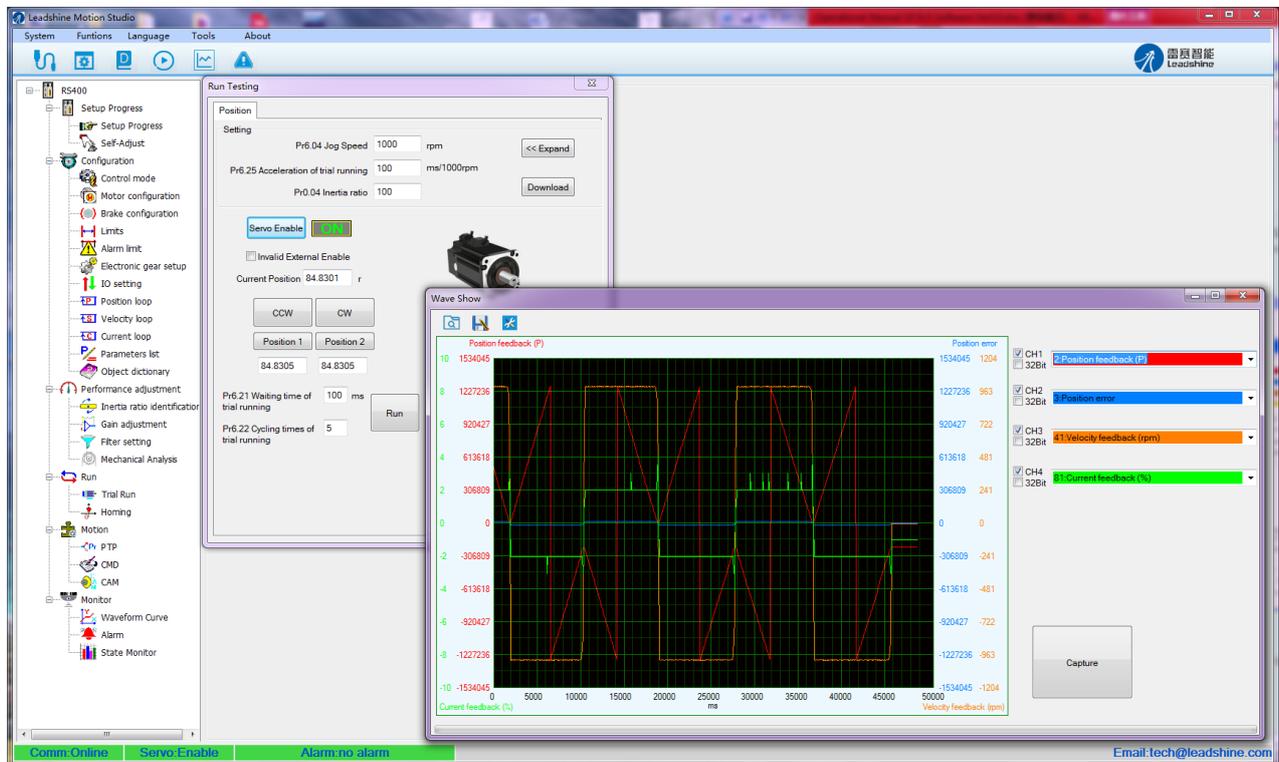


Operational Manual Of ELP Software



The screenshot displays the Leadshine Motion Studio software interface. The main window is titled "Leadshine Motion Studio" and features a menu bar with "System", "Functions", "Language", "Tools", and "About". A left-hand navigation tree shows a project named "RS400" with various configuration categories such as "Setup Progress", "Configuration", "Performance adjustment", "Run", "Motion", and "Monitor".

The central "Run Testing" panel is active, showing configuration settings for a motor. The "Position" section includes:

- Pr6.04 Jog Speed: 1000 rpm
- Pr6.25 Acceleration of trial running: 100 ms/1000rpm
- Pr6.04 Inertia ratio: 100

Buttons for "Servo Enable" (ON), "Invalid External Enable", "CCW", "CW", "Position 1", and "Position 2" are visible. The "Current Position" is shown as 84.8301 r. A "Run" button is at the bottom right of this panel.

The "Wave Show" window is overlaid on the bottom right, displaying a graph of "Position feedback (F)" over time (0 to 50000 ms). The graph shows a square wave pattern. The y-axis ranges from -10 to 10. The x-axis ranges from 0 to 50000 ms. A legend on the right side of the graph lists:

- CH1: Position feedback (F)
- CH2: Position error
- CH3: Velocity feedback (rpm)
- CH4: Current feedback (%)

A "Capture" button is located at the bottom right of the graph area.

At the bottom of the software window, a status bar shows "Comm: Online", "Servo: Enable", and "Alarm: no alarm". The email address "Email: tech@leadshine.com" is displayed in the bottom right corner.

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Chapter 1 Introduction

This software can run in Windows XP, Windows Vista, Win7. The computer make data exchanged and debug ELP series driver by series port communication. Please read the operation specification of driver when using.

1. System composition

This software is matched with ELP series driver, can't be used for other driver.

2. Running condition

CPU: above 1.5GHz

RAM: above 256M

Hard disk capacity: above 10G

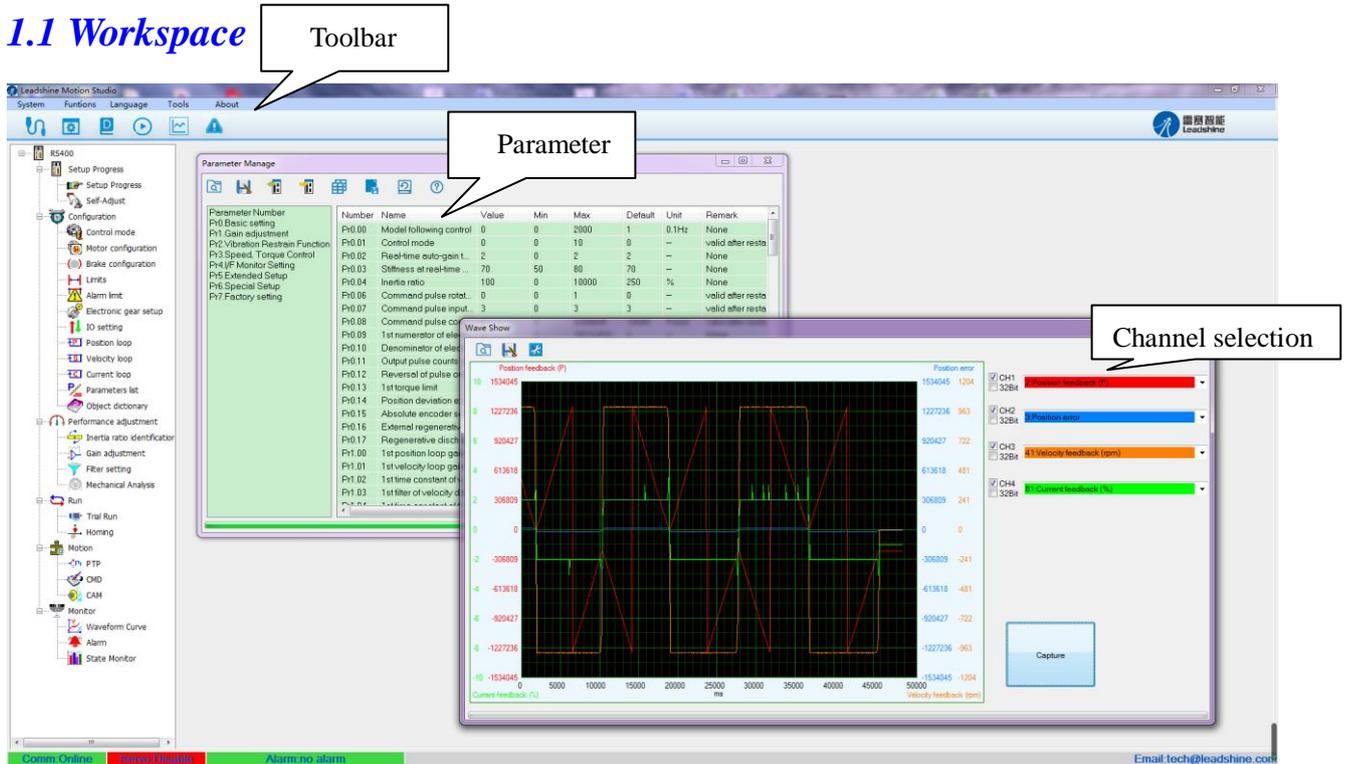
Displayer: resolution 1024*768, color 24 bit

Communication interface: normal series or USB series adapter

Note: because of the update of software version, the chart maybe different and actual.

Protuner for ELP series is a software tool designed to configure and tune the Leadshine ELP series digital servo driver. The user can tune the velocity/current loop and adjust the position loop parameters in this software.

1.1 Workspace



Parameter

| Parameter Number | Number | Name | Value | Min | Max | Default | Unit | Remark |
|------------------|--------|-------------------------|-------|-----|-------|---------|-------|-------------------|
| Pi0.00 | 0 | Model following control | 0 | 0 | 2000 | 1 | 0.1Hz | None |
| Pi0.01 | 0 | Control mode | 0 | 0 | 10 | 0 | | valid after resta |
| Pi0.02 | 2 | Real-time auto-gain L | 0 | 2 | 2 | 2 | | None |
| Pi0.03 | 70 | Stiffness at real-time | 70 | 50 | 80 | 70 | | None |
| Pi0.04 | 100 | Inertia ratio | 100 | 0 | 10000 | 250 | % | None |
| Pi0.06 | 0 | Command pulse rotat. | 0 | 1 | 0 | 0 | | valid after resta |
| Pi0.07 | 3 | Command pulse input | 3 | 0 | 3 | 3 | | valid after resta |
| Pi0.08 | | Command pulse co | | | | | | |
| Pi0.09 | | 1st numerator of alle | | | | | | |
| Pi0.10 | | Denominator of alle | | | | | | |
| Pi0.11 | | Output pulse count | | | | | | |
| Pi0.12 | | Reversal of pulse co | | | | | | |
| Pi0.13 | | 1st torque limit | | | | | | |
| Pi0.14 | | Position deviation e | | | | | | |
| Pi0.15 | | Absolute encoder se | | | | | | |
| Pi0.16 | | External regenerative | | | | | | |
| Pi0.17 | | Regenerative disch | | | | | | |
| Pi1.00 | | 1st position loop ga | | | | | | |
| Pi1.01 | | 1st velocity loop ga | | | | | | |
| Pi1.02 | | 1st time constant of | | | | | | |
| Pi1.03 | | 1st filter of velocity | | | | | | |

Channel selection

- CH1: Position feedback (mm)
- CH2: Position error
- CH3: Velocity feedback (rpm)
- CH4: Current feedback (%)

1.2 Menus and Toolbar

Menus and toolbars are at the top of the workspace. Users can click menu bar to view the pull-down menu. The toolbar below the menu offers the common commands.



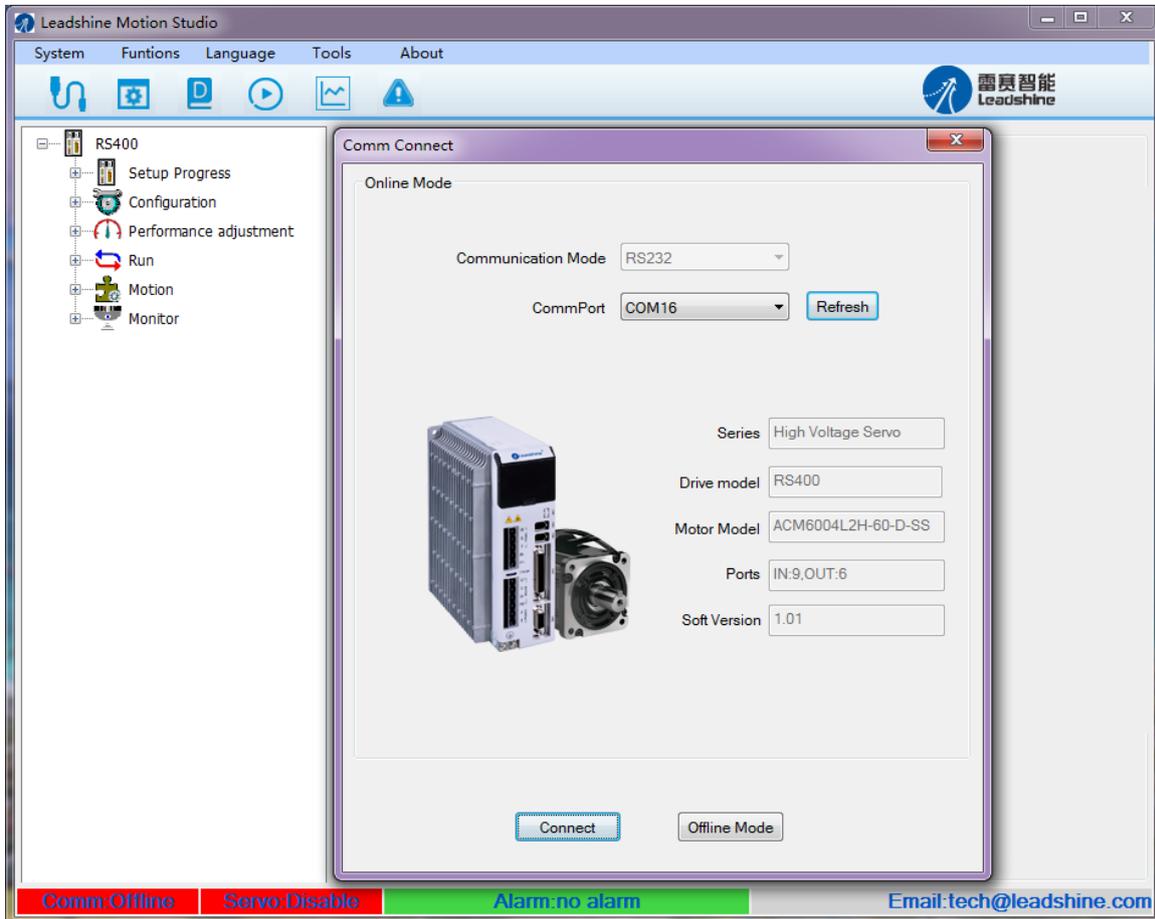
| | | | |
|-------------------------|---------------------|---|--|
| System -> | Connect | | Communication setup dialog box, users can select the parameter of communication and connect computer to driver |
| | Exit | | Read, display, modify the parameter of driver, save the value of parameter to project file or local disk |
| Functions -> | Save Parameter | | Save parameter into Non-Volatile Memory |
| | Software Reset | | Software reset to make the parameters setting valid instead of restart power-supply |
| Language-> | Chinese | | Switch the software to Chinese version |
| | English | | Switch the software to English version |
| Tools-> | Debug Tool | | Fast set specify address parameter. convenience to professional fast setup |
| Parameter Manage | Read parameter file |  | Reading parameter setup from the folder (the project file from PC computer) |
| | Save parameter |  | Make the current values of parameter saved as project file; while users can write note before |
| | Upload |  | Upload the parameters values of driver to the computer. |
| | Download |  | Make the modified values of parameter downloaded to the driver. |
| | Parameter compare |  | Compare the difference of parameter value of two projects and display it out. |
| | Save to Driver |  | Save parameter into Non-Volatile Memory |
| | Factory Reset |  | Reset all values of parameter to defaults |
| | Help |  | Check the explanation of parameters |
| Run Testing | Run Test |  | Run the driver, debug the parameters to performance better. |
| Wave Show | Wave Show |  | Monitor current running state, debugging |
| Alarm Info | Alarm Info |  | Check the alarm history of driver |

Chapter 2 Using the software

2.1 Connecting driver



Click “” to connect driver and PC computer.



If the driver is power off, click “Offline Mode”.

In general, if the driver is power on, set Comm Port , like the picture above, then click “Connect” to enter the interface.

Note:



Before clicking the Connect button, please make sure:

- 1) The RS232 cable has been connected between the drive and the PC’s USB port.
- 2) The drive has been powered on and the green LED is on.

The motor is unnecessary connecting to the drive if users just want to change the parameters but not tuning.

2.2 Off-line using

Users can operate software as no connection between driver and PC computer, users can see the parameter value of projects which is saved in PC.

2.3 Parameter Management

**Read parameters file:**

Reading parameter setup from the folder (the project file from PC computer)

Save parameters:

Make the current values of parameter saved as project file; while users can write note before save it so that other users can clearly know some effect of this project.

Unload:

Upload the parameters values of driver to the computer.

Download:

Make the modified values of parameter downloaded to the driver.

Parameter Compare:

Compare the difference of parameter value of two projects and display it out.

Save To Driver:

Save parameter into Non-Volatile Memory

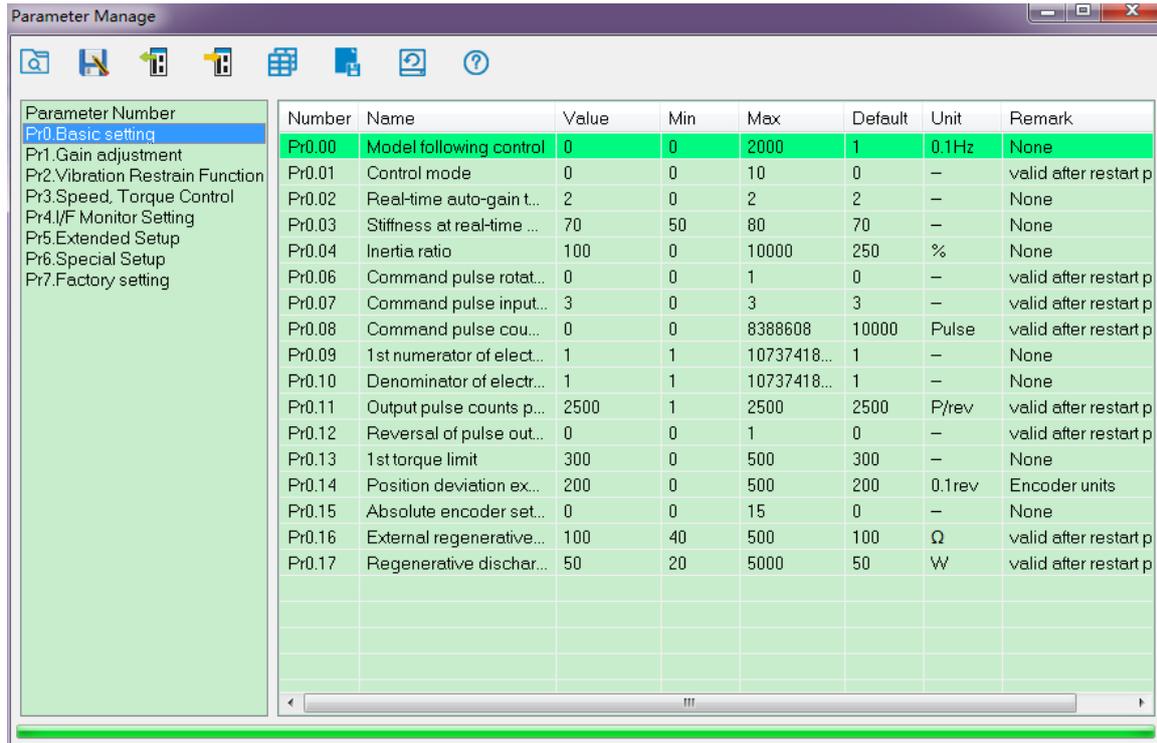
Factory Reset:

Reset all values of parameter to defaults

Help

Check the explanation of parameters.

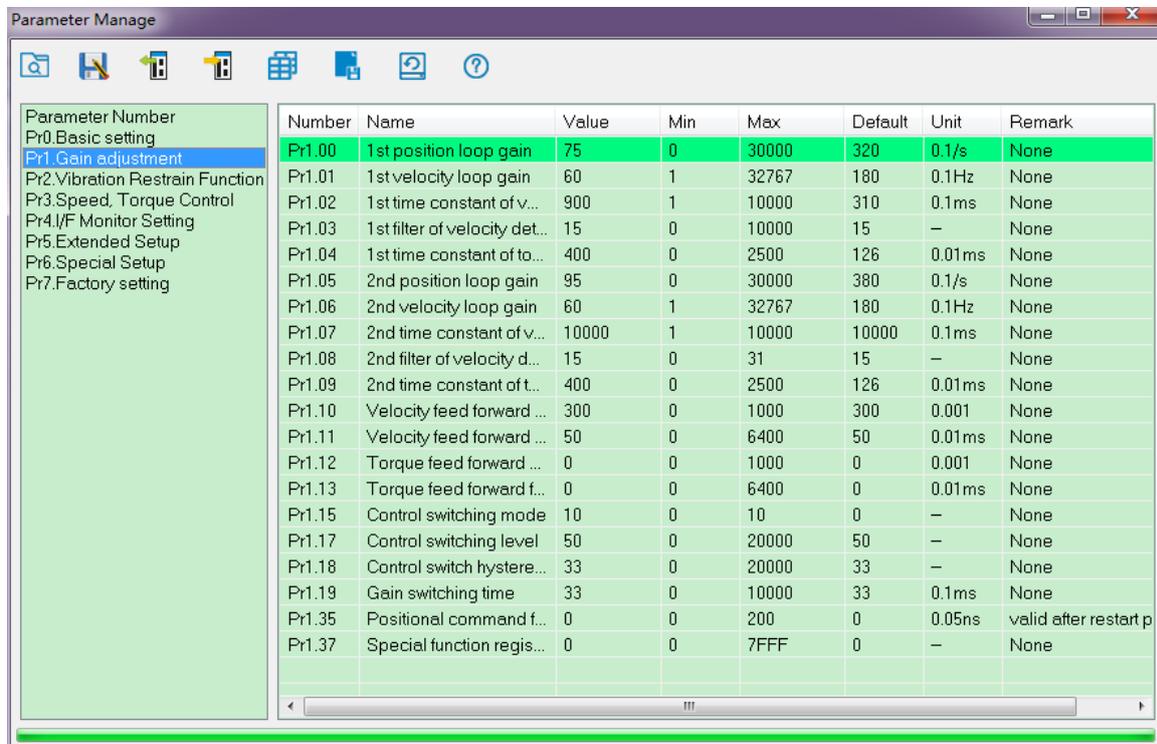
Basic setting



| Parameter Number | Number | Name | Value | Min | Max | Default | Unit | Remark |
|---------------------------------|--------|----------------------------|-------|-----|-------------|---------|--------|-----------------------|
| Pr0.Basic setting | Pr0.00 | Model following control | 0 | 0 | 2000 | 1 | 0.1Hz | None |
| Pr1.Gain adjustment | Pr0.01 | Control mode | 0 | 0 | 10 | 0 | - | valid after restart p |
| Pr2.Vibration Restrain Function | Pr0.02 | Real-time auto-gain t... | 2 | 0 | 2 | 2 | - | None |
| Pr3.Speed, Torque Control | Pr0.03 | Stiffness at real-time ... | 70 | 50 | 80 | 70 | - | None |
| Pr4.I/F Monitor Setting | Pr0.04 | Inertia ratio | 100 | 0 | 10000 | 250 | % | None |
| Pr5.Extended Setup | Pr0.06 | Command pulse rotat... | 0 | 0 | 1 | 0 | - | valid after restart p |
| Pr6.Special Setup | Pr0.07 | Command pulse input... | 3 | 0 | 3 | 3 | - | valid after restart p |
| Pr7.Factory setting | Pr0.08 | Command pulse cou... | 0 | 0 | 8388608 | 10000 | Pulse | valid after restart p |
| | Pr0.09 | 1st numerator of elect... | 1 | 1 | 10737418... | 1 | - | None |
| | Pr0.10 | Denominator of electr... | 1 | 1 | 10737418... | 1 | - | None |
| | Pr0.11 | Output pulse counts p... | 2500 | 1 | 2500 | 2500 | P/rev | valid after restart p |
| | Pr0.12 | Reversal of pulse out... | 0 | 0 | 1 | 0 | - | valid after restart p |
| | Pr0.13 | 1st torque limit | 300 | 0 | 500 | 300 | - | None |
| | Pr0.14 | Position deviation ex... | 200 | 0 | 500 | 200 | 0.1rev | Encoder units |
| | Pr0.15 | Absolute encoder set... | 0 | 0 | 15 | 0 | - | None |
| | Pr0.16 | External regenerative... | 100 | 40 | 500 | 100 | Q | valid after restart p |
| | Pr0.17 | Regenerative dischar... | 50 | 20 | 5000 | 50 | W | valid after restart p |

In this window, users can set the values of this kind of parameter. Users can set the control mode, etc.

