

# Working with Motion Studio

*AC Servo Drive*



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## Before we start

Please prepare the following items before we start to work with Motion Studio.

1. Leadshine AC Servo Drive (EL6/ELP/EL7 Series)
2. Leadshine AC Servo Motor (Recommended by Leadshine to be matched with driver)
3. Data cable
  - a. Ethernet-to-DB9 female– For EL6 series AC servo drives
  - b. Mini-USB – For ELP/EL7 series AC servo drives  
*(Please mind that a charging cable might not be able to transfer data.)*
4. Motor power cables (**Direct** or **Aviation** connector depending on motor models)
5. Encoder cables(**Direct** or **Aviation** connector depending on motor models)
6. Motion Studio. Can be downloaded on our website [www.leadshine.com](http://www.leadshine.com)

## System requirement to run Motion Studio

Operating system: Windows XP or above

CPU: 1.5GHz or above

RAM: 256MB or above

Hard disk capacity: 10GB or above

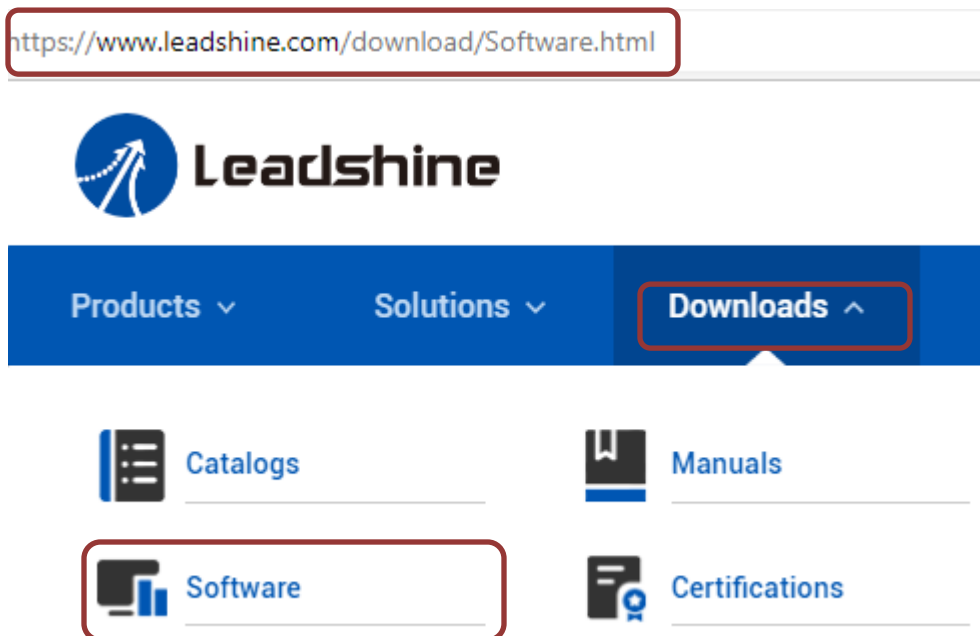
Display: Resolution 1024\*768, color 24 bit

Communication interface: USB Type-A series adapter


## Introduction

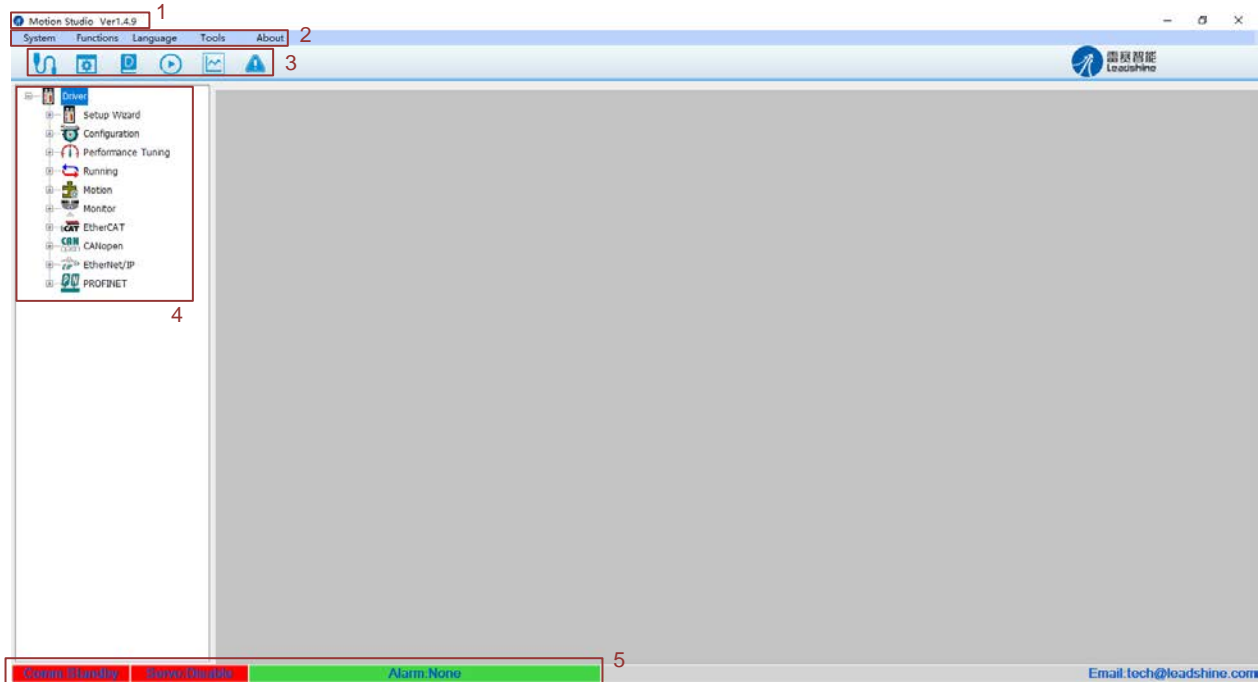
Motion Studio is a free-to-use software developed by Leadshine Technology Co., Ltd. for simple commissioning of Leadshine AC servo products. Through Motion Studio, users can connect the drivers to PC for parameters reading & writing, system performance tuning, trial run, driver status & data monitoring and much more. Most of the functions can be realized without connecting the driver to a main power supply.

**There is no need to install Motion Studio.** Download “MotionStudio\_ACServo” for designated Leadshine products on our website and unzip the file. Click on MotionStudio.exe to start the software. User manual for Motion Studio can be found in Help folder. It is recommended to save Motion Studio in other disks than C: drive.



## Getting started with Motion Studio

After unzipping “MotionStudio\_ACServo”, click on  **MotionStudio.exe** to start Motion Studio.









*Motion Studio Workspace*

### ① Motion Studio software version

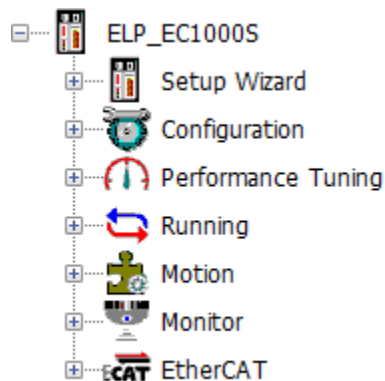
### ② Pull-down menu

|                  |  |
|------------------|--|
| <b>System</b>    | <ul style="list-style-type: none"> <li>▪ To connect to servo drives</li> <li>▪ To exit software</li> </ul>   |
| <b>Functions</b> | <ul style="list-style-type: none"> <li>▪ To save modified parameters</li> <li>▪ To reset software</li> <li>▪ To login to admin's rights</li> </ul> |
| <b>Languages</b> | <ul style="list-style-type: none"> <li>▪ To switch between Chinese and English display languages</li> </ul>  |
| <b>Tools</b>     | <ul style="list-style-type: none"> <li>▪ Serial Port Tool</li> <li>▪ USB Tool</li> <li>▪ Object Dict Tool</li> <li>▪ Register Tool</li> </ul>      |
| <b>About</b>     | <ul style="list-style-type: none"> <li>▪ Platform info</li> <li>▪ User manual</li> </ul>   |

### ③ Quick Access buttons

|   |                          |   |
|---|--------------------------|---|
|  | <b>Connect</b>           | <ul style="list-style-type: none"> <li>To connect or disconnect servo drives in online or offline mode</li> <li>To check information of connected servo products</li> </ul>   |
|  | <b>Parameters List</b>   | <ul style="list-style-type: none"> <li>To read/write, modify, compare servo drive parameters</li> <li>To save parameters files as backup.</li> <li>To restore parameters back to factory default</li> </ul>                       |
|  | <b>Object Dictionary</b> | <ul style="list-style-type: none"> <li>To read/write, modify, compare servo drive objects.</li> <li>To save object dictionary as backup</li> <li>To configure PDO</li> <li>To restore objects back to factory default.</li> </ul> |
|  | <b>Trial Run</b>         | <ul style="list-style-type: none"> <li>To test run servo products after connected to driver and motor (Need to connect to main power supply)</li> <li>To run inertia identification</li> </ul>                                    |
|  | <b>Scope</b>             | <ul style="list-style-type: none"> <li>To capture driver data waveforms</li> <li>To read captured driver's data</li> </ul>  |
|  | <b>Alarm Info</b>        | <ul style="list-style-type: none"> <li>To check current occurrence of error or alarm historical records</li> <li>To check the cause(s) of motor stops running</li> </ul>  |

### ④ Navigation tree




Driver model no. will appear on top of the navigation tree. Branches of the navigation tree will adapt according to the communication protocol of the connected servo drive. For example, servo drives with EtherCAT communication protocol will only have EtherCAT appearing on the navigation tree.

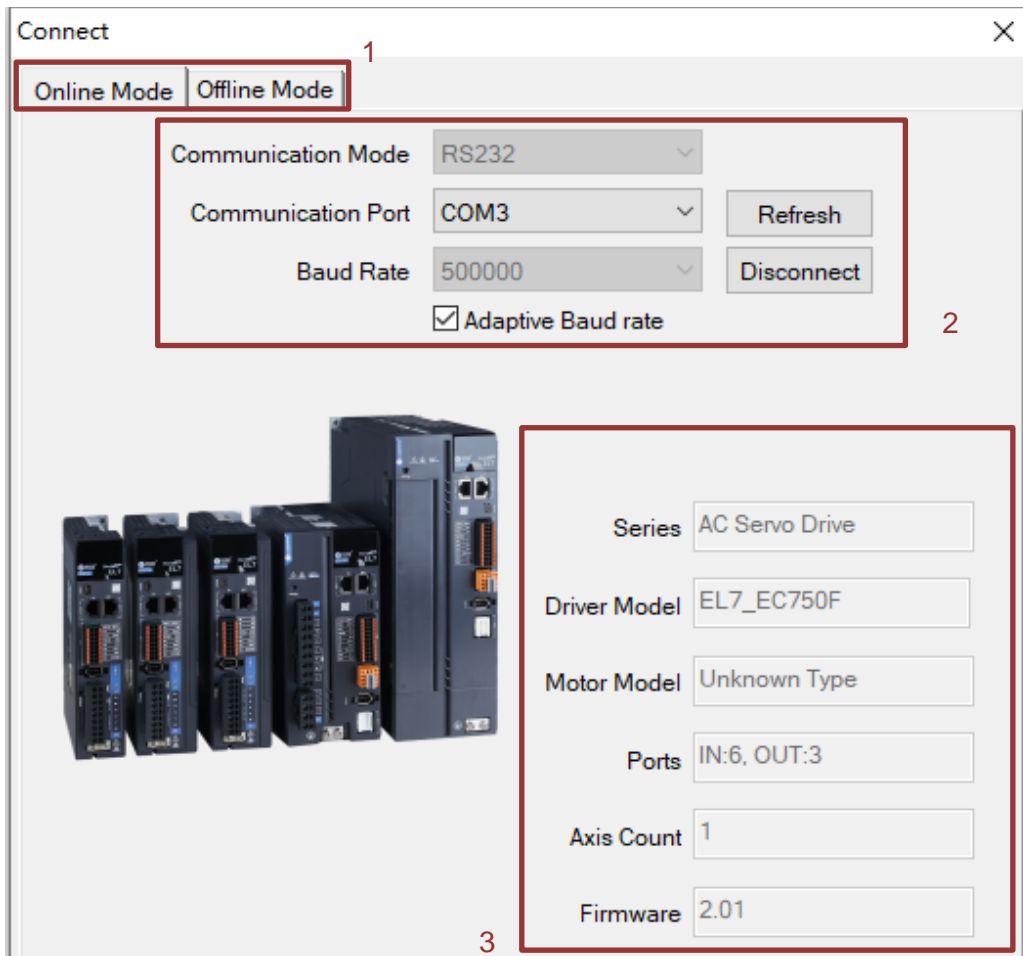
*Branches and their extension functions will be explained in following chapters of the manual.*

### ⑤ Status bar


|              |   |
|--------------|---|
| <b>Comm</b>  | To show connection status of the servo drive <ul style="list-style-type: none"> <li>Standby (Red) – No driver connected yet</li> <li>Online (Green) – Driver successfully connected.</li> </ul> |
| <b>Servo</b> | To show the status of the servo drive <ul style="list-style-type: none"> <li>Disable (Red) – Servo drive is powered-off.</li> <li>Enable (Green) - Servo drive is powered-on.</li> </ul>        |
| <b>Alarm</b> | To show alarm status <ul style="list-style-type: none"> <li>None (Green) – No alarm</li> <li>Other (Red) – Servo error occurs.</li> </ul>   |

## Connect to Servo Drive

1. Click on .
2. “**Connect**” pop-up window will appear.

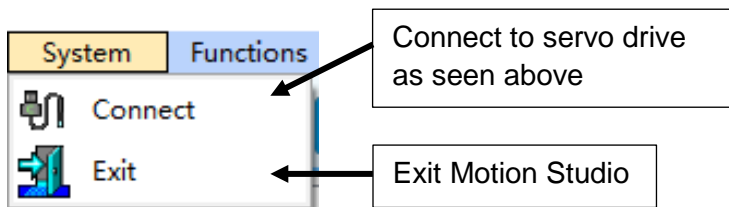


|   |  |
|---|--|
| ① | <ul style="list-style-type: none"> <li>▪ Online mode: Driver and motor connecting to USB port automatically identified</li> <li>▪ Offline mode: Use offline mode to read parameters saved in PC.</li> </ul>  |
| ② | <ul style="list-style-type: none"> <li>▪ Only RS232 communication mode is supported for the moment being.</li> <li>▪ Communication Port can be automatically identified by clicking on “<b>Refresh</b>”. If driver failed to connect, please verify data cable or change to another USB port.</li> <li>▪ Check “<b>Adaptive Baud rate</b>” and click on “<b>Connect</b>” to connect to servo products.</li> </ul> <p><i>Driver can be connected to PC without main power supply.</i></p> |
| ③ | <ul style="list-style-type: none"> <li>▪ Servo products info such as series, model no., ports, axis count and firmware version can be found here.</li> </ul>   |

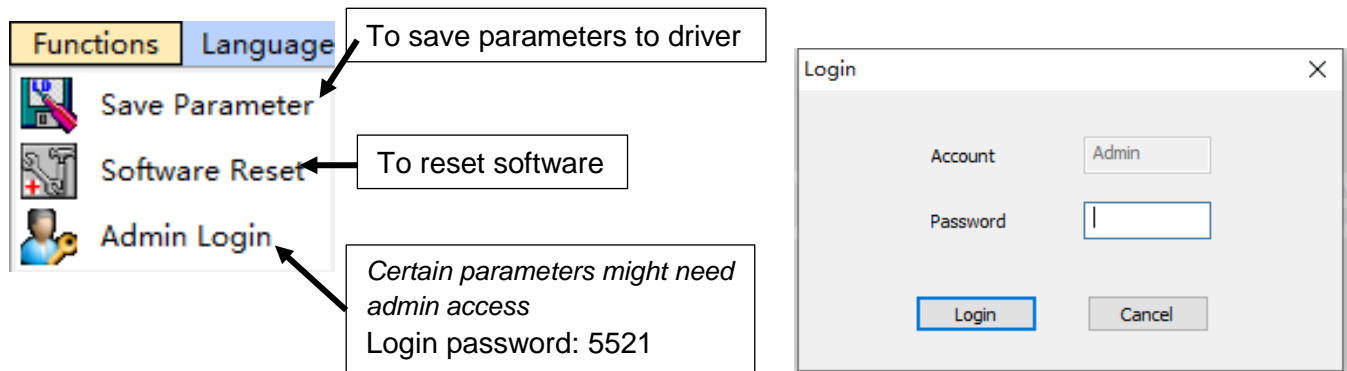
3. When servo drive is connected to PC through data cable, **USb** will appear on the front panel of the servo drive. Err0D2 will appear due to no main power supply connected, it doesn't affect most tuning works of the servo drive.
4. Once successfully connected, Comm on status bar will turn green with "Comm: Online".  

5. Connect window will close automatically in 3s after successfully connected.
6. If connection failed, please verify:
  - a. Data cable. Charging cable might not be able to transfer data.
  - b. Change another USB port.
  - c. Any alarm error which needs to be reset.

