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Drive CM User Manual

Servo Configuration Tool

Ver. 1.0

Safety Precautions

- Before use, please read Safety Precautions to use the product correctly.
- After reading this manual, store it in a readily accessible location for future reference.

LS Mecapion

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1. About the Manual

1.1 Functions and Purpose of Drive CM Manual

This manual explains how to install Drive CM, a dedicated PC software for L7NH, L7P INDEXER and PEGASUS Drive, as well as its functions and technical support.

This manual does not explain 7NH, L7P INDEXER and PEGASUS Drive, unless it is necessary to understand Drive CM's functions. For more information on the those drives, please refer to their own manuals.

1.2 Structure of Drive CM Manual

This manual is composed of three chapters.

Below are the brief introductions of those chapters.

Chapter 1: Explains the purpose and structure of the manual and usage precautions for Drive CM

Chapter 2: Explains the system environment and installation of Drive CM

Chapter 3: Explains the structure of Drive CM

1.3 Usage Precautions for Drive CM

Please keep in mind the precautions below while using Drive CM.

- Any misuse may lead to a malfunction of the computer or servo drive, causing serious damage to the human body or equipment. Take extra caution during operation.
- For USB cable, use double shielded, Twisted Pair and EMI filter attached cable. (similar product: KU-AMB518 by SANWA)
- Do not connect or remove the cable while the drive is on or while this software is running.
- Failure to set up properly may cause a runaway or other problem, destroying the machine. Fully understand the drive and this manual before operation.
- Ensure that safety is secured around the operation area before operation.
- Please check the locations of the motor and machine before operation.
- Before starting operation, ensure that the safety functions such as POT, NOT, EMG and STO are enabled.
- Even in other cases than the position control, check the settings of the electronic gear..
- Check the position command before entering.
- Ensure that the operating space is sufficient.
- If used as a vertical axis, ensure that the system does not fall when the servo is off.

We are not responsible for any event that occurs due to user's violation of the above precautions.

2. Installing Drive CM

Drive CM provides an executable file used to install the software on the user's PC. You should check if this file has been provided, as it is needed to run Drive CM on the user's PC.

2.1 System Requirements for installing Drive CM

Categories	Recommended system requirements
OS	Windows XP, Windows 7 and Windows 8 (x86: 32bit, x64: 64bit)
CPU	Dual Core 2.5 GHz or higher
RAM	2GB
PORT	USB port that supports USB 1.0 or higher (Ethernet, RS-422)

Table 1 System Requirements

Note 1. Windows XP, Windows 7, Windows 8 and .NET Framework are the registered trade marks of Microsoft, USA.

The system requirements for installing Drive CM are as shown in <Table 1> above.

If the recommended system requirements are not met, you may not install and run the software properly.

You can install the software on the following OS's: Microsoft Windows XP, Windows 7, and Windows 8, for both x86 (32 bit) and x64 (64 bit) Systems. You may not install the software on other OS's except the ones listed above. By the way, Drive CM is only executable when .NET Framework is already installed. For the OS's that support .NET Framework, refer to the following Table 2.

Version	OS's supported
.NET Framework 4.0	Windows Servo 2003, Windows Servo 2008, Windows Servo R2, Windows Servo R2 SP1, Windows Vista, Windows XP, Windows 7, and Windows 8

Table 2 OS's that support .NET Framework 4.0

2.1.1 Installing Drive CM

(1) The Installer Files are provided for Drive CM. First, the user computer system type has to be identified. Once it has been identified, double-click on Setup_32bit(x86) or Setup_64bit(x64) according to the system type to start installation. (How to check the system type: Control Panel→ System→ System Type)

Figure 2-1.1

(2) On the Welcome to the Drive CM Setup Wizard window as shown in Figure 2-1.2, click Next.

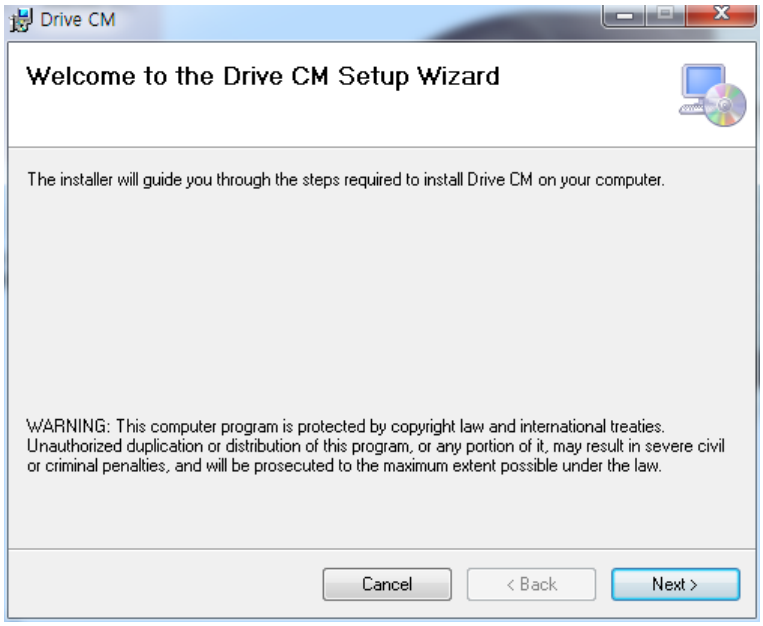


Figure 2-1.2

(3) Select the installation folder for Drive CM, as shown in Figure 2-1.3.

