake will protect the brake from potential damage. The actual time is the lowest one between PA48 and the required time for the motor to decrease the speed to the set value of PA49.	0~300 ×10Ms
49	Brake operating speed when the motor is running	Set the brake working speed from current cut-off to mechanical brake enabled,(output terminal BRK from ON to OFF)	0~3600 r/min
50	Sampling Gain for Bus Voltage	It is used to compensate the voltage offset for the input DC Bus. This parameter is not allowed to be changed.	10~3000
51	Dynamic Gear ratio	0:dynamic gear ratio invalid, the function of the input terminal INH is to disable the pulse command, gear ratio is decided by PA12/PA13  1:dynamic gear ratio is effective, the function of the input terminal INH is to switch over the gear, when INH is in an invalid electric level,(valid electric level is set by PA62), gear ratio is decided by PA12/PA13, when INH is in an valid electric level, the gear ratio is PA52/PA13.	0~1
52	Electronic gear ration( num	Check PA51	

	erator)														
53	SON Force enable position	0: the drive can't be force enabled. 1:the drive can be force enabled.	0~1												
54	Z output pulse logic/ bandwidth select	<b>bit0</b> : Z pulse output bandwidth bit0 = 0, Z pulse direct output; bit0 = 1, Z pulse output with pulse width of 1ms <b>bit1</b> : Z pulse output logic bit1 = 0, positive logic output bit1 = 1, negative logic output	0~1												
55	Reserved	Reserved	1~250												
56	DO output effective electric level	<p>This parameter is to define the electric level of output terminals BRK COIN ALM</p> <table border="1"> <tr> <td>Symbol</td><td>DO3</td><td>DO2</td><td>DO1</td></tr> <tr> <td>default</td><td>(BRK)</td><td>(COIN)</td><td>(ALM)</td></tr> <tr> <td>Control position</td><td>PA56.2</td><td>PA56.1</td><td>PA56.0</td></tr> </table> <p>PA56.2=0,BRK effective level is low; PA56.2=1,BRK effective level is high. PA56.1=0,COIN effective level is low; PA56.1=1,COIN effective level is high. PA56.0=0,ALM effective level is low; PA56.0=1,ALM effective level is high.</p>	Symbol	DO3	DO2	DO1	default	(BRK)	(COIN)	(ALM)	Control position	PA56.2	PA56.1	PA56.0	000~111
Symbol	DO3	DO2	DO1												
default	(BRK)	(COIN)	(ALM)												
Control position	PA56.2	PA56.1	PA56.0												
57	DO1(ALM) self define	DO has three actual output terminals, 5 functions: PA57=1,DO1 is fined as ALM; servo is alarm; PA57=2,DO1 is defined as SRDY; servo is ready; PA57=3,DO1 is defined as COIN; when PA4=0, COIN means position reached, when PA4=1, it means speed reached. PA57=4,DO1 is defined as BRK; control brake	1~5												

		PA57=5,DO1 is defined as TRQL; Torque arrived																
58	DO2(COIN) ) self define	Refer to PA57	1~5															
59	DO3(BRK) self define	Refer to PA57	1~5															
60	Reserved																	
61	Input filtering time constant	1. Define the input filtering time constant. 2. The lower this value is, the better response performance you will get, but in the meantime, it'll be very easy to introduce interference.  The bigger this value is, the poorer response you will get, but you will get a better anti-interference performance.	0~100 ms															
62	Input terminal DI effective electric level self define	<div>This parameter is to define the electric level of input terminal DI:<table><tr><td>Symbol</td><td>DI4</td><td>DI3</td><td>DI2</td><td>DI1</td></tr><tr><td>Default definition</td><td>(ALRS)</td><td>(SC2)</td><td>(CLE)</td><td>(SON)</td></tr><tr><td>Control position</td><td>PA62.3</td><td>PA62.2</td><td>PA62.1</td><td>PA62.0</td></tr></table> PA62.3=0,DI4 effective level is low; PA62.3=1,DI4 effective level is high; PA62.2=0,DI3 effective level is low; PA62.2=1,DI3 effective level is high; PA62.1=0,DI2 effective level is low; PA62.1=1,DI2 effective level is high; PA62.0=0,DI1 effective level is low; PA62.0=1,DI1 effective level is high;</div>	Symbol	DI4	DI3	DI2	DI1	Default definition	(ALRS)	(SC2)	(CLE)	(SON)	Control position	PA62.3	PA62.2	PA62.1	PA62.0	0000 ~1111
Symbol	DI4	DI3	DI2	DI1														
Default definition	(ALRS)	(SC2)	(CLE)	(SON)														
Control position	PA62.3	PA62.2	PA62.1	PA62.0														