## Pull-down Menu

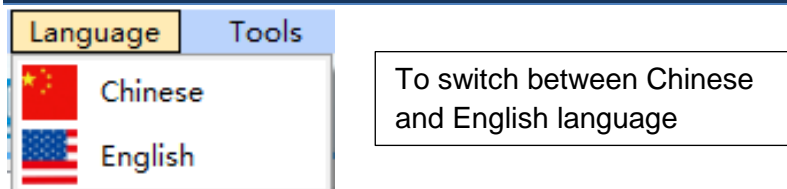
### System



### Functions

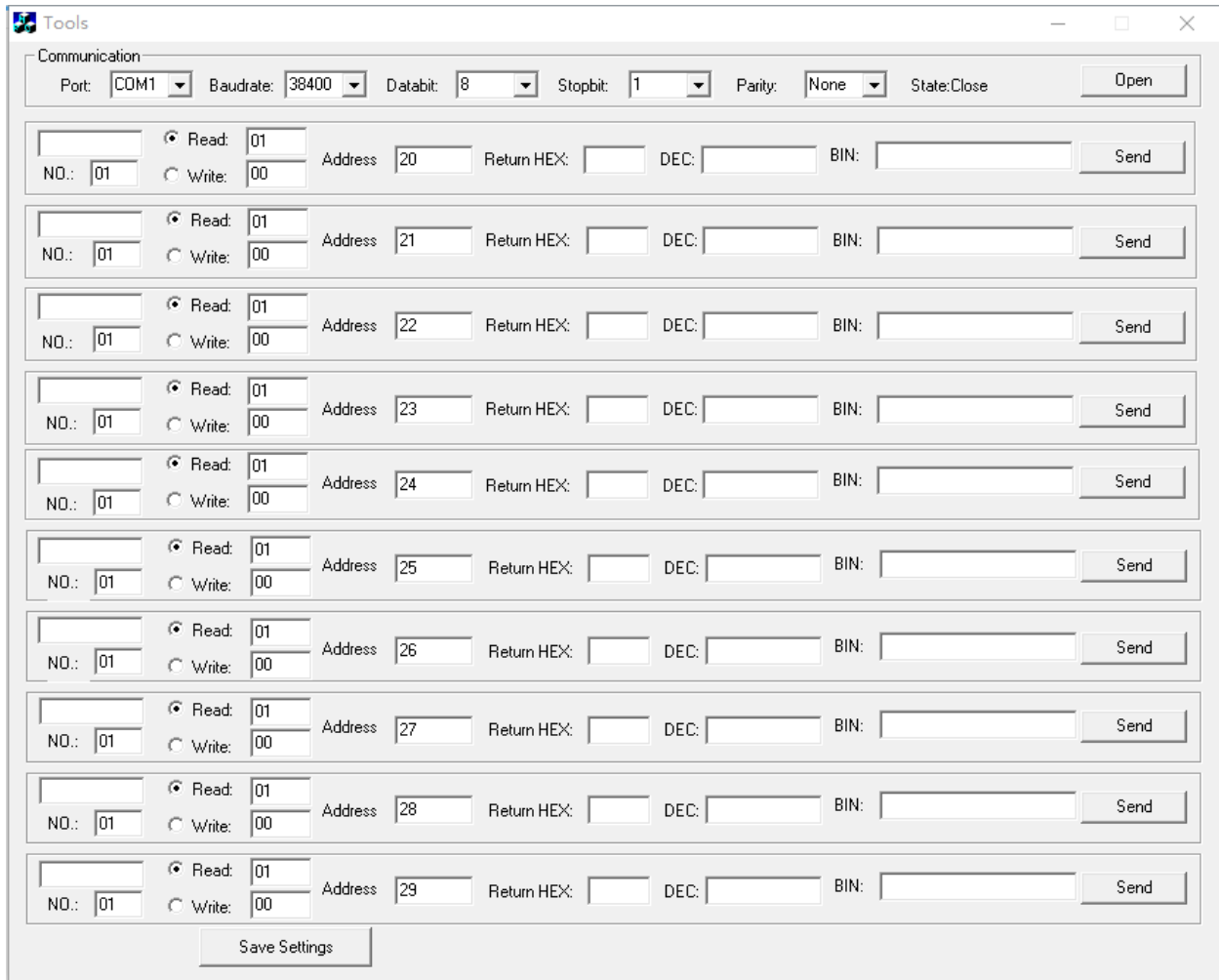
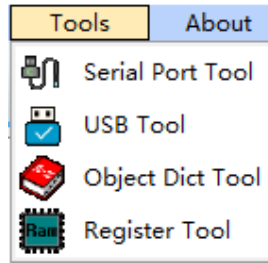


### Language





## Tools



**USB Debug Tool**

Init

Driver No.:

Address(Dec):

Simple R/W

Return:

Write:  Return:

Batch Size R/W

len = 0

(Hex)

len = 0

**Object Dictionary Tool**

Object Dictionary Region

Index(HEX)  SubIndex(HEX)

Value(HEX)  Value(DEC)  Error Code(HEX)

Object Dictionary Region 1

Index(HEX)  SubIndex(HEX)

Value(HEX)  Value(DEC)  Error Code(HEX)   Continuous read

Object Dictionary Region 2

Index(HEX)  SubIndex(HEX)

Value(HEX)  Value(DEC)  Error Code(HEX)   Continuous read

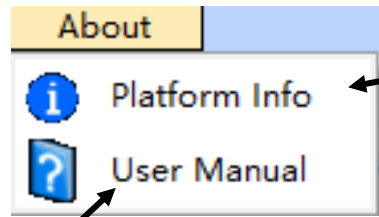
**Register Tool**

Register Region

Address(HEX)  Value(HEX)  Value(DEC)

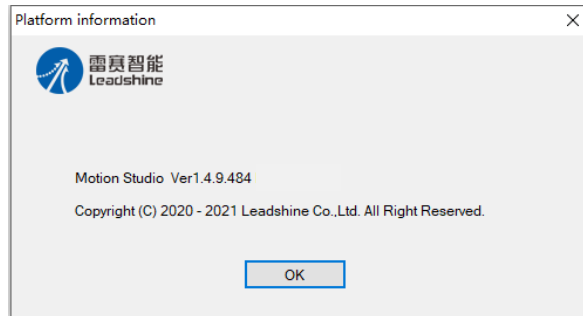
Continuous read

## About



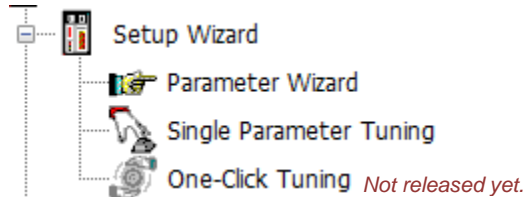
Access to Parameter descriptions and Motion Studio User Manual

Access to Parameter descriptions and Motion Studio User Manual



# Navigation tree

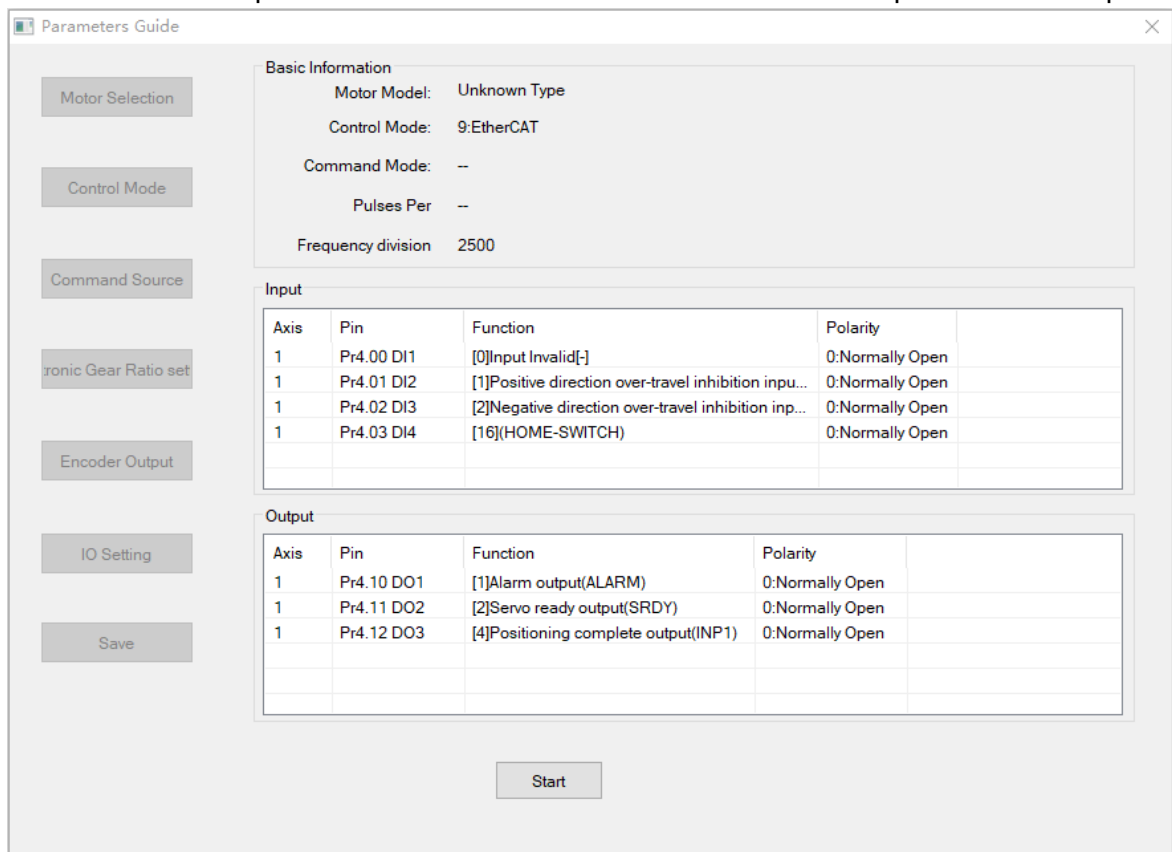
## Setup Wizard



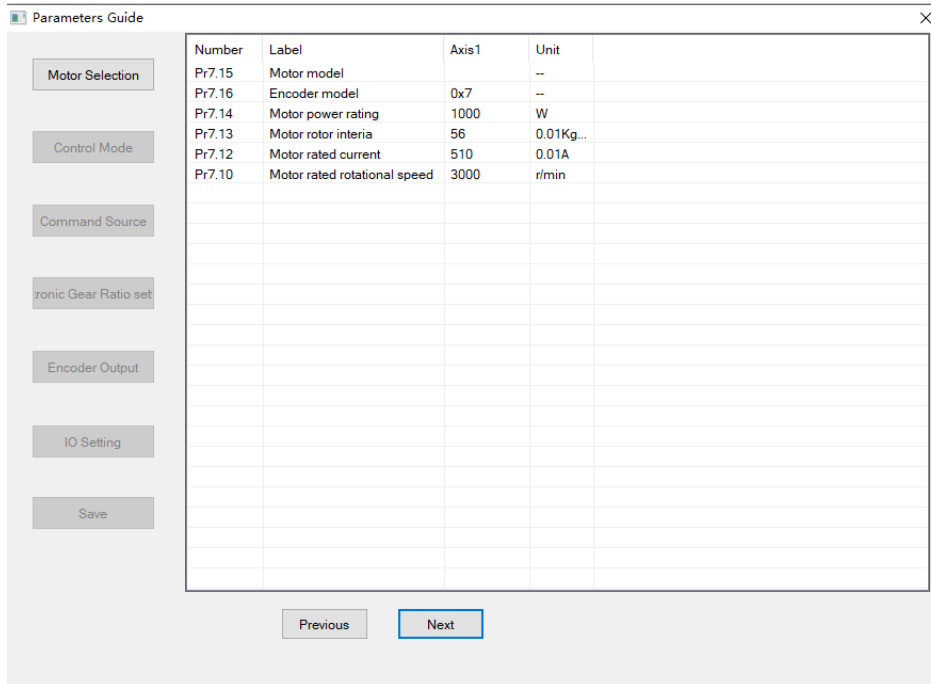
### Parameter Wizard

Step-by-step guide to set up servo drives. Most of the parameters are automatically identified and set to default value once servo drive + motor is connected but users may need some customizations to servo parameters and settings.

1. Start screen of Parameter wizard consists of basic information of the servo products, I/O interfaces and setup menu on the left. Click on “Start” to start servo parameters setup.



- On motor selection page, user can find out more about motor and encoder specifications. Users are not recommended to modify any parameters on this page as it might cause abnormal behavior of the driver or motor. Click on “Next” to go to the next page or “Previous” to go back to previous page.

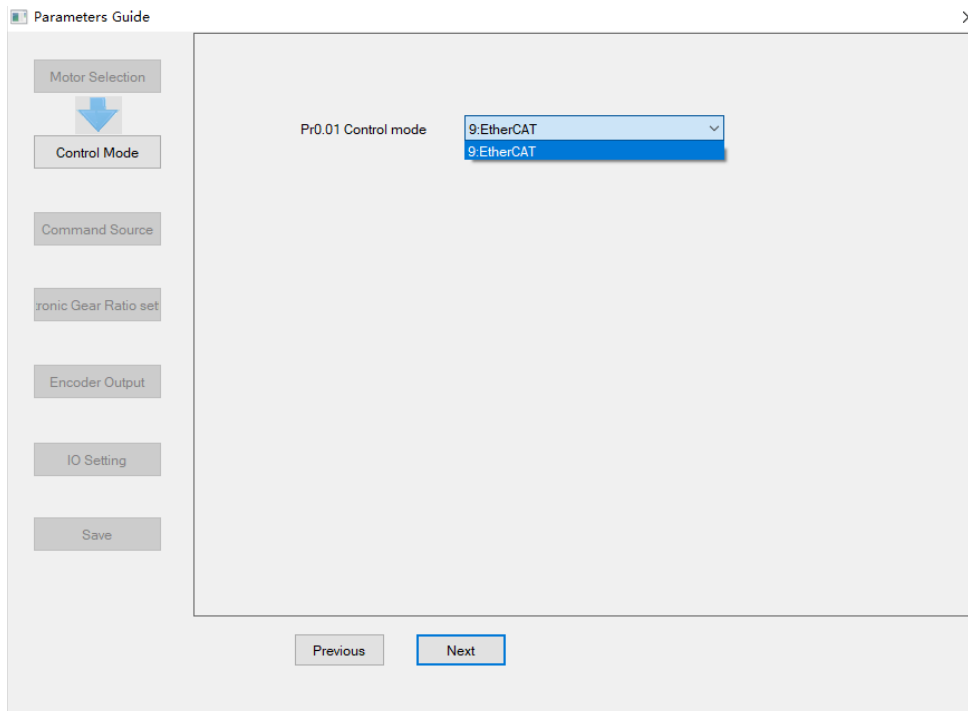


The screenshot shows the 'Parameters Guide' window with a sidebar on the left containing buttons for 'Motor Selection', 'Control Mode', 'Command Source', 'Tonic Gear Ratio set', 'Encoder Output', 'IO Setting', and 'Save'. The main area contains a table with the following data:

| Number | Label                        | Axis1 | Unit      |
|--------|------------------------------|-------|-----------|
| Pr7.15 | Motor model                  | --    | --        |
| Pr7.16 | Encoder model                | 0x7   | --        |
| Pr7.14 | Motor power rating           | 1000  | W         |
| Pr7.13 | Motor rotor inertia          | 56    | 0.01Kg... |
| Pr7.12 | Motor rated current          | 510   | 0.01A     |
| Pr7.10 | Motor rated rotational speed | 3000  | r/min     |

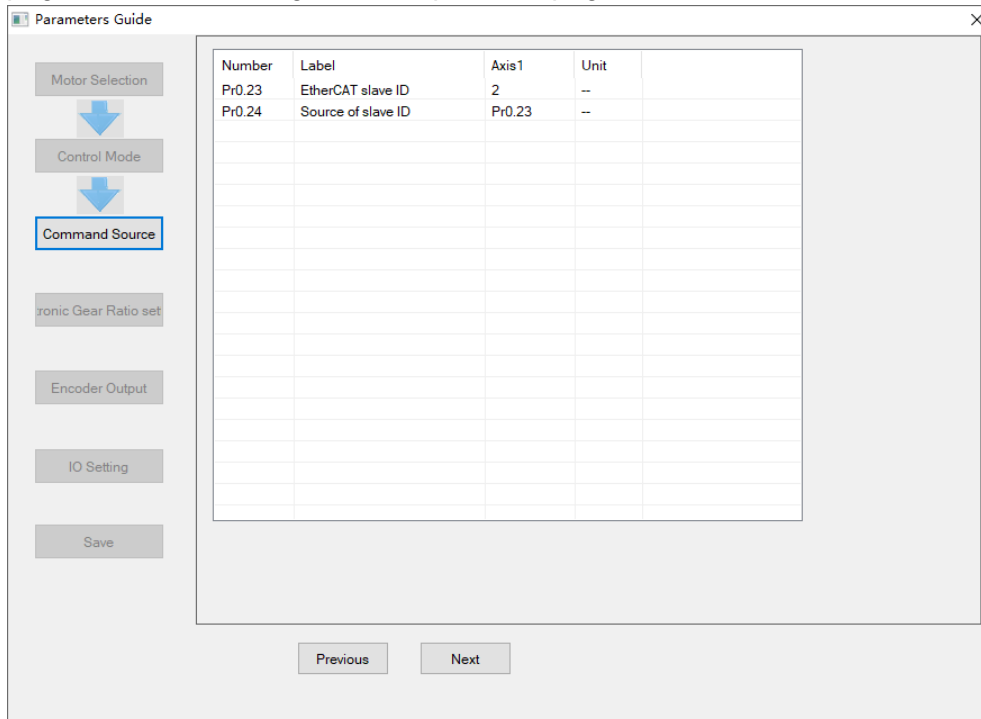
At the bottom of the window are 'Previous' and 'Next' buttons.