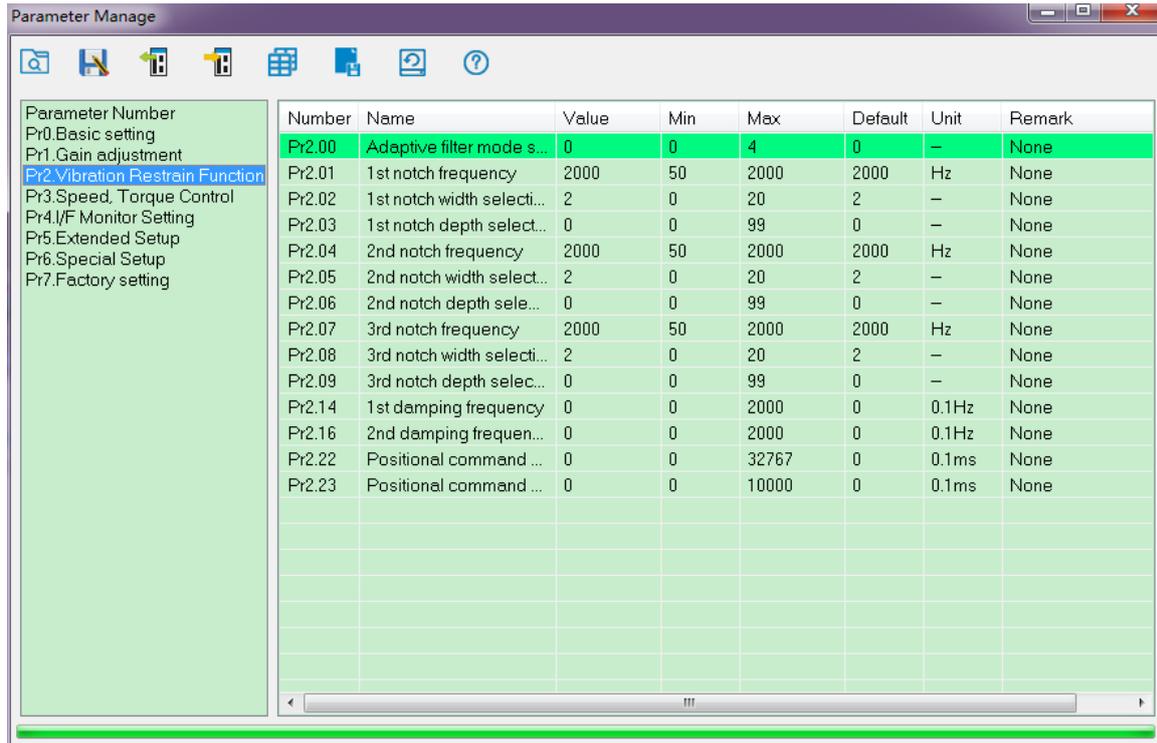
Gain adjustment



| Parameter Number | Number | Name | Value | Min | Max | Default | Unit | Remark |
|---------------------------------|--------|-------------------------------|-------|-----|-------|---------|--------|-----------------------|
| Pr0.Basic setting | Pr1.00 | 1st position loop gain | 75 | 0 | 30000 | 320 | 0.1/s | None |
| Pr1.Gain adjustment | Pr1.01 | 1st velocity loop gain | 60 | 1 | 32767 | 180 | 0.1Hz | None |
| Pr2.Vibration Restrain Function | Pr1.02 | 1st time constant of v... | 900 | 1 | 10000 | 310 | 0.1ms | None |
| Pr3.Speed, Torque Control | Pr1.03 | 1st filter of velocity det... | 15 | 0 | 10000 | 15 | - | None |
| Pr4.I/F Monitor Setting | Pr1.04 | 1st time constant of to... | 400 | 0 | 2500 | 126 | 0.01ms | None |
| Pr5.Extended Setup | Pr1.05 | 2nd position loop gain | 95 | 0 | 30000 | 380 | 0.1/s | None |
| Pr6.Special Setup | Pr1.06 | 2nd velocity loop gain | 60 | 1 | 32767 | 180 | 0.1Hz | None |
| Pr7.Factory setting | Pr1.07 | 2nd time constant of v... | 10000 | 1 | 10000 | 10000 | 0.1ms | None |
| | Pr1.08 | 2nd filter of velocity d... | 15 | 0 | 31 | 15 | - | None |
| | Pr1.09 | 2nd time constant of t... | 400 | 0 | 2500 | 126 | 0.01ms | None |
| | Pr1.10 | Velocity feed forward ... | 300 | 0 | 1000 | 300 | 0.001 | None |
| | Pr1.11 | Velocity feed forward ... | 50 | 0 | 6400 | 50 | 0.01ms | None |
| | Pr1.12 | Torque feed forward ... | 0 | 0 | 1000 | 0 | 0.001 | None |
| | Pr1.13 | Torque feed forward f... | 0 | 0 | 6400 | 0 | 0.01ms | None |
| | Pr1.15 | Control switching mode | 10 | 0 | 10 | 0 | - | None |
| | Pr1.17 | Control switching level | 50 | 0 | 20000 | 50 | - | None |
| | Pr1.18 | Control switch hystere... | 33 | 0 | 20000 | 33 | - | None |
| | Pr1.19 | Gain switching time | 33 | 0 | 10000 | 33 | 0.1ms | None |
| | Pr1.35 | Positional command f... | 0 | 0 | 200 | 0 | 0.05ns | valid after restart p |
| | Pr1.37 | Special function regis... | 0 | 0 | 7FFF | 0 | - | None |

In this window, users can set the values of parameter about gain adjustment.

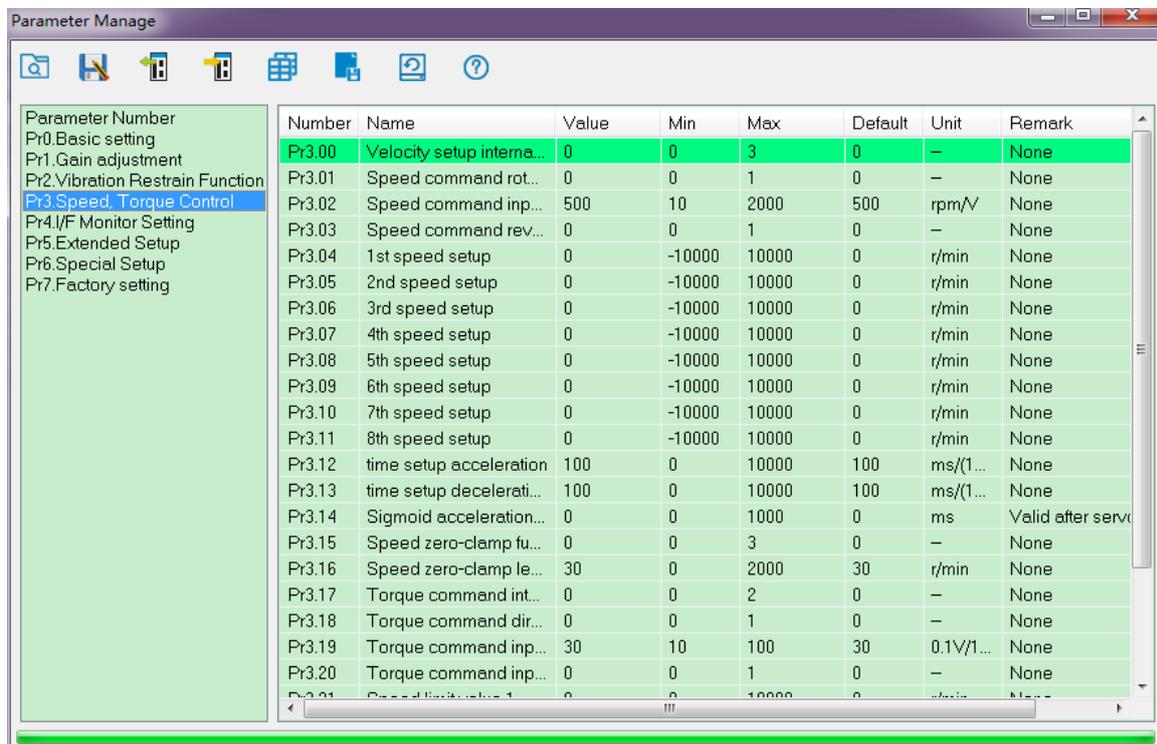
Vibration suppression



| Parameter Number | Number | Name | Value | Min | Max | Default | Unit | Remark |
|---------------------------------|--------|----------------------------|-------|-----|-------|---------|-------|--------|
| Pr0.Basic setting | | | | | | | | |
| Pr1.Gain adjustment | | | | | | | | |
| Pr2.Vibration Restrain Function | Pr2.00 | Adaptive filter mode s... | 0 | 0 | 4 | 0 | — | None |
| Pr3.Speed, Torque Control | Pr2.01 | 1st notch frequency | 2000 | 50 | 2000 | 2000 | Hz | None |
| Pr4.I/F Monitor Setting | Pr2.02 | 1st notch width selecti... | 2 | 0 | 20 | 2 | — | None |
| Pr5.Extended Setup | Pr2.03 | 1st notch depth select... | 0 | 0 | 99 | 0 | — | None |
| Pr6.Special Setup | Pr2.04 | 2nd notch frequency | 2000 | 50 | 2000 | 2000 | Hz | None |
| Pr7.Factory setting | Pr2.05 | 2nd notch width select... | 2 | 0 | 20 | 2 | — | None |
| | Pr2.06 | 2nd notch depth sele... | 0 | 0 | 99 | 0 | — | None |
| | Pr2.07 | 3rd notch frequency | 2000 | 50 | 2000 | 2000 | Hz | None |
| | Pr2.08 | 3rd notch width selecti... | 2 | 0 | 20 | 2 | — | None |
| | Pr2.09 | 3rd notch depth selec... | 0 | 0 | 99 | 0 | — | None |
| | Pr2.14 | 1st damping frequency | 0 | 0 | 2000 | 0 | 0.1Hz | None |
| | Pr2.16 | 2nd damping frequen... | 0 | 0 | 2000 | 0 | 0.1Hz | None |
| | Pr2.22 | Positional command ... | 0 | 0 | 32767 | 0 | 0.1ms | None |
| | Pr2.23 | Positional command ... | 0 | 0 | 10000 | 0 | 0.1ms | None |

In this window, users can set the values of parameter about vibration and disturbance suppression.

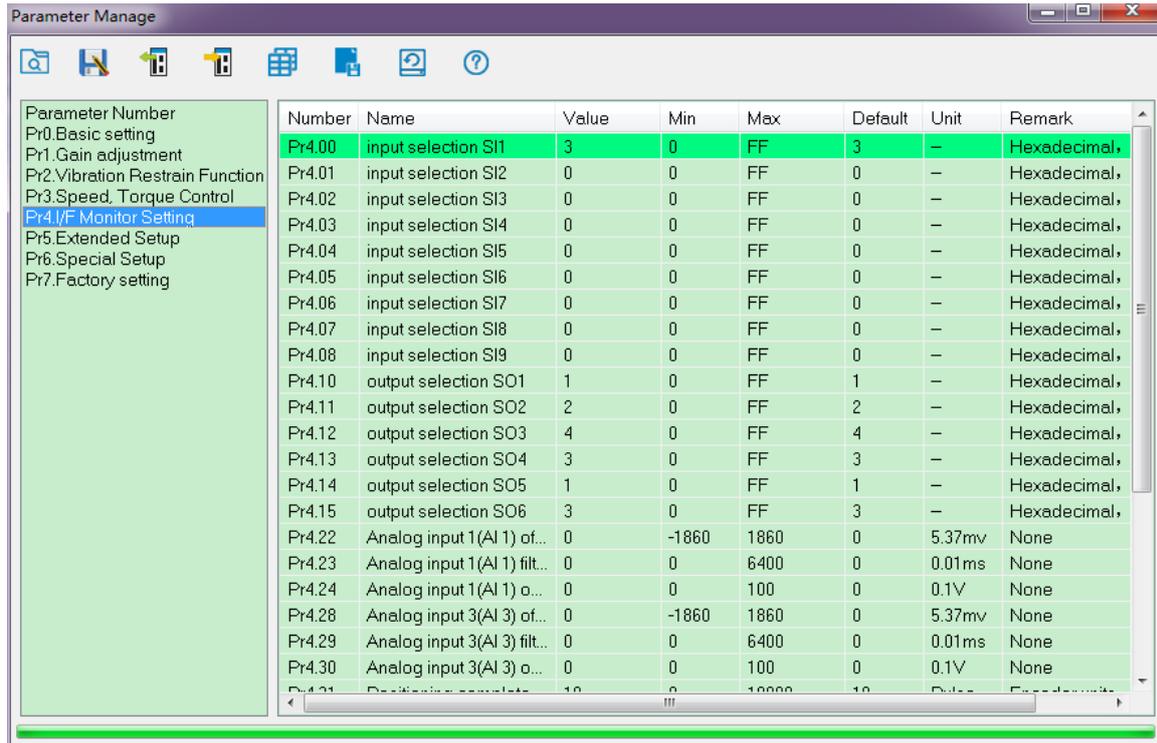
Velocity torque control



| Parameter Number | Number | Name | Value | Min | Max | Default | Unit | Remark |
|---------------------------------|--------|---------------------------|-------|--------|-------|---------|-----------|------------------|
| Pr0.Basic setting | | | | | | | | |
| Pr1.Gain adjustment | | | | | | | | |
| Pr2.Vibration Restrain Function | | | | | | | | |
| Pr3.Speed, Torque Control | Pr3.00 | Velocity setup interna... | 0 | 0 | 3 | 0 | — | None |
| Pr4.I/F Monitor Setting | Pr3.01 | Speed command rot... | 0 | 0 | 1 | 0 | — | None |
| Pr5.Extended Setup | Pr3.02 | Speed command inp... | 500 | 10 | 2000 | 500 | rpm/V | None |
| Pr6.Special Setup | Pr3.03 | Speed command rev... | 0 | 0 | 1 | 0 | — | None |
| Pr7.Factory setting | Pr3.04 | 1st speed setup | 0 | -10000 | 10000 | 0 | r/min | None |
| | Pr3.05 | 2nd speed setup | 0 | -10000 | 10000 | 0 | r/min | None |
| | Pr3.06 | 3rd speed setup | 0 | -10000 | 10000 | 0 | r/min | None |
| | Pr3.07 | 4th speed setup | 0 | -10000 | 10000 | 0 | r/min | None |
| | Pr3.08 | 5th speed setup | 0 | -10000 | 10000 | 0 | r/min | None |
| | Pr3.09 | 6th speed setup | 0 | -10000 | 10000 | 0 | r/min | None |
| | Pr3.10 | 7th speed setup | 0 | -10000 | 10000 | 0 | r/min | None |
| | Pr3.11 | 8th speed setup | 0 | -10000 | 10000 | 0 | r/min | None |
| | Pr3.12 | time setup acceleration | 100 | 0 | 10000 | 100 | ms/(1... | None |
| | Pr3.13 | time setup decelerati... | 100 | 0 | 10000 | 100 | ms/(1... | None |
| | Pr3.14 | Sigmoid acceleration... | 0 | 0 | 1000 | 0 | ms | Valid after serv |
| | Pr3.15 | Speed zero-clamp fu... | 0 | 0 | 3 | 0 | — | None |
| | Pr3.16 | Speed zero-clamp le... | 30 | 0 | 2000 | 30 | r/min | None |
| | Pr3.17 | Torque command int... | 0 | 0 | 2 | 0 | — | None |
| | Pr3.18 | Torque command dir... | 0 | 0 | 1 | 0 | — | None |
| | Pr3.19 | Torque command inp... | 30 | 10 | 100 | 30 | 0.1V/1... | None |
| | Pr3.20 | Torque command inp... | 0 | 0 | 1 | 0 | — | None |
| | Pr3.21 | Speed feedback gain 1 | 0 | 0 | 10000 | 0 | rpm/V | None |

In this parameter window, users can set the values of parameter about velocity / torque control.

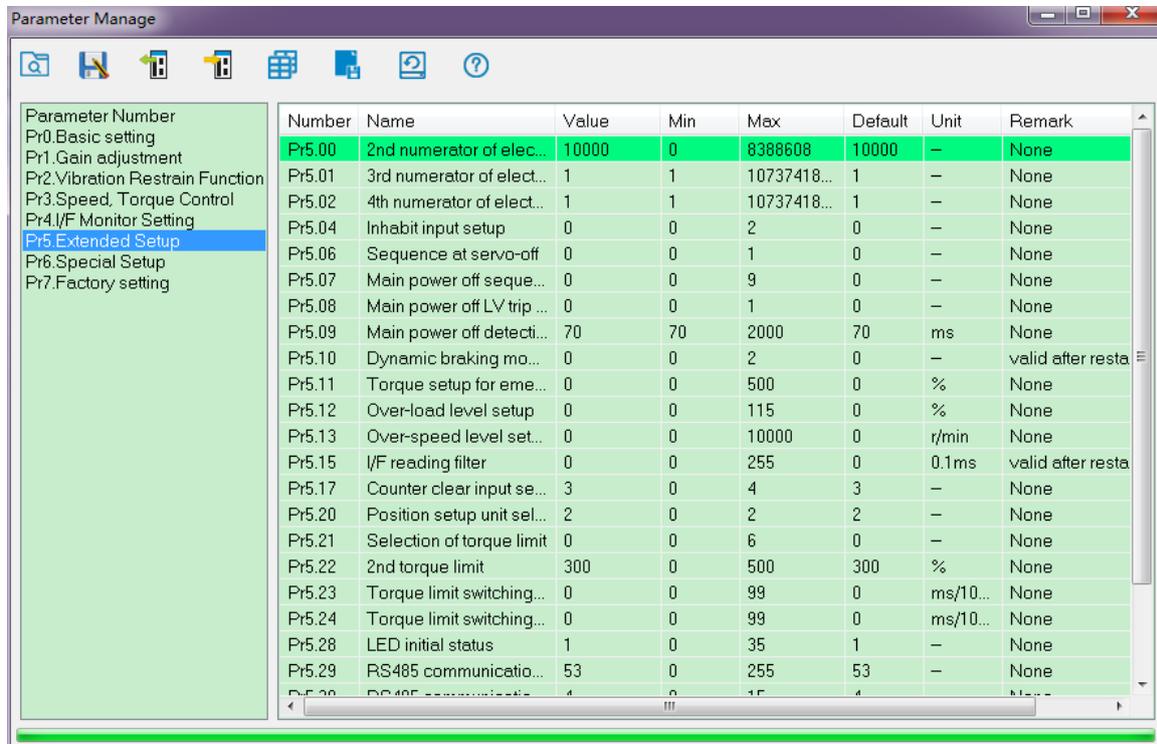
Monitor setup



| Parameter Number | Number | Name | Value | Min | Max | Default | Unit | Remark |
|---------------------------------|--------|------------------------------|-------|-------|------|---------|--------|--------------|
| Pr0.Basic setting | Pr4.00 | input selection SI1 | 3 | 0 | FF | 3 | — | Hexadecimal, |
| Pr1.Gain adjustment | Pr4.01 | input selection SI2 | 0 | 0 | FF | 0 | — | Hexadecimal, |
| Pr2.Vibration Restrain Function | Pr4.02 | input selection SI3 | 0 | 0 | FF | 0 | — | Hexadecimal, |
| Pr3.Speed, Torque Control | Pr4.03 | input selection SI4 | 0 | 0 | FF | 0 | — | Hexadecimal, |
| Pr4.I/F Monitor Setting | Pr4.04 | input selection SI5 | 0 | 0 | FF | 0 | — | Hexadecimal, |
| Pr5.Extended Setup | Pr4.05 | input selection SI6 | 0 | 0 | FF | 0 | — | Hexadecimal, |
| Pr6.Special Setup | Pr4.06 | input selection SI7 | 0 | 0 | FF | 0 | — | Hexadecimal, |
| Pr7.Factory setting | Pr4.07 | input selection SI8 | 0 | 0 | FF | 0 | — | Hexadecimal, |
| | Pr4.08 | input selection SI9 | 0 | 0 | FF | 0 | — | Hexadecimal, |
| | Pr4.10 | output selection SO1 | 1 | 0 | FF | 1 | — | Hexadecimal, |
| | Pr4.11 | output selection SO2 | 2 | 0 | FF | 2 | — | Hexadecimal, |
| | Pr4.12 | output selection SO3 | 4 | 0 | FF | 4 | — | Hexadecimal, |
| | Pr4.13 | output selection SO4 | 3 | 0 | FF | 3 | — | Hexadecimal, |
| | Pr4.14 | output selection SO5 | 1 | 0 | FF | 1 | — | Hexadecimal, |
| | Pr4.15 | output selection SO6 | 3 | 0 | FF | 3 | — | Hexadecimal, |
| | Pr4.22 | Analog input 1(AI 1) of... | 0 | -1860 | 1860 | 0 | 5.37mv | None |
| | Pr4.23 | Analog input 1(AI 1) filt... | 0 | 0 | 6400 | 0 | 0.01ms | None |
| | Pr4.24 | Analog input 1(AI 1) o... | 0 | 0 | 100 | 0 | 0.1V | None |
| | Pr4.28 | Analog input 3(AI 3) of... | 0 | -1860 | 1860 | 0 | 5.37mv | None |
| | Pr4.29 | Analog input 3(AI 3) filt... | 0 | 0 | 6400 | 0 | 0.01ms | None |
| | Pr4.30 | Analog input 3(AI 3) o... | 0 | 0 | 100 | 0 | 0.1V | None |

In this window, users can set the values of parameter about input/output setting, speed zero clamping, etc.