63	DI1(SON) self define	DI1 has 4 actual output terminals, with 8 different functions: PA63=1, DI1 is defined as SON, servo on; PA63=2, DI1 is defined as CLE/SC1/ZCLAMP; PA63=3, DI1 is defined as INH/SC2; PA63=4, DI1 is defined as ALRS; PA63=5, DI1 is defined as FSTP; PA63=6, DI1 is defined as RSTP; PA63=7, DI1 is defined as AIR; Analog input reverse. PA63=8, DI1 is defined as control mode switching	1~8
64	DI2(CLE) self define	Refer to PA63	1~8
65	DI3(SC2)s elf define	Refer to PA63	1~8
66	DI4(ALRS) self define	Refer to PA63	1~8
67	Motor thermal protection level	There are 5 levels of motor thermal protection, generally set automatically according to the motor model, the customer does not need to change.	1~5
68	Pulse window filtering	<ul style="list-style-type: none"> <li>Perform window filtering on the pulse signal PULS. Pulses with a width less than the set value will be filtered out.</li> <li>Increasing PA68 can increase the anti-interference ability of the drive pulse reception, but if it is set too large, it may filter out normal pulses, resulting in motor jitter.</li> <li>When most PLC controller pulse signal frequency is lower than 100khz, PA68 can be set to about 20</li> </ul>	0~250
69	Drive thermal protection	There are two thermal protection level of the driver, which are usually set automatically, and the customer does not need to change it.	1~2

	level		
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NOTE: The value of the parameter which is identified by \* would be different for different drive type( Drive model).

## VI Electronic gear ratio

Mechanical transmission ratio and the pulses per circle of the servo motor encoder couldn't be identified by the host controller. But the unit pulse generated by host controller could be corresponded to the actual moving distance by setting the electronic gear ratio. Electronic gear ratio of the servo system could be calculated as the following.

N1: Numerator of the electronic gear ratio ( PA12 )

M1: Denominator of the electronic gear ratio ( PA13 )

P1: Number of pulses corresponding to 1mm in the host controller

F2: Number of encoder pulses per circle

S1: Screw pitch of the mechanical transmission (mm)

F1: Number of pulses required by actual moving distance 1mm.

$F1 = N1 * P1 / M1$  ( pulses / mm ) for host controller

$F1 = F2 / S1$  ( pulses / mm ) for actual moving distance

Therefore the electronic gear ratio  $N1/M1$  is equal to  $F2/(S1 * P1)$ .

For example, if P1 of the host is 1000 pulses/mm, F2 of the H series servo drive is 10000, S1 of the screw is 6mm, the electronic gear ratio  $N1/M1 = 10000/(1000 * 6) = 5/3$ . So you could set the parameter PA12 ( N1 )=5 and the PA13 ( M1 )=3.

If there is a gearbox between screw and motor, the ratio of the gearbox is  $N2/M2$ ;

N2: rotation number of the motor

M2: rotation number of the screw

$F1 = N1 * P1 / M1$  ( pulses / mm ) for host controller

$F1 = F2 * N2 / (S1 * M2)$  ( pulses / mm ) for actual moving distance

Therefore the electronic gear ratio  $N1/M1$  is equal to

$$F2 \cdot N2 / (S1 \cdot P1 \cdot M2)$$

For the above-mentioned example, if the ratio of the gearbox is:

$$N2/M2 = 5/3$$

According to the formula, the electronic gear ratio

$$N1/M1 = 10000 \cdot 5 / (1000 \cdot 6 \cdot 3) = 25/9.$$

So you should set the parameter PA12 (  $N1$  )=25 and the PA13 (  $M1$  )=9 for the mechanical transmission system with a gearbox.

## VII Trouble shooting

1. When any trouble occurs, the “Err xx” would be displayed on the digital keypad and blink. “xx” is the code for the error kind. The common errors are Err 3, Err 6, Err 9, Err 11, Err 12, Err 17 and Err 38, which would be due to improper wiring or mechanical problem.

Generally, the drive could work properly by re-powering. If the error still occurs or the occurs frequently, please contact with SE or distributor of MACTROL-REFU .