- On control mode page, control mode of the driver is automatically identified. Click on “Next” to go to the next page or “Previous” to go back to previous page.

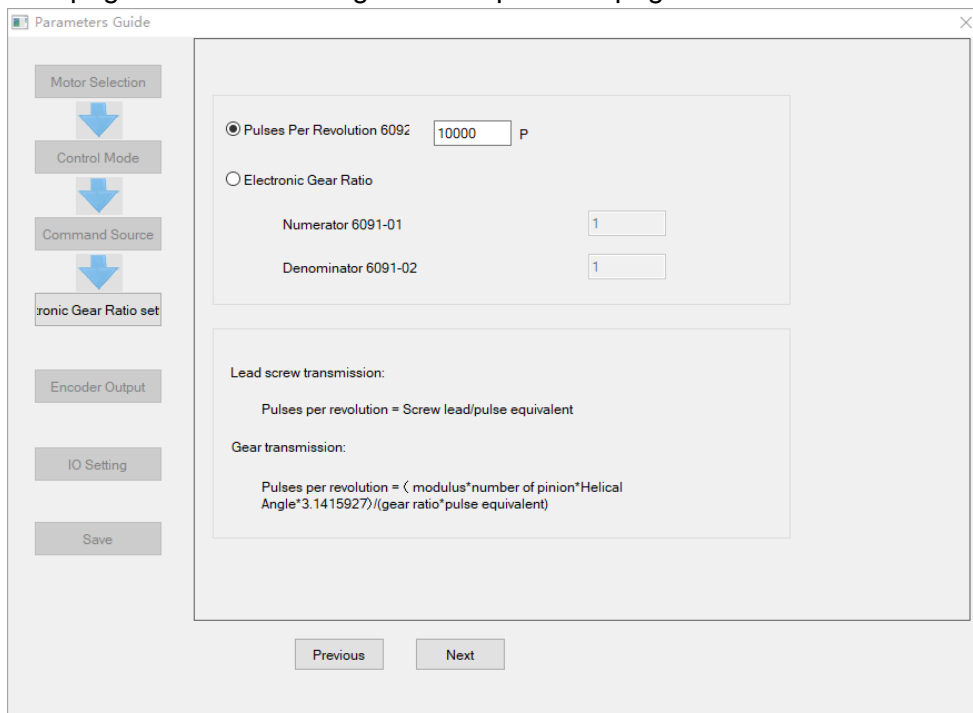


The screenshot shows the 'Parameters Guide' window with the 'Control Mode' button selected in the sidebar, indicated by a blue arrow. The main area displays 'Pr0.01 Control mode' with a dropdown menu showing '9.EtherCAT' selected. The 'Next' button at the bottom is highlighted in blue.

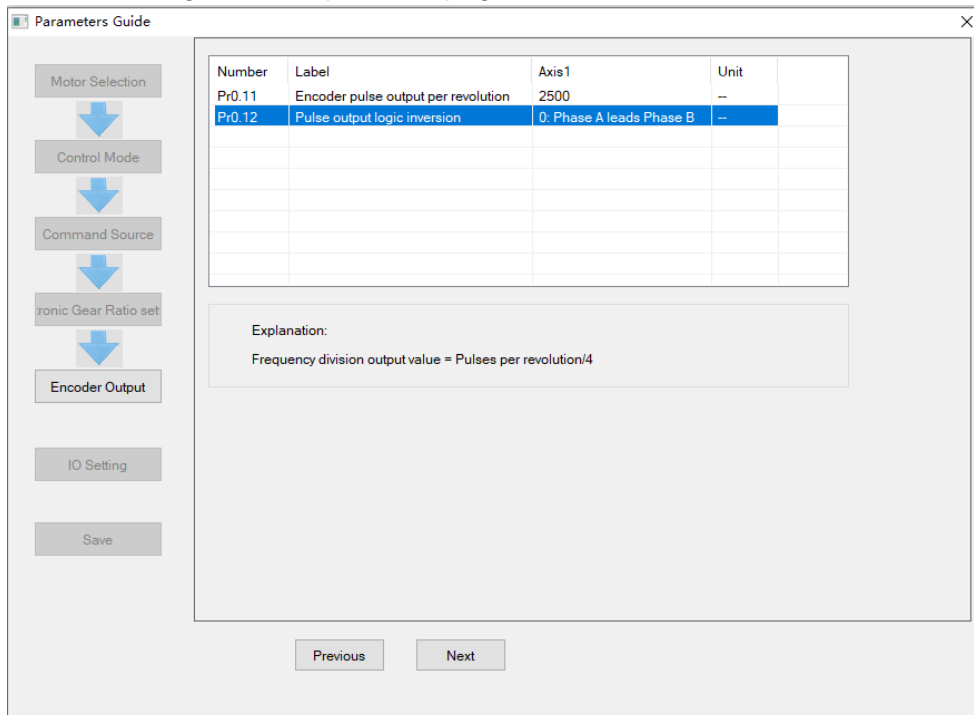
- On command source page, set up slave ID source. Click on “Next” to go to the next page or “Previous” to go back to previous page.



- On Electronic Gear Ratio page, users can choose between setting pulses per revolution or electronic gear ratio. Calculation formulas are provided. Click on “Next” to go to the next page or “Previous” to go back to previous page.



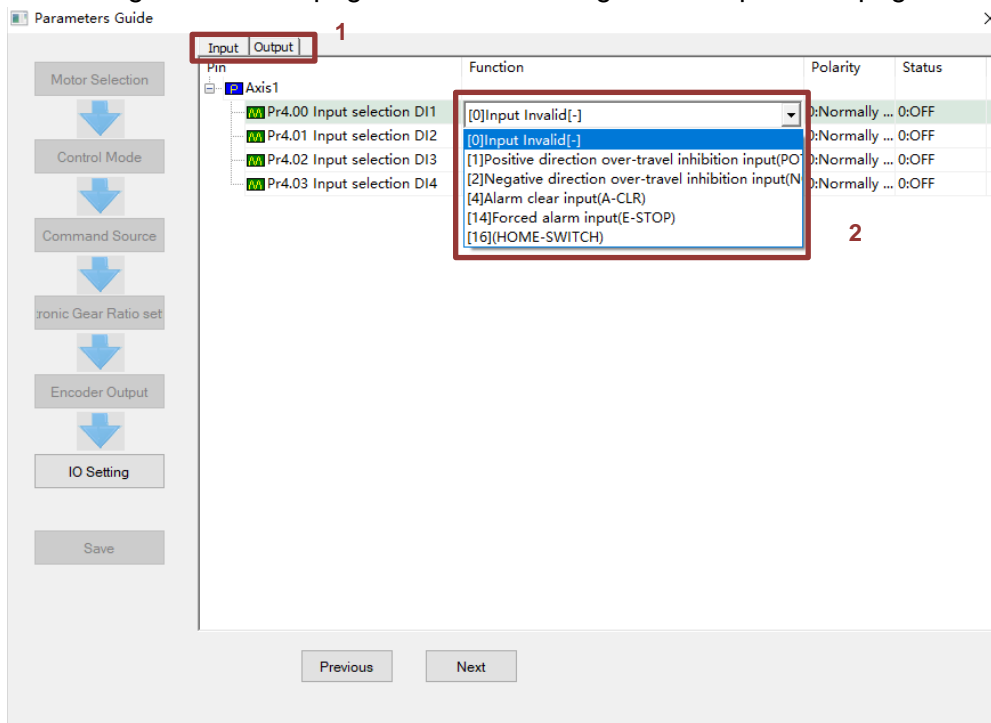
- On Encoder Output page, users can set up encoder pulse output per revolution (= Pulses per revolution/4) and pulse logic. Click on “Next” to go to the next page or “Previous” to go back to previous page.



| Number | Label                               | Axis1                    | Unit |
|--------|-------------------------------------|--------------------------|------|
| Pr0.11 | Encoder pulse output per revolution | 2500                     | --   |
| Pr0.12 | Pulse output logic inversion        | 0: Phase A leads Phase B | --   |

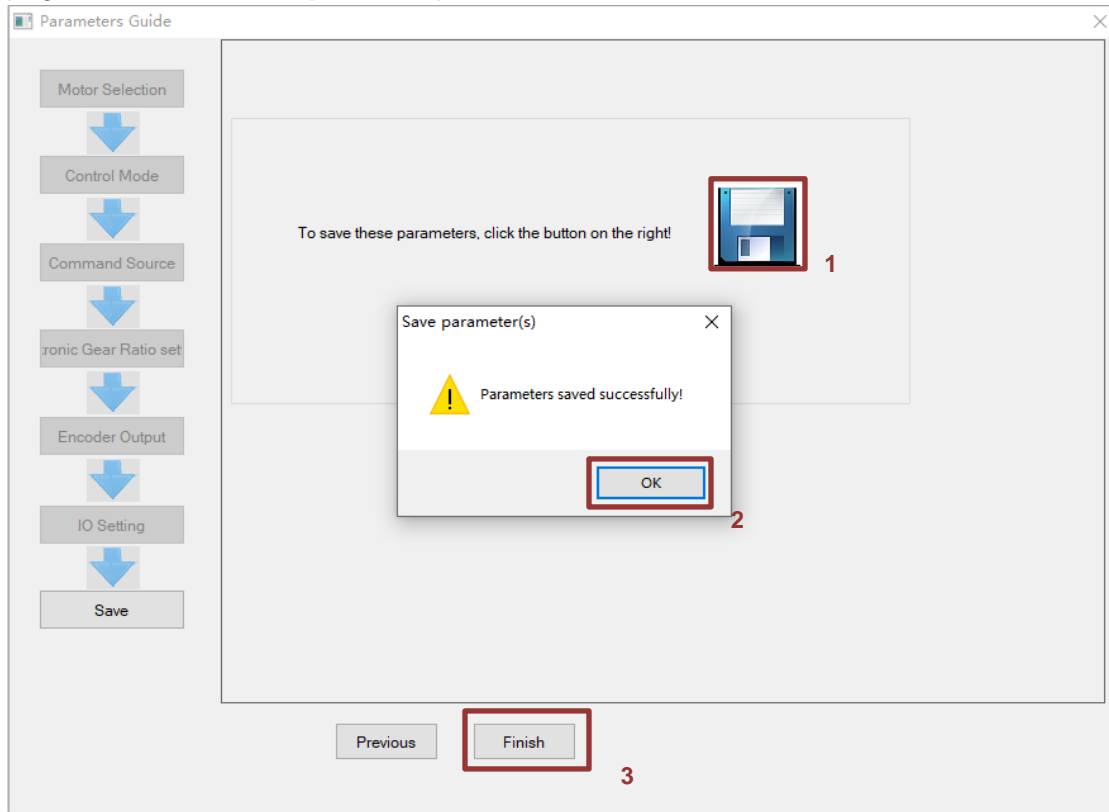
Explanation:  
Frequency division output value = Pulses per revolution/4

- On IO settings page, users can allocate DI/DO signals to selected channels. Click on “Next” to go to the next page or “Previous” to go back to previous page.



| Pin                        | Function  | Polarity           | Status |
|----------------------------|---|--------------------|--------|
| Axis1                      |   |                    |        |
| Pr4.00 Input selection DI1 | [0]Input Invalid[-]                                   | Normally ... 0:OFF |        |
| Pr4.01 Input selection DI2 | [0]Input Invalid[-]                                   | Normally ... 0:OFF |        |
| Pr4.02 Input selection DI3 | [1]Positive direction over-travel inhibition input(PO | Normally ... 0:OFF |        |
| Pr4.03 Input selection DI4 | [2]Negative direction over-travel inhibition input(N  | Normally ... 0:OFF |        |

8. On Save page, users can save modified parameters. Click on “Next” to go to the next page or “Finish” to complete setup.



### Single Parameter Tuning

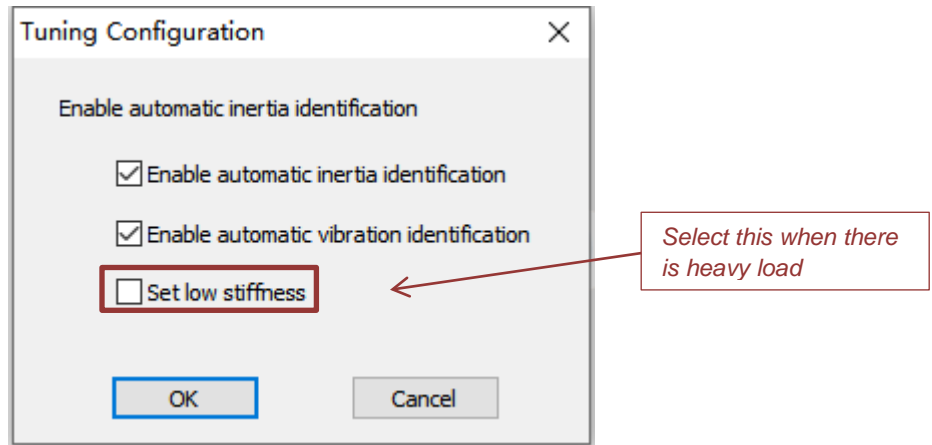
Set a mechanical stiffness level and the driver will automatically tune the parameters accordingly, including inertia measuring and vibration suppression to fulfill responsiveness and stability needs. At same time, more advanced functions can be applied, for example: Command pulse filter, low frequency vibration suppression, etc.

Recommended for applications where inertia changes is minute. Single parameter tuning is more complicated to set up compared to one-click tuning. Use single parameter tuning when one-click tuning doesn't fulfill the needs.

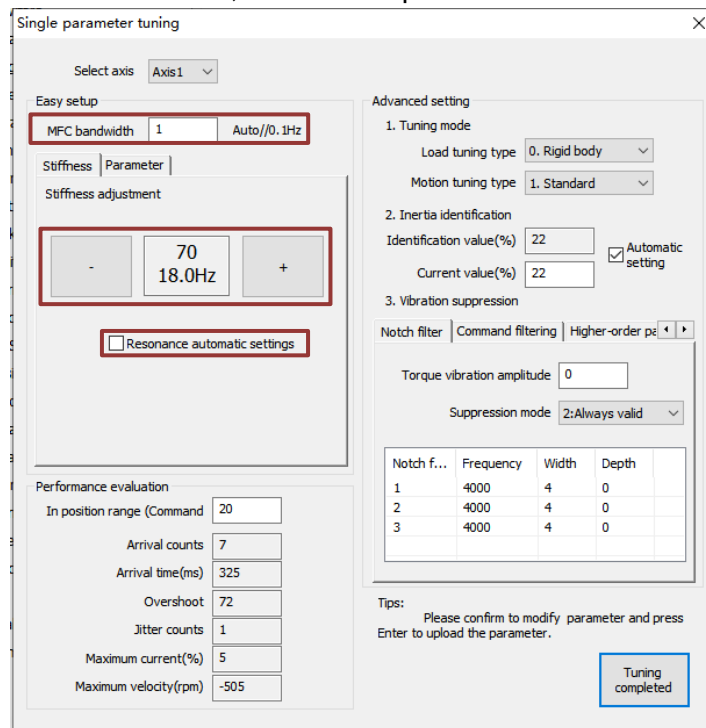


### Easy Mode

1. Click on “Single Parameter Tuning” under Setup Wizard. Choose “Enable automatic inertia identification” and “Enable automation vibration identification”. If the system is heavily loaded with Pr0.03 mechanical stiffness value lower than 70, by selecting “Set low stiffness”, initial Pr0.03 value in Single Parameter Tuning will start at 70.



2. Set the value of MFC bandwidth, stiffness as per the table below under Easy Setup.



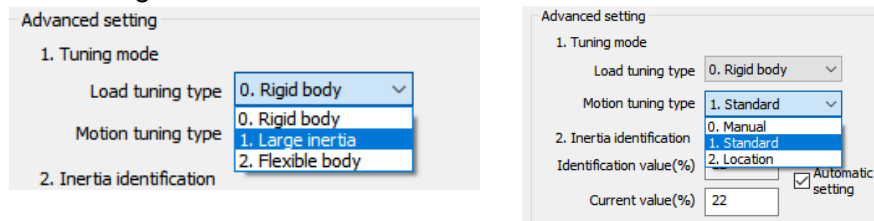
| MFC bandwidth set value | Description   |
|-------------------------|---|
| 0                       | Deactivate model-following control function   |
| <b>【1】</b>              | Automatically adjust MFC bandwidth  |
| 2~9                     | Invalid   |
| 10~2000                 | Manually adjust MFC bandwidth;<br>Recommended 30-100 for transportation belt applications |

Stiffness level goes from 81-50 with 50 being highest stiffness level. Velocity response improves with higher stiffness level but vibration might occur. For flexible structures, decrease stiffness level and setup vibration suppression.