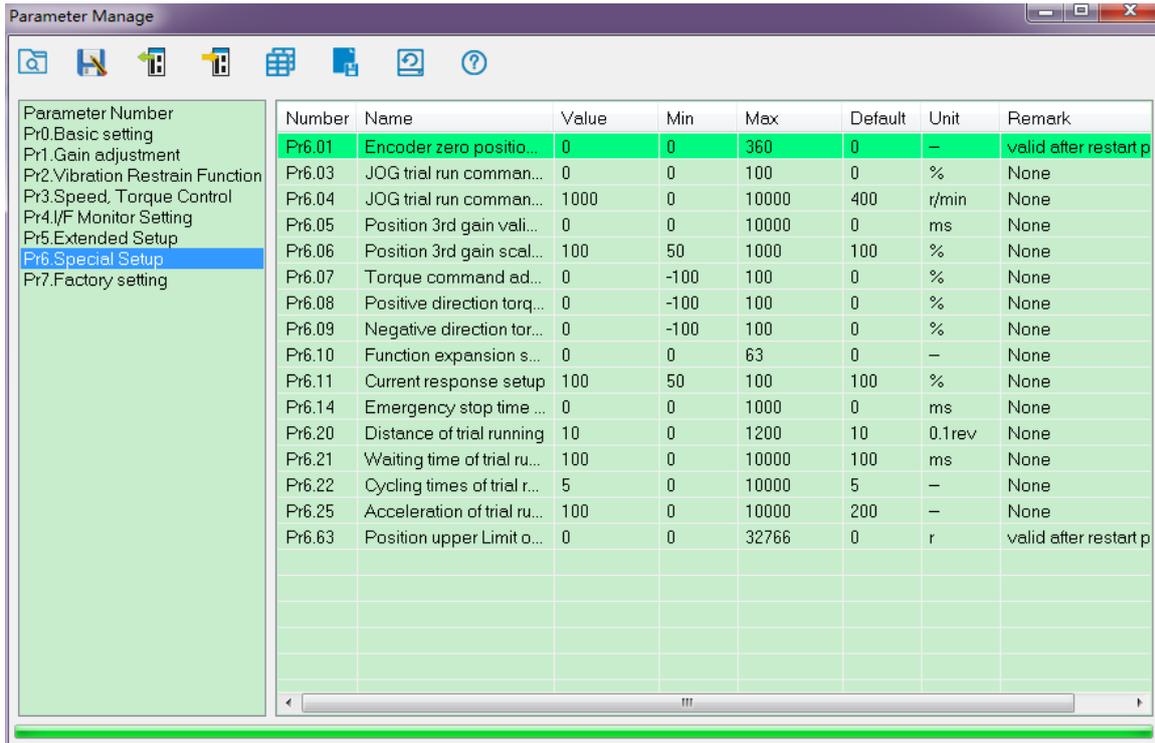
Extension setting



| Parameter Number | Number | Name | Value | Min | Max | Default | Unit | Remark |
|---------------------------------|--------|----------------------------|-------|-----|-------------|---------|----------|-------------------|
| Pr0.Basic setting | Pr5.00 | 2nd numerator of elec... | 10000 | 0 | 8388608 | 10000 | — | None |
| Pr1.Gain adjustment | Pr5.01 | 3rd numerator of elect... | 1 | 1 | 10737418... | 1 | — | None |
| Pr2.Vibration Restrain Function | Pr5.02 | 4th numerator of elect... | 1 | 1 | 10737418... | 1 | — | None |
| Pr3.Speed, Torque Control | Pr5.04 | Inhabit input setup | 0 | 0 | 2 | 0 | — | None |
| Pr4.I/F Monitor Setting | Pr5.06 | Sequence at servo-off | 0 | 0 | 1 | 0 | — | None |
| Pr5.Extended Setup | Pr5.07 | Main power off seque... | 0 | 0 | 9 | 0 | — | None |
| Pr6.Special Setup | Pr5.08 | Main power off LV trip ... | 0 | 0 | 1 | 0 | — | None |
| Pr7.Factory setting | Pr5.09 | Main power off detecti... | 70 | 70 | 2000 | 70 | ms | None |
| | Pr5.10 | Dynamic braking mo... | 0 | 0 | 2 | 0 | — | valid after resta |
| | Pr5.11 | Torque setup for eme... | 0 | 0 | 500 | 0 | % | None |
| | Pr5.12 | Over-load level setup | 0 | 0 | 115 | 0 | % | None |
| | Pr5.13 | Over-speed level set... | 0 | 0 | 10000 | 0 | r/min | None |
| | Pr5.15 | I/F reading filter | 0 | 0 | 255 | 0 | 0.1ms | valid after resta |
| | Pr5.17 | Counter clear input se... | 3 | 0 | 4 | 3 | — | None |
| | Pr5.20 | Position setup unit sel... | 2 | 0 | 2 | 2 | — | None |
| | Pr5.21 | Selection of torque limit | 0 | 0 | 6 | 0 | — | None |
| | Pr5.22 | 2nd torque limit | 300 | 0 | 500 | 300 | % | None |
| | Pr5.23 | Torque limit switching... | 0 | 0 | 99 | 0 | ms/10... | None |
| | Pr5.24 | Torque limit switching... | 0 | 0 | 99 | 0 | ms/10... | None |
| | Pr5.28 | LED initial status | 1 | 0 | 35 | 1 | — | None |
| | Pr5.29 | RS485 communicatio... | 53 | 0 | 255 | 53 | — | None |

In this window, users can set the values of parameter about extended function.

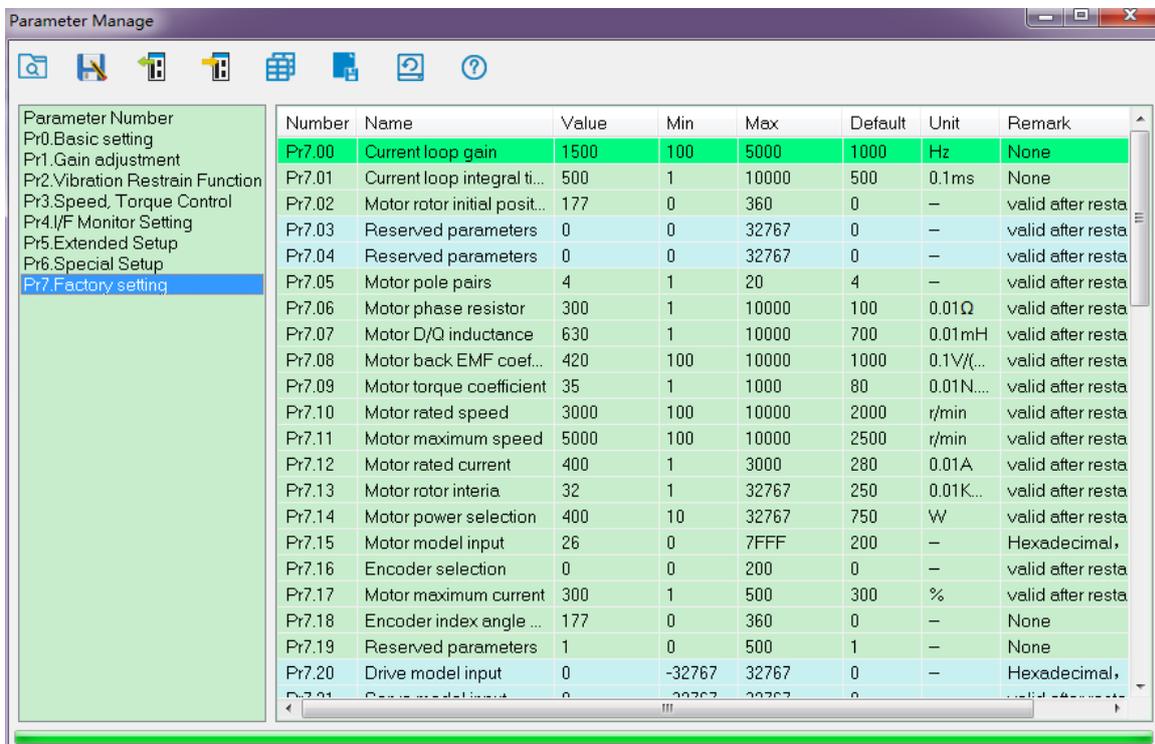
Special setting



| Parameter Number | Number | Name | Value | Min | Max | Default | Unit | Remark |
|---------------------------------|--------|-----------------------------|-------|------|-------|---------|--------|-----------------------|
| Pr0.Basic setting | Pr6.01 | Encoder zero positio... | 0 | 0 | 360 | 0 | — | valid after restart p |
| Pr1.Gain adjustment | Pr6.03 | JOG trial run comman... | 0 | 0 | 100 | 0 | % | None |
| Pr2.Vibration Restrain Function | Pr6.04 | JOG trial run comman... | 1000 | 0 | 10000 | 400 | r/min | None |
| Pr3.Speed, Torque Control | Pr6.05 | Position 3rd gain vali... | 0 | 0 | 10000 | 0 | ms | None |
| Pr4.I/F Monitor Setting | Pr6.06 | Position 3rd gain scal... | 100 | 50 | 1000 | 100 | % | None |
| Pr5.Extended Setup | Pr6.07 | Torque command ad... | 0 | -100 | 100 | 0 | % | None |
| Pr6.Special Setup | Pr6.08 | Positive direction torq... | 0 | -100 | 100 | 0 | % | None |
| Pr7.Factory setting | Pr6.09 | Negative direction tor... | 0 | -100 | 100 | 0 | % | None |
| | Pr6.10 | Function expansion s... | 0 | 0 | 63 | 0 | — | None |
| | Pr6.11 | Current response setup | 100 | 50 | 100 | 100 | % | None |
| | Pr6.14 | Emergency stop time ... | 0 | 0 | 1000 | 0 | ms | None |
| | Pr6.20 | Distance of trial running | 10 | 0 | 1200 | 10 | 0.1rev | None |
| | Pr6.21 | Waiting time of trial ru... | 100 | 0 | 10000 | 100 | ms | None |
| | Pr6.22 | Cycling times of trial r... | 5 | 0 | 10000 | 5 | — | None |
| | Pr6.25 | Acceleration of trial ru... | 100 | 0 | 10000 | 200 | — | None |
| | Pr6.63 | Position upper Limit o... | 0 | 0 | 32766 | 0 | r | valid after restart p |

In this window, users can set the values of parameter about special setting, trial run parameter, etc.

Factory setup



| Parameter Number | Number | Name | Value | Min | Max | Default | Unit | Remark |
|---------------------------------|--------|-----------------------------|-------|--------|-------|---------|-----------|-------------------|
| Pr0.Basic setting | Pr7.00 | Current loop gain | 1500 | 100 | 5000 | 1000 | Hz | None |
| Pr1.Gain adjustment | Pr7.01 | Current loop integral ti... | 500 | 1 | 10000 | 500 | 0.1ms | None |
| Pr2.Vibration Restrain Function | Pr7.02 | Motor rotor initial posi... | 177 | 0 | 360 | 0 | — | valid after resta |
| Pr3.Speed, Torque Control | Pr7.03 | Reserved parameters | 0 | 0 | 32767 | 0 | — | valid after resta |
| Pr4.I/F Monitor Setting | Pr7.04 | Reserved parameters | 0 | 0 | 32767 | 0 | — | valid after resta |
| Pr5.Extended Setup | Pr7.05 | Motor pole pairs | 4 | 1 | 20 | 4 | — | valid after resta |
| Pr6.Special Setup | Pr7.06 | Motor phase resistor | 300 | 1 | 10000 | 100 | 0.01Ω | valid after resta |
| Pr7.Factory setting | Pr7.07 | Motor D/Q inductance | 630 | 1 | 10000 | 700 | 0.01mH | valid after resta |
| | Pr7.08 | Motor back EMF coef... | 420 | 100 | 10000 | 1000 | 0.1V/(... | valid after resta |
| | Pr7.09 | Motor torque coefficient | 35 | 1 | 1000 | 80 | 0.01N... | valid after resta |
| | Pr7.10 | Motor rated speed | 3000 | 100 | 10000 | 2000 | r/min | valid after resta |
| | Pr7.11 | Motor maximum speed | 5000 | 100 | 10000 | 2500 | r/min | valid after resta |
| | Pr7.12 | Motor rated current | 400 | 1 | 3000 | 280 | 0.01A | valid after resta |
| | Pr7.13 | Motor rotor inertia | 32 | 1 | 32767 | 250 | 0.01K... | valid after resta |
| | Pr7.14 | Motor power selection | 400 | 10 | 32767 | 750 | W | valid after resta |
| | Pr7.15 | Motor model input | 26 | 0 | 7FFF | 200 | — | Hexadecimal, |
| | Pr7.16 | Encoder selection | 0 | 0 | 200 | 0 | — | valid after resta |
| | Pr7.17 | Motor maximum current | 300 | 1 | 500 | 300 | % | valid after resta |
| | Pr7.18 | Encoder index angle ... | 177 | 0 | 360 | 0 | — | None |
| | Pr7.19 | Reserved parameters | 1 | 0 | 500 | 1 | — | None |
| | Pr7.20 | Drive model input | 0 | -32767 | 32767 | 0 | — | Hexadecimal, |

In this window, users can set the values of parameter about motor setting.

If the motor isn't included in motor library, then users can match this motor through modifying the parameter of Pr7.00 – Pr7.16. First, set Pr7.15=0, then set other parameters according to the specification of motor.

In general, we can't see all the parameters like the picture above, we can make some operation to see all of them, just refer to the appendix about how to find the hidden parameter.

Notice:

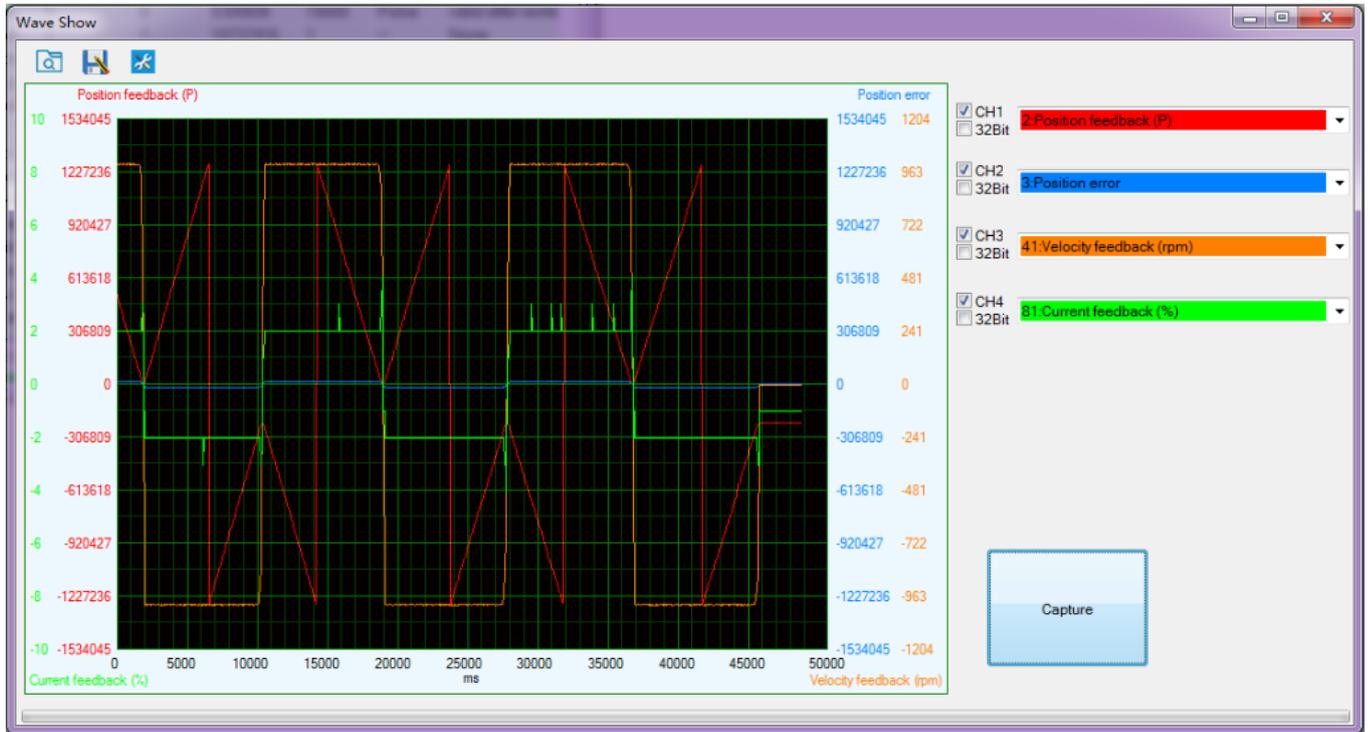
Restart the driver to make some modified values of parameter valid.

2.4 Wave Show

If users want to see monitor the status of performance when the motor is running, for example, the driver and motor are running position feedback、 position error、 velocity feedback and current feedback, users can click



to analysis these data.



Load wave file from the computer.



Save current wave record as wave file.



Wave capture setting.

Sampling interval:

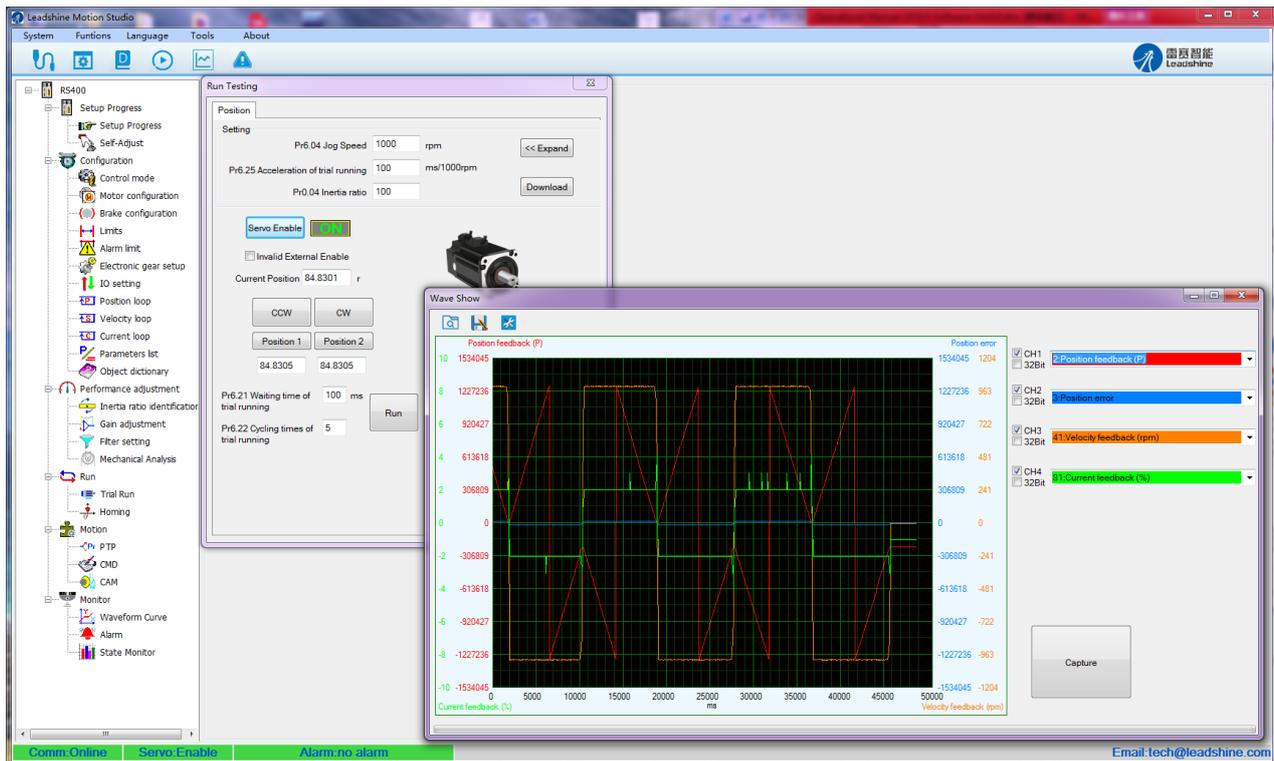
The time value of sampling interval.

Chapter 3 Run Test

There is position mode in run testing.

Position Mode Tuning Window

In position mode, the parameter what users need to adjust is Jog Speed, ACC time, Inertia ratio, etc. users can setup real-time auto adjust mode, then adjust real-time auto adjust rigidity. Users need to **decrease** the rigidity for better performance. If the noise exists while it means the rigidity is too big.