### 2. Fault messages table

**Table 6.1** Fault messages

Display Code	Fault Name	Fault Description
- -	Normal	There is no error.
1	Over speed	Motor's control speed exceeds the limit of normal speed.
2	Over voltage	Max circuit voltage exceeds its maximum allowable value.
3	Under voltage	Max circuit voltage is below its minimum specified value.
4	Excessive position Deviation	Position control deviation value exceeds the limit of its allowable setting value.

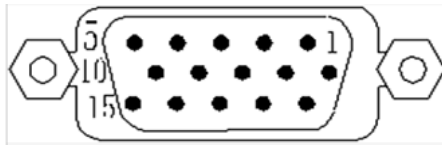
5	Internal parameter setting error	Driver model, motor model is set incorrectly
6	Motor model setting error	Wrong motor model is set.
7	Limit switch error	Forward or Reverse limit switch is activated
8	Position counter Overflow	Position counter overflow occurs.
9	Encoder error	Pulse signal is in error.
11	Current response Fault	Current error has exceeded the specified value for a long time.
12	Short circuit	Main circuit current is higher than 1.5 multiple of drive's instantaneous maximum current value.
13	Drive temperature error	The temperature of drive is over high.
14	Regeneration error	Regeneration control operation is in error.
17	Speed response fault	Speed error has exceeded the specified value for a long time.
19	Warm reset	Software warm global reset
20	EE-PROM error	An error occurs when writing the correct settings into EE-PROM.
21	DI Function setting Error	DI Duplicate function settings

22	DO Function setting Error	DO Duplicate function settings
23	Current sensor adjustment error	Adjusted value of the current sensor exceeds the limit of its allowable setting value when perform electrical adjustment.
29	Overload for motor	Servo motor is overload.
30	Pulse Z error	The pulse Z of the encoder is lost.
32	U,V,W error	The wiring connections of U,V,W (for encoder interface) are in error
37	Instantaneous overload for motor	The instantaneous load of the motor is heavier than 1.5 multiple of motor's maximum load value..
38	Motor temperature error	The motor is overload for a long time.
39	Enable both forward and reverse	
40		
10,15,16,18,24, 25,26,27, 28,31,33,34,35,36.		Reserved

## VIII Signal Terminal Definition

### 1. The Layout and View of CN1

The CN1 which is consisted of DB15M is the encoder signal interface terminal. The view and the layout of the CN1 is shown as the following:



**Figure 7.1** The view and layout of the CN1 encoder signal interface terminal



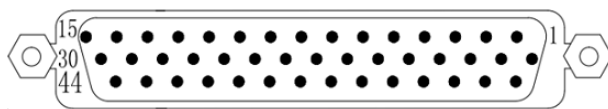
## 2. Signal Identification for CN1

**Table 7.1** Terminal signal identification for CN1

PIN No.	Terminal Identification	Description
10	A+	Connected to A+ signal
5	A-	Connected to A- signal
4	B+	Connected to B+ signal
9	B-	Connected to B+ signal
3	Z+	Connected to Z+ signal
8	Z-	Connected to Z+ signal
12	U+	Connected to U+ signal
11	U-	Connected to U- signal
6	V+	Connected to V+ signal
1	V-	Connected to V- signal
7	W+	Connected to W+ signal
2	W-	Connected to W- signal
13	+5V	Power supply 5V
14	GND	Gnd for power supply
Shield	PE	Shielding

### 3. The Layout and View of CN2

CN2 is the control signal I/O interface, which terminal is named as DB44M. The view and the layout of the CN2 is shown as the following:



**Figure 7.2** The view and layout of the CN2 I/O interface terminal

### 4. Signals Explanation of Connector CN2

**Table 7.2** CN2 Terminal Signal Identification

PIN No.	Terminal Identification	Description
3	OA+	Encoder signal output A, B, Z ( Line-driver output ). The motor encoder signals are available through these terminals.
19	OA-	
4	OB+	
20	OB-	
5	OZ+	
21	OZ-	Encoder signal Z open-collector output.
34	CZ	
35,36	DGND	Ground for encoder signal.
29,30	COM+	COM+ is the common voltage rail of the DI and DO signals. The range is DC12~24V and the available current should be greater than 100mA