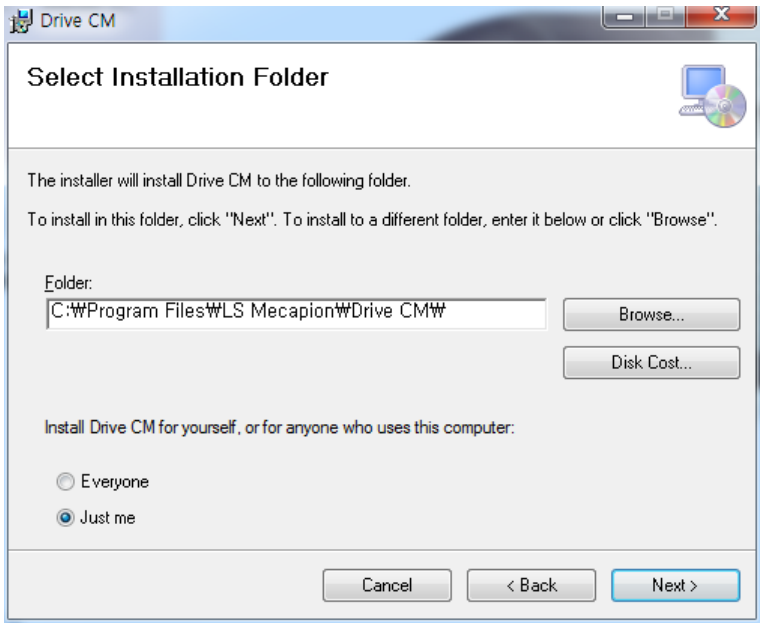


Figure 2-1.3

(4) The installation program is ready to install Drive CMin the user's computer. To start installation, click on Next.

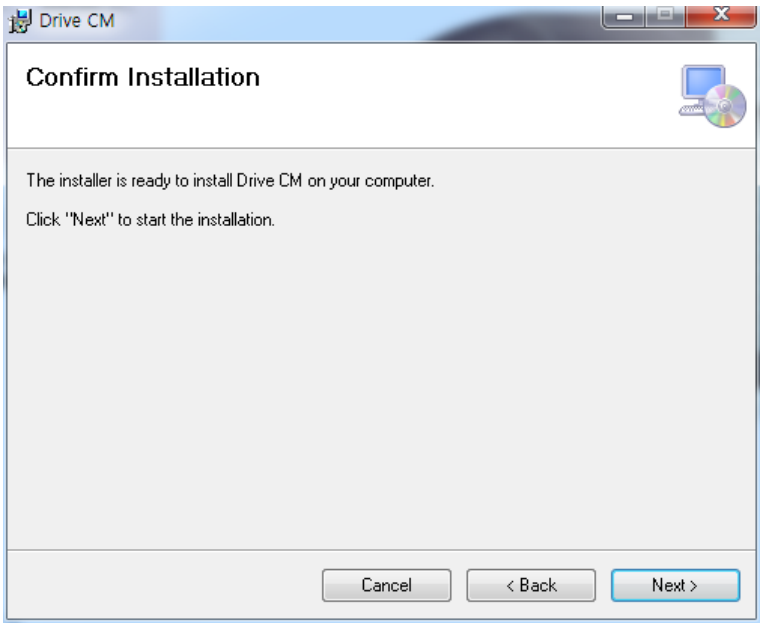


Figure 2-1.4

(5) Drive CM is being installed. Please wait until the installation is complete.

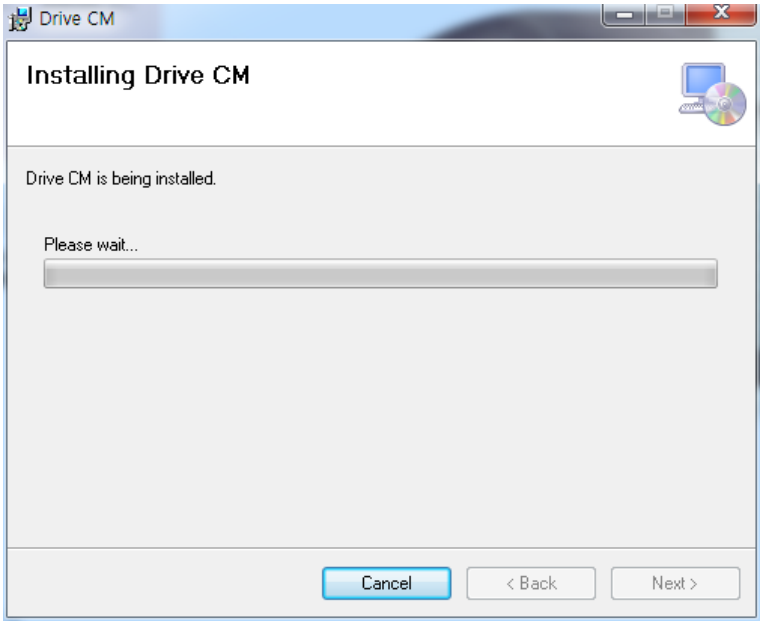


Figure 2-1.5

(6) Drive CM has been successfully installed. Click Close to exit.