3. Resonance automatic settings: Automatically identified vibration under actual stiffness level settings. Default value is restored when no vibration is detected. If not selected, value will not be restored to default.

### Advanced mode

4. Set Tuning mode.



#### Load tuning type

**Rigid body:** Structure with low flexibility (i.e. screw leads)

**High Inertia:** 30-40 times higher than load inertia.

**Flexible body:** Low stiffness (i.e. belt)

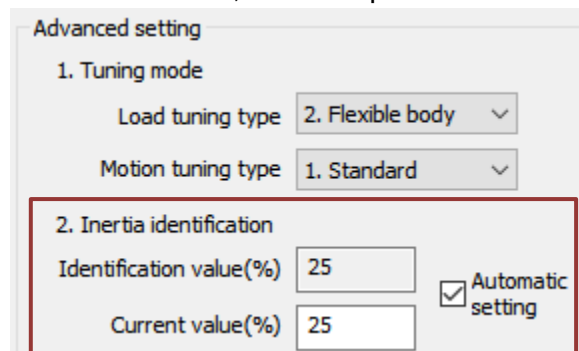
#### Motion tuning type

**Manual:** Auto adjustment off. Parameters under Easy Setup available to be modified.

**Standard:** Prioritize stability. No switch gaining.

**Location:** Recommended for horizontal axis with variable load or ball screw structures.

5. Inertia identification is automatically enabled at the start.  
 Identification value (%): Inertia ratio will be automatically identified with yellow box blinking on every successful identification  
 Current value (%): If "Automatic setting" is selected, inertia ratio will be automatically synchronize to Pr0.04. If not selected, user can press Enter to set the value to Pr0.04.



6. Vibration suppression: Notch filter

**Torque vibration amplitude:** 0% - Max. sensitivity, 100% - Deactivated (*Adjust accordingly*)

**Suppression mode:** 0 – Adaptive notch filter **deactivated**

1 – Adaptive notch filter **valid for once**

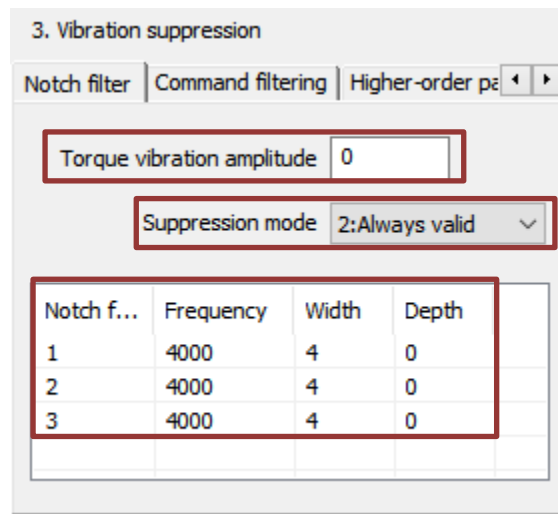
2 – Adaptive notch filter **always valid**

**Notch filter:** 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> notch filter

Frequency(Hz): 50~2000

Width: 0~20

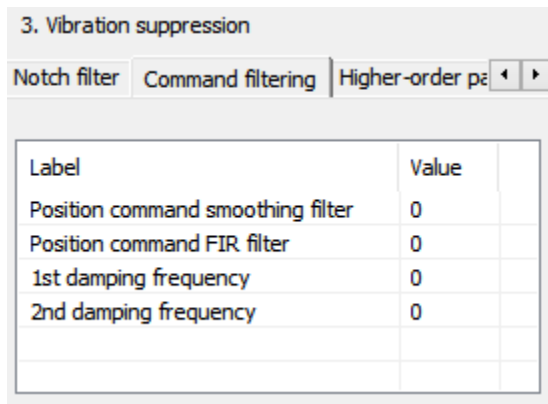
Depth: 0~99



*Right click on notch filter parameters to **cut, paste** or **reset** the parameters*

Vibration suppression: Command filtering

*(These parameters are manually set, cannot be automatically identified.)*



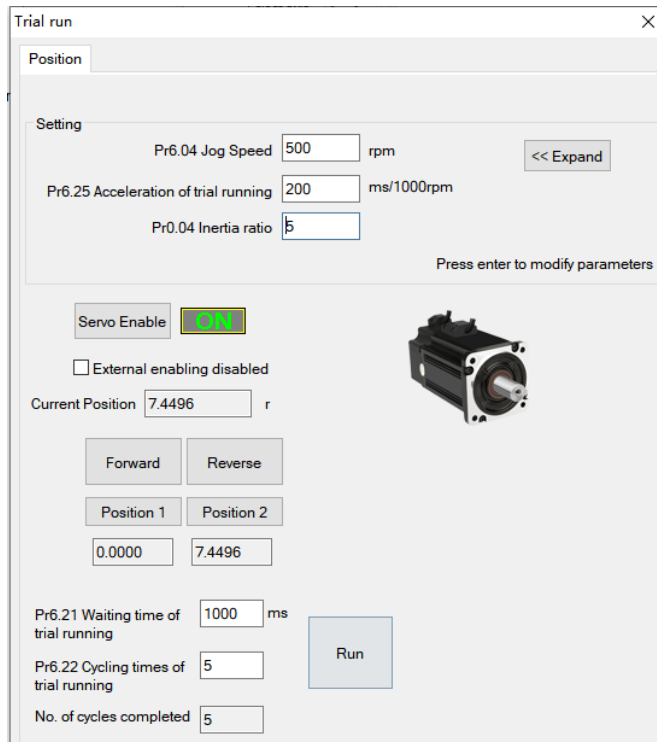
| Parameter                         | Range(Unit)    | Description                                |
|-----------------------------------|----------------|--|
| Position command smoothing filter | 0~32767(0.1ms) | Large set value might elongate tuning time |
| Position command FIR filter       | 0~10000(0.1ms) |  |
| 1 <sup>st</sup> damping frequency | 10~2000(0.1Hz) | To suppress mechanical end vibration       |
| 2 <sup>nd</sup> damping frequency | 10~2000(0.1Hz) |  |

### Vibration suppression: Higher-order Parameters



| Parameter                   | Range(Unit) | Description  |
|-----------------------------|-------------|--|
| Velocity observer gain      | 0~32767     | Defaulted to stable gain and bandwidth. Set = 1 to deactivate. |
| Velocity observer bandwidth | 0~32767(ms) |  |
| Current response settings   | 50~100(%)   | Current loop related effective value ratio                     |

7. After the settings are done, use trial run to run the motor for at least 5 cycles.



Jog speed > 300rpm

Acceleration < 600ms

Position 1 and Position 2 should be around 5r

Interval waiting time between cycles should be < 500ms with at least 5 cycles

### 8. Performance evaluation

Single parameter tuning

Select axis: Axis1

Easy setup  
 MFC bandwidth: 1 Auto//0.1Hz  
 Stiffness: Parameter  
 Stiffness adjustment: 70 18.0Hz  
 Resonance automatic settings

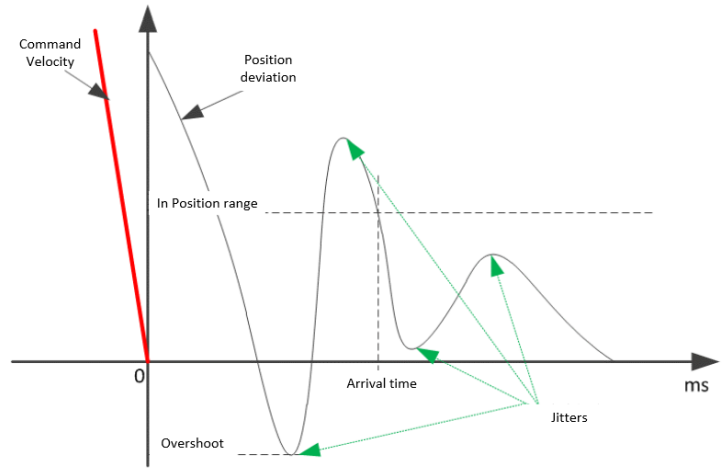
Advanced setting  
 1. Tuning mode: Load tuning type: 2. Flexible body Motion tuning type: 1. Standard  
 2. Inertia identification: Identification value(%): 13 Current value(%): 13  Automatic setting  
 3. Vibration suppression: Notch filter: Command filtering Higher-order pe: Torque vibration amplitude: 0 Suppression mode: 2:Always valid

| Notch f... | Frequency | Width | Depth |
|------------|-----------|-------|-------|
| 1          | 4000      | 4     | 0     |
| 2          | 4000      | 4     | 0     |
| 3          | 4000      | 4     | 0     |

Performance evaluation  
 In position range(0.0001r): 20  
 Arrival counts: 11  
 Arrival time(ms): 18  
 Overshoot: 15  
 Jitter counts: 1  
 Maximum current(%): 5  
 Maximum velocity(rpm): -501

Tips: Please confirm to modify parameter and press Enter to upload the parameter.

Tuning completed



|                   |  |
|-------------------|--|
| In position range | To set the velocity deviation between target velocity and actual velocity                            |
| Arrival counts    | Number of times target value is arrived  |
| Overshoot         | The difference between target value and actual value.<br>10%(White) < Overshoot(Yellow) < 100% (Red) |
| Jitter counts     | Detected jitters. Jitter count = 1(Yellow), more than 1(Red). Default(White)                         |
| Max. current      | Percentage of max. current   |

Use Scope to get desired waveform by decreasing stiffness value manually.

Scope

CH1: Axis1 - 49:Position command velocity  
 CH2: Axis1 - 48:Velocity feedback before filter  
 CH3: Axis1 - 3:Position deviation  
 CH4: Axis1 - 80:Current setting(%)

CH1: Axis1 - 49:Position command velocity  
 CH2: Axis1 - 48:Velocity feedback before filter  
 CH3: Axis1 - 3:Position deviation  
 CH4: Axis1 - 80:Current setting(%)  
 CH5: Axis1 - 4A:Internal position command velocity  
 CH6: Axis1 - 40:Velocity setting

Trigger: Trigger Source: Axis1 - 1:Velocity feedback  
 Trigger Mode: 0:Rising edge trigger  
 Trigger Threshold: 30

Sampling Frame and Precision  
 Single Frame and High Precision  
 Sampling Interval: 5.000  
 Multi Frame and Low Precision  
 Sampling Interval: 100

X = 500,000.  
 CH1 = 499. CH2 = 500.  
 CH3 = 1517. CH4 = 47.

Capture

9. Disable automatic inertia and vibration identification. Confirm to save parameters or restore to previous settings if the tuning setup is not wanted.

X

To maintain stability, it is recommended

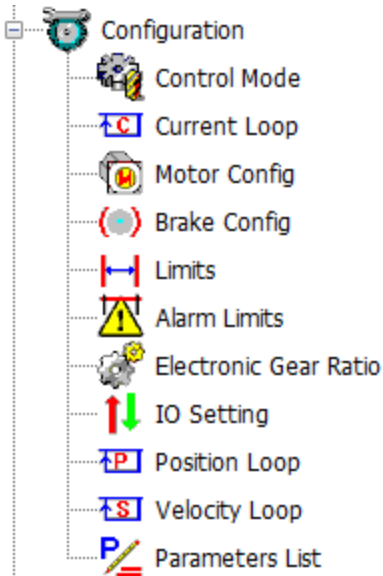
Disable automatic inertia identification

Disable automatic vibration identification

| Device | Modified Para... | Label                         | Before tuning | After tuning |
|--------|------------------|-------------------------------|---------------|--------------|
| Axis1  | Pr0.02           | Real time Auto Gain Adjusting | 0x121         | 0x111        |
| Axis1  | Pr0.04           | Inertia ratio                 | 25            | 22           |
| Axis1  | Pr2.01           | 1st notch frequency           | 4000          | 400          |
| Axis1  | Pr2.03           | 1st notch depth selection     | 0             | 72           |
|        |                  |                               |               |              |
|        |                  |                               |               |              |
|        |                  |                               |               |              |
|        |                  |                               |               |              |
|        |                  |                               |               |              |
|        |                  |                               |               |              |
|        |                  |                               |               |              |

Restore Previous
Confirm to save

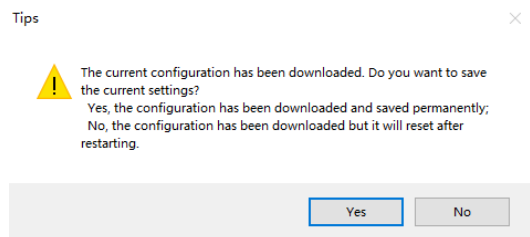
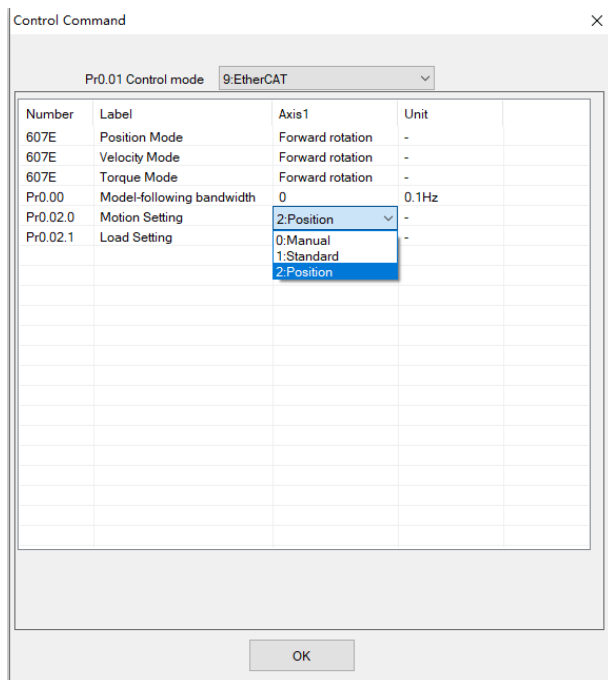
## Configuration



Most of the parameters settings can be set up in *Configuration*. Please refer to the parameters description chapter in the manual for explanation and further details on each parameter and their functions.

### Control Mode

To set up control mode and Model Following Control (MFC) related parameters. Click on drop-down menu of each parameter for functions/selection assignments. Click “OK” after modification

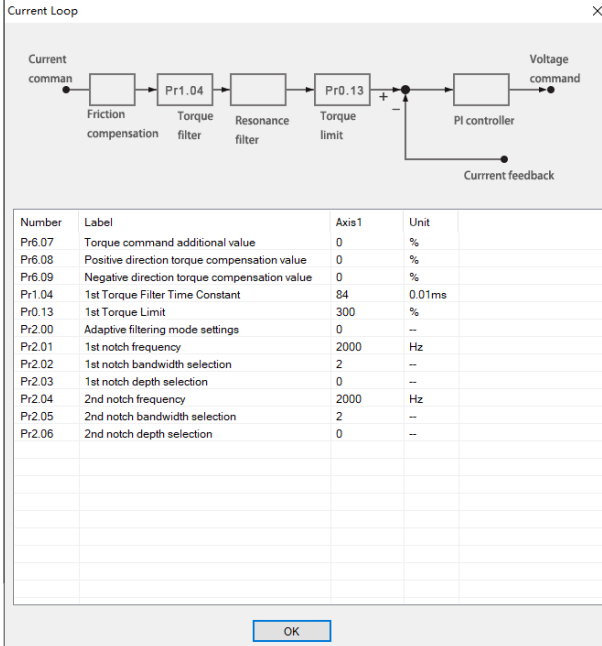


*Click on “Yes” to save modification permanently. It is recommended to back up parameters before modifying crucial parameters.*

*Click on “No” and parameters will be restored after servo drive is restarted.*

## Current loop (Torque loop)

To set up current loop (Torque loop) related parameters. Notch filters can be activated if vibration suppression is required. Pr2.01 - Pr2.06 are valid if Pr2.00 adaptive filtering mode is disabled.