1、Set parameters for run testing:

Specially pay attention to Pr0.03 Stiffness and Pr0.04 Inertia ratio which strongly corresponding to better performance

2、Run testing guidance

Click button "Servo enable"

Click "CCW" to make motor run to CCW direction, click "Position 1" to save the testing position limit 1

Click "CW" to make motor run to CW direction, click "Position 2" to save the testing position limit 2

Click "Run" to start Testing progress

3、During the Run Testing progress, the wave show monitor the performance of the current parameters setting.

Run Testing ✕

Position

Setting

Pr6.04 Jog Speed rpm << Expand

Pr6.25 Acceleration of trial running ms/1000rpm

Pr0.04 Inertia ratio Download

Servo Enable ON

Invalid External Enable

Current Position r

Pr6.21 Waiting time of trial running ms

Pr6.22 Cycling times of trial running



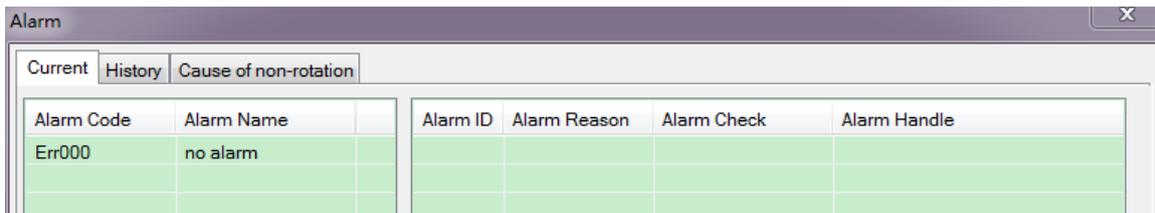
Chapter 4 Alarm and Tool

4.1 Current alarm



Click the “” :

Then the window showing like this:

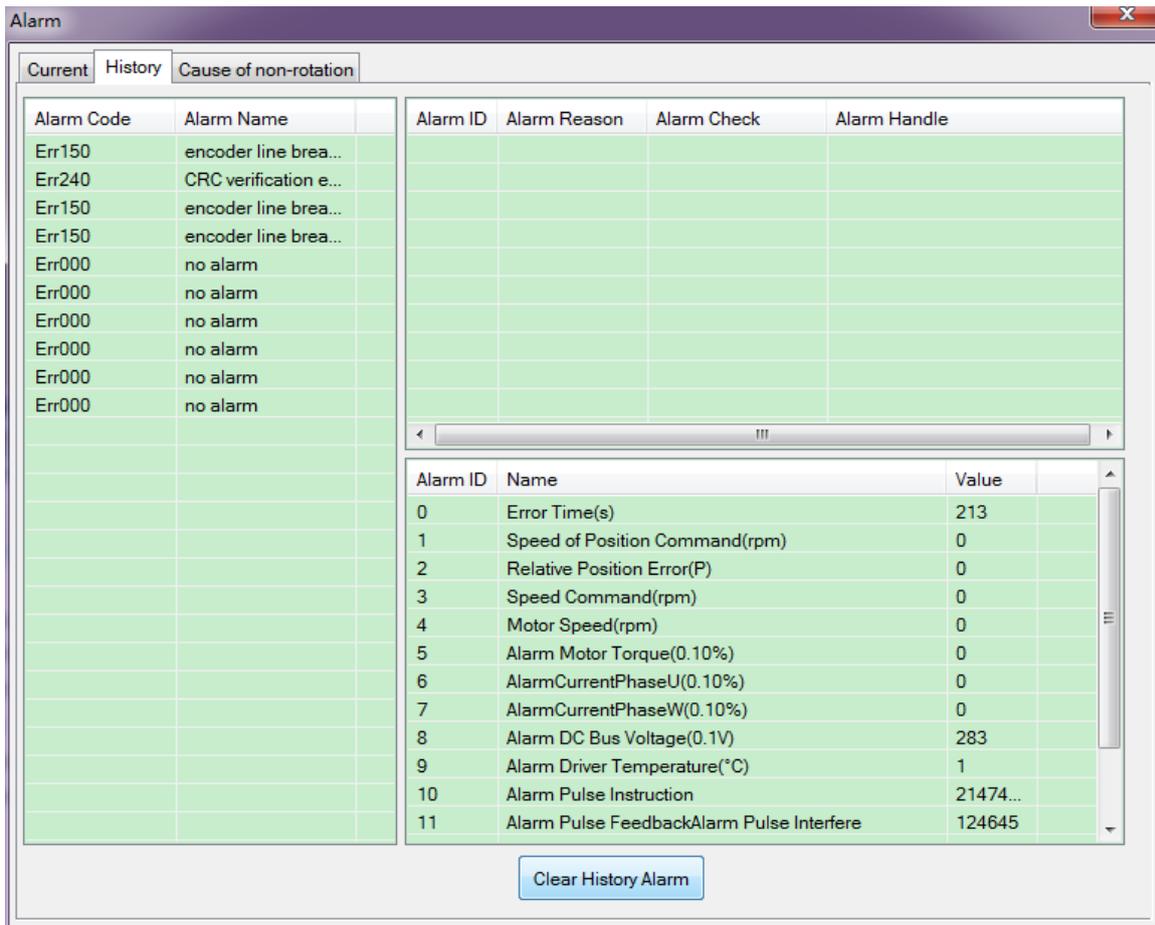


| Alarm Code | Alarm Name | Alarm ID | Alarm Reason | Alarm Check | Alarm Handle |
|------------|------------|----------|--------------|-------------|--------------|
| Err000 | no alarm | | | | |

Users can see the alarms after power on, the alarm will be eliminated after power off .

4.2 History alarm

The history alarm can mostly record 13 alarms, Click read history alarm will appear all of history alarm numbers and alarm name. Click alarm name to display alarm reason and process method. When the number of alarm exceed 13 alarms, users need to click clear history alarm, it will clear all of history alarms.



| Alarm Code | Alarm Name | Alarm ID | Alarm Reason | Alarm Check | Alarm Handle |
|------------|-----------------------|----------|--------------|-------------|--------------|
| Err150 | encoder line brea... | | | | |
| Err240 | CRC verification e... | | | | |
| Err150 | encoder line brea... | | | | |
| Err150 | encoder line brea... | | | | |
| Err000 | no alarm | | | | |
| Err000 | no alarm | | | | |
| Err000 | no alarm | | | | |
| Err000 | no alarm | | | | |
| Err000 | no alarm | | | | |
| Err000 | no alarm | | | | |

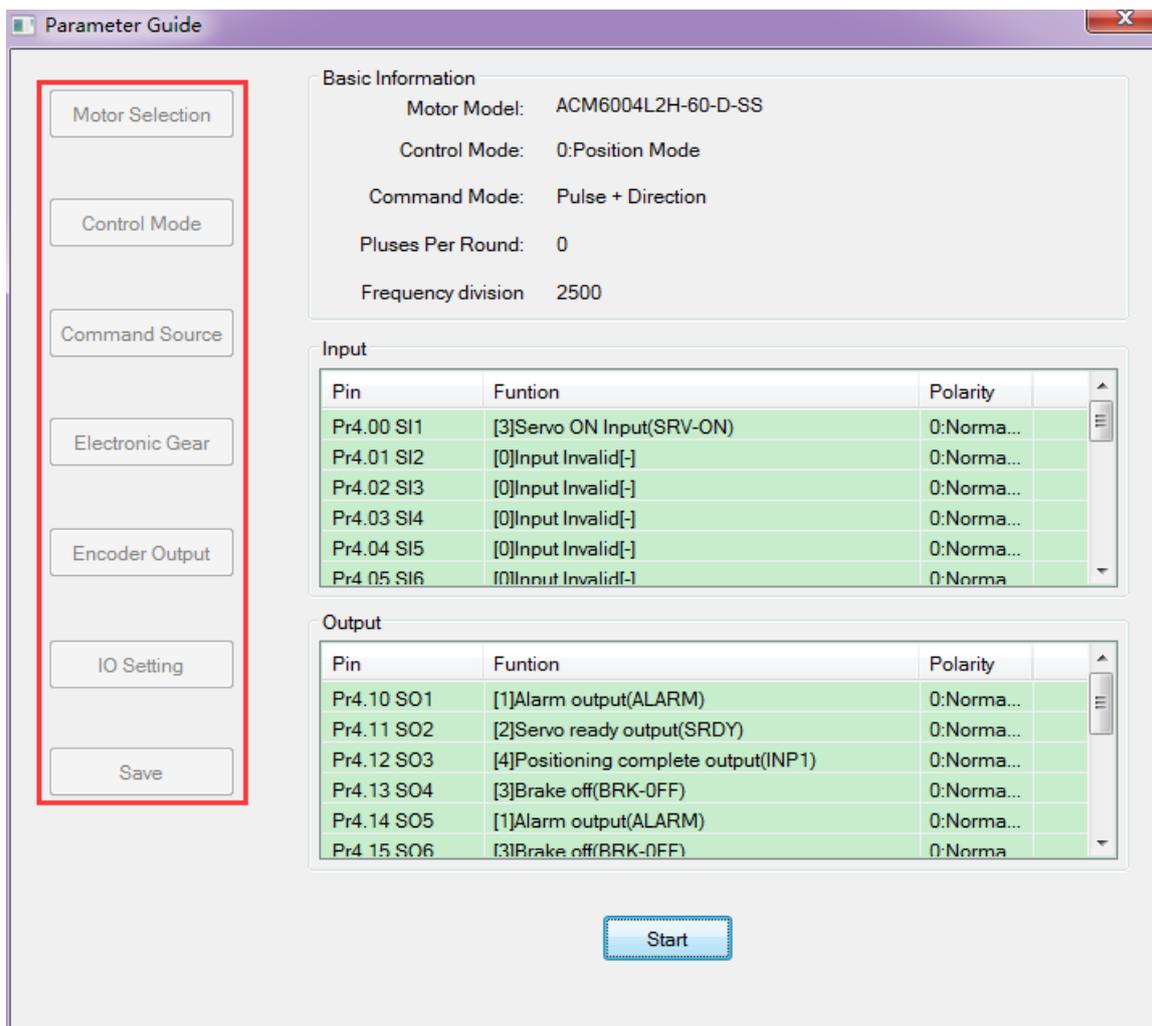
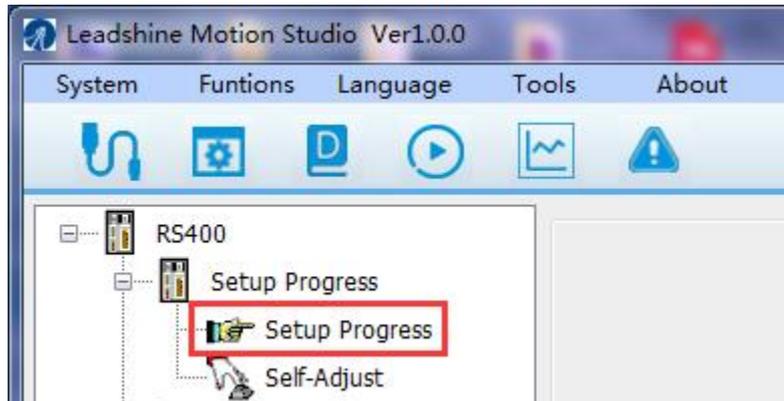
| Alarm ID | Name | Value |
|----------|---|----------|
| 0 | Error Time(s) | 213 |
| 1 | Speed of Position Command(rpm) | 0 |
| 2 | Relative Position Error(P) | 0 |
| 3 | Speed Command(rpm) | 0 |
| 4 | Motor Speed(rpm) | 0 |
| 5 | Alarm Motor Torque(0.10%) | 0 |
| 6 | AlarmCurrentPhaseU(0.10%) | 0 |
| 7 | AlarmCurrentPhaseW(0.10%) | 0 |
| 8 | Alarm DC Bus Voltage(0.1V) | 283 |
| 9 | Alarm Driver Temperature(°C) | 1 |
| 10 | Alarm Pulse Instruction | 21474... |
| 11 | Alarm Pulse FeedbackAlarm Pulse Interfere | 124645 |

Clear History Alarm

Chapter 5 Configuring the Driver

5.1 Setup progress

The debug software for ELP series is newly designed. To configure a new drive, users can follow the **Setup Progress** to set the parameters for special application.



To follow the setup progress, there are 6 steps :

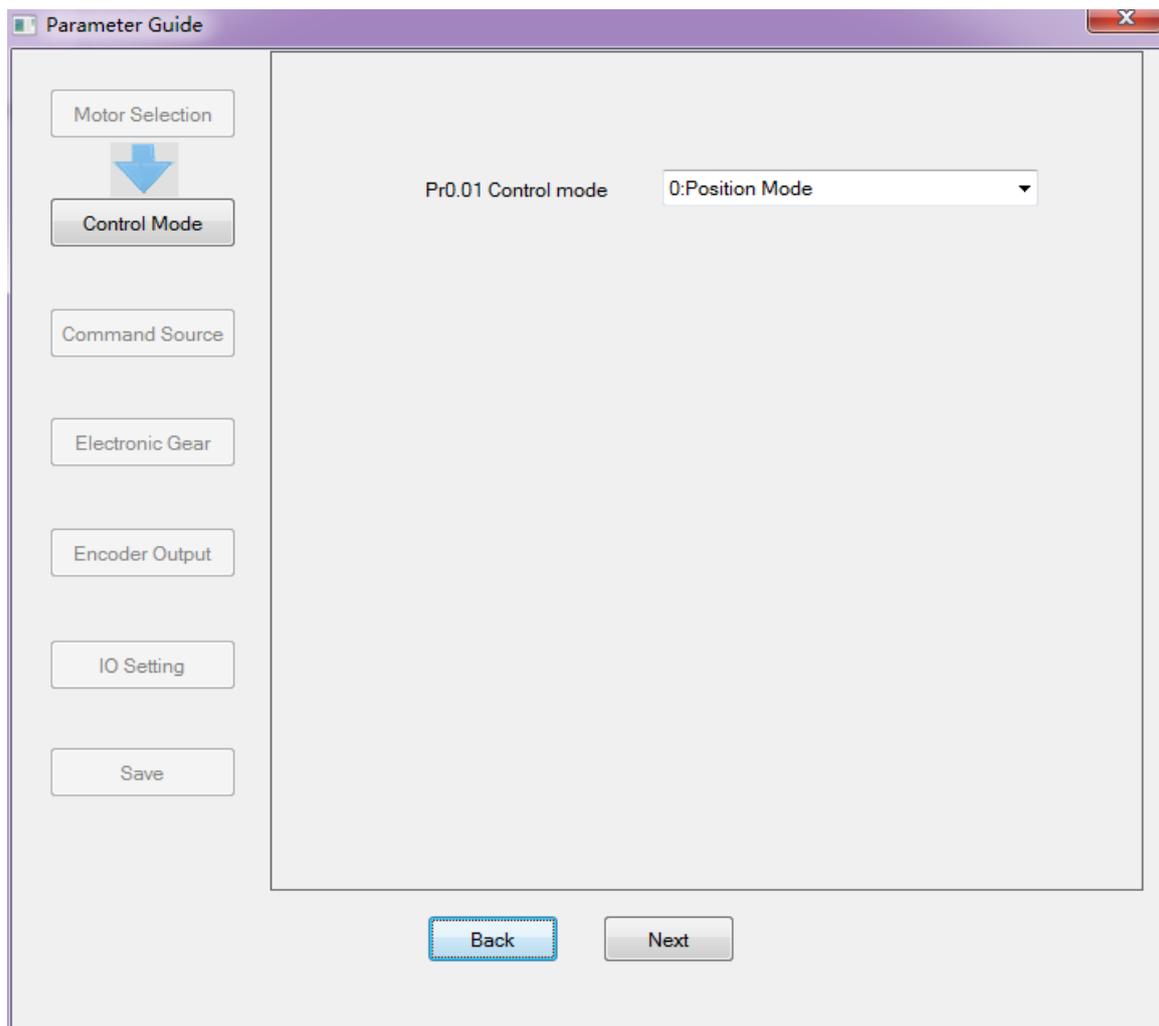
1. Motor Selection

The motor model is automatically detect by serial communication of encoder, so users could go to the 2nd Step—> Control Mode

2. Control Mode

There are 3 modes for selection, select the control mode according to mechanical system and the application.

- Position Mode:
Mainly for positioning application. (Pulse+Direction / CW+CCW/A+B phase)
- Velocity Mode:
Mainly for velocity application. (Analog / Internal Speed / Analog and Internal Speed)
- Torque Mode:
Mainly for torque application. (Analog)



3. Command Source

Select the command source according to the control mode and controller command source. The command source for each control mode is showing as follows:

- Position Mode:
(Pulse+Direction / CW+CCW/A+B phase)
- Velocity Mode:
(Analog / Internal Speed / Analog and Internal Speed)
- Torque Mode:
(Analog)

4. Electronic Gear

When the transmission structure is screw:

$$\text{Pulses per round} = \text{Screw lead} / \text{Pulse equivalent}$$

When the transmission structure is rack and pinion:

$$\text{Pulses per round} = (\text{Modulus} * \text{Number of pinion} * \text{Helical angle} * 3.1415627) / (\text{Gear ratio} * \text{Pulse equivalent})$$

5. Encoder Output

The output pulses counts per motor revolution = Pulses Per Round / 4

6. IO Setting

There are 9 inputs, the function of general-purpose input is selected by parameters.

Inputs functions:

Servo-ON, Alarm clear, Positive/Negative Limit, Control mode switching, Gain switching, Deviation counter clear, Command pulse inhibition, Electronic gear switching, Torque limit switching, Speed zero clamp, Speed command sign input, Torque command sign input, E-STOP, Inertia ratio switching, Internal speed selection.

There are 6 outputs, the function of general-purpose input is selected by parameters.

Outputs functions:

Alarm output, Servo-Ready, Positioning complete, At-speed, Zero-speed, Velocity consistent, Positional command ON/OFF, Servo-ON, Home-OK.

The polarity of inputs and outputs can be configured as normally open or normally closed.

If users select normally open, the external connection is needed. If users select normally closed, the external connection is no need.

7. Save

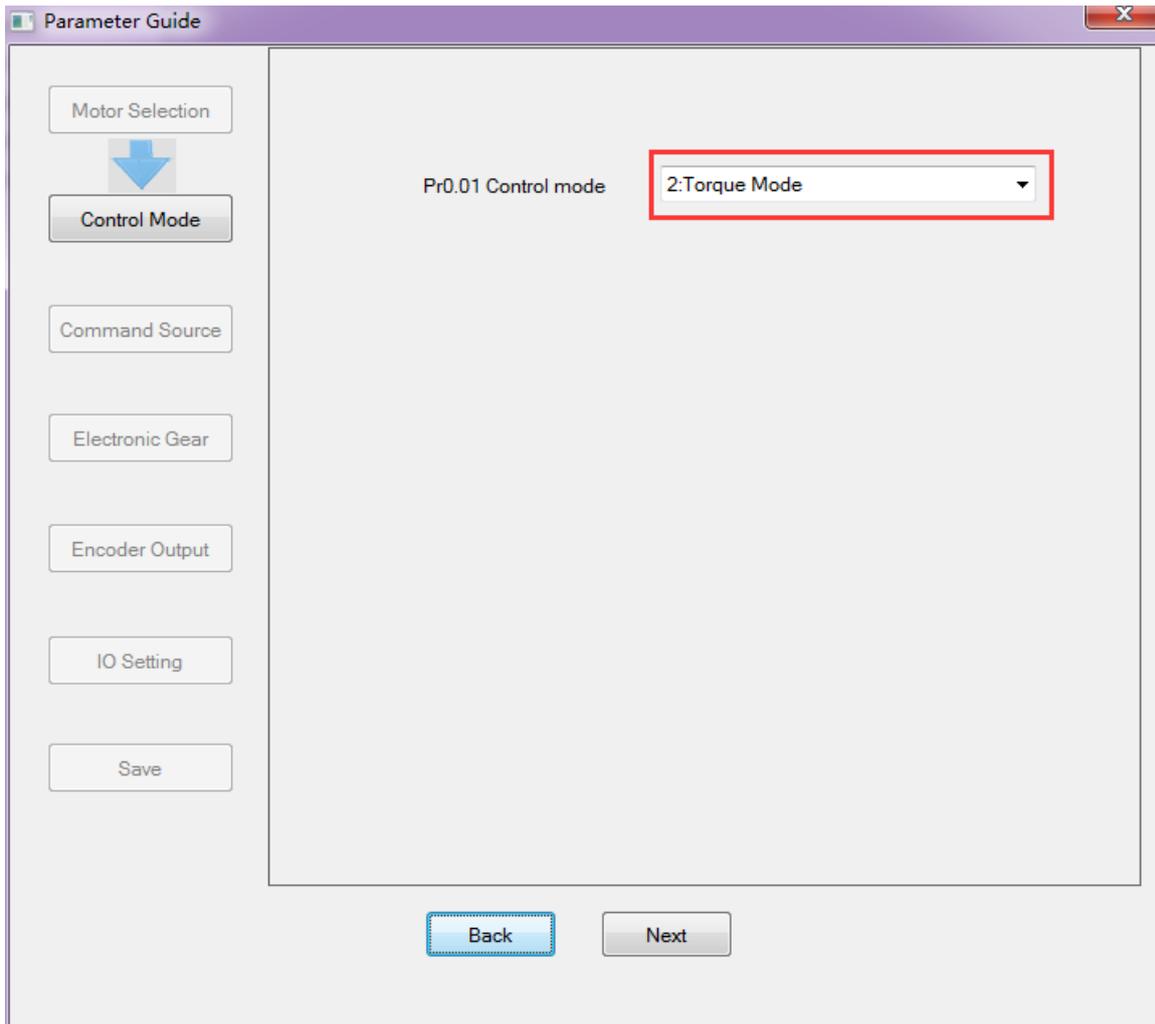
After the all the configuration, users should save the parameters into NVM. (Non-Volatile Memory)

Before running ELP series driver, users need to select different work mode according to mechanical system and the application, while different work mode need to wire in different way, please refer to user manual. when driver wiring connecting was finished, users can tune the parameter with ProTuner software.

5.2 Torque mode

The command resource of torque mode is *Analog Input*, via AI3 send $\pm 10V$ analog input signal, in torque mode, users can't see waveform curve, but users can setup related parameters with torque mode.