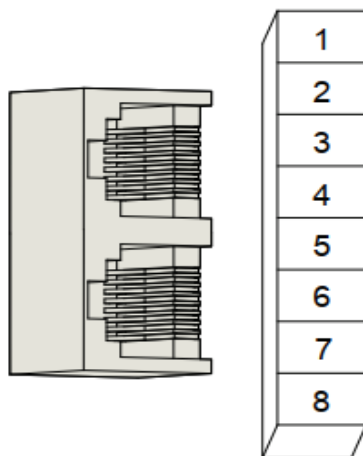
41	SON	<p>Servo enable signal input terminal.</p> <p>SON ON: enable the drive.</p> <p>SON OFF: drive off and the motor is in a free state.</p> <p>Note 1: The motor must be still before enable the drive.</p> <p>Note 2: Any other command should be inputted after the son on signal at least 50ms.</p>
12	ZCLAMP/ CLE/SC1	<p>In the speed control model when PA22=1 the input terminal is defined as the zero speed clamping function.</p> <p>When PA4=0 the terminal is defined as deviation counter reset function</p> <p>The input terminal is defined as the speed command selection SC1 in the speed control model (PA4=1) when the parameter PA22=0</p>
28	SC2/INH	<p>The input terminal is defined as the speed command selection in the speed control model when PA4=1 and PA22=0. Used to select the different internal speed through the combination of SC1 and SC2.</p> <p>SC1 OFF, SC2 OFF: internal speed 1.</p> <p>SC1 ON , SC2 OFF: internal speed 2.</p> <p>SC1 OFF, SC2 ON : internal speed 3.</p> <p>SC1 ON , SC2 ON : internal speed 4.</p>
26	SC3	Eight-point positioning BIT0
11	SC4/CCW	Eight-point positioning BIT1

42	SC5/CW	Eight-point positioning BIT2
27	ALRS	Clear alarm signal input Pin
7	ALM	Servo Alarm signal output Pin.
8	ALM-	Servo Alarm signal output Pin negative.
9	BRK	BRK is activated actuation of motor brake
10	BRK-	BRK is activated actuation of motor brake negative.
37	OUT1/SRDY+	Quasi-stop in-place output
38	OUT1-/SRDY-	Quasi-stop in-place output negative.
39	COIN	In the position control mode (PA4=0), COIN is activated when the position error is equal and below the setting value of PA16. In the speed control mode (PA=1), COIN will be activated when the drive has detected the motor has reached the Target Rotation Speed setting as defined in parameter PA28.
40	COIN-	COIN Pin negative.
31	AS+	Motor speed command: -10V~+10V, corresponds to -3000~+3000 r/min command and the input impedance is 10kΩ
16	AS-	
1,17	AGND	The reference ground for analog input signals.
6	+24VIN	When the pulse is DC24V, connect the external 24V positive
14	PULS+	Position Pulse Input

13	PULS-	Position Sign Input
44	SIGN+	
43	SIGN-	
22,23	XGnd	DC24V output Gnd, customised
24,25	+24Vout	DC24V output 24V, customised
Shield	PE	Shielding (connected to ground)

## 5. The Layout and View of CN3,CN4

The CN3,CN4 which is consisted of IEEE1394 is the encoder signal interface terminal. The view and the layout of the CN3,CN4 is shown as the following:



**Figure 7.3** The view and layout of the CN3,CN4 encoder signal interface terminal

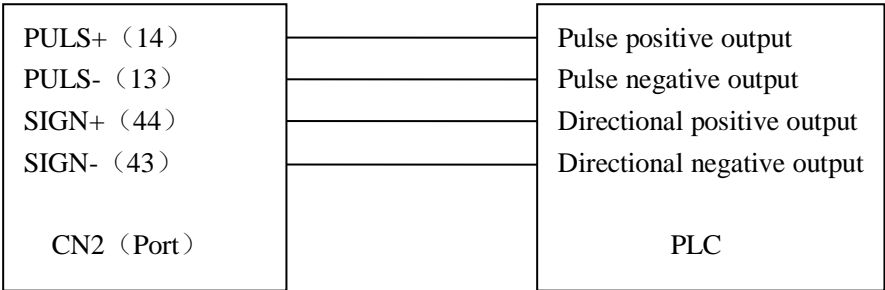
6. Signal Identification for CN3,CN4

Table 7.3 CN3,CN4 Terminal Signal Identification

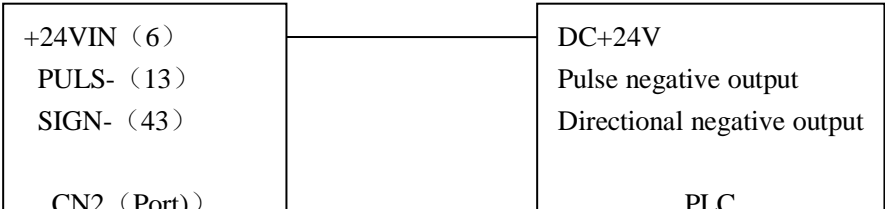
PIN No.	Terminal Identification	Description
1	A	RS485 signal A
2	B	RS485 signal B
Shield	PE	Shielding (connected to ground)