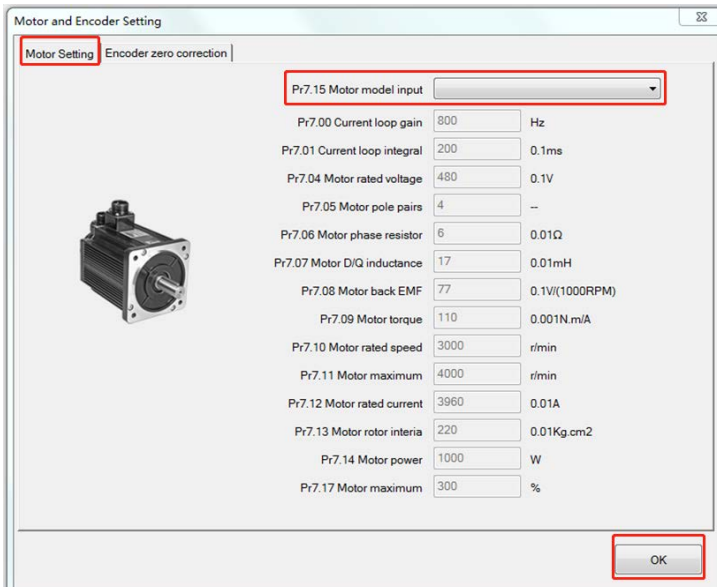


The diagram shows a control loop starting with 'Current command' entering a 'Friction compensation' block, followed by a 'Torque filter' block (Pr1.04), a 'Resonance filter' block, and a 'Torque limit' block (Pr0.13). The output of the torque limit block is summed with 'Current feedback' (indicated by a minus sign) and fed into a 'PI controller' block, which outputs the 'Voltage command'.

| Number | Label  | Axis1 | Unit   |
|--------|--|-------|--------|
| Pr6.07 | Torque command additional value              | 0     | %      |
| Pr6.08 | Positive direction torque compensation value | 0     | %      |
| Pr6.09 | Negative direction torque compensation value | 0     | %      |
| Pr1.04 | 1st Torque Filter Time Constant              | 84    | 0.01ms |
| Pr0.13 | 1st Torque Limit                             | 300   | %      |
| Pr2.00 | Adaptive filtering mode settings             | 0     | --     |
| Pr2.01 | 1st notch frequency                          | 2000  | Hz     |
| Pr2.02 | 1st notch bandwidth selection                | 2     | --     |
| Pr2.03 | 1st notch depth selection                    | 0     | --     |
| Pr2.04 | 2nd notch frequency                          | 2000  | Hz     |
| Pr2.05 | 2nd notch bandwidth selection                | 2     | --     |
| Pr2.06 | 2nd notch depth selection                    | 0     | --     |

## Motor Config.

Only for motor with incremental ABZ+Hall UVW encoder. Select motor model on Motor model input and click on “OK” to save motor parameter settings.



The 'Motor and Encoder Setting' dialog box has two tabs: 'Motor Setting' (selected) and 'Encoder zero correction'. The 'Pr7.15 Motor model input' dropdown menu is highlighted with a red box. Below it, various motor parameters are listed with input fields and units:

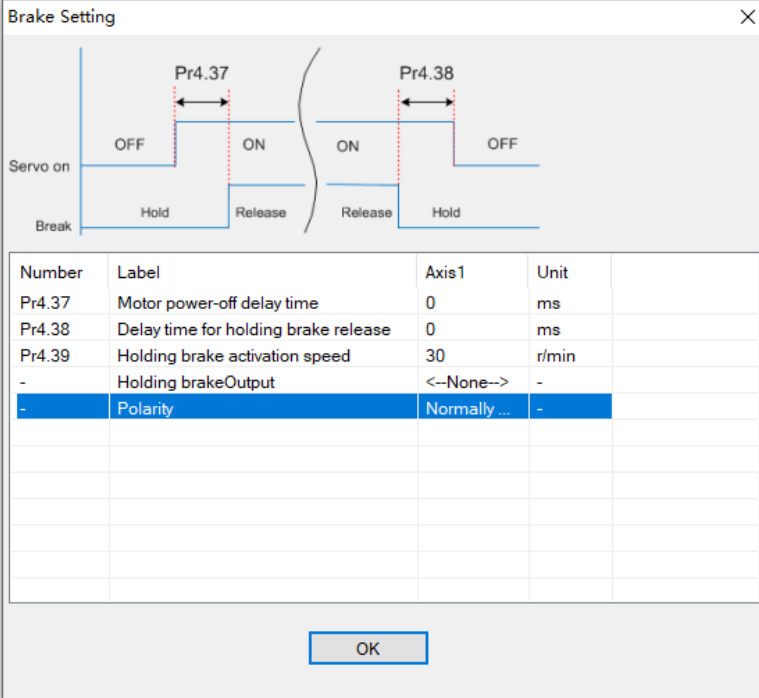
- Pr7.00 Current loop gain: 800 Hz
- Pr7.01 Current loop integral: 200 0.1ms
- Pr7.04 Motor rated voltage: 480 0.1V
- Pr7.05 Motor pole pairs: 4 --
- Pr7.06 Motor phase resistor: 6 0.01Ω
- Pr7.07 Motor D/Q inductance: 17 0.01mH
- Pr7.08 Motor back EMF: 77 0.1V/(1000RPM)
- Pr7.09 Motor torque: 110 0.001N.m/A
- Pr7.10 Motor rated speed: 3000 r/min
- Pr7.11 Motor maximum: 4000 r/min
- Pr7.12 Motor rated current: 3960 0.01A
- Pr7.13 Motor rotor inertia: 220 0.01Kg.cm2
- Pr7.14 Motor power: 1000 W
- Pr7.17 Motor maximum: 300 %

An image of a motor is shown on the left side of the dialog. The 'OK' button at the bottom right is also highlighted with a red box.



### Brake Config.

To set up holding brake output signal, activation and delay time.

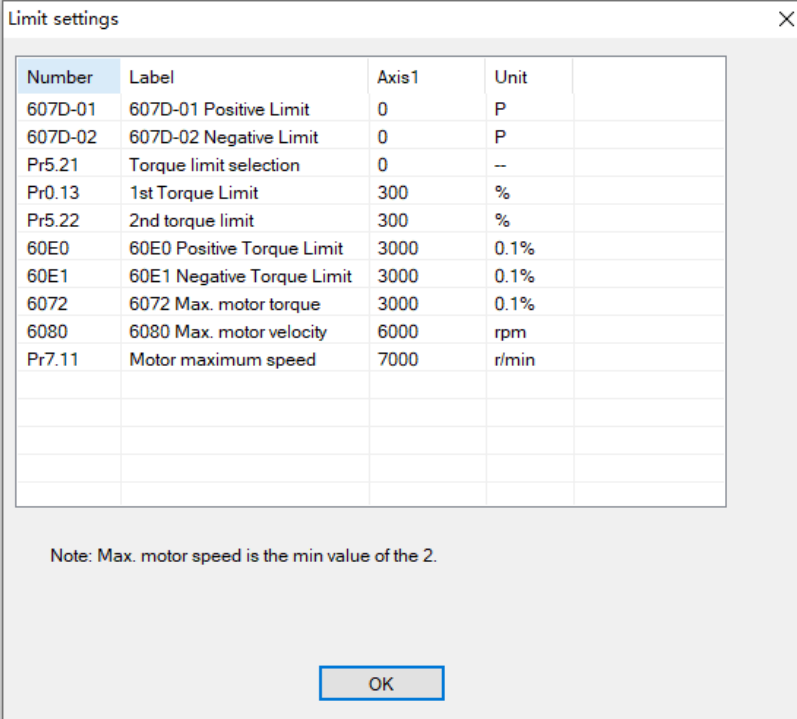


The Brake Setting dialog box includes a timing diagram and a table of parameters. The diagram shows the relationship between Servo on, Break, Hold, Release, and the delay times Pr4.37 and Pr4.38. The table below lists the parameters:

| Number | Label                                | Axis1        | Unit  |
|--------|--------------------------------------|--------------|-------|
| Pr4.37 | Motor power-off delay time           | 0            | ms    |
| Pr4.38 | Delay time for holding brake release | 0            | ms    |
| Pr4.39 | Holding brake activation speed       | 30           | r/min |
| -      | Holding brakeOutput                  | <--None-->   | -     |
| -      | Polarity                             | Normally ... | -     |

### Limits

To set up positional, torque and velocity limits. Max. motor speed is the min. value of limit set in Pr7.11 and 6080h.



The Limit settings dialog box contains a table of parameters and a note. The table lists various limit settings:

| Number  | Label                      | Axis1 | Unit  |
|---------|----------------------------|-------|-------|
| 607D-01 | 607D-01 Positive Limit     | 0     | P     |
| 607D-02 | 607D-02 Negative Limit     | 0     | P     |
| Pr5.21  | Torque limit selection     | 0     | --    |
| Pr0.13  | 1st Torque Limit           | 300   | %     |
| Pr5.22  | 2nd torque limit           | 300   | %     |
| 60E0    | 60E0 Positive Torque Limit | 3000  | 0.1%  |
| 60E1    | 60E1 Negative Torque Limit | 3000  | 0.1%  |
| 6072    | 6072 Max. motor torque     | 3000  | 0.1%  |
| 6080    | 6080 Max. motor velocity   | 6000  | rpm   |
| Pr7.11  | Motor maximum speed        | 7000  | r/min |

Note: Max. motor speed is the min value of the 2.

## Alarm limits

To set alarm threshold value (value which alarm occurs once exceeded).

Alarm threshold settings ×

| Number | Label   | Axis1 | Unit   |
|--------|---|-------|--------|
| Pr7.25 | Temperature setting for fan on                  | 50    | °C     |
| Pr7.27 | Driver over-temperature alarm threshold setting | 105   | °C     |
| Pr7.30 | Undervoltage threshold value                    | 140   | V      |
| Pr7.34 | Overvoltage threshold value                     | 400   | V      |
| Pr7.32 | Vent on threshold value settings                | 380   | V      |
| Pr0.16 | Regenerative resistance                         | 50    | Ω      |
| Pr0.17 | Regenerative resistor power rating              | 75    | W      |
| Pr7.35 | Relay control mode setting                      | 0     | --     |
| Pr7.36 | Relay close threshold value                     | 200   | V      |
| Pr0.14 | Excessive Position Deviation Settings           | 200   | 0.1rev |
|        |   |       |        |
|        |   |       |        |
|        |   |       |        |
|        |   |       |        |
|        |   |       |        |
|        |   |       |        |
|        |   |       |        |
|        |   |       |        |
|        |   |       |        |
|        |   |       |        |
|        |   |       |        |

Warning: Set these parameters under professional guidance!

## Electronic Gear Ratio

To set up Pulses per revolution or electronic gear ratio. Calculation formulas are provided.

Electronic Gear Ratio ×

Pulses Per Revolution 6092  P

Electronic Gear Ratio

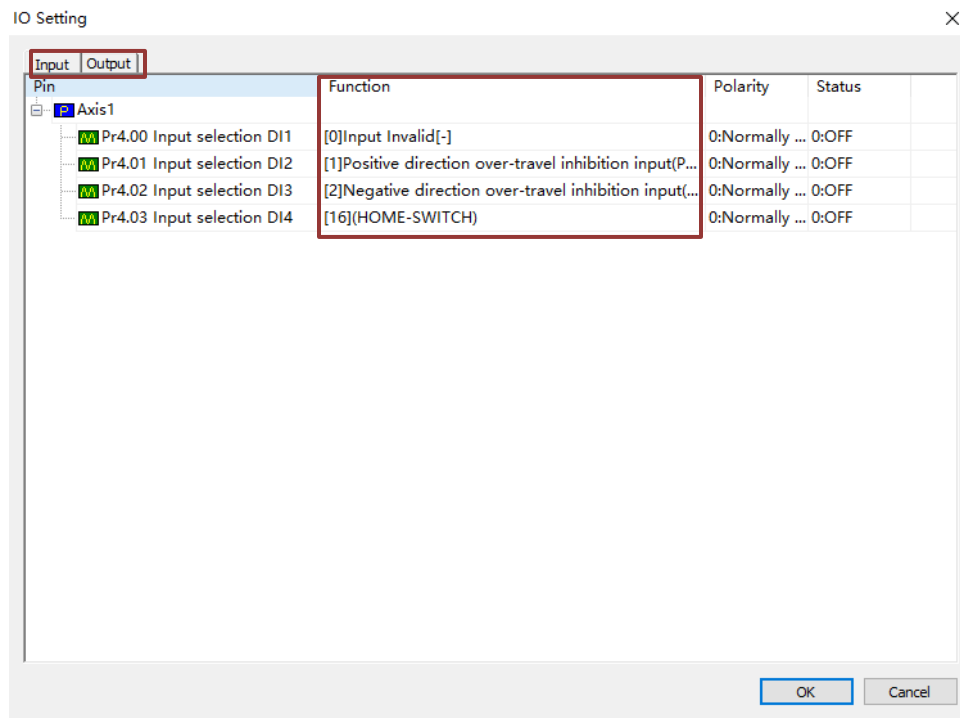
Numerator 6091-01   
 Denominator 6091-02

Lead screw transmission:  
Pulses per revolution = Screw lead/pulse equivalent

Gear transmission:  
Pulses per revolution = ( modulus\*number of pinion\*Helical Angle\*3.1415927)/(gear ratio\*pulse equivalent)

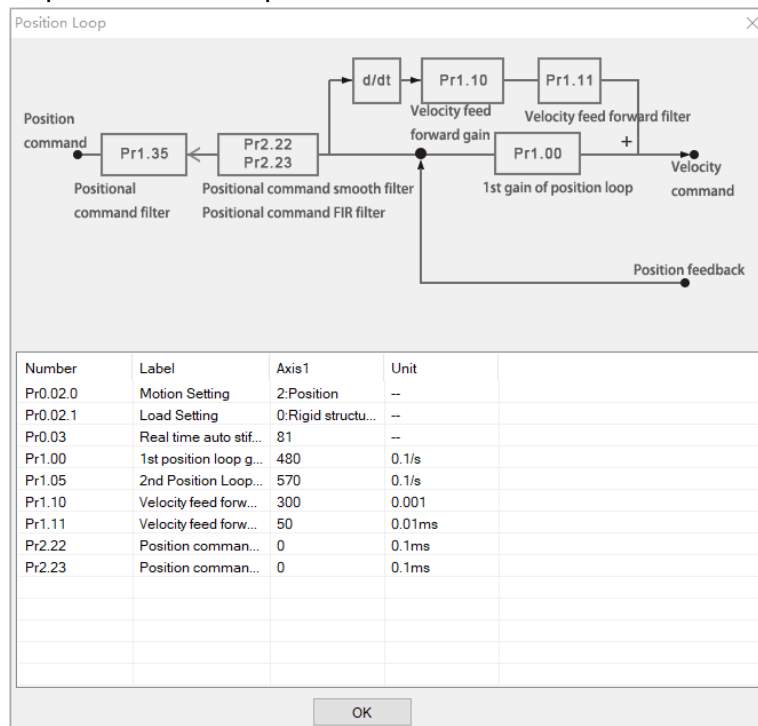
## IO Settings

DI/DO signals can be switched on the tab above. DI/DO signals for each channel can be assigned using the drop-down menu on each channel.



## Position loop

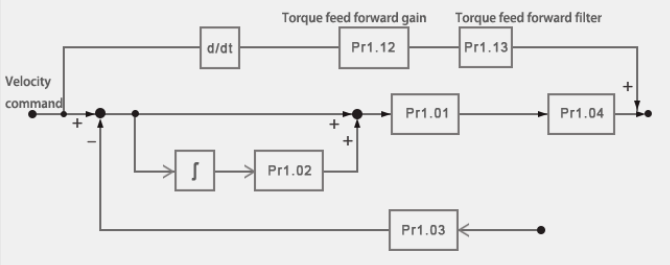
To set up position loop control related parameters.



## Velocity loop

To set up velocity loop control related parameters.