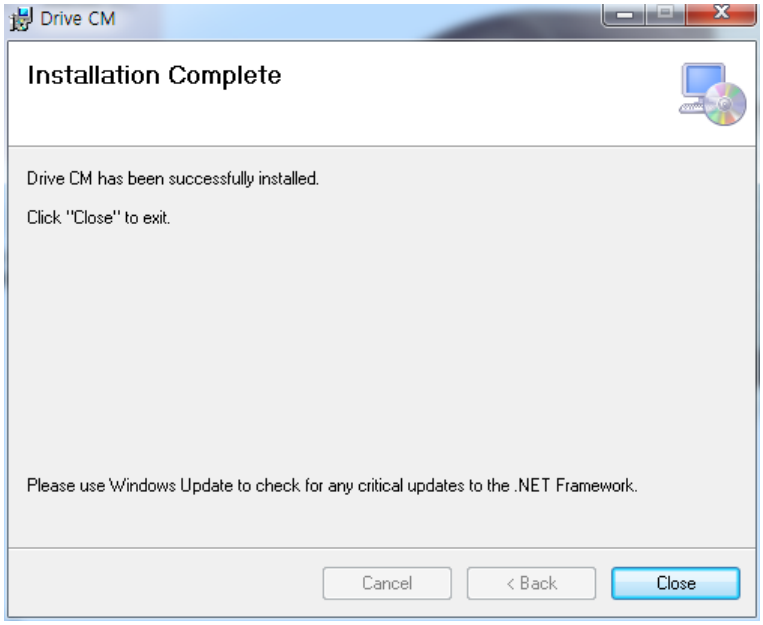


Figure 2-1.6

When the installation process is complete, the Drive CM's shortcut icons are generated on the Windows Desktop. Then go to Windows→Start→All Programs→Drive CM. Double click the Drive CM icon to run it.

Figure 2-1.6

3. Structure of Drive CM

Drive CM is a PC software for L7NH, L7P INDEXER and PEGASUS Drive and supports the functions of Servo Drive for monitoring, operation, parameter setting and firmware upgrade.

3.1 Main Dialogue

The following Figure 3-1 shows the Main Dialogue screen that is displayed when Drive CM is first run.