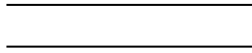
7. MR-ECOS-220 series driver connected with PLC

Pulse output signal is DC + 5V wiring method



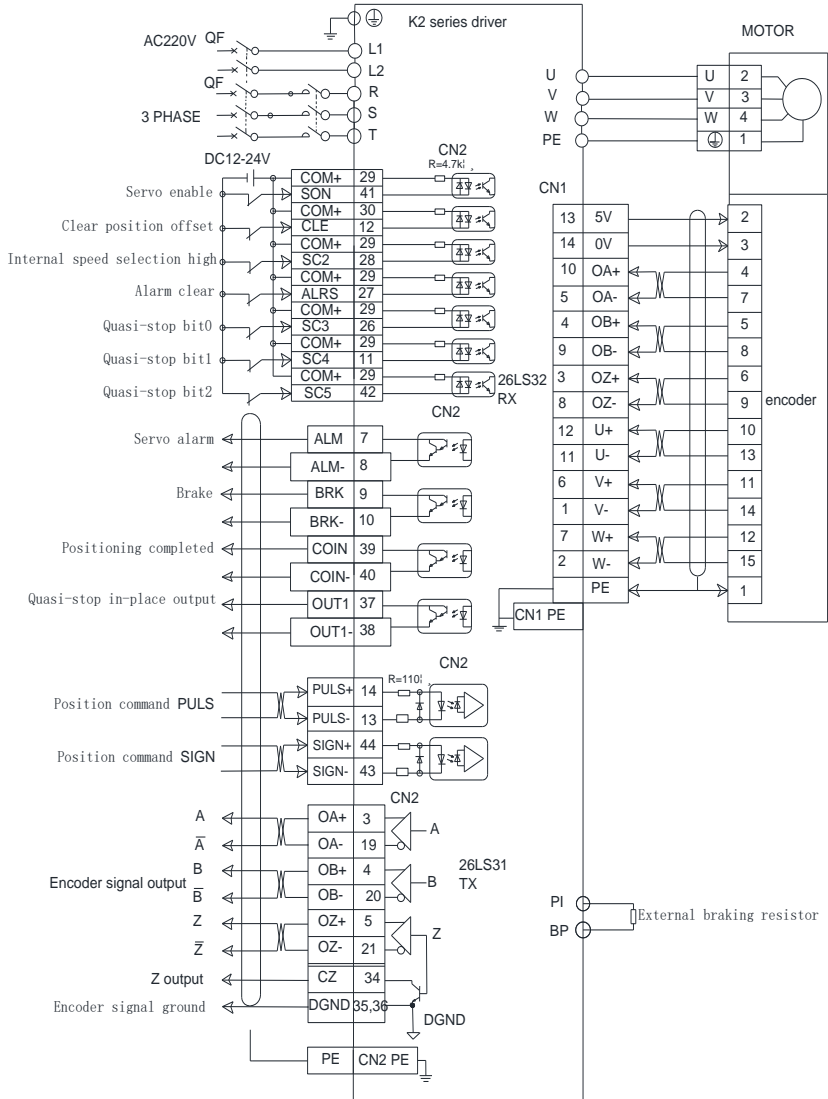
Pulse output signal is DC + 24V wiring method





## 8. Position control standard wiring diagram

**Figure7.3** Position control standard wiring diagram

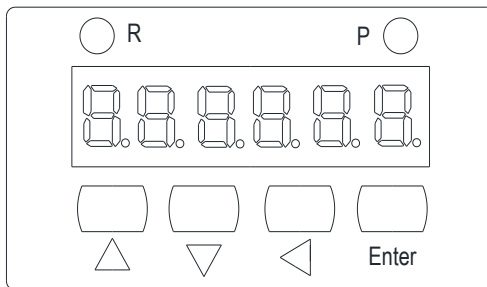




## IX Display and Operation

### 1. Description of the digital keypad

The digital keypad includes 4 function keys and the display panel which is composed of 6 LED. The Figure 4.1 shows all of the features of the digital keypad and an overview of their functions.