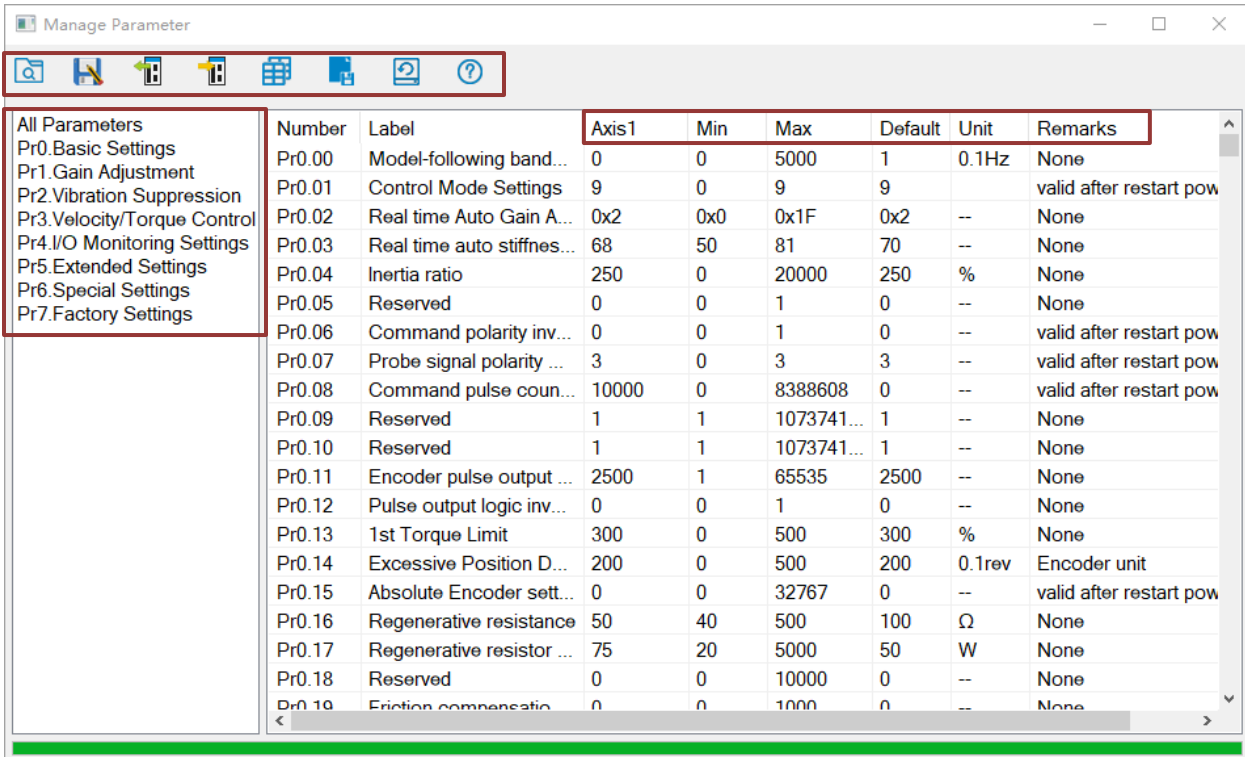
Velocity Loop
✕











| Number   | Label                            | Axis1          | Unit   |
|----------|----------------------------------|----------------|--------|
| Pr0.02.0 | Motion Setting                   | 2.Position     | --     |
| Pr0.02.1 | Load Setting                     | 0.Rigid str... | --     |
| Pr0.03   | Real time auto stiffness adj...  | 81             | --     |
| Pr0.04   | Inertia ratio                    | 250            | %      |
| Pr1.01   | 1st velocity loop gain           | 270            | 0.1Hz  |
| Pr1.02   | 1st Integral Time Constant ...   | 210            | 0.1ms  |
| Pr1.03   | 1st velocity detection filter    | 15             | --     |
| Pr1.12   | Torque feed forward gain         | 0              | 0.001  |
| Pr1.06   | 2nd velocity loop gain           | 270            | 0.1Hz  |
| Pr1.07   | 2nd Integral Time Constant...    | 10000          | 0.1ms  |
| Pr1.08   | 2nd velocity detection filter    | 15             | --     |
| Pr1.13   | Torque feed forward filter ti... | 0              | 0.01ms |

## Parameters List

All servo drive parameters are listed in the parameters list. Parameters will be of default value at initial use. Parameters are classified into different categories on the left panel. Please be aware of **recommended range** when modifying the value on **Axis** column and **remarks** of the parameters as some parameter modifications may require servo drive restart to be valid. Admin right may be required for certain parameters.




|                             | Number | Label                      | Axis1 | Min | Max        | Default | Unit   | Remarks                 |
|-----------------------------|--------|----------------------------|-------|-----|------------|---------|--------|-------------------------|
| All Parameters              | Pr0.00 | Model-following band...    | 0     | 0   | 5000       | 1       | 0.1Hz  | None                    |
| Pr0.Basic Settings          | Pr0.01 | Control Mode Settings      | 9     | 0   | 9          | 9       | --     | valid after restart pow |
| Pr1.Gain Adjustment         | Pr0.02 | Real time Auto Gain A...   | 0x2   | 0x0 | 0x1F       | 0x2     | --     | None                    |
| Pr2.Vibration Suppression   | Pr0.03 | Real time auto stiffnes... | 68    | 50  | 81         | 70      | --     | None                    |
| Pr3.Velocity/Torque Control | Pr0.04 | Inertia ratio              | 250   | 0   | 20000      | 250     | %      | None                    |
| Pr4.I/O Monitoring Settings | Pr0.05 | Reserved                   | 0     | 0   | 1          | 0       | --     | None                    |
| Pr5.Extended Settings       | Pr0.06 | Command polarity inv...    | 0     | 0   | 1          | 0       | --     | valid after restart pow |
| Pr6.Special Settings        | Pr0.07 | Probe signal polarity ...  | 3     | 0   | 3          | 3       | --     | valid after restart pow |
| Pr7.Factory Settings        | Pr0.08 | Command pulse coun...      | 10000 | 0   | 8388608    | 0       | --     | valid after restart pow |
|                             | Pr0.09 | Reserved                   | 1     | 1   | 1073741... | 1       | --     | None                    |
|                             | Pr0.10 | Reserved                   | 1     | 1   | 1073741... | 1       | --     | None                    |
|                             | Pr0.11 | Encoder pulse output ...   | 2500  | 1   | 65535      | 2500    | --     | None                    |
|                             | Pr0.12 | Pulse output logic inv...  | 0     | 0   | 1          | 0       | --     | None                    |
|                             | Pr0.13 | 1st Torque Limit           | 300   | 0   | 500        | 300     | %      | None                    |
|                             | Pr0.14 | Excessive Position D...    | 200   | 0   | 500        | 200     | 0.1rev | Encoder unit            |
|                             | Pr0.15 | Absolute Encoder sett...   | 0     | 0   | 32767      | 0       | --     | valid after restart pow |
|                             | Pr0.16 | Regenerative resistance    | 50    | 40  | 500        | 100     | Ω      | None                    |
|                             | Pr0.17 | Regenerative resistor ...  | 75    | 20  | 5000       | 50      | W      | None                    |
|                             | Pr0.18 | Reserved                   | 0     | 0   | 10000      | 0       | --     | None                    |
|                             | Pr0.19 | Friction compensatio       | 0     | 0   | 1000       | 0       | --     | None                    |

|   |                             |   |
|---|-----------------------------|---|
|  | <b>Read parameter files</b> | Read parameter settings save on PC (.Isr files)   |
|  | <b>Save parameters</b>      | Save current parameter files as .Isr files. Recommended to back up parameter settings before any modification.            |
|  | <b>Read from driver</b>     | Read parameter settings from driver   |
|  | <b>Write to driver</b>      | Write parameters to drivers.  |
|  | <b>Compare parameters*</b>  | Parameters comparison can be made between current parameter settings, saved parameter files and parameter default values. |
|  | <b>Save to driver</b>       | Save parameters into drivers.   |
|  | <b>Factory reset</b>        | Restore all parameters back to factory default  |
|  | <b>Help</b>                 | Parameters description can be found in Motion Studio User Manual  |

## Compare parameter



Parameter values can be compared by clicking on  in Parameters List. “Compare Parameters” window will appear with option to set up parameter 1 and 2 for comparison. Parameters between different axes can also be compared.

Compare parameters
×

Parameter 1 Current Parameter ▾

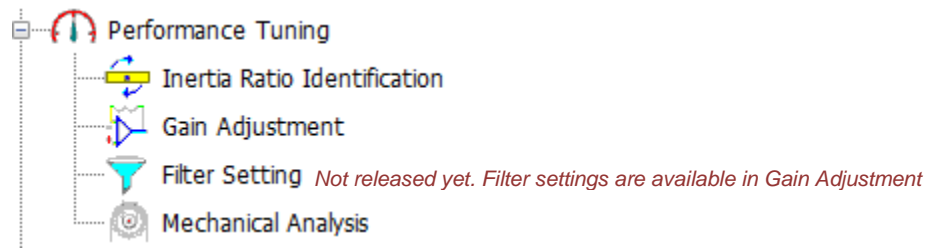
Parameter 2 Default ▾

Show Axis1 ▾  Compare axis parameters

Compare

| Axis | Parameter Type | Label                          | Parameter Value 1 | Parameter Value 2 |
|------|----------------|--------------------------------|-------------------|-------------------|
| 1    | Pr0.00         | Model-following bandwidth      | 0                 | 1                 |
| 1    | Pr0.03         | Real time auto stiffness ad... | 68                | 70                |
| 1    | Pr0.08         | Command pulse counts p...      | 10000             | 0                 |
| 1    | Pr0.16         | Regenerative resistance        | 50                | 100               |
| 1    | Pr0.17         | Regenerative resistor pow...   | 75                | 50                |
| 1    | Pr1.00         | 1st position loop gain         | 480               | 320               |
| 1    | Pr1.01         | 1st velocity loop gain         | 270               | 180               |
| 1    | Pr1.02         | 1st Integral Time Constant ... | 210               | 310               |
| 1    | Pr1.04         | 1st Torque Filter Time Con...  | 84                | 126               |
| 1    | Pr1.05         | 2nd Position Loop Gain         | 570               | 380               |
| 1    | Pr1.06         | 2nd velocity loop gain         | 270               | 180               |
| 1    | Pr1.09         | 2nd Torque Filter Time Co...   | 84                | 126               |
| 1    | Pr2.01         | 1st notch frequency            | 2000              | 4000              |
| 1    | Pr2.04         | 2nd notch frequency            | 2000              | 4000              |
| 1    | Pr2.07         | 3rd notch frequency            | 2000              | 4000              |
| 1    | Pr3.12         | Acceleration time settings     | 100               | 0                 |
| 1    | Pr3.13         | Deceleration time settings     | 100               | 0                 |
| 1    | Pr4.11         | Output selection DO2           | 0x2               | 0x3               |

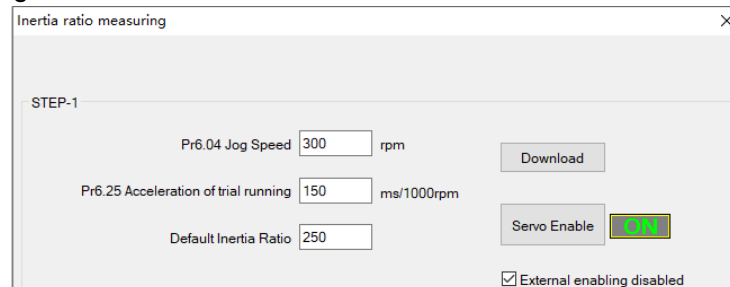
## Performance Tuning



### Inertia Ratio Identification

Inertia ratio of the servo product can be automatically identified using “Inertia Ratio Identification”. It is a step-by-step guided operation for performance tuning.

1. Set trial run velocity Pr6.04 and trial run acceleration Pr6.25, click on ‘Download’ to modify parameters. It is recommended to leave the parameters at default values. Then, Tick “External enabling disabled” and click on “Servo on” to enable the servo drive.

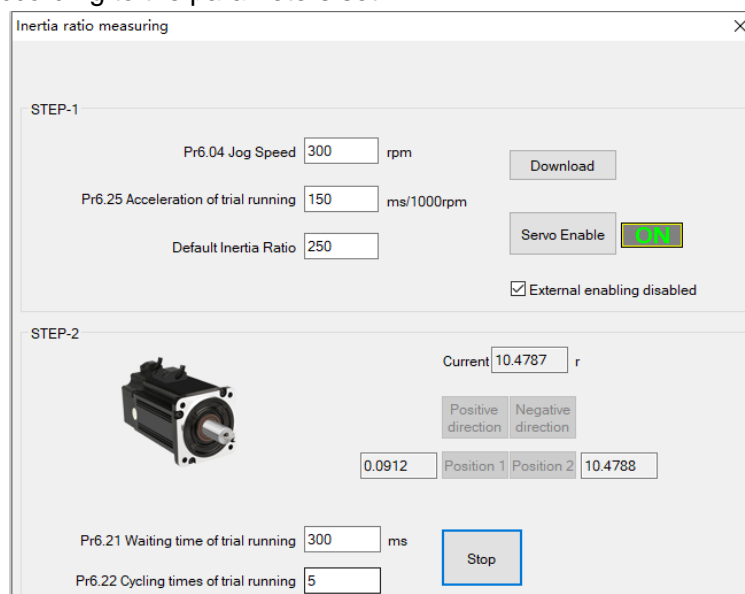


The screenshot shows the 'Inertia ratio measuring' dialog box, Step 1. The parameters are:

- Pr6.04 Jog Speed: 300 rpm
- Pr6.25 Acceleration of trial running: 150 ms/1000rpm
- Default Inertia Ratio: 250

Buttons include 'Download', 'Servo Enable' (ON), and a checked checkbox for 'External enabling disabled'.

2. Click and hold “Positive direction” to start the motor. Current position will show motor position. Click on POS 1 to save current position as starting point. Click and hold “Negative direction” to start the motor again. Click on POS 2 to save current position as ending point. Then, Set the waiting time between each cycle in Pr6.21 and no. of cycles in Pr6.22. Click on ‘Run’ and motor will run according to the parameters set.





The screenshot shows the 'Inertia ratio measuring' dialog box, Step 2. The parameters are:

- Pr6.04 Jog Speed: 300 rpm
- Pr6.25 Acceleration of trial running: 150 ms/1000rpm
- Default Inertia Ratio: 250

Buttons include 'Download', 'Servo Enable' (ON), and a checked checkbox for 'External enabling disabled'.

STEP-2 shows a motor icon, 'Current' 10.4787 r, 'Positive direction' and 'Negative direction' buttons, 'Position 1' 0.0912 and 'Position 2' 10.4788, 'Pr6.21 Waiting time of trial running' 300 ms, and 'Pr6.22 Cycling times of trial running' 5. A 'Stop' button is also present.

- After the calculation is done, inertia ratio will be calculated automatically and click on 'Write' to enter the calculated value into Pr0.04. Click on "  " to enter Parameters List to check or modify Pr0.04. Then, click on "  " to save parameters to driver.

**Inertia ratio measuring** ✕

---

**STEP-1**


Pr6.04 Jog Speed  rpm Download

Pr6.25 Acceleration of trial running  ms/1000rpm Servo Enable

Default Inertia Ratio   External enabling disabled

---

**STEP-2**



Current  r

Positive direction  Negative direction

Position 1  Position 2

Pr6.21 Waiting time of trial running  ms

Pr6.22 Cycling times of trial running

---

**STEP-3**

Inertia Ratio

*Please take note:*

- Trial run velocity and distance should be optimal to prevent any axis from bumping into objects.*
- It is recommended to move only in 1 direction for vertically mounted axis. Take precaution before moving the axis.*
- For applications with higher frictional drag, please set a minimal travel distance.*



## Gain Adjustment

Gain adjustment can be done automatically or manually. There are options for easy adjustments such as Single Parameter Tuning or One-click Tuning. Please refer to related AC servo drive series user manual for details on gain adjustment. Step-by-step guide to gain adjustment of different modes are available in product user manual. This section is only for introduction to gain and filter parameters tuning interface. Parameters descriptions are available in Help.

Gain Adjustment
✕

Gain Config

Filter Config

| Number   | Label                   | Axis1              | Unit   |  |
|----------|-------------------------|--------------------|--------|--|
| Pr0.02.0 | Motion Setting          | 2:Position         | --     |  |
| Pr0.02.1 | Load Setting            | 0:Rigid structu... | --     |  |
| Pr0.03   | Real time auto stif...  |                    | --     |  |
| Pr1.00   | 1st position loop g...  | 480                | 0.1/s  |  |
| Pr1.01   | 1st velocity loop g...  | 270                | 0.1Hz  |  |
| Pr1.02   | 1st Integral Time ...   | 210                | 0.1ms  |  |
| Pr1.03   | 1st velocity detecti... | 15                 | --     |  |
| Pr1.04   | 1st Torque Filter T...  | 84                 | 0.01ms |  |
| Pr1.05   | 2nd Position Loop...    | 570                | 0.1/s  |  |
| Pr1.06   | 2nd velocity loop ...   | 270                | 0.1Hz  |  |
| Pr1.07   | 2nd Integral Time ...   | 10000              | 0.1ms  |  |

Notch Filter

Vibration Filter

| Number | Label                  | Axis1             | Unit |  |
|--------|------------------------|-------------------|------|--|
| Pr2.00 | Adaptive filtering ... | 0:Disable auto... | --   |  |
| Pr2.01 | 1st notch frequency    | 2000              | Hz   |  |
| Pr2.02 | 1st notch bandwid...   | 2                 | --   |  |
| Pr2.03 | 1st notch depth se...  | 0                 | --   |  |
| Pr2.04 | 2nd notch frequen...   | 2000              | Hz   |  |
| Pr2.05 | 2nd notch bandwi...    | 2                 | --   |  |
| Pr2.06 | 2nd notch depth s...   | 0                 | --   |  |
| Pr2.07 | 3rd notch frequency    | 2000              | Hz   |  |
| Pr2.08 | 3rd notch bandwi...    | 2                 | --   |  |

Pr0.01 Control mode

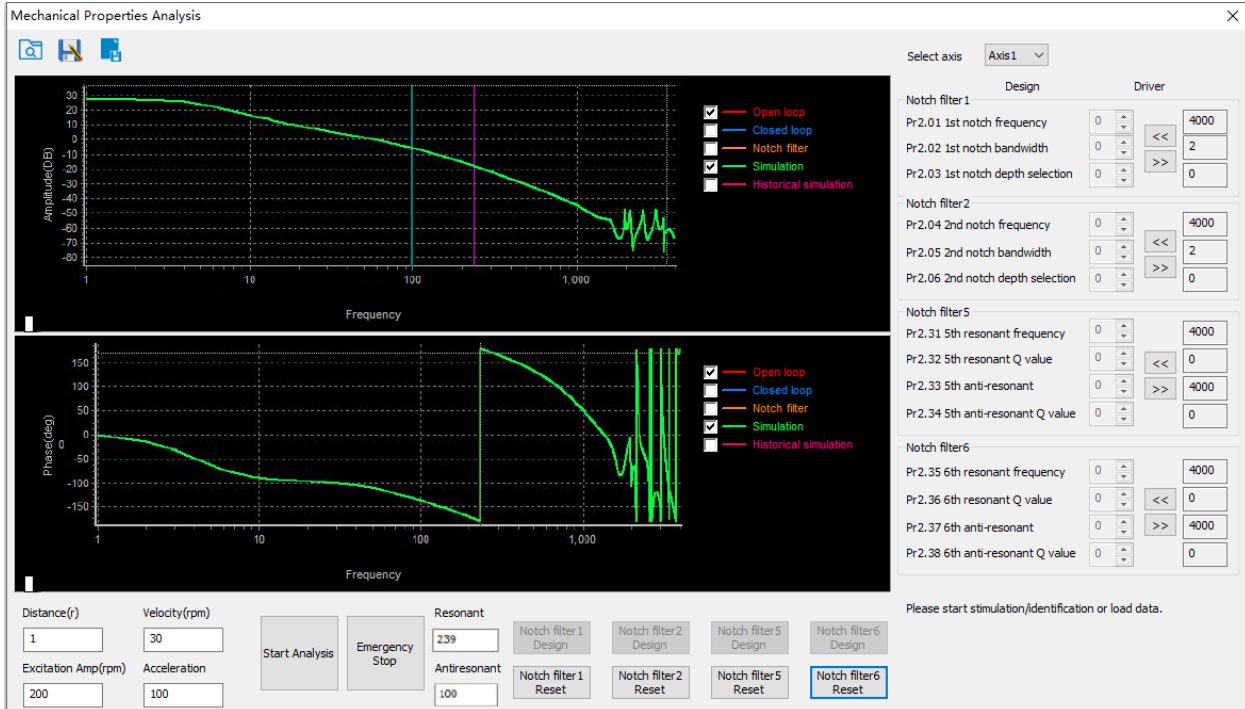
9:EtherCAT

Pr0.04 Inertia ratio

Click on "OK" to save modified parameters.