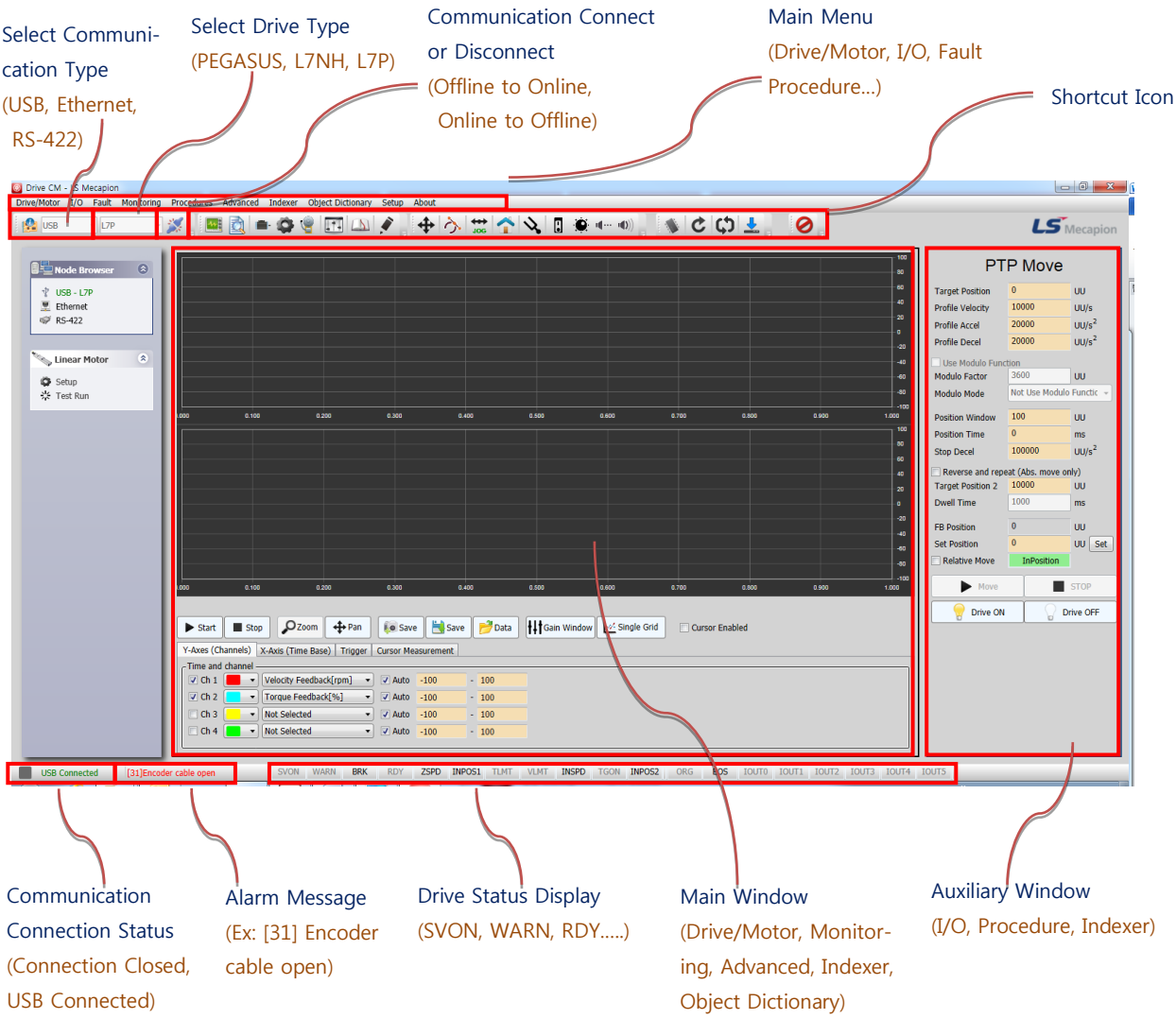


Figure 3-1

■ Using Shortcut Icons

By using shortcut icons which represent frequently used functions under the main menu, you can execute the corresponding functions quickly.

For the each function usages, please refer to 3. Structure of Drive CM.

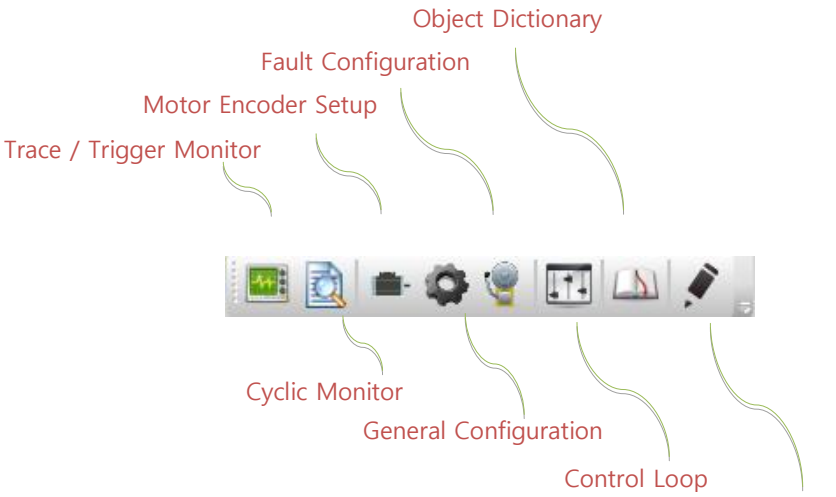


Figure 3-1.1

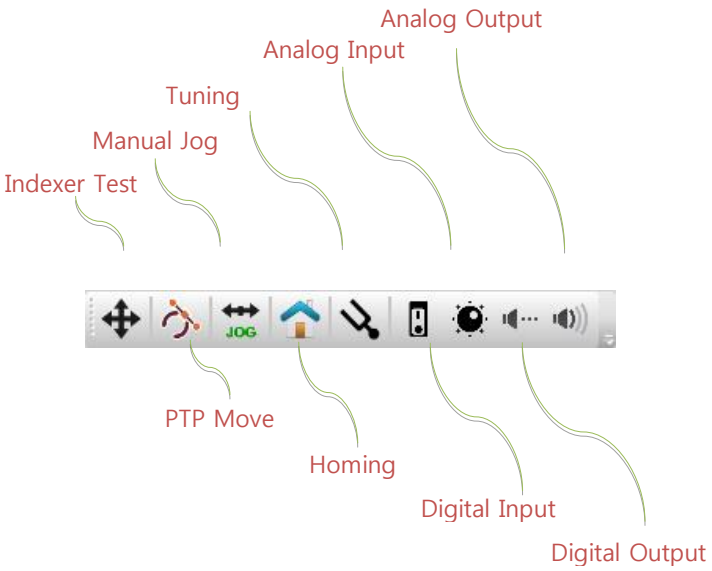


Figure 3-1.2

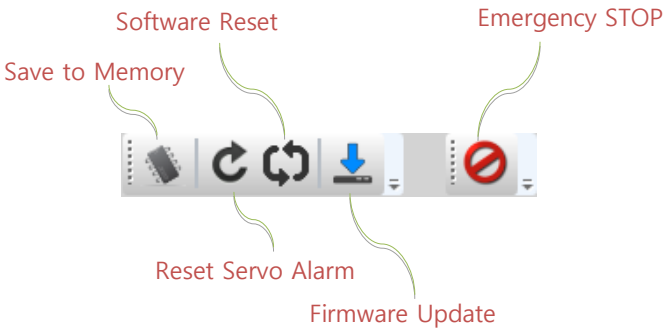

Software Reset
Emergency STOP
Save to Memory
Reset Servo Alarm
Firmware Update

Figure 3-1.3

3.1.1 Connecting the Communication Port

Drive CM provides USB, Ethernet (EtherCAT) and RS-422 communication to connect with the servo drive.