**Figure 8.1** Overview about the keypad

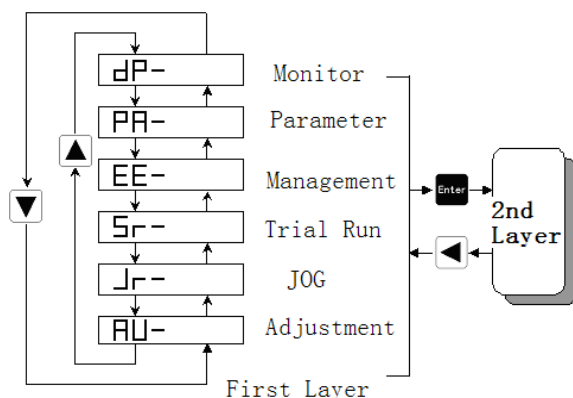
**Table 8.1** Function instructions for the digital keypad

Symbol	Name	Function
Power	Power supply	The LED light to indicate the control power is applied.
Run	Running status	The LED lights to indicate the main power is applied to the circuit and the drive is enabled.
▲	Up key	Pressing the Up and Down key can scroll through and change monitor codes, parameter groups and various parameter settings.
▼	Down key	
◀	Return key	Pressing the Return key can exit the menu or cancel the operation or the settings.
<b>Enter</b>	Set	Pressing the Set key can enter the menu or determine and save the operation or the parameter settings.

Note : If some fault occurs, the 6 bit LED display will be blinking.

## 2. Main menu

As the first layer of the operational processes, the main menu consists of six parts. You can use the Up and Down key to change the content of the main menu display and press the Set key to enter the second layer, as well you could press the Return key to quit the second layer to the main menu.



**Figure 8.2** Flowchart for the main menu of the operational processes

### 3. Monitor Display (DP--)

Users could press the Up and the down key to find the monitor display of the main menu. When “dp-” is displayed, please press the Set key to enter the layer for monitor mode. There are 19 kinds status for the monitor display shown as the following. You could select the display you need using the Up and Down key and then press the Set key to enter the specific monitor and display interface.

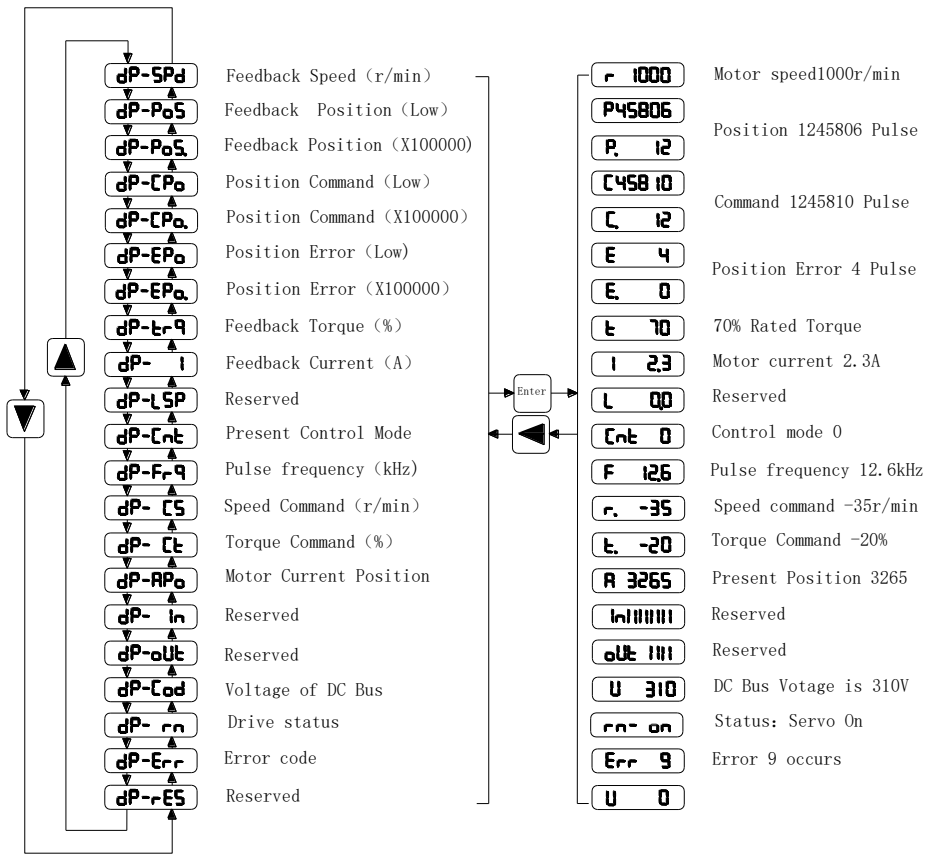
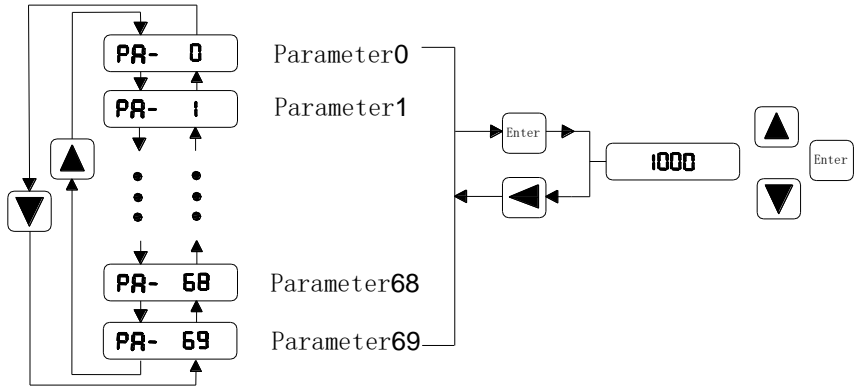