## Mechanical Analysis

To determine mechanical and set up notch filter parameters to suppress vibration caused by resonance.



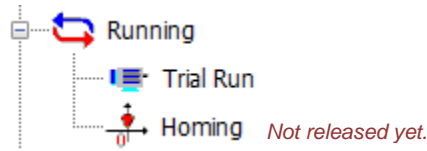
The screenshot displays the 'Mechanical Properties Analysis' window. It features two main plots: 'Amplitude (DB)' vs 'Frequency' and 'Phase (deg)' vs 'Frequency'. The Amplitude plot shows a resonance peak at approximately 239 Hz. The Phase plot shows a corresponding phase shift. A legend on the right of each plot identifies 'Open loop', 'Closed loop', 'Notch filter', 'Simulation', and 'Historical simulation'. Below the plots are input fields for Distance (r), Velocity (rpm), Excitation Amp (rpm), and Acceleration. There are also buttons for 'Start Analysis', 'Emergency Stop', 'Resonant', 'Antiresonant', and 'Notch filter' Design/Reset for filters 1, 2, 5, and 6. On the right side, a 'Design' panel allows configuring parameters for Notch filter 1, 2, 5, and 6, including notch frequency, bandwidth, and depth selection, with corresponding 'Driver' values.

To avoid strong vibration, please first set lower excitation amplitude. However, if the set value is too low, data waveform will include some degree of distortion.

If vibration occurs during tests which can't be reduce through lowering electrical current excitation, it might be due to excessive gain. Please lower velocity gain and set notch filter as accordance from the mechanical properties analysis. Or might be due to inertia settings (Pr.0.04) is too large, please use optimal inertia ratio value.

Click on "Start" to start mechanical properties analysis. Click on Notch Filter Design to get the identified notch filter settings. Use the arrow keys on the right panel to save the parameters to driver. Notch filter 1 and 2 is available on all servo drive models while notch filter 5 and 6 is model dependent. All analysis can be saved and read as .mch files.

## Running



### Trial Run

To test run servo products after successfully connected to Motion Studio and initial setup is done. Main power supply and motor/encoder cable need to be connected to use this function.

×

Position

**Setting** 1

|                                      |     |            |
|--------------------------------------|-----|------------|
| Pr6.04 Jog Speed                     | 300 | rpm        |
| Pr6.25 Acceleration of trial running | 150 | ms/1000rpm |
| Pr0.04 Inertia ratio                 | 250 |            |

<< Expand


Press enter to modify parameters

Servo Enable

ON

External enabling disabled

Current Position  r



Positive  
direction

Negative  
direction

Position 1

Position 2

10.4785

10.4785

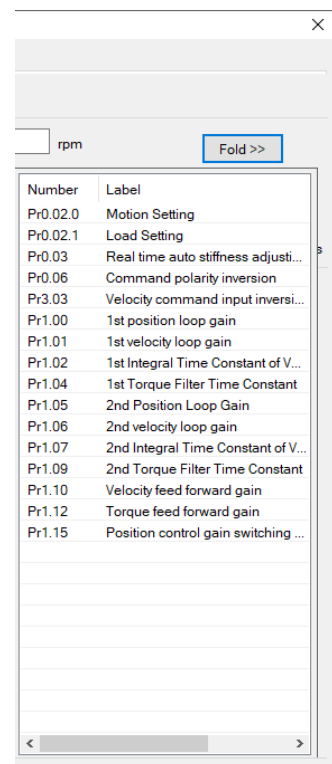
Pr6.21 Waiting time of trial running  ms

Run

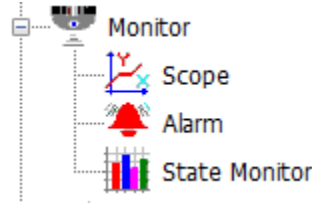
Pr6.22 Cycling times of trial running

1. Set jog velocity and acceleration. If unsure, leave both at default value. Press enter for modification of parameters to be valid.
2. Enable servo drive by clicking Servo Enable. **ON** indicates servo drive and motor are enabled.
3. Click and hold “Positive Direction” or “Negative Direction” for motor to rotate in desired direction. Click on Position 1 and Position 2 to set current point as starting and ending point of trial run. It is recommended to have at least 10r (10 revolutions) between Position 1 and 2
4. Set Pr6.21 for the time interval between each cycle and no. of cycles of the trial run.
5. Click on “Run” to start the motor. Click on “Stop” to stop the motor or motor will stop after completing the no. of cycles set.

*Other related parameters can be found on the right after clicking on “Expand”. Servo drive needs to be enabled. Click on “Fold” to retract these parameters when not needed.*

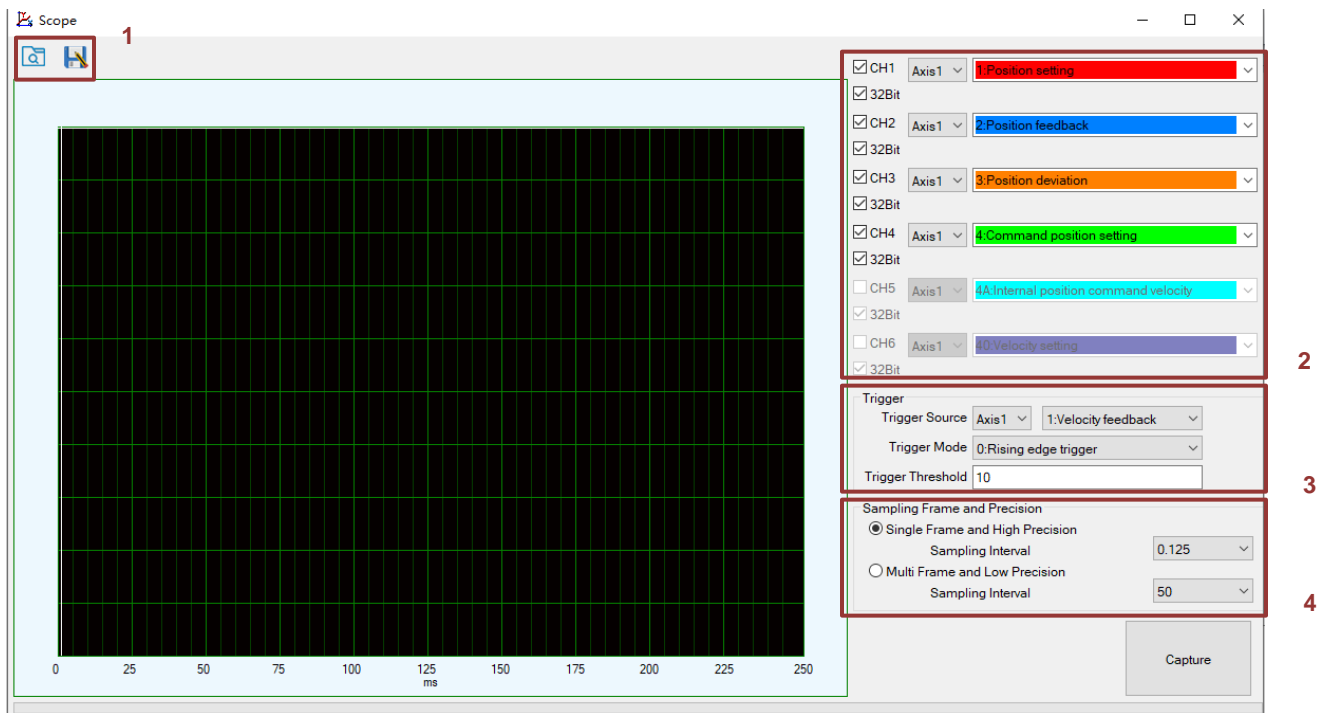


## Monitor



### Scope

To read or save captured data in waveform. Multiple different data of servo drives can be monitored using scope.



|   |  |
|---|--|
| ① | To read saved waveform files (.csv)  To save captured waveform as .csv file. |
| ② | Can monitor up to 6 variables at the same time (Servo drive model dependent) |
| ③ | Set trigger source, mode and conditions for waveform capturing to start      |
| ④ | Set sampling size and its precision according to user's needs.               |

## Alarm

To check error messages, causes and recommended solutions. Clear alarm after handling the error successfully. Historical records of alarms can also be found in this function. Alarms related to motor stops rotating is highlighted in different for users to easy detect the cause of error(s), solve the error and return axis to normal operational status.

*Please make sure to handle alarm as recommended before clearing*

| Device | Alarm Code | Alarm label                   | Clearable | Error Level |
|--------|------------|-------------------------------|-----------|-------------|
| Axis1  | Err0D2     | No main power supply detected | Yes       | 2           |

*Click on the error in this list to get error analysis on the table below*

Clear

**Error Analysis**

| ID | Cause                | Check                            | Handle  |
|----|----------------------|----------------------------------|---|
| 1  | No main power supply | Verify L1.L2.L3 terminal voltage | 1. Increase main power supply voltage ; 2. Secure conn... |

**Error Diagnostic**

| ID | Label | Value |
|----|-------|-------|
|----|-------|-------|

*Error report can be generated and saved as .csv file.*

Generate Report

| Alarm Code | Alarm label |
|------------|-------------|
| Err000     | No alarm    |
| Err000     | No alarm    |
| Err000     | No alarm    |
| Err000     | No alarm    |
| Err000     | No alarm    |
| Err000     | No alarm    |
| Err000     | No alarm    |
| Err000     | No alarm    |
| Err000     | No alarm    |
| Err000     | No alarm    |
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| Err000     | No alarm    |
| Err000     | No alarm    |
| Err000     | No alarm    |
| Err000     | No alarm    |
| Err000     | No alarm    |
| Err000     | No alarm    |
| Err000     | No alarm    |

Alarm historical record

| ID | Label   | Value |
|----|---|-------|
| 0  | Downtime(s)                                   | NULL  |
| 1  | Position command velocity(rpm)                | NULL  |
| 2  | Relative position deviation(P)                | NULL  |
| 3  | Velocity setting(rpm)                         | NULL  |
| 4  | Motor velocity(rpm)                           | NULL  |
| 5  | Motor torque(0.1%)                            | NULL  |
| 6  | U/A phase current(0.1%)                       | NULL  |
| 7  | W/B phase current(0.1%)                       | NULL  |
| 8  | DC bus voltage(V)                             | NULL  |
| 9  | Driver/MCU temperature(°C)                    | NULL  |
| 10 | Command position(P)                           | NULL  |
| 11 | Feedback position(P)                          | NULL  |
| 12 | Encoder error count(Time)                     | NULL  |
| 13 | Max. motor current under 2s(0.1%)             | NULL  |
| 14 | Motor overload ratio(%)                       | NULL  |
| 15 | Regenerative resistor overload ratio(%)       | NULL  |
| 16 | Internal status                               | NULL  |
| 17 | Input status                                  | NULL  |
| 18 | Output status                                 | NULL  |
| 19 | Encoder status                                | NULL  |
| 20 | 6040&6041(Control word& status word)          | NULL  |
| 21 | 6060&6061(Operation mode selection & display) | NULL  |
| 22 | 607A (Target position)                        | NULL  |
|    | 6064 (Actual position feedback)               | NULL  |

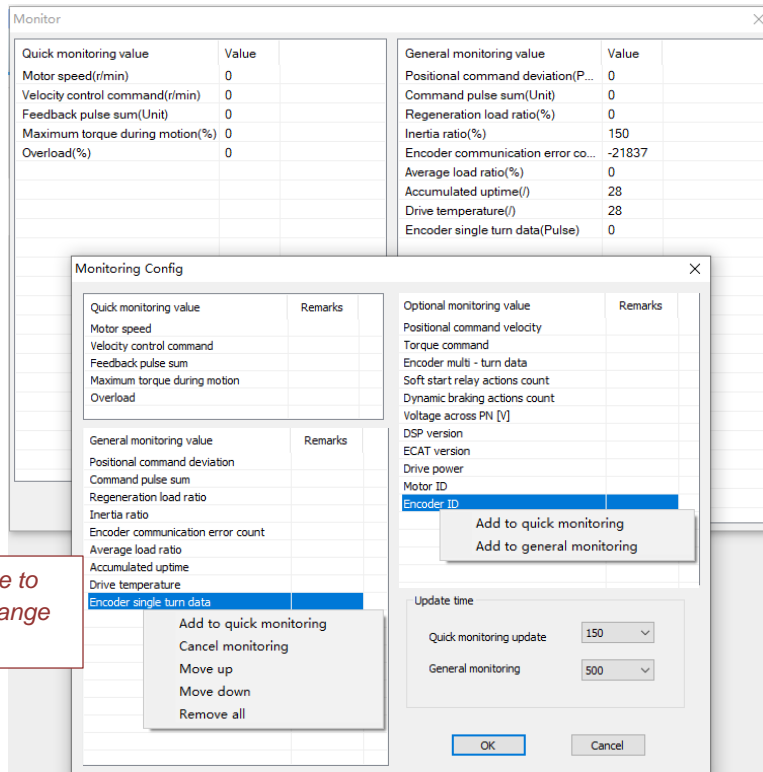
Data record when alarm occurs

## State Monitor

The difference between short interval monitoring and general monitoring is the data sampling time interval. All data/variables can be added or removed from each monitoring list and the time intervals can be modified according to users' needs.