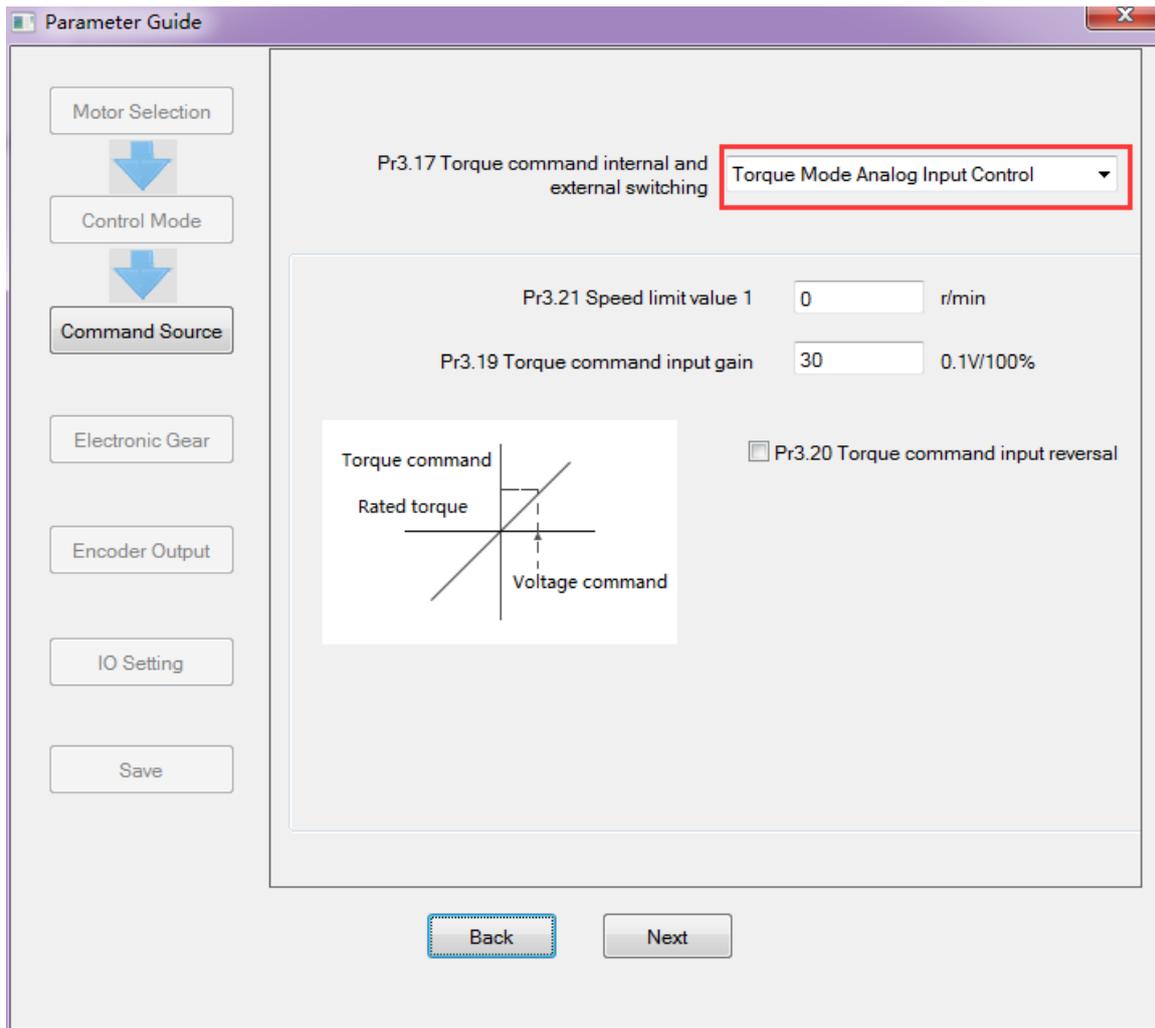
5.2.1 Setup progress—Control Mode window



In setup progress—Control Mode window, users need to set Pr0.01=2 to select Torque Mode.

5.2.2 Setup progress—Command Source window

Users need select the *Torque Mode Analog Input Control* as command resource for torque mode; (待替换)



5.2.3 Setup progress—IO Setting window

Then in setup progress—IO Setting(Input) window, users need select Pr4.00 SI1 as **Servo ON Input** to make motor enable.

Users can select SI2~SI9 input as other functions. Such as : **Alarm clear**, **Positive limit**, **Negative limit** . etc

Then in setup progress—IO Setting(Output) window, users can select SO1~SO6 output as other functions. Such as : **Alarm output**, **Servo ready output** . etc

5.2.4 Save the setting

After the all the configuration, users should save the parameters into NVM. (Non-Volatile Memory)

Then users need to download and save the new settings to the driver, then restart the power supply or software reset to make new values of parameters valid .

5.2.5 Operation

When users have finished the above all of these parameters setting, users can give analog input AI3 signal to drive by CN1 port. The motor will work in torque mode, if users aren't satisfied with the performance of motor, users can continue adjusting related torque parameter.

About the tuning of current loop gain

Users can adjust the gain of current loop gain pr7.00 and current loop integral time pr7.01. in general , users can't see the parameter except pr7.15 and pr7.16, so refer to the appendix on how to find the hidden parameter.

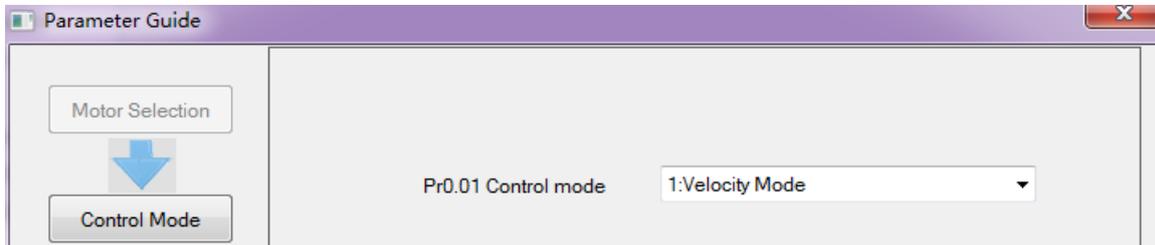
Parameter Manage

| Parameter Number | Number | Name | Value | Min | Max | Default | Unit | Remark |
|---------------------------------|--------|-----------------------------------|-------|--------|-------|---------|-----------|-------------|
| Pr0.Basic setting | Pr7.00 | Current loop gain | 1500 | 100 | 5000 | 1000 | Hz | None |
| Pr1.Gain adjustment | Pr7.01 | Current loop integral time | 500 | 1 | 10000 | 500 | 0.1ms | None |
| Pr2.Vibration Restrain Function | Pr7.02 | Motor rotor initial position a... | 177 | 0 | 360 | 0 | — | valid after |
| Pr3.Speed, Torque Control | Pr7.03 | Reserved parameters | 0 | 0 | 32767 | 0 | — | valid after |
| Pr4.I/F Monitor Setting | Pr7.04 | Reserved parameters | 0 | 0 | 32767 | 0 | — | valid after |
| Pr5.Extended Setup | Pr7.05 | Motor pole pairs | 4 | 1 | 20 | 4 | — | valid after |
| Pr6.Special Setup | Pr7.06 | Motor phase resistor | 300 | 1 | 10000 | 100 | 0.01Ω | valid after |
| Pr7.Factory setting | Pr7.07 | Motor D/Q inductance | 630 | 1 | 10000 | 700 | 0.01mH | valid after |
| | Pr7.08 | Motor back EMF coefficient | 420 | 100 | 10000 | 1000 | 0.1V/(... | valid after |
| | Pr7.09 | Motor torque coefficient | 35 | 1 | 1000 | 80 | 0.01N... | valid after |
| | Pr7.10 | Motor rated speed | 3000 | 100 | 10000 | 2000 | r/min | valid after |
| | Pr7.11 | Motor maximum speed | 5000 | 100 | 10000 | 2500 | r/min | valid after |
| | Pr7.12 | Motor rated current | 400 | 1 | 3000 | 280 | 0.01A | valid after |
| | Pr7.13 | Motor rotor inertia | 32 | 1 | 32767 | 250 | 0.01K... | valid after |
| | Pr7.14 | Motor power selection | 400 | 10 | 32767 | 750 | W | valid after |
| | Pr7.15 | Motor model input | 26 | 0 | 7FFF | 200 | — | Hexadeci |
| | Pr7.16 | Encoder selection | 0 | 0 | 200 | 0 | — | valid after |
| | Pr7.17 | Motor maximum current | 300 | 1 | 500 | 300 | % | valid after |
| | Pr7.18 | Encoder index angle comp... | 177 | 0 | 360 | 0 | — | None |
| | Pr7.19 | Reserved parameters | 1 | 0 | 500 | 1 | — | None |
| | Pr7.20 | Drive model input | 0 | -32767 | 32767 | 0 | — | Hexadeci |
| | Pr7.21 | Drive model input | 0 | -32767 | 32767 | 0 | — | valid after |

5.3 Velocity mode

The command resource of velocity mode is *Analog input / Internal Speed / Internal Speed and Analog*, via AI1 send $\pm 10V$ analog input signal, in velocity mode, users can setup related parameters with velocity mode.

5.3.1 Setup progress—Control Mode window



In setup progress—Control Mode window, users need to set Pr0.01=1 to select Velocity Mode.

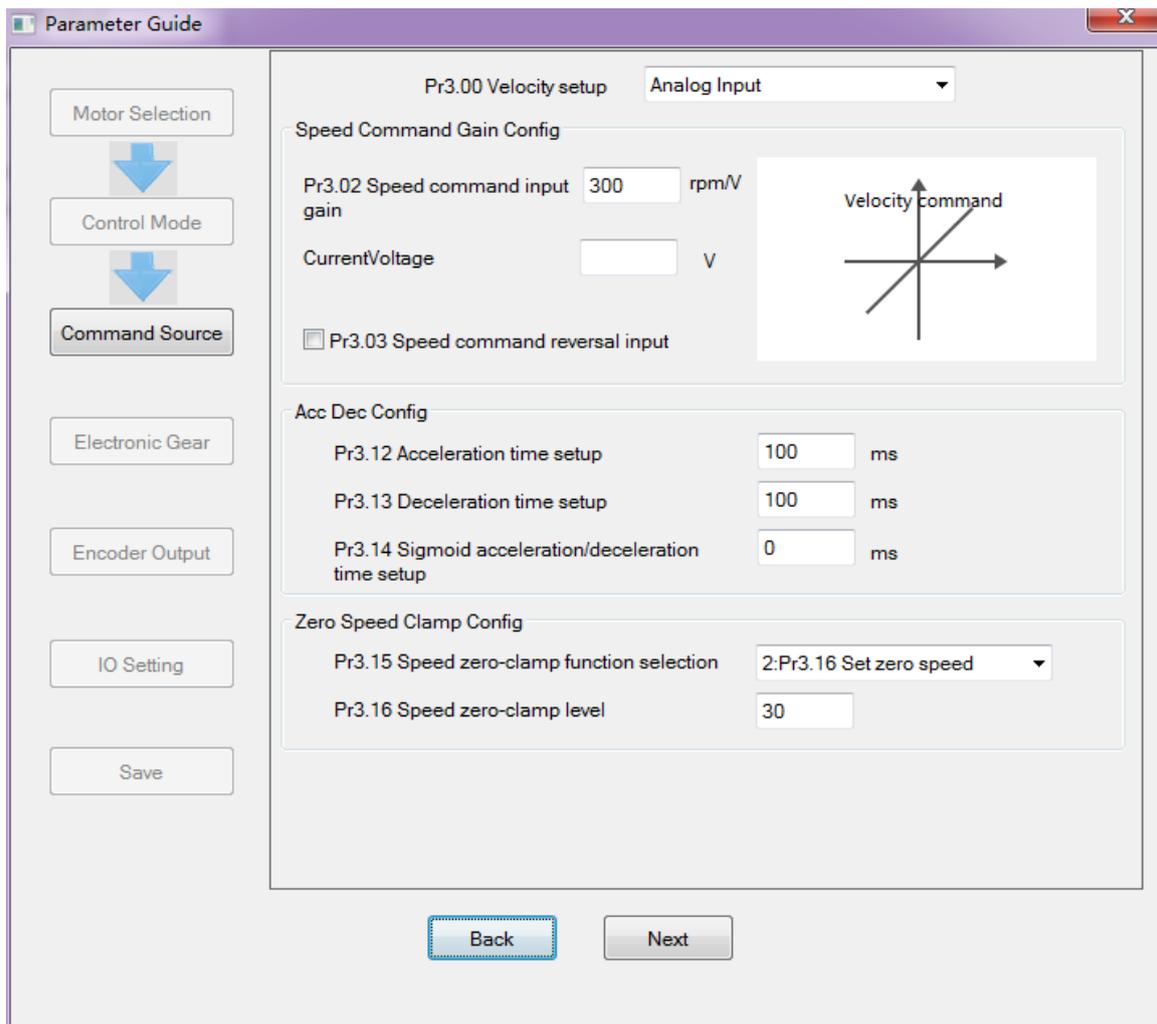
5.3.2 Setup progress—Command Source window

Users select the command resource for velocity mode

A : Select Pr3.00—Analog Input as velocity mode command resource

The command of speed mode is *Analog Input*, via AI1 send $\pm 10V$ analog input signal, in speed mode, we can setup related parameter with speed mode.

Then set other parameters related to Velocity Mode—Analog Input, such as Pr3.02 Speed command input gain, Pr3.12~Pr3.14(Acc and Dec), Pr3.15 Speed zero-clamp function selection, Pr3.16 Speed zero-clamp level.



| | | | | | |
|---------------|---|-------|------|---------|----------------------|
| Pr3.00 | Speed setup, Internal /External switching | Range | unit | default | Related control mode |
| | | 0-3 | - | 0 | S |

This driver is equipped with internal speed setup function so that users can control the speed with contact inputs only.

| Setup value | Speed setup method |
|-------------|--|
| 0 | Analog speed command(SCR) |
| 1 | Internal speed command 1st to 4th speed(PR3.04-PR3.07) |
| 2 | Internal speed command 1st to 3rd speed (PR3.04-PR3.06), Analog speed command(SCR) |
| 3 | Internal speed command 1st to 8th speed (PR3.04-PR3.11) |

<relationship between Pr3.00 Internal/External switching speed setup and the internal command speed selection 1-3 and speed command to be selected>

| Setup value | selection 1 of internal command speed(INTSPD1) | selection 2 of internal command speed (INTSPD2) | selection 3 of internal command speed (INTSPD3) | selection of Speed command |
|-------------|--|---|---|----------------------------|
| 1 | OFF | OFF | NO effect | 1st speed |
| | ON | OFF | | 2nd speed |
| | OFF | ON | | 3rd speed |
| | ON | ON | | 4th speed |
| 2 | OFF | OFF | NO effect | 1st speed |
| | ON | OFF | | 2nd speed |
| | OFF | ON | | 3rd speed |
| | ON | ON | | Analog speed command |
| 3 | The same as [Pr3.00=1] | | OFF | 1st to 4th speed |
| | OFF | OFF | ON | 5th speed |
| | ON | OFF | ON | 6th speed |
| | OFF | ON | ON | 7th speed |

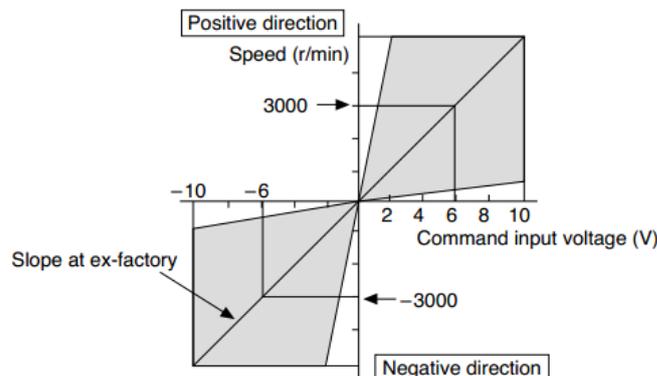
| | | | | | |
|---------------|-----------------------------|---------|-----------|---------|----------------------|
| Pr3.02 | Input gain of speed command | Range | unit | default | Related control mode |
| | | 10-2000 | (r/min)/v | 500 | S T |

Based on the voltage applied to the analog speed command (SCR), set up the conversion gain to motor command speed.

Users can set up "slope" of relation between the command input voltage and motor speed, with Pr3.02. Default is set to Pr3.02=500(r/min)/V, hence input of 6V becomes 3000r/min.

Notice:

1. Do not apply more than $\pm 10V$ to the speed command input(SCR).
2. When users compose a position loop outside of the driver while users use the driver in velocity control mode, the setup of Pr3.02 gives larger variance to the overall servo system.
3. Pay an extra attention to oscillation caused by larger setup of Pr3.02.



| | | | | | |
|--------|---------------------------------|-------|------|---------|----------------------|
| Pr3.03 | Reversal of speed command input | Range | unit | default | Related control mode |
| | | 0-1 | - | 0 | S |

Specify the polarity of the voltage applied to the analog speed command (SPR).

| Setup value | Motor rotating direction | |
|-------------|--------------------------|--|
| 0 | Non-reversal | [+ voltage] → [+ direction] [- voltage] → [-direction] |
| 1 | reversal | [+ voltage] → [- direction] [- voltage] → [+direction] |

Caution: When users compose the servo drive system with this driver set to velocity control mode and external positioning unit, the motor might perform an abnormal action if the polarity of the speed command signal from the unit and the polarity of this parameter setup does not match.

| | | | | | |
|--------|-------------------------|---------|---------------|---------|----------------------|
| Pr3.12 | time setup acceleration | Range | unit | default | Related control mode |
| | | 0-10000 | Ms(1000r/min) | 100 | S |
| Pr3.13 | time setup deceleration | Range | unit | default | Related control mode |
| | | 0-10000 | Ms(1000r/min) | 100 | S |

Set up acceleration/deceleration processing time in response to the speed command input.

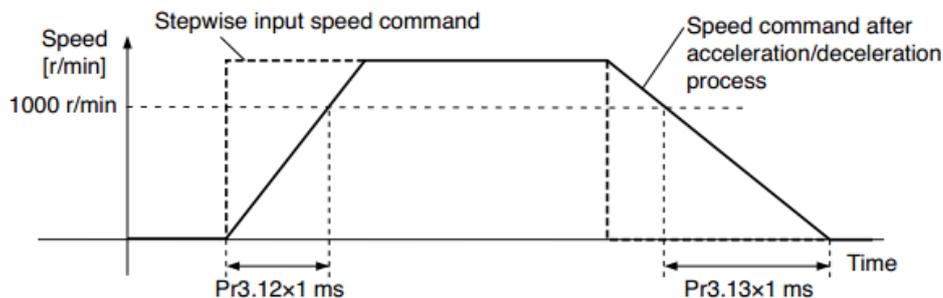
Set the time required for the speed command(stepwise input)to reach 1000r/min to Pr3.12

Acceleration time setup. Also set the time required for the speed command to reach from 1000r/min to 0 r/min, to Pr3.13 Deceleration time setup.

Assuming that the target value of the speed command is V_c (r/min), the time required for acceleration/deceleration can be computed from the formula shown below.

$$\text{Acceleration time (ms)} = V_c / 1000 * \text{Pr3.12} * 1 \text{ms}$$

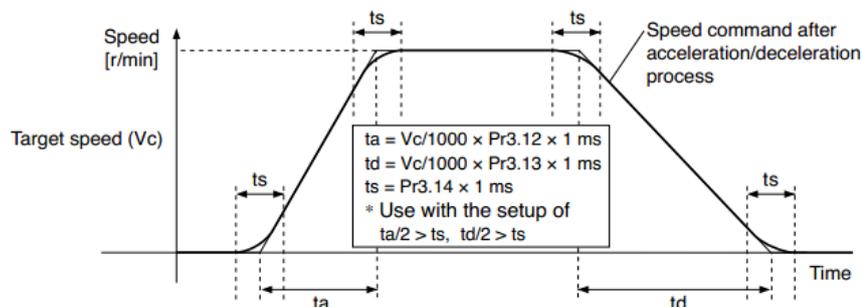
$$\text{Deceleration time (ms)} = V_c / 1000 * \text{Pr3.13} * 1 \text{ms}$$



| | | | | | |
|--------|--|--------|------|---------|----------------------|
| Pr3.14 | Sigmoid acceleration/deceleration time setup | Range | unit | default | Related control mode |
| | | 0-1000 | ms | 0 | S |

Set S-curve time for acceleration/deceleration process when the speed command is applied.

According to Pr3.12 Acceleration time setup and Pr3.13 Deceleration time setup, set up sigmoid time with time width centering the inflection point of acceleration/deceleration.