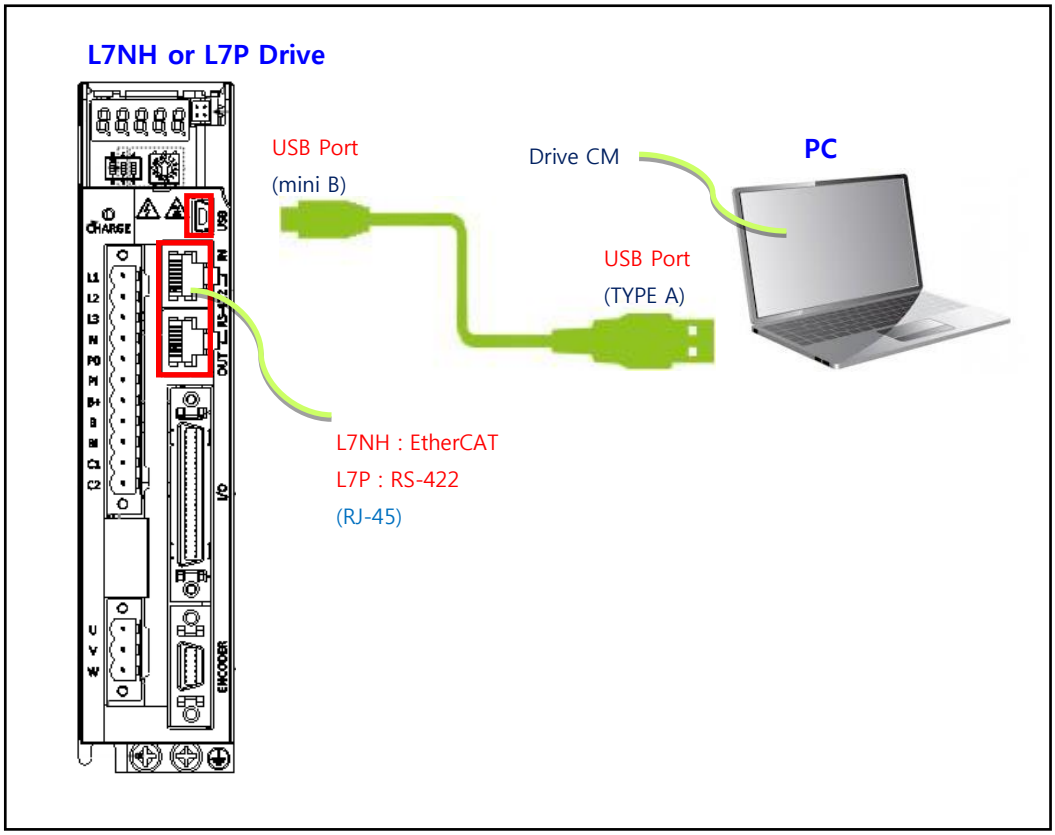


Figure 3-1.4 L7NH, L7P Connection

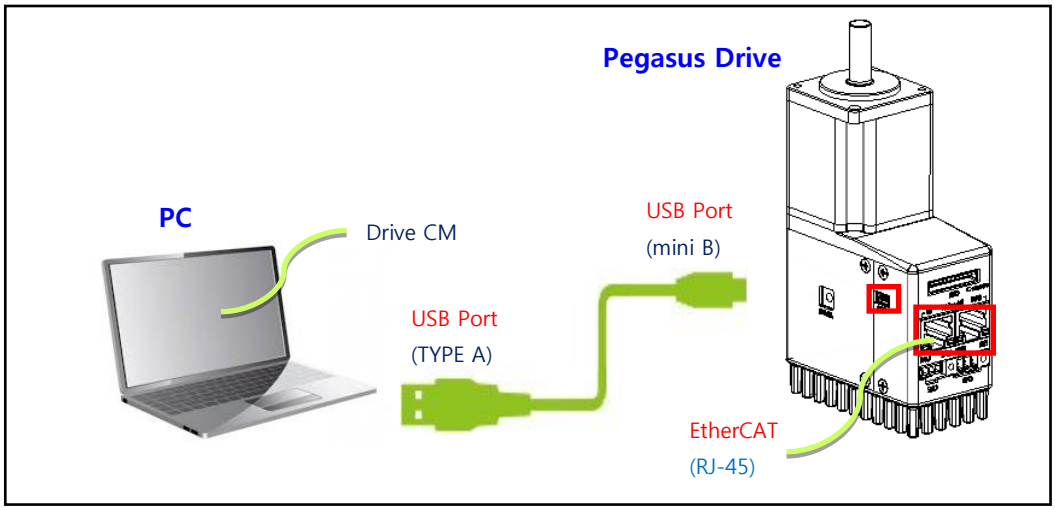


Figure 3-1.5 Pegasus Connection

■ Connecting the USB Port

(1) Select USB from the three options of USB, Ethernet or RS-422 at the top-left of the screen, as shown in Figure 3-1.

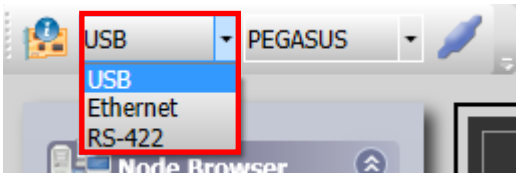


Figure 3-1.6

(2) Select one from the three types of drives (PEGASUS, L7NH, L7P) as shown in the figure on the right side of USB.

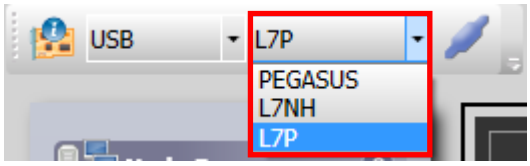


Figure 3-1.7

(3) After selecting the drive, click the button as shown below to connect communication.

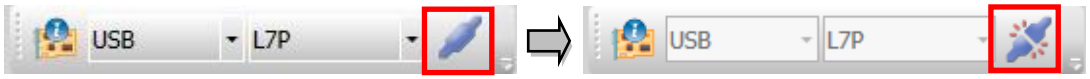


Figure 3-1.8

(4) You should check setting of drive's information is to be set correctly, when pop-up window is come up.

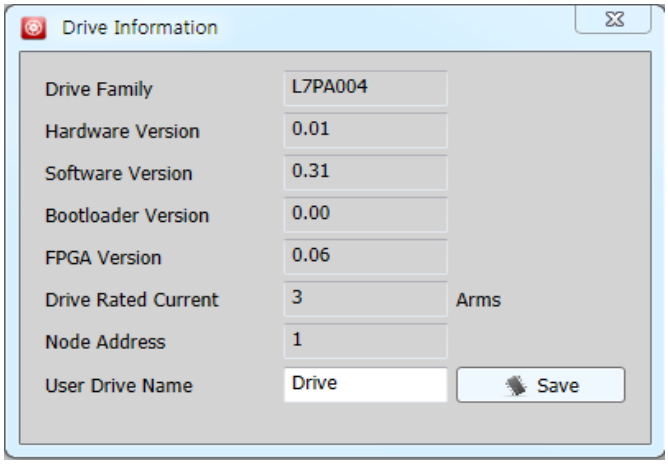


Figure 3-1.9

(5) Once all communication settings are complete, communication connection status at the left bottom of Main Dialogue and Node Browser is changed as follows. (green)

Figure 3-10

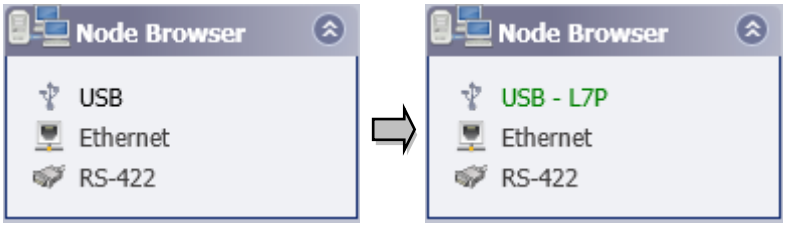


Figure 3-1.11

■ Connecting Ethernet Port (only below window 8 version)

Select Ethernet from the three options of USB, Ethernet or RS-422 at the top-left of the screen, as shown in Figure 3-1.

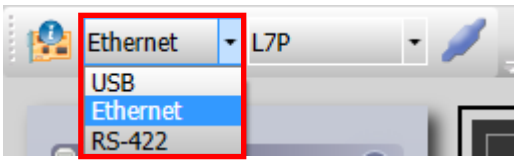


Figure 3-1.12

(1) Select one from the two types of drives (PEGASUS, L7NH) as shown in the figure on the right side of Ethernet.

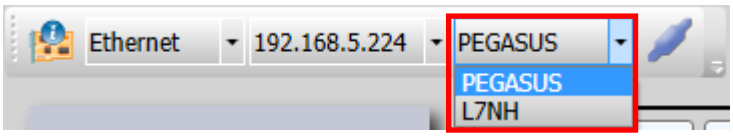


Figure 3-1.13

(2) If you click Configuration under Setup menu, the following popup window appears.

For a detailed configuration method, please refer to 3.10.1 Configuration.