**Short Interval monitoring:** Sampling time interval of 50-200ms per cycle.

**General monitoring:** Sampling time interval 300ms up to 5000ms per cycle.



| Quick monitoring value          | Value |
|---------------------------------|-------|
| Motor speed(r/min)              | 0     |
| Velocity control command(r/min) | 0     |
| Feedback pulse sum(Unit)        | 0     |
| Maximum torque during motion(%) | 0     |
| Overload(%)                     | 0     |

| General monitoring value          | Value  |
|-----------------------------------|--------|
| Positional command deviation(P... | 0      |
| Command pulse sum(Unit)           | 0      |
| Regeneration load ratio(%)        | 0      |
| Inertia ratio(%)                  | 150    |
| Encoder communication error co... | -21837 |
| Average load ratio(%)             | 0      |
| Accumulated uptime(/)             | 28     |
| Drive temperature(/)              | 28     |
| Encoder single turn data(Pulse)   | 0      |

| Quick monitoring value       | Remarks |
|------------------------------|---------|
| Motor speed                  |         |
| Velocity control command     |         |
| Feedback pulse sum           |         |
| Maximum torque during motion |         |
| Overload                     |         |

| General monitoring value          | Remarks |
|-----------------------------------|---------|
| Positional command deviation      |         |
| Command pulse sum                 |         |
| Regeneration load ratio           |         |
| Inertia ratio                     |         |
| Encoder communication error count |         |
| Average load ratio                |         |
| Accumulated uptime                |         |
| Drive temperature                 |         |
| Encoder single turn data          |         |

| Optional monitoring value      | Remarks |
|--------------------------------|---------|
| Positional command velocity    |         |
| Torque command                 |         |
| Encoder multi - turn data      |         |
| Soft start relay actions count |         |
| Dynamic braking actions count  |         |
| Voltage across PN [V]          |         |
| DSP version                    |         |
| ECAT version                   |         |
| Drive power                    |         |
| Motor ID                       |         |
| Encoder ID                     |         |

Add to quick monitoring  
Cancel monitoring  
Move up  
Move down  
Remove all

Add to quick monitoring  
Add to general monitoring

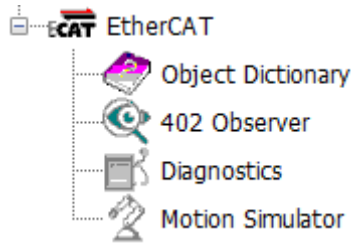
Update time  
Quick monitoring update: 150  
General monitoring: 500

*Add variables to required monitoring mode*

*Right click on variable to add, remove or rearrange variables in the list*

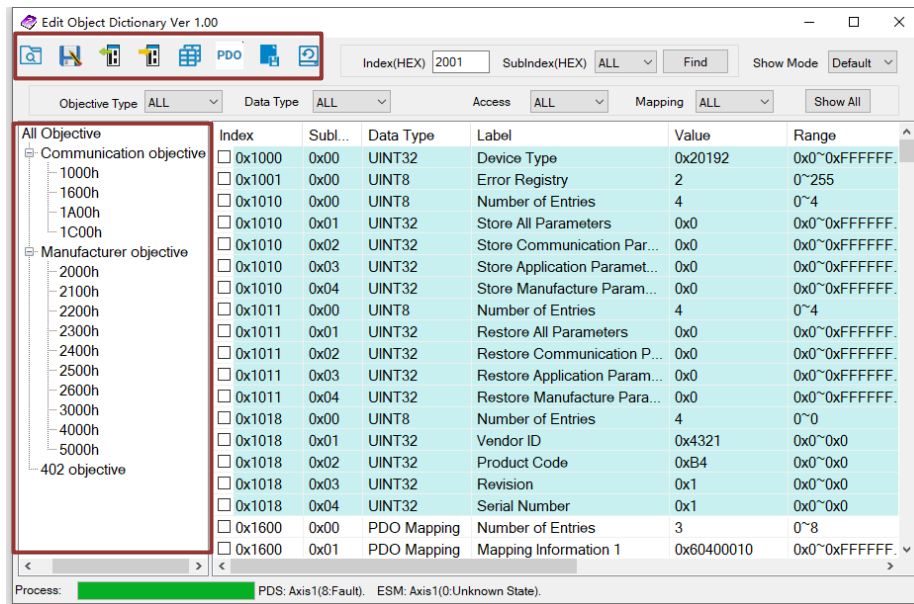
*Set sampling time interval for 2 different modes*









## EtherCAT



### Object Dictionary

To edit Object Dictionary. Descriptions can be found in Parameters Guide. Object categories can be found on the left panel. Objects can be filtered to make locating specific object easier.



|   |                           |   |
|---|---------------------------|---|
|  | <b>Read object files</b>  | Read object settings save on PC (.obd files)  |
|  | <b>Save objects</b>       | Save current object files as .obd files. Recommended to back up object settings before any modification.      |
|  | <b>Read from driver</b>   | Read object settings from driver  |
|  | <b>Write to driver</b>    | Write objects to drivers.   |
|  | <b>Compare objects</b>    | Objects comparison can be made between current object settings, saved object files and object default values. |
|  | <b>PDO configuration*</b> | To modify Process Data Objects  |
|  | <b>Save to driver</b>     | Save objects into drivers.  |
|  | <b>Factory reset</b>      | Restore all objects back to factory default   |



## PDO configuration

PDO Configuration

Receive PDO | Transmit PDO | SDO

| Label   | Index  | SubIndex | Bit length |
|---|--------|----------|------------|
| <input checked="" type="checkbox"/> Receive PDO 1   | 0x1600 | 0x00     |            |
| <input checked="" type="checkbox"/> Control Word    | 0x6040 | 0x00     | 16         |
| <input checked="" type="checkbox"/> Target Position | 0x607A | 0x00     | 32         |
| <input checked="" type="checkbox"/> Probe Function  | 0x60B8 | 0x00     | 16         |
| <input type="checkbox"/> Receive PDO 2              | 0x1601 | 0x00     |            |
| <input type="checkbox"/> Control Word               | 0x6040 | 0x00     | 16         |
| <input type="checkbox"/> Target Position            | 0x607A | 0x00     | 32         |
| <input type="checkbox"/> Profile Velocity           | 0x6081 | 0x00     | 32         |
| <input type="checkbox"/> Profile Acceleration       | 0x6083 | 0x00     | 32         |
| <input type="checkbox"/> Profile Deceleration       | 0x6084 | 0x00     | 32         |
| <input type="checkbox"/> Operation Mode             | 0x6060 | 0x00     | 8          |
| <input type="checkbox"/> Receive PDO 3              | 0x1602 | 0x00     |            |
| <input type="checkbox"/> Control Word               | 0x6040 | 0x00     | 16         |
| <input type="checkbox"/> Target Velocity            | 0x60FF | 0x00     | 32         |
| <input type="checkbox"/> Profile Acceleration       | 0x6083 | 0x00     | 32         |
| <input type="checkbox"/> Profile Deceleration       | 0x6084 | 0x00     | 32         |
| <input type="checkbox"/> Operation Mode             | 0x6060 | 0x00     | 8          |
| <input type="checkbox"/> Receive PDO 4              | 0x1603 | 0x00     |            |
| <input type="checkbox"/> Control Word               | 0x6040 | 0x00     | 16         |
| <input type="checkbox"/> Homing Method              | 0x6098 | 0x00     | 8          |
| <input type="checkbox"/> Limit Switch Velocity      | 0x6099 | 0x01     | 32         |
| <input type="checkbox"/> Homing Velocity            | 0x6099 | 0x02     | 32         |
| <input type="checkbox"/> Homing Acceleration        | 0x609A | 0x00     | 32         |
| <input type="checkbox"/> Home Offset                | 0x607C | 0x00     | 32         |
| <input type="checkbox"/> Operation Mode             | 0x6060 | 0x00     | 8          |

Tip: Double click to edit PDO

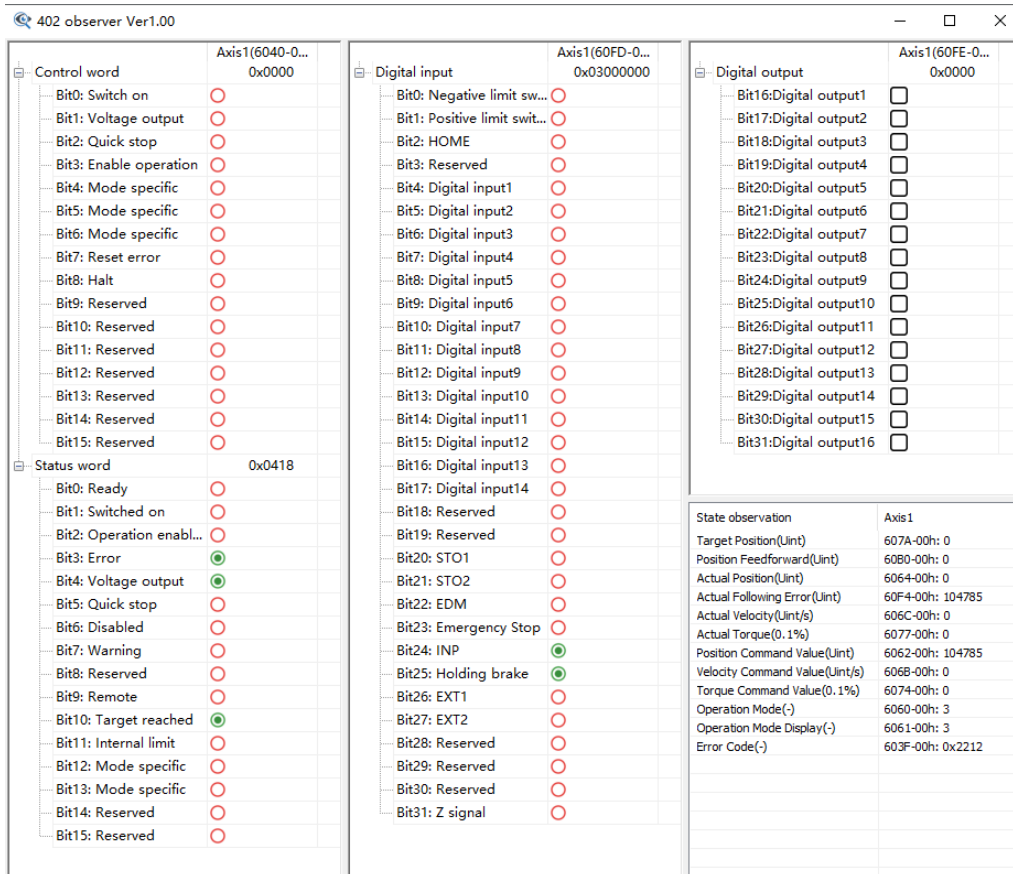
PDO Configuration

Receive PDO | Transmit PDO | SDO

| ID | Index : SubIndex | Label                 | Value      | Bit le... |
|----|------------------|-----------------------|------------|-----------|
| 1  | 0x1600 - 0x01    | Mapping Information 1 | 0x60400010 | 32        |
| 2  | 0x1600 - 0x02    | Mapping Information 2 | 0x607A0020 | 32        |
| 3  | 0x1600 - 0x03    | Mapping Information 3 | 0x60B80010 | 32        |
| 4  | 0x1600 - 0x00    | Number of Entries     | 3          | 32        |
| 5  | 0x1601 - 0x01    | Mapping Information 1 | 0x60400010 | 32        |
| 6  | 0x1601 - 0x02    | Mapping Information 2 | 0x607A0020 | 32        |
| 7  | 0x1601 - 0x03    | Mapping Information 3 | 0x60810020 | 32        |
| 8  | 0x1601 - 0x04    | Mapping Information 4 | 0x60830020 | 32        |
| 9  | 0x1601 - 0x05    | Mapping Information 5 | 0x60840020 | 32        |
| 10 | 0x1601 - 0x06    | Mapping Information 6 | 0x60600008 | 32        |
| 11 | 0x1601 - 0x00    | Number of Entries     | 6          | 32        |
| 12 | 0x1602 - 0x01    | Mapping Information 1 | 0x60400010 | 32        |
| 13 | 0x1602 - 0x02    | Mapping Information 2 | 0x60FF0020 | 32        |
| 14 | 0x1602 - 0x03    | Mapping Information 3 | 0x60830020 | 32        |
| 15 | 0x1602 - 0x04    | Mapping Information 4 | 0x60840020 | 32        |
| 16 | 0x1602 - 0x05    | Mapping Information 5 | 0x60600008 | 32        |
| 17 | 0x1602 - 0x00    | Number of Entries     | 5          | 32        |
| 18 | 0x1603 - 0x01    | Mapping Information 1 | 0x60400010 | 32        |
| 19 | 0x1603 - 0x02    | Mapping Information 2 | 0x60980008 | 32        |
| 20 | 0x1603 - 0x03    | Mapping Information 3 | 0x6099120  | 32        |
| 21 | 0x1603 - 0x04    | Mapping Information 4 | 0x6099220  | 32        |
| 22 | 0x1603 - 0x05    | Mapping Information 5 | 0x609A0020 | 32        |
| 23 | 0x1603 - 0x06    | Mapping Information 6 | 0x607C0020 | 32        |
| 24 | 0x1603 - 0x07    | Mapping Information 7 | 0x60600008 | 32        |
| 25 | 0x1603 - 0x00    | Number of Entries     | 7          | 32        |
| 26 | 0x1A00 - 0x01    | Mapping Information 1 | 0x603F0010 | 32        |
| 27 | 0x1A00 - 0x02    | Mapping Information 2 | 0x60410010 | 32        |
| 28 | 0x1A00 - 0x03    | Mapping Information 3 | 0x60610008 | 32        |
| 29 | 0x1A00 - 0x04    | Mapping Information 4 | 0x60640020 | 32        |
| 30 | 0x1A00 - 0x05    | Mapping Information 5 | 0x60B90010 | 32        |
| 31 | 0x1A00 - 0x06    | Mapping Information 6 | 0x60BA0020 | 32        |
| 32 | 0x1A00 - 0x07    | Mapping Information 7 | 0x60FD0020 | 32        |
| 33 | 0x1A00 - 0x00    | Number of Entries     | 7          | 32        |
| 34 | 0x1A01 - 0x00    | Number of Entries     | 0          | 32        |
| 35 | 0x1C12 - 0x01    | SM2 PDO Mapping 0     | 0x1600     | 16        |
| 36 | 0x1C12 - 0x00    | Number of Entries     | 1          | 8         |

## 402 observer

To monitor control/status word and DI/DO state



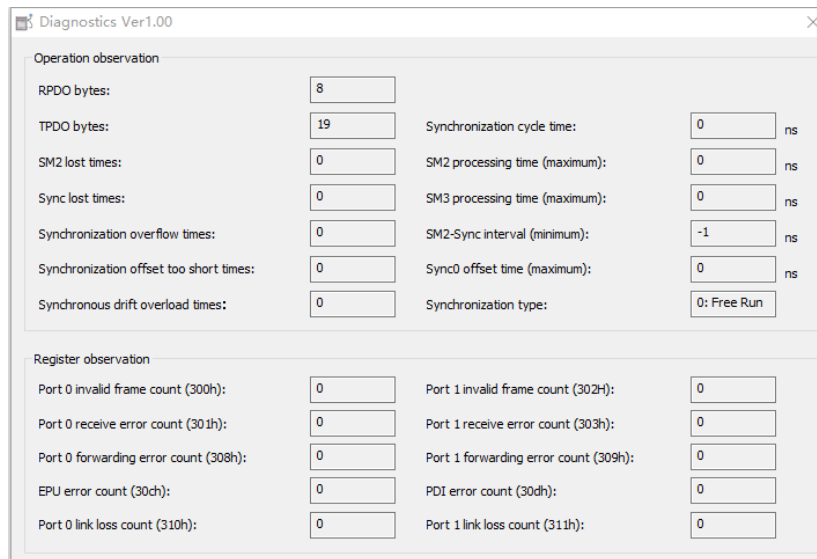
The screenshot displays the '402 observer Ver1.00' window, which is divided into several sections for monitoring Axis1 (6040-0...).

- Control word (0x0000):** A list of 16 bits. Bit 4 (Mode specific) and Bit 15 (Reserved) are currently active (indicated by red circles).
- Status word (0x0418):** A list of 16 bits. Bit 3 (Error), Bit 4 (Voltage output), Bit 10 (Target reached), and Bit 25 (Holding brake) are active (indicated by green circles).
- Digital input (0x03000000):** A list of 32 bits. Bit 25 (Holding brake) and Bit 31 (Z signal) are active (indicated by green circles).
- Digital output (0x0000):** A list of 16 bits, all currently inactive (indicated by empty circles).
- State observation (Axis1):** A table showing various parameters:
 

| Parameter                      | Value            |
|--------------------------------|------------------|
| Target Position(Uint)          | 607A-00h: 0      |
| Position Feedforward(Uint)     | 6080-00h: 0      |
| Actual Position(Uint)          | 6064-00h: 0      |
| Actual Following Error(Uint)   | 60F4-00h: 104785 |
| Actual Velocity(Uint/s)        | 606C-00h: 0      |
| Actual Torque(0.1%)            | 6077-00h: 0      |
| Position Command Value(Uint)   | 6062-00h: 104785 |
| Velocity Command Value(Uint/s) | 606B-00h: 0      |
| Torque Command Value(0.1%)     | 6074-00h: 0      |
| Operation Mode(-)              | 6060-00h: 3      |
| Operation Mode Display(-)      | 6061-00h: 3      |
| Error Code(-)                  | 603F-00h: 0x2212 |

## Diagnostics

Operation and Register Operation can be found here



The screenshot displays the 'Diagnostics Ver1.00' window, which is divided into two main sections: Operation observation and Register observation.

- Operation observation:** A table of timing and synchronization parameters:
 

|   |    |                                |             |
|---|----|--------------------------------|-------------|
| RPDO bytes:                             | 8  | Synchronization cycle time:    | 0 ns        |
| TPDO bytes:                             | 19 | SM2 processing time (maximum): | 0 ns        |
| SM2 lost times:                         | 0  | SM3 processing time (maximum): | 0 ns        |
| Sync lost times:                        | 0  | SM2-Sync interval (minimum):   | -1 ns       |
| Synchronization overflow times:         | 0  | Sync0 offset time (maximum):   | 0 ns        |
| Synchronization offset too short times: | 0  | Synchronization type:          | 0: Free Run |
| Synchronous drift overload times:       | 0  |                                |             |
- Register observation:** A table of error counts for Port 0 and Port 1:
 

|                                       |   |                                       |   |
|---------------------------------------|---|---------------------------------------|---|
| Port 0 invalid frame count (300h):    | 0 | Port 1 invalid frame count (302h):    | 0 |
| Port 0 receive error count (301h):    | 0 | Port 1 receive error count (303h):    | 0 |
| Port 0 forwarding error count (308h): | 0 | Port 1 forwarding error count (309h): | 0 |
| EPU error count (30ch):               | 0 | PDI error count (30dh):               | 0 |
| Port 0 link loss count (310h):        | 0 | Port 1 link loss count (311h):        | 0 |

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