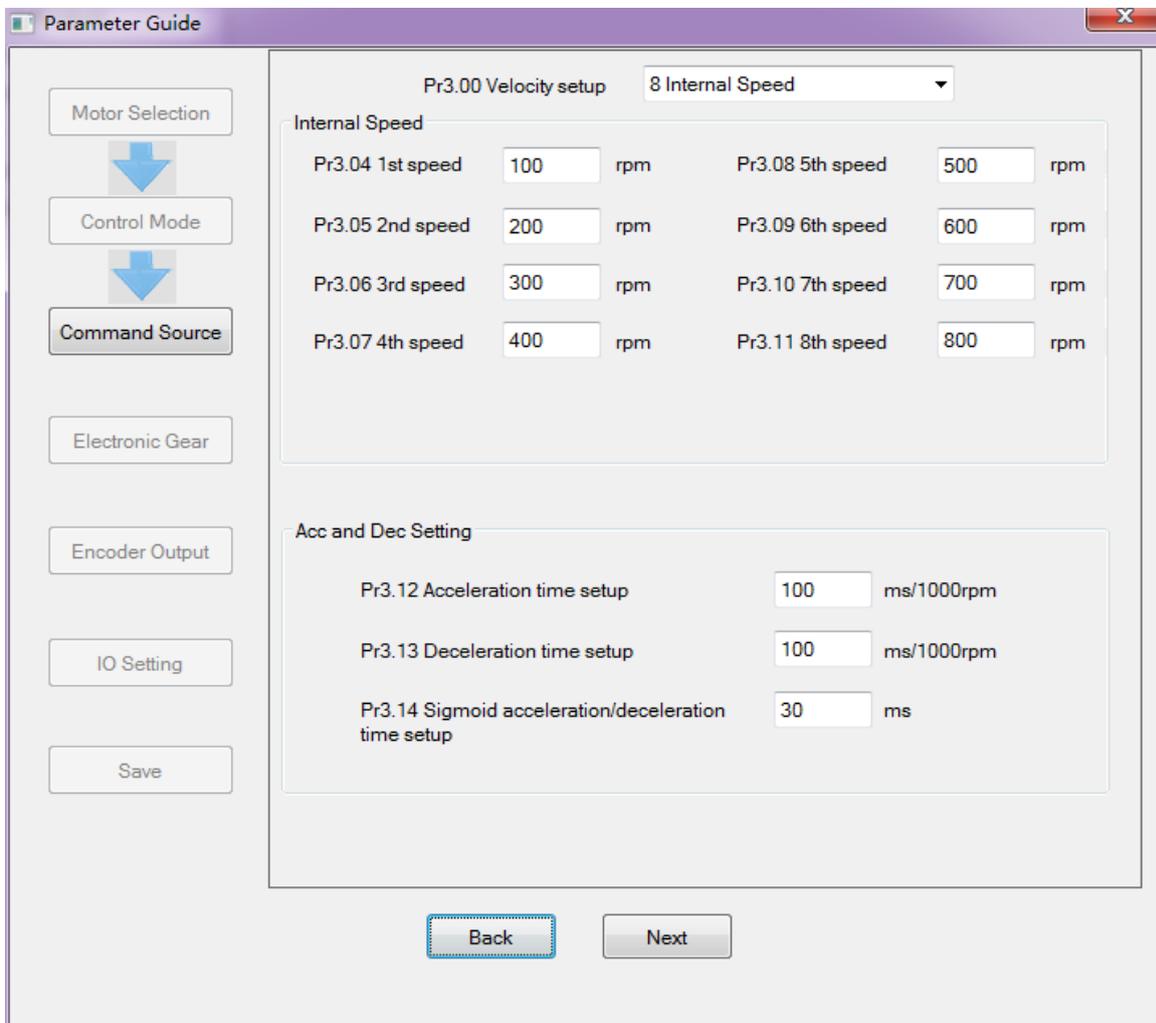
| Pr3.15 | Speed zero-clamp function selection | Range | unit | default | Related control mode |
|--------|-------------------------------------|-------|------|---------|----------------------|
| | | 0-3 | - | 0 | S |

- If Pr3.15=0, the function of zero clamp is forbidden. It means the motor rotates with actual velocity which is controlled by the analog voltage input 1 even if the velocity is less than 10 rpm. The motor runs no matter what the value of Pr3.16 is. The actual velocity is controlled by external the analog voltage input .
- If Pr3.15=1 and the input signal of Zero Speed is available in the same time, the function of zero clamp works. It means motor will stop rotating in servo-on condition no matter what the velocity of motor is, and motor stop rotating no matter what the value of Pr3.16 is.
- If Pr3.15=2 , the function of zero clamp belongs to the value of Pr3.16. If the actual velocity is less than the value of Pr3.16, the motor will stop rotating in servo-on condition.

| Pr3.16 | Speed zero-clamp level | Range | unit | default | Related control mode |
|--------|------------------------|----------|-------|---------|----------------------|
| | | 0 -20000 | r/min | 30 | S |

When analog speed given value under speed control mode less than zero speed clamp level setup, speed command will set to 0 strongly.

B : Select Pr3.00—8 Internal Speed as velocity mode command resource



Parameter Guide

Pr3.00 Velocity setup: 8 Internal Speed

Internal Speed

| | | | | | |
|------------------|-----|-----|------------------|-----|-----|
| Pr3.04 1st speed | 100 | rpm | Pr3.08 5th speed | 500 | rpm |
| Pr3.05 2nd speed | 200 | rpm | Pr3.09 6th speed | 600 | rpm |
| Pr3.06 3rd speed | 300 | rpm | Pr3.10 7th speed | 700 | rpm |
| Pr3.07 4th speed | 400 | rpm | Pr3.11 8th speed | 800 | rpm |

Acc and Dec Setting

| | | |
|---|-----|------------|
| Pr3.12 Acceleration time setup | 100 | ms/1000rpm |
| Pr3.13 Deceleration time setup | 100 | ms/1000rpm |
| Pr3.14 Sigmoid acceleration/deceleration time setup | 30 | ms |

Navigation: Back, Next

Then set other parameters related to Velocity Mode—8 Internal Speed, such as Pr3.04~Pr3.11、Pr3.12~Pr3.14(Acc and Dec)

5.3.3 Setup progress—IO Setting window

A、 For Analog Input as velocity mode command resource

In setup progress—IO Setting(Input) window , users need select Pr4.00 SI1 as *Servo ON Input* to make motor enable.

Users can select SI2~SI9 input as other functions. Such as : *Alarm clear* , *Positive limit* , *Negative limit* . etc

In setup progress—IO Setting(Output) window, users can select SO1~SO6 output as other functions. Such as : *Alarm output* , *Servo ready output* . etc

B、 For 8 Internal Speed as velocity mode command resource

In setup progress—IO Setting(Input) window , users need select Pr4.00 SI1 as *Servo ON Input* to make motor enable.

Users need select SI2~SI4 inputs as *Selection 1~3 input of internal command speed*

| Selection 1 of internal command speed(INTSPD1) | Selection 2 of internal command speed (INTSPD2) | Selection 3 of internal command speed (INTSPD3) | Selection of Speed command |
|--|---|---|----------------------------|
| OFF | OFF | OFF | 1st speed |
| ON | OFF | OFF | 2nd speed |
| OFF | ON | OFF | 3rd speed |
| ON | ON | OFF | 4th speed |
| OFF | OFF | ON | 5th speed |
| ON | OFF | ON | 6th speed |
| OFF | ON | ON | 7th speed |
| ON | ON | ON | 8th speed |

Users can select SI5~SI9 input as other functions. Such as : *Alarm clear* , *Positive limit* , *Negative limit* . etc

In setup progress—IO Setting(Output) window, users can select SO1~SO6 output as other functions. Such as : *Alarm output* , *Servo ready output* . etc

5.3.4 Save the setting

After the all the configuration, users should save the parameters into NVM. (Non-Volatile Memory)

Then users need to download and save the new settings to the driver, then restart the power supply or software reset to make new values of parameters valid .

5.3.5 Operation

When users have finished the above all of these parameters setting .

A、 For Analog Input as velocity mode command resource

Users can give analog input AI1 signal to drive by CN1 port. The motor will work in speed mode, if users aren't satisfied with the performance of motor, users can continue adjusting related speed parameter.

B、 For 8 Internal Speed as velocity mode command resource

Users can select one of 8 internal speed by SI inputs signal of CN1 port. The motor will work in speed mode, if users aren't satisfied with the performance of motor, users can continue adjusting related speed parameter.

5.4 Position mode

The command resource of velocity mode is *Pulse+Direction / CW + CCW / A + B phase* , in position mode, users can setup related parameter with position mode.

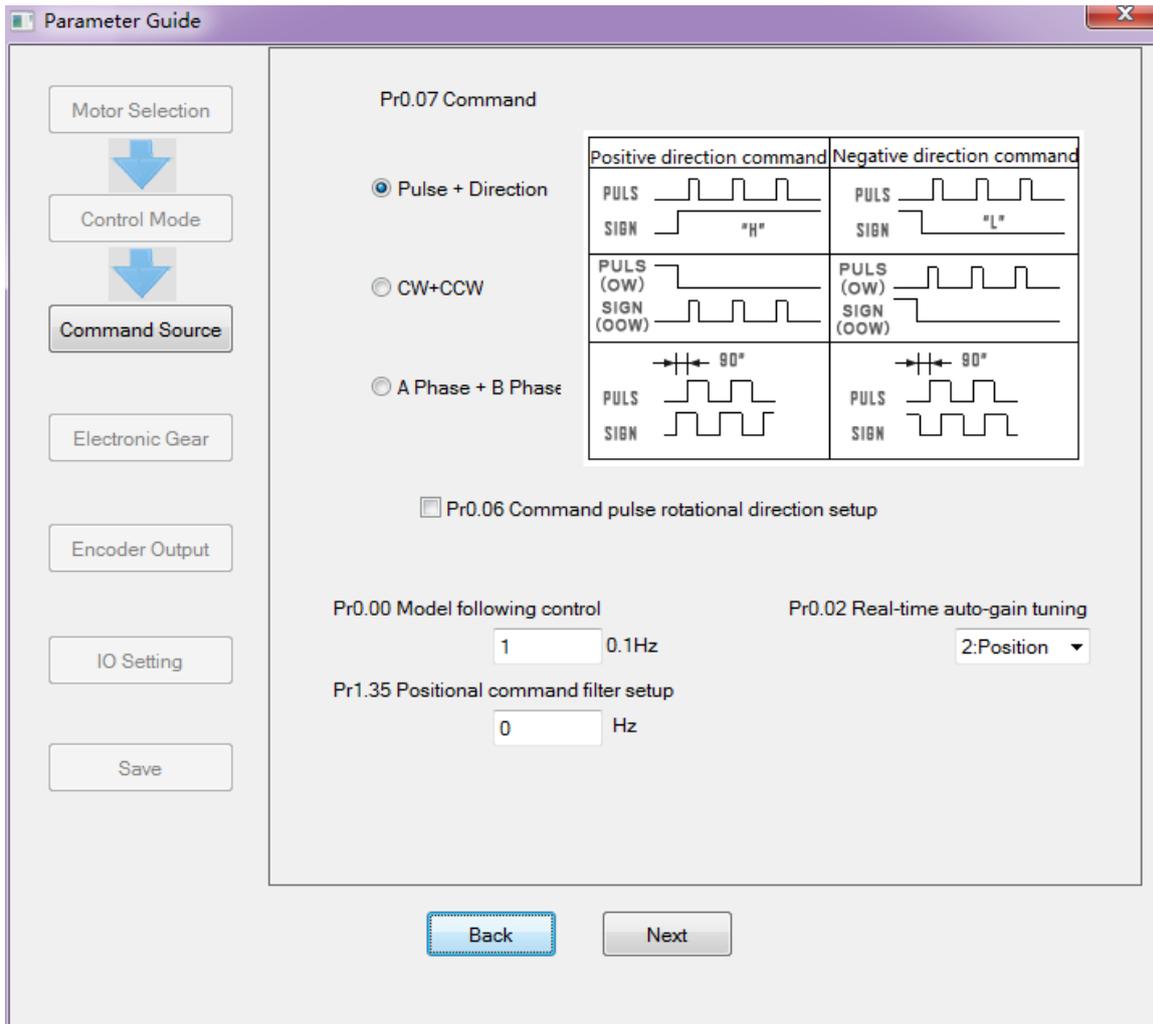
5.4.1 Setup progress—Control Mode window



In setup progress—Control Mode window, users need to set Pr0.01=0 to select Position Mode.

5.4.2 Setup progress—Command Source window

Users select the command resource for position mode

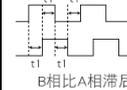
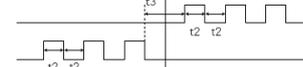
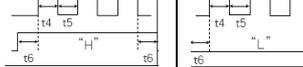
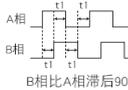
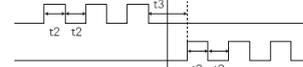
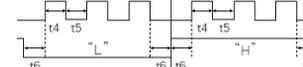


Then set other parameters related to Position Mode, such as Pr0.06 Command Pulse Rotational Direction Setup, Pr0.00 Mode loop gain, Pr0.02 Real-time Auto-gain Tuning, Pr1.35 Positional command filter setup.

| Pr0.06* | Command Pulse Rotational Direction Setup | Range | unit | default | Related control mode | |
|---------|--|-------|------|---------|----------------------|--|
| | | 0-1 | - | 0 | P | |

Set command pulse input rotate direction, command pulse input type

| | | | | | | | |
|----------------|---------------------------------------|-------|------|---------|----------------------|--|--|
| Pr0.07* | Command Pulse Input Mode Setup | Range | unit | default | Related control mode | | |
| | | 0-3 | - | 3 | P | | |

| Pr0.06 | Pr0.07 | Command Pulse Format | Signal | Positive Direction Command | Negative Direction Command |
|--------|--------|---|------------|--|---|
| 0 | 0 or 2 | 90 phase difference 2-phase pulse(A phase +B phase) | Pulse sign |  B相比A相超前90° |  B相比A相滞后90° |
| | 1 | Positive direction pulse + negative direction pulse | Pulse sign |  | |
| | 3 | Pulse + sign | Pulse sign |  | |
| 1 | 0 or 2 | 90 phase difference 2 phase pulse(A phase +B phase) | Pulse sign |  B相比A相滞后90° |  B相比A相超前90° |
| | 1 | Positive direction pulse + negative direction pulse | Pulse sign |  | |
| | 3 | Pulse + sign | Pulse sign |  | |

Command pulse input signal allow largest frequency and smallest time width

| PULS/SIGN Signal Input I/F | | Permissible Max. Input Frequency | Smallest Time Width | | | | | |
|----------------------------|-------------------------|----------------------------------|---------------------|-----|-----|-----|-----|-----|
| | | | t1 | t2 | t3 | t4 | t5 | t6 |
| Pulse series interface | Long distance interface | 500kpps | 2 | 1 | 1 | 1 | 1 | 1 |
| | Open-collector output | 200kpps | 5 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |

| | | | | | | | |
|---------------|-----------------------|--------|-------|-------------|----------------------|---|---|
| Pr0.00 | Mode loop gain | Range | unit | defau lt | Related control mode | | |
| | | 0-2000 | 0.1Hz | 0 | P | S | T |

Set up the bandwidth of MFC , it is similar to the response bandwidth

| Setup value | Meaning |
|-------------|--|
| 0 | Disable the function. |
| 1 | Enable the function , set the bandwidth automatically , recommended for most application . |
| 2-10 | Forbidden and reserved . |
| 11-20000 | Set the bandwidth manually , 1.1Hz – 2000Hz |

MFC is used to enhance the performance of dynamic tracing for input command , make positioning faster , cut down the tracking error , run more smooth and steady . It is very useful for multi-axis synchronous movement and interpolation, the performance will be better.

The main way to use this function :

- a. Choose the right control mode : Pr001 = 0
- b. Set up the inertia of ratio : Pr004
- c. Set up the rigidity : Pr003
- d. Set up the Pr000 :
 - 1) If no multi-axis synchronous movement , set Pr000 as 1 or more than 10 ;
 - 2) If multi-axis synchronous movement needed , set Pr000 as the same for all the axes .
 - 3) If Pr000 is more than 10 , start with 100 , or 150 , 200 , 250 ,

Caution:

1. Set up the right control mode , the right inertia of ratio and rigidity firstly .
2. Don't change the value of Pr000 when the motor is running , otherwise vibration occurs
3. Set up a small value from the beginning if using it in manual mode , smaller value means running more smooth and steady , while bigger one means faster positioning

| | | | | | | | |
|---------------|-----------------------------------|-------|------|---------|----------------------|---|---|
| Pr0.02 | Real-time Auto-gain Tuning | Range | unit | default | Related control mode | | |
| | | 0-2 | - | 0 | P | S | T |

Users can set up the action mode of the real-time auto-gain tuning.

| Setup value | mode | Varying degree of load inertia in motion |
|-------------|----------|---|
| 0 | Manual | Real-time auto-gain tuning function is disabled. |
| 1 | Standard | Basic mode. do not use unbalanced load, friction compensation or gain switching |
| 2 | Position | Main application is positioning. it is recommended to use this mode on equipment without unbalanced horizontal axis, ball screw driving equipment with low friction, etc. |

Caution: If pr0.02=1 or 2 , users can't modify the values of pr1.01 – pr1.13, the values of them depend on the real-time auto-gain tuning ,all of them are set by the driver itself.

Users can select different operation mode in real-time automatic adjustment mode, generally select Locate mode. If users want to adjust gain parameter by yourself, users can select Manual mode, then users can adjust related parameter step by step until system requirement.

Users can adjust position loop gain, velocity integration time constant and ratio of inertia for tuning position loop tuning. If users need stronger rigid, users only need adjust ratio of inertia, then adjust gain and integration

In **Manual** mode, users can setup Kp, Ki and other related parameters. During tuning position loop, users can adjust KI to a very small value in advance and hold it constant, then users can enlarge the value of Kp parameter slowly until system oscillation occurs, at this moment users can enlarge the value of Vi parameter slowly until system oscillation occurs, at this moment the basic adjustment of system finished.

In **Position** mode. It is unavailable to modify the value of pr1.00- 1.14, we just change the value of real-time automatic adjustment rigid, firstly we select a smaller value.

| | | | | | | | |
|----------------|--|-------|--------|---------|----------------------|--|--|
| Pr1.35* | positional command filter setup | Range | unit | default | Related control mode | | |
| | | 0-200 | 0.05us | 0 | P | | |

Do filtering for positional command pulse, eliminate the interference of the narrow pulse, over-large setup will influence the input of high frequency positional command pulse, and make more time-delayed.

5.4.3 Setup progress—Electronic Gear window

| | | | | | | | |
|---------------|--|---------------|-------|---------|----------------------|---|---|
| Pr0.08 | Command pulse counts per one motor revolution | Range | unit | default | Related control mode | | |
| | | 0-8388 608 | pulse | 0 | P | S | T |

Set the command pulse that causes single turn of the motor shaft.

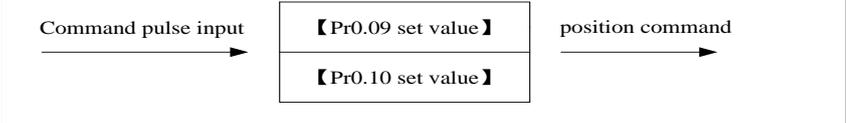
- 1) If Pr008≠0 , the actual turns = pulse number / Pr008
- 2) If Pr008 = 0 , Pr009 1st numerator of electronic gear and Pr0.10 Denominator of electronic Gear become valid.

When the transmission structure is screw:

$$\text{Pulses per round} = \text{Screw lead} / \text{Pulse equivalent}$$

When the transmission structure is rack and pinion:

Pulses per round = (Modulus*Number of pinion*Helical angle*3.1415627) / (Gear ratio*Pulse equivalent)

| Pr0.09 | 1st numerator of electronic gear | Range | unit | default | Related control mode | |
|--|----------------------------------|--|------|---------|----------------------|--|
| | | 1-10737 41824 | - | 1 | P | |
| Set the numerator of division/multiplication operation made according to the command pulse input. | | | | | | |
| Pr0.10 | denominator of electronic gear | Range | unit | default | Related control mode | |
| | | 1-10737 41824 | - | 1 | P | |
| Set the denominator of division/multiplication operation made according to the command pulse input. | | | | | | |
| Pr0.09 | Pr0.10 | Command division/multiplication operation | | | | |
| 1-10737 41824 | 1-10737 41824 |  | | | | |
| 1、 Settings: (1)The driver input command pulse number is X (2)The pulse number of encoder after frequency division and frequency doubling is Y (3)The number of pulses per revolution of the motor encoder is Z (4)Number of turns of motor is W 2、 Calculations: (1) $Y=X* Pr0.09 / Pr0.10$ (2)17Bit encoder: $Z=2^{17} = 131072$ 23Bit encoder: $Z=2^{23} = 8388608$ | | | | | | |

5.4.4 Setup progress—Encoder Output window

The output pulses counts per motor revolution = Pulses Per Round / 4

5.4.5 Setup progress—IO Setting window

In setup progress—IO Setting(Input) window , users need select Pr4.00 SI1 as **Servo ON Input** to make motor enable.

Users can select SI2~SI9 input as other functions. Such as : **Alarm clear** , **Positive limit** , **Negative limit** . etc

In setup progress—IO Setting(Output) window, users can select SO1~SO6 output as other functions. Such as : **Alarm output** , **Servo ready output** . etc

5.4.6 Save the setting

After the all the configuration, users should save the parameters into NVM. (Non-Volatile Memory)
Then users need to download and save the new settings to the driver, then restart the power supply or software reset to make new values of parameters valid .

5.4.7 Operation

When users have finished the above all of these parameters setting .

Users can give signal to drive by CN1 port. The motor will work in position mode, if users aren't satisfied with the performance of motor, users can continue adjusting related speed parameter.