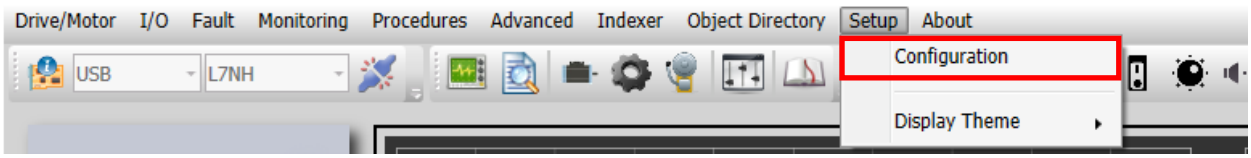


Figure 3-1.14

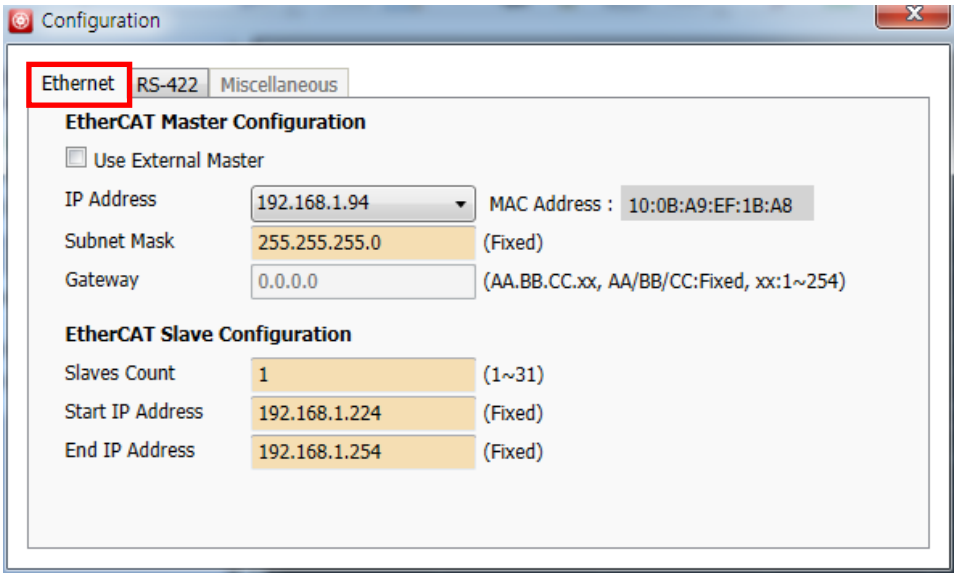


Figure 3-1.15

IP Address information of My PC (EtherCAT Master Configuration) and Drive (EtherCAT Slave Configuration) is automatically displayed. Enter the number of drives to be connected in Slaves Count and close the screen.

(3) After selecting the drive, select Slave IP to connect to and click the button as below to connect commnunication.

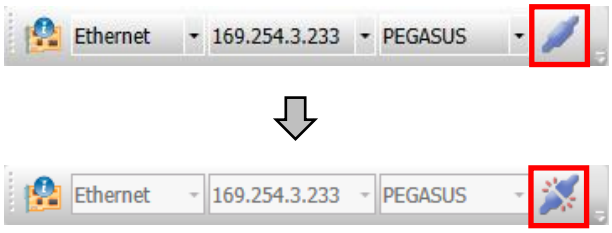


Figure 3-1.16

(4) Figure 3-1.17 Check the accuracy of drive‘s information, the following popup window appears.

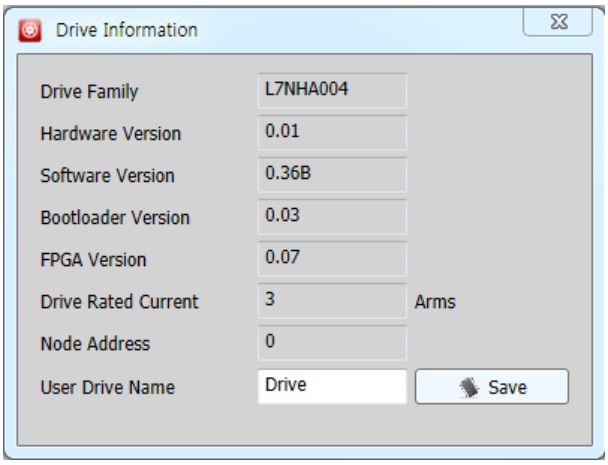


Figure 3-1.17

(5) When the communication setup is finished, the connection status marker at the bottom-left of Main Dialogue changes as shown in the following figure. (A green box marker blinks.)

Figure 3-1.18

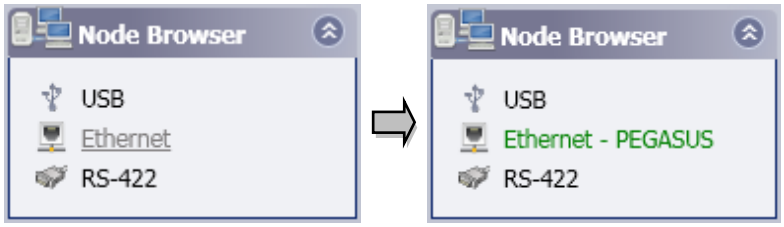


Figure 3-1.19

■ Connecting RS-422 Port

Select RS-422 from the three options of USB, Ethernet or RS-422 at the top-left of the screen, as shown in Figure 3-1.