Figure 8.3 Diagram for the operational processes of the monitor display

#### 4. Parameter setting (PA--)

You could find the “PA-” on the main menu by using the Up and Down key, and then enter the parameter selection interface by pressing the Set key. By using the Up and Down key you could select the parameter which you want to change, and then press the Set key to enter the parameter modification interface. You could use

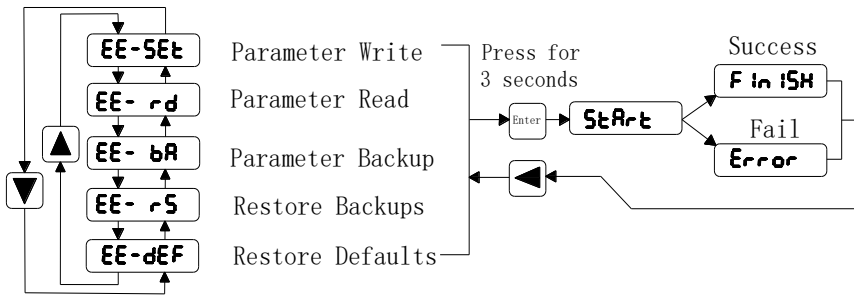
the Up and Down key to change parameter to the value you required. When the parameters is modified, the point of the last LED digital tube will be light, that means the parameter is changed but not ye be effective. You could press the Set key to make it, then the point will go out. You could use the Return key to quit.



**Figure 8.4** Diagram for the operational processes of parameter setting

## 5. Parameter Management (EE--)

You could find the “EE-” on the main menu by using the Up and Down key, and then enter the parameter management interface by pressing the Set key. The representative meaning of each symbol is shown in the figure 4.5. By using the Up and Down key you could select the operation which you need. And then press and hold the Set key for 3 seconds, when “FINISH” is displayed on the LED means the operation is completed. But if “Error” is displayed, the operation fails, and then please press the Return key to quit.



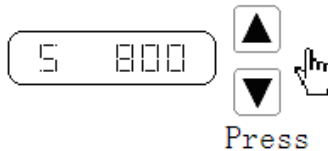
**Figure 8.5** Diagram for the operational processes of parameter management

- **EE-set** Write operation: the parameters will be written in the parameters district of the EEPROM. Even if the power is down the parameter will not be lost.
- **EE-rd** Read operation: read the data from the parameter district of the EEPROM to the parameter list of the software. If the parameter are modified to result in an error by improper operation, you could use this feature to restore the parameters.
- **EE-rs** Restore the parameter: read the data saved in the backup area of the EEPROM into the parameter list of the software. If you want the backup parameter be long-term effective, you need to perform a write operation.
- **EE-def** Restore the default parameters: read all of the defaults into the parameter list, and then write the parameters into the EEPROM. Even if the drive is restart, the defaults is still effective. After this operation, you should ensure that the motor

code (PA1) is adapted for the using motor.