5.5 Performance adjustment

5.5.1 Inertia ratio identification

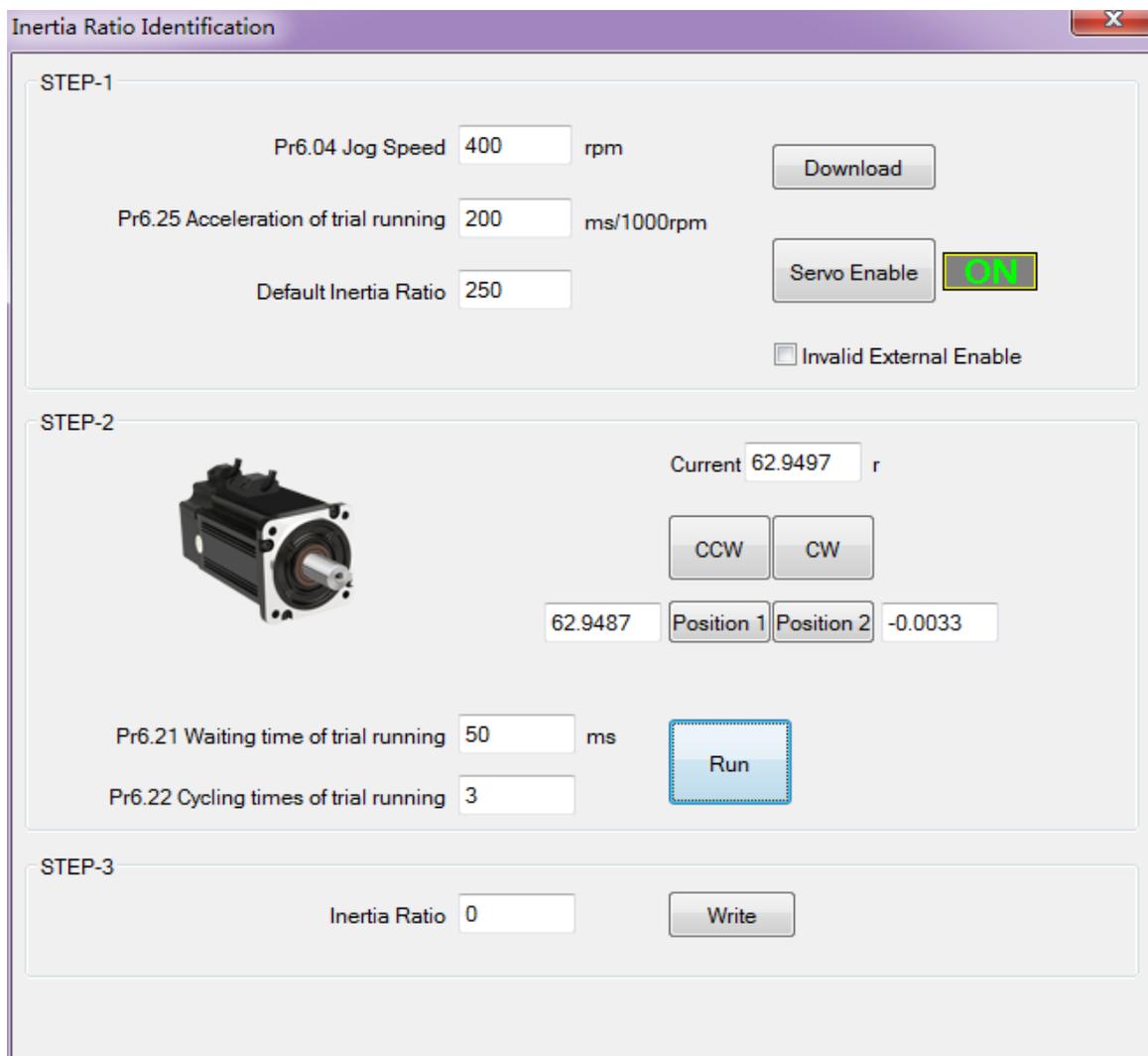
Pre-conditions: 1、 Servo disable. 2、 Positive limit and negative limit invalid

Steps:

- 1、 Set the Jog speed Pr6.04, and the setting should not be too large(600~1000rpm is recommend)
Set the Acc Pr6.25(50~100 ms/1000rpm is recommend)
Set the Default Inertia Ratio.

Download these settings, then **Servo Enable**.

- 2、 Click “CCW” to make motor run to CCW direction, click “Position 1” to save the position limit 1
Click “CW” to make motor run to CW direction, click “Position 2” to save the position limit 2
Click “Run” to start Inertia ratio identification.



Inertia Ratio Identification

STEP-1

Pr6.04 Jog Speed rpm

Pr6.25 Acceleration of trial running ms/1000rpm

Default Inertia Ratio **ON**

Invalid External Enable

STEP-2

 Current r

Pr6.21 Waiting time of trial running ms

Pr6.22 Cycling times of trial running

STEP-3

Inertia Ratio

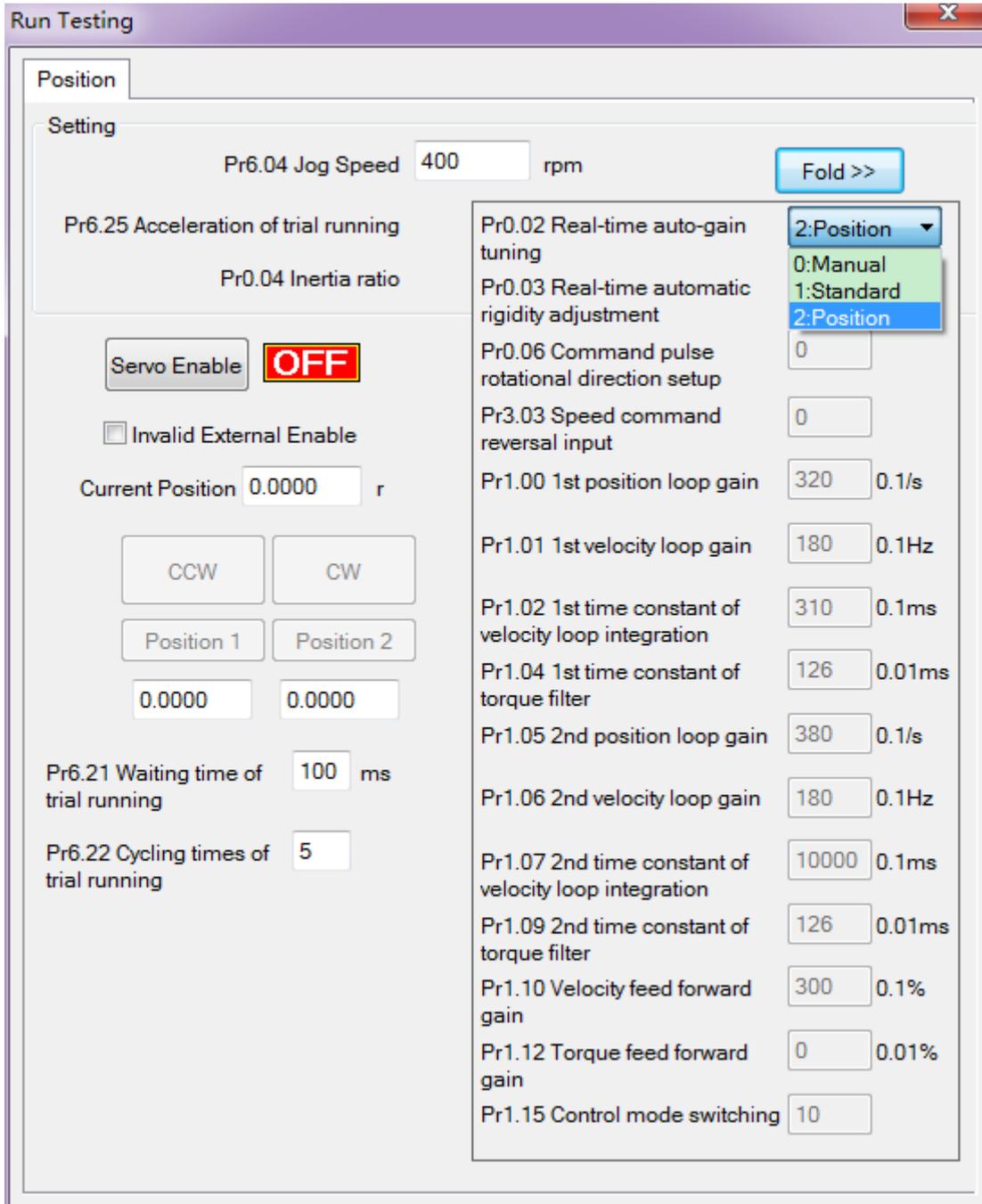
- 3、 After finishing, Click “Write” to save the Inertia ratio identification result

5.5.2 Gain adjustment

To tuning for better performance, users need turning position loop parameters. Users need to open **Run Testing** window.

Users can select different operation mode in real-time automatic adjustment mode, generally select **Position** mode. If users want to adjust gain parameters by yourself, users can select **Manual** mode, then users can adjust related parameter step by step until meet system requirement.

Users can adjust position loop gain, velocity integration time constant and ratio of inertia for position loop tuning. If users need stronger rigid, users only need adjust ratio of inertia, then adjust gain and integration



In **Manual** mode(Pr0.02=0), users can setup Kp, Ki and other related parameters. During tuning position loop, users can adjust KI to a very small value in advance and hold it constant, then users can enlarge the value of Kp parameter slowly until system oscillation occurs, at this moment users can enlarge the value of Vi parameter slowly until system oscillation occurs, at this moment the basic adjustment of system finished.

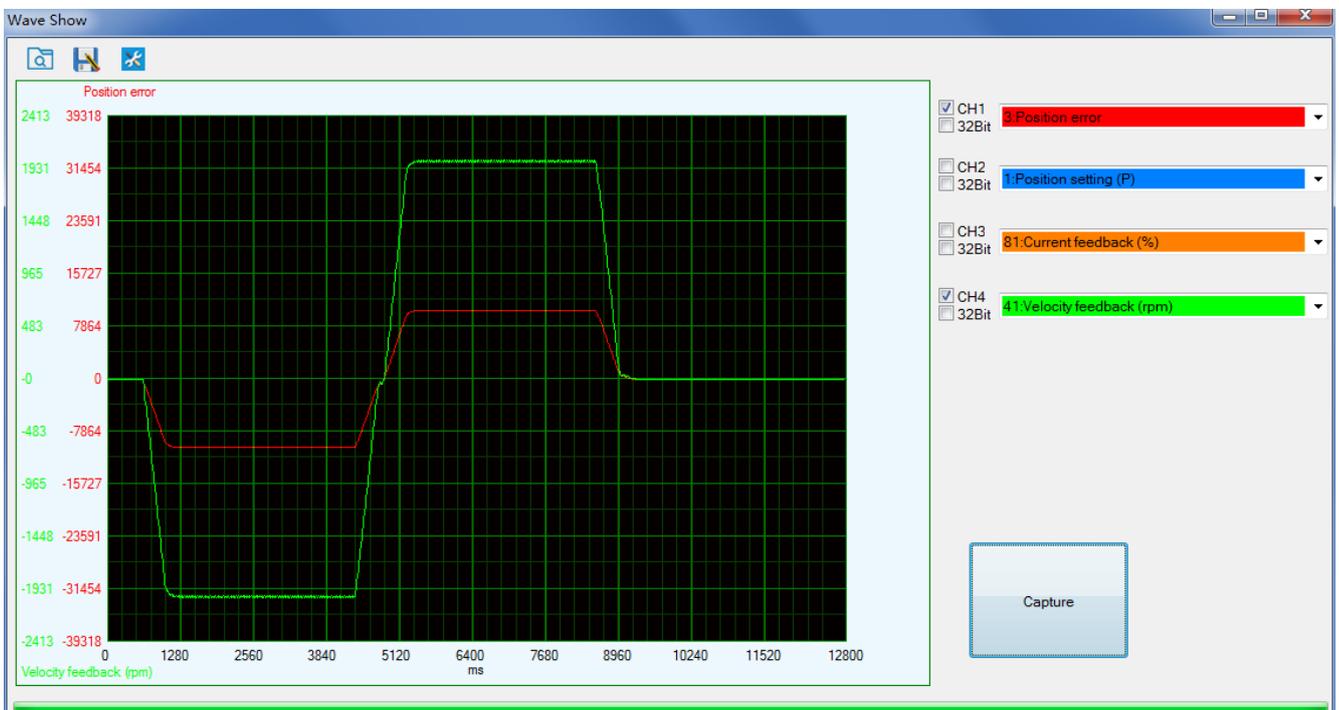
In **Standard** mode(Pr0.02=1), **it is usually for interpolation movement**. It is unavailable to modify the value of Pr1.00- 1.14, we just change the value of Pr0.03 real-time automatic adjustment rigid.

In **Position** mode(Pr0.02=2), **it is usually for point to point movement**. It is unavailable to modify the value of Pr1.00- 1.14, we just change the value of Pr0.03 real-time automatic adjustment rigid.

The definition of Pr0.03

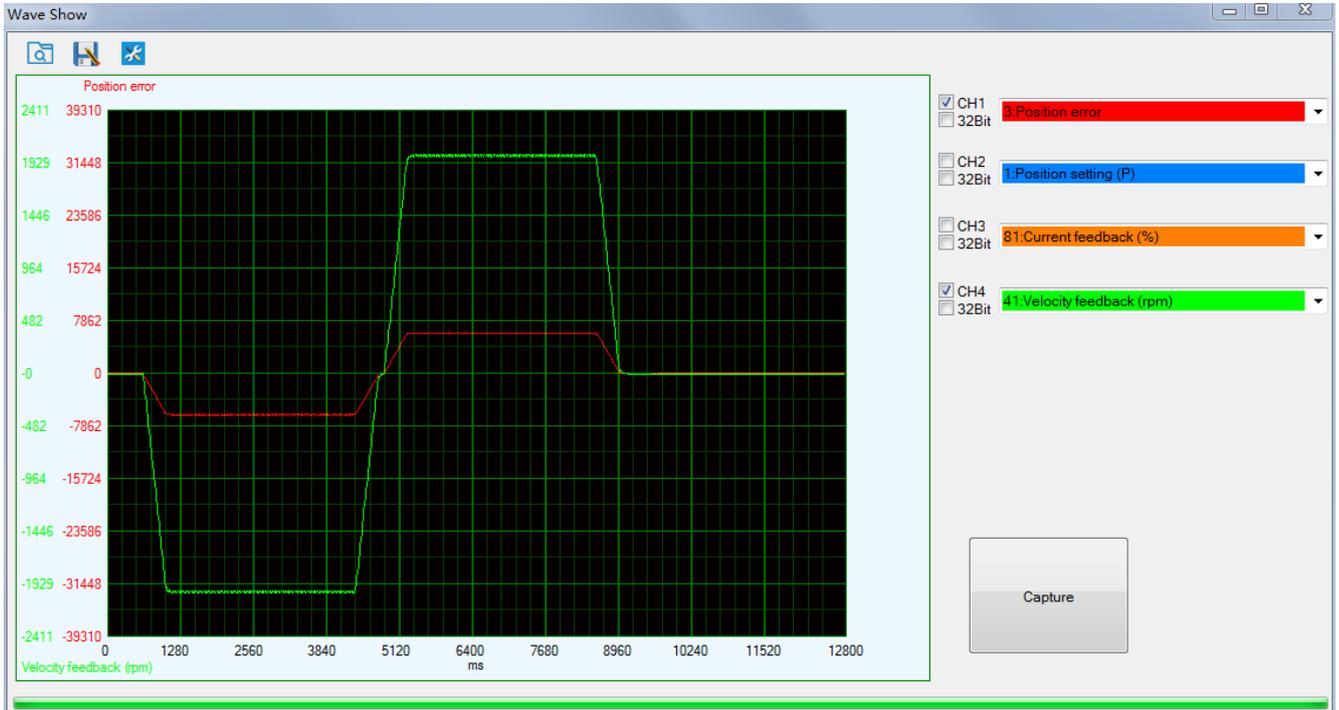
| Pr0.03 | Selection of machine stiffness at real-time auto-gain tuning | Range | unit | default | Related control mode | | |
|---|--|--------|------|---------|----------------------|---|---|
| | | 50 -81 | - | 70 | P | S | T |
| You can set up response while the real-time auto-gain tuning is valid. | | | | | | | |
| Low ———▶ Machine stiffness ———▶ High Low ———▶ Servo gain ———▶ High 81.80.....70.69.68.....51.50 Low ———▶ Response ———▶ High | | | | | | | |
| <p>Notice: Lower the setup value, higher the velocity response and servo stiffness will be obtained. However, when decreasing the value, check the resulting operation to avoid oscillation or vibration. Control gain is updated while the motor is stopped. If the motor can't be stopped due to excessively low gain or continuous application of one-way direction command ,any change made to Pr0.03 is not used for update. If the changed stiffness setting is made valid after the motor stopped, abnormal sound or oscillation will be generated. To prevent this problem, stop the motor after changing the stiffness setting and check that the changed setting is enabled.</p> | | | | | | | |

The following figure showing Pr0.02=2, Pr0.03=70, the position error (curve in red) is unacceptable!

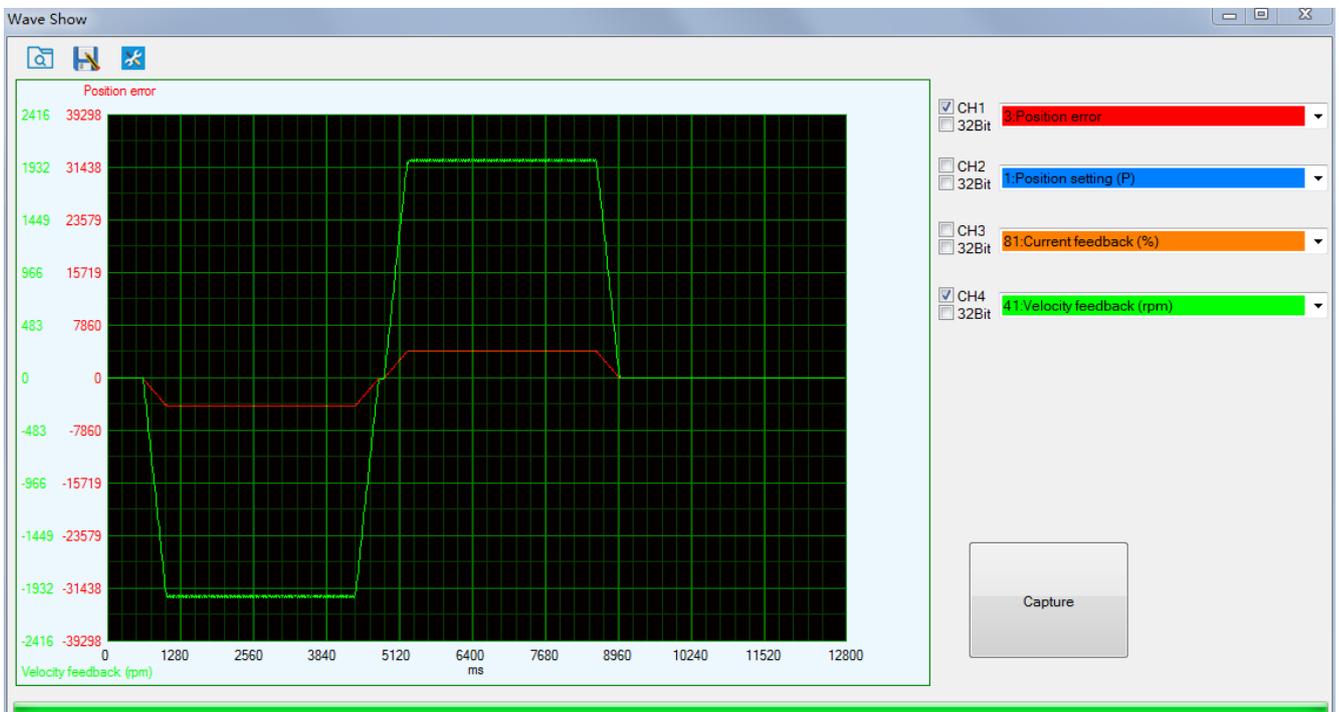


Then we continue decreasing value of Pr0.03, then the position error become smaller and smaller.