Note 4) After making the computer recognize RS-422 Converter, execute Drive CM.

(1) ‘Select L7P from the three types as shown in the figure on the right side of RS-422

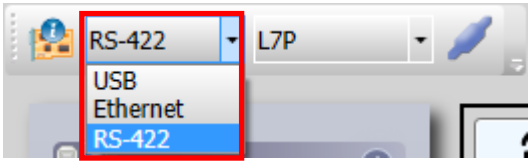


Figure 3-1.20

그림 3-1.21

(2) ‘Click Configuration under Setup menu.

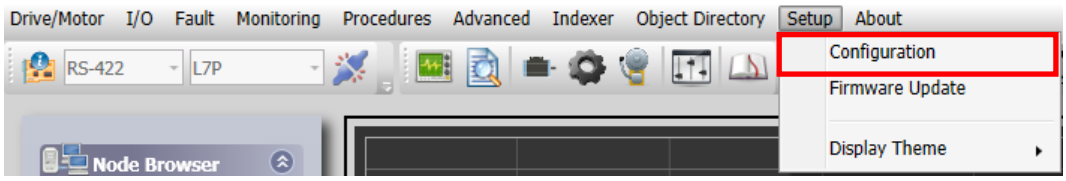


Figure 3-1.22

(3) Set Node ID, Serial COM Port, Baud rate, if the following popup window appears.

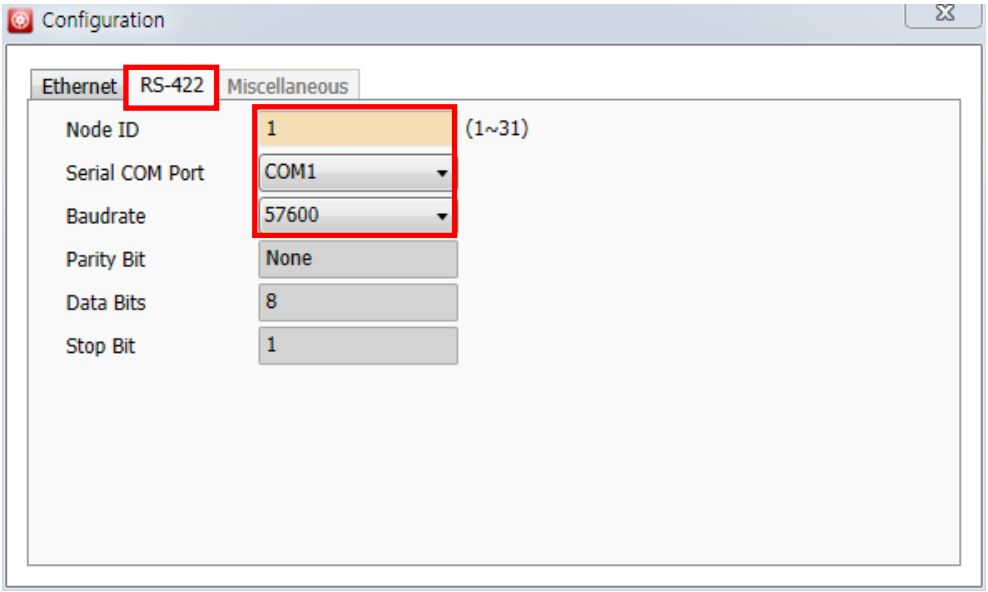


Figure 3-1.23

(4) After selecting the drive, click the button as shown below to connect communication.

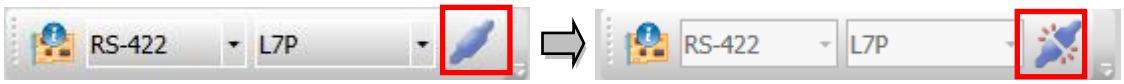


Figure 3-1.24

(5) Check the accuracy of drive's information, the following popup window appears.

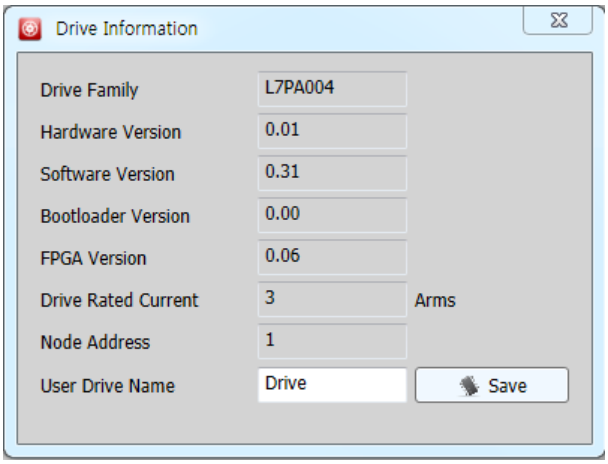


Figure 3-1.25

(6) Once all communication settings are complete, communication connection status at the left bottom of Main Dialogue and Node Browser is changed as follows. (green)

Figure 3-1.26

3.2 Drive/Motor