## 6. Speed trial run without load (Sr--)

You can enable the “Sr” operation mode by set parameter PA4=3. You could find the “Sr-” on the main menu by using the Up and Down key, and then enter the speed trial run operation interface by pressing the Set key. When “Sr 0.0” is displayed and the units is r/min, you could change the speed command by pressing Up or Down key.



**Figure 8.6** Diagram for the speed command entering of speed trial run

## 7. JOG trial run without load (Jr--)

You can enable the “Sr” operation mode by set parameter PA4=4 and change the JOG speed command by setting parameter PA 21. You could find the “Jr-” on the main menu by using the Up and Down key, and then enter the JOG trial run operation interface by pressing the Set key. When “J 0.0” is displayed and the units is r/min, you could press Up or Down key to jog the motor CCW or CW direction. The motor will only rotate while the arrow key is activated.

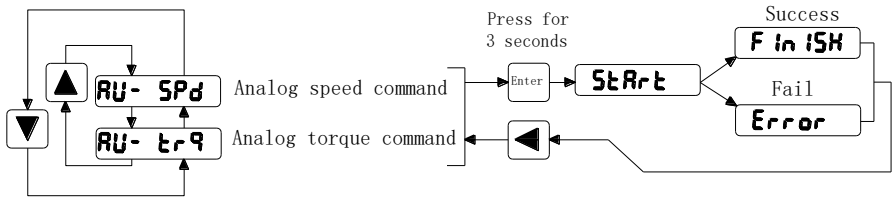


**Figure 8.7** Diagram for the JOG trial run



## 8. Zero-offset adjustment

By the operation the drive could automatically detects the zero bias of the analog speed or torque command, and write the value in the parameter PA45 or PA39. At last the drive will save the parameter in the EEPROM automatically. You could find the “AU-” on the main menu by using the Up and Down key, and then enter the operation interface for Zero-offset adjustment by pressing the Set key. The AU-SPD correspond to the speed zero-offset adjustment and the AU-trq correspond to torque zero-offset adjustment. You could select the process by Up or Down key, and then you should press and hold the Set key for 3 seconds till the LED displays “FINISH”.



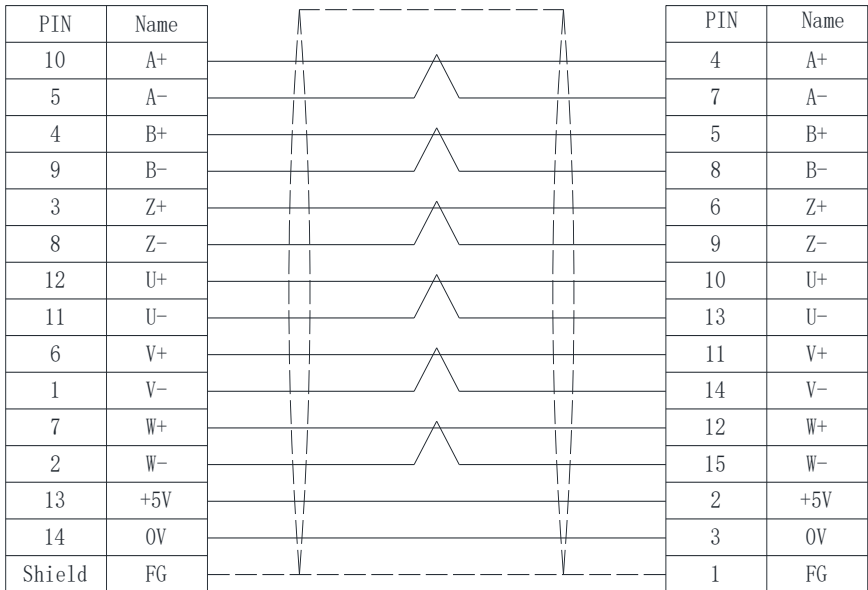
**Figure 8.8** Diagram for the operational processes of analog zero-offset adjustment

## X Definition of Encoder cable

The wiring definitions of the encoder cable is shown as the following:

CN1 of Servo Drive

Motor Terminal



**Figure 9.1** Connecting diagram for encoder cable between MR-ECOS-220 drive and motor

**Thanks for choosing MACTROL-REFU product.**

**For any technique support, please feel free to contact our support team.**

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