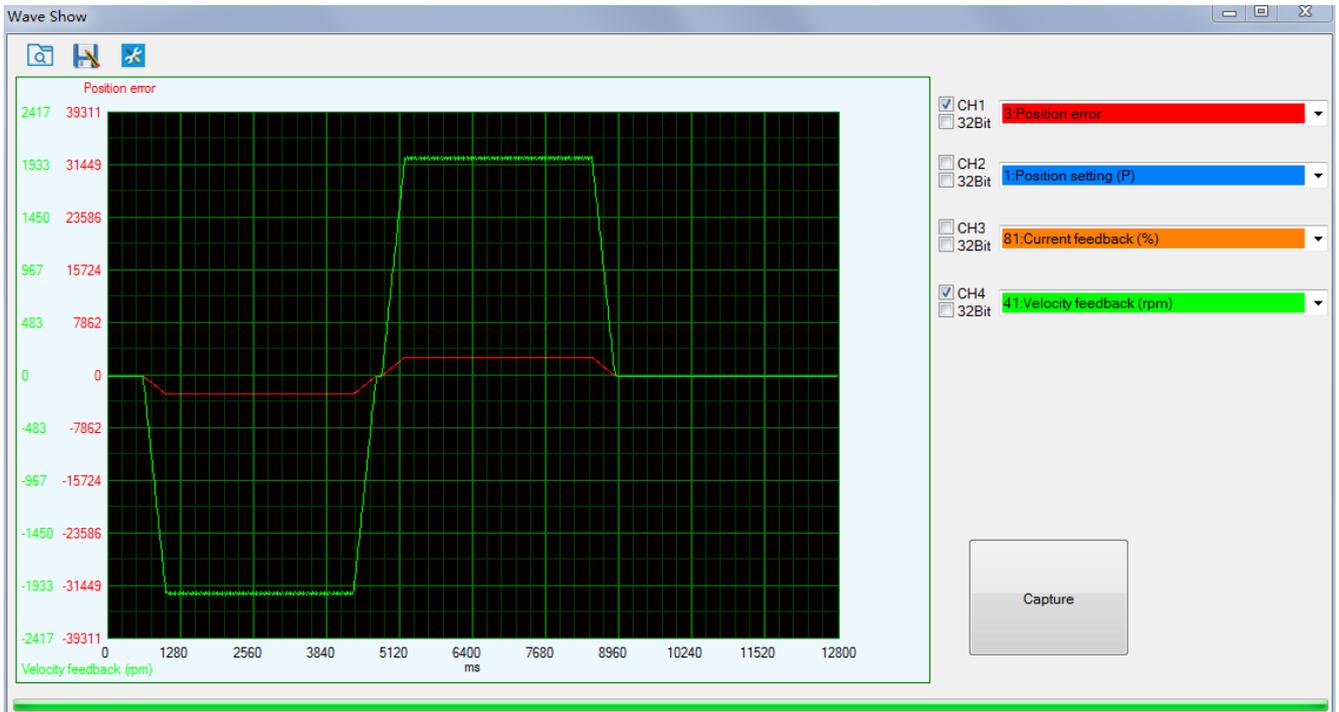
Pr0.03=68



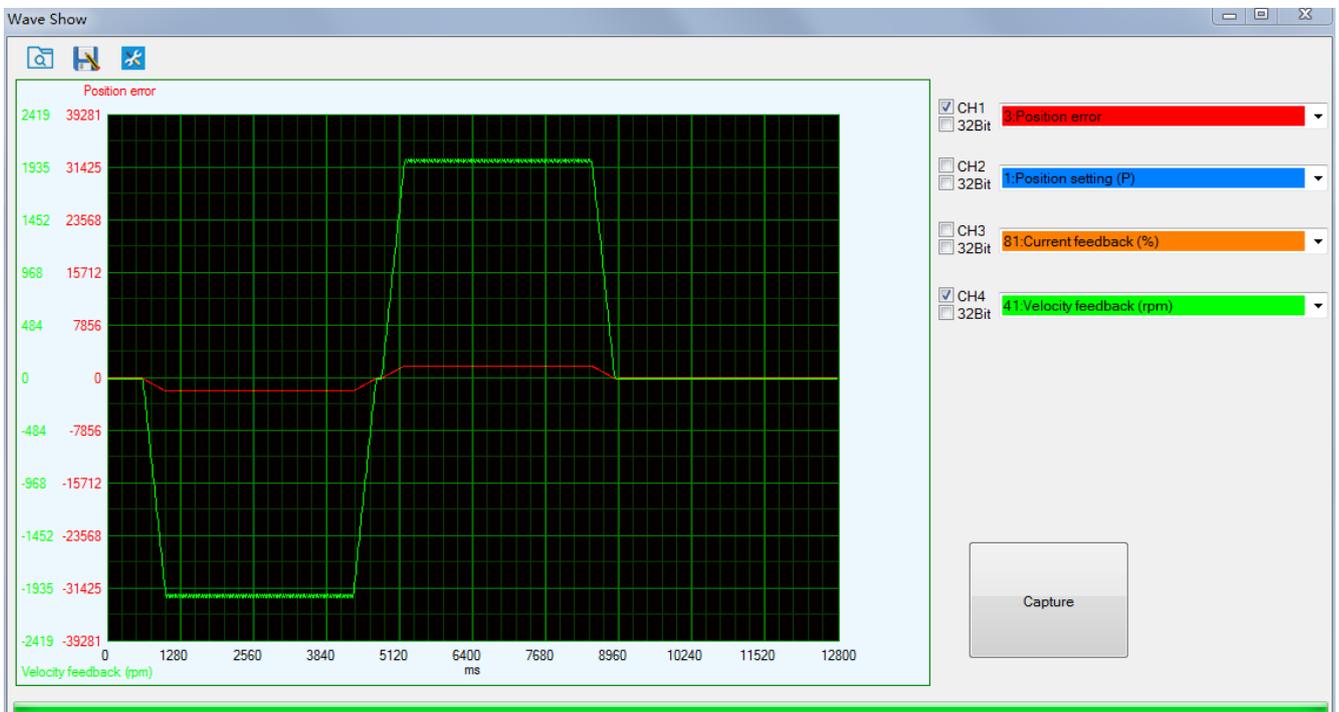
Pr0.03=66



Pr0.03=64

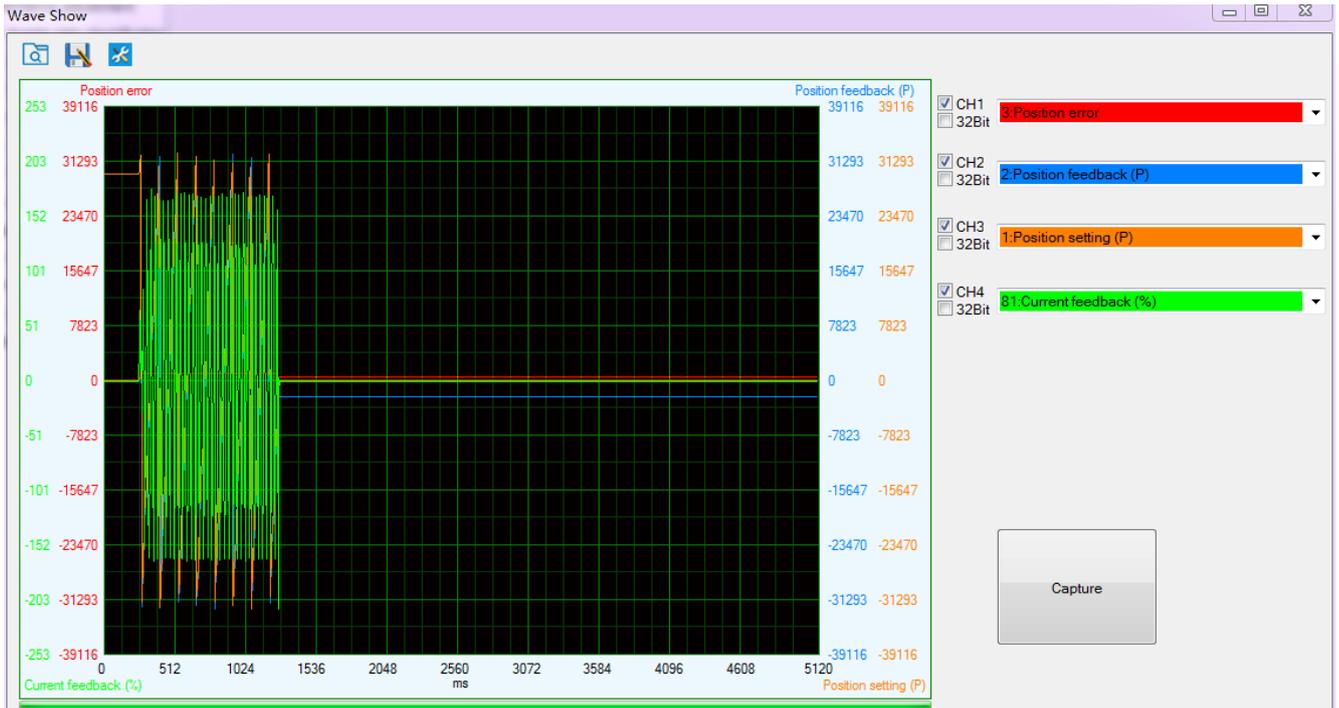


Pr0.03=62



As we continue decreasing the value of Pr0.03, then the position loop gain K_p become bigger and bigger, the integration time constant V_i become smaller and smaller, the position error become close to zero.

Pr0.03=61



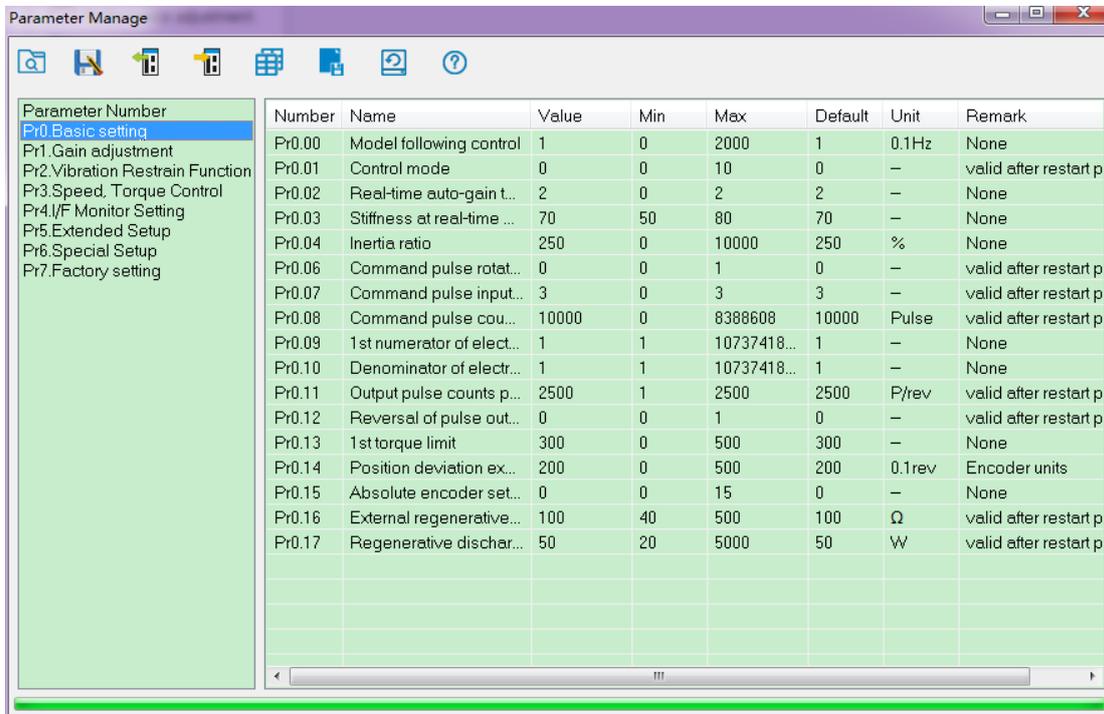
The noise of motor occurs and alarm occurs if the position loop gain becomes bigger, so just make sure there is no noise.

Finally, we set Pr0.03=62, the basic setting for position loop is finished **in Position mode**.

Appendix

How to find the hidden parameter of ProTuner

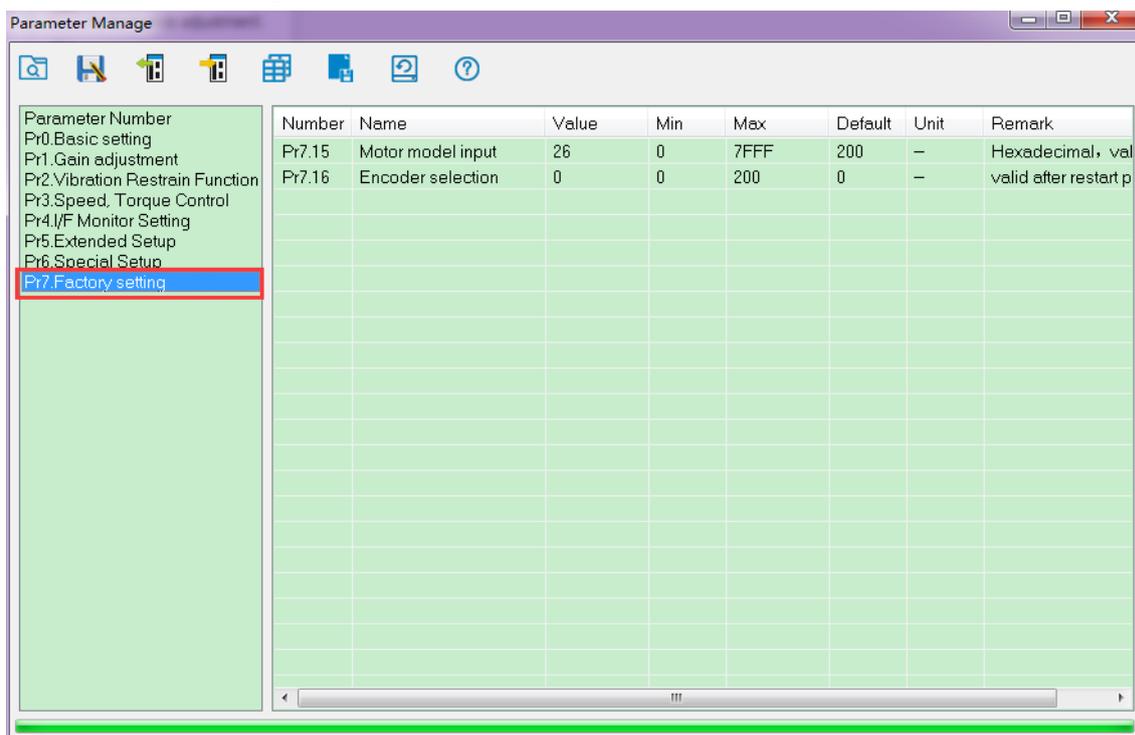
1. Run the software of ProTuner , we just find part of the parameter :



| Parameter Number | Number | Name | Value | Min | Max | Default | Unit | Remark |
|---------------------------------|--------|----------------------------|-------|-----|-------------|---------|--------|-----------------------|
| Pr0.Basic setting | Pr0.00 | Model following control | 1 | 0 | 2000 | 1 | 0.1Hz | None |
| Pr1.Gain adjustment | Pr0.01 | Control mode | 0 | 0 | 10 | 0 | – | valid after restart p |
| Pr2.Vibration Restrain Function | Pr0.02 | Real-time auto-gain t... | 2 | 0 | 2 | 2 | – | None |
| Pr3.Speed, Torque Control | Pr0.03 | Stiffness at real-time ... | 70 | 50 | 80 | 70 | – | None |
| Pr4.I/F Monitor Setting | Pr0.04 | Inertia ratio | 250 | 0 | 10000 | 250 | % | None |
| Pr5.Extended Setup | Pr0.06 | Command pulse rotat... | 0 | 0 | 1 | 0 | – | valid after restart p |
| Pr6.Special Setup | Pr0.07 | Command pulse input... | 3 | 0 | 3 | 3 | – | valid after restart p |
| Pr7.Factory setting | Pr0.08 | Command pulse cou... | 10000 | 0 | 8388608 | 10000 | Pulse | valid after restart p |
| | Pr0.09 | 1st numerator of elect... | 1 | 1 | 10737418... | 1 | – | None |
| | Pr0.10 | Denominator of electr... | 1 | 1 | 10737418... | 1 | – | None |
| | Pr0.11 | Output pulse counts p... | 2500 | 1 | 2500 | 2500 | P/rev | valid after restart p |
| | Pr0.12 | Reversal of pulse out... | 0 | 0 | 1 | 0 | – | valid after restart p |
| | Pr0.13 | 1st torque limit | 300 | 0 | 500 | 300 | – | None |
| | Pr0.14 | Position deviation ex... | 200 | 0 | 500 | 200 | 0.1rev | Encoder units |
| | Pr0.15 | Absolute encoder set... | 0 | 0 | 15 | 0 | – | None |
| | Pr0.16 | External regenerative... | 100 | 40 | 500 | 100 | Ω | valid after restart p |
| | Pr0.17 | Regenerative dischar... | 50 | 20 | 5000 | 50 | W | valid after restart p |

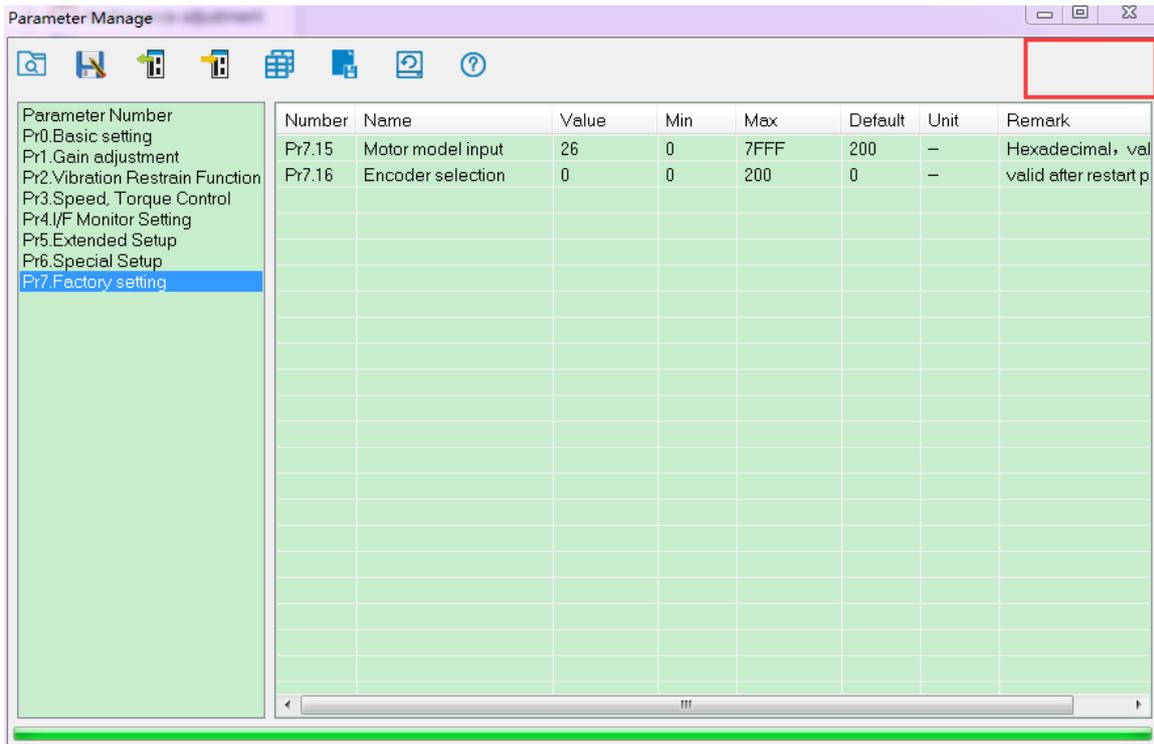
2. Now here is the way to find all of them :

- a. Click “Factory setting” :

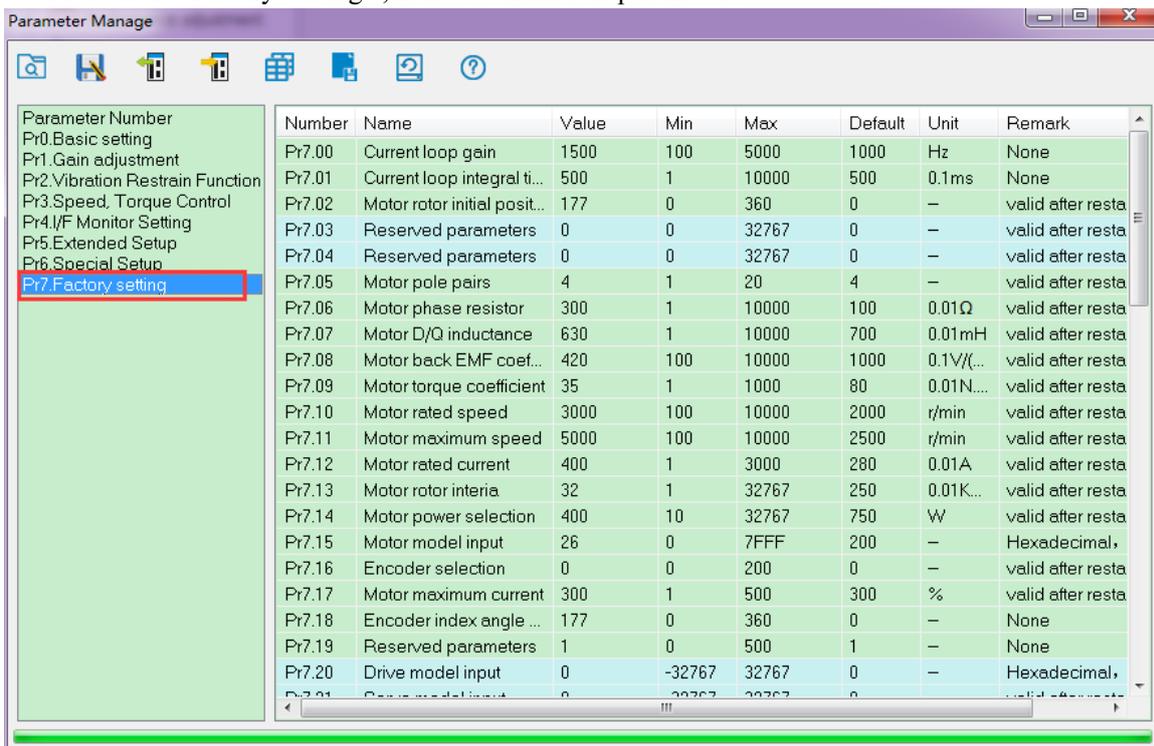


| Parameter Number | Number | Name | Value | Min | Max | Default | Unit | Remark |
|---------------------|--------|-------------------|-------|-----|------|---------|------|-----------------------|
| Pr7.Factory setting | Pr7.15 | Motor model input | 26 | 0 | 7FFF | 200 | – | Hexadecimal, val |
| | Pr7.16 | Encoder selection | 0 | 0 | 200 | 0 | – | valid after restart p |

b. Click “here” 5 times:



c. Then click “ Factory Setting” ,then we can find all parameters:

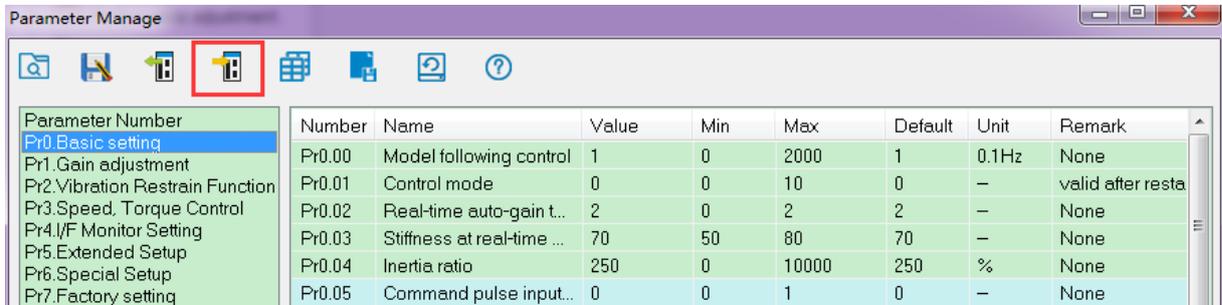


If users restart the software ProTuner , just make the same steps above.

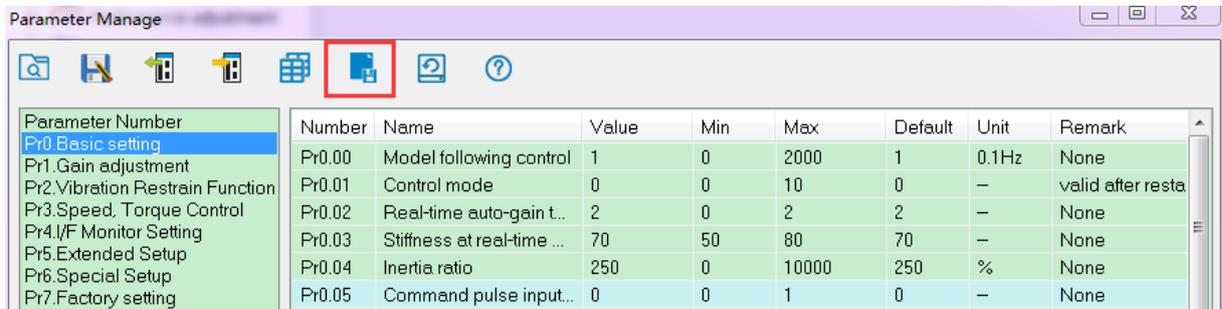
How to modify the new values of parameter to the driver

Sometimes, we need to restart the driver to make it available after modifying the values of parameter, so it is very important to follow the right step. Users need to do the operation with the steps below:

1. Modify the value of parameter.
2. Click “download “:



3. Click “save”:



4. Then users can power off the driver and restart it again, or users can **Software Reset** to make the new parameters setting valid.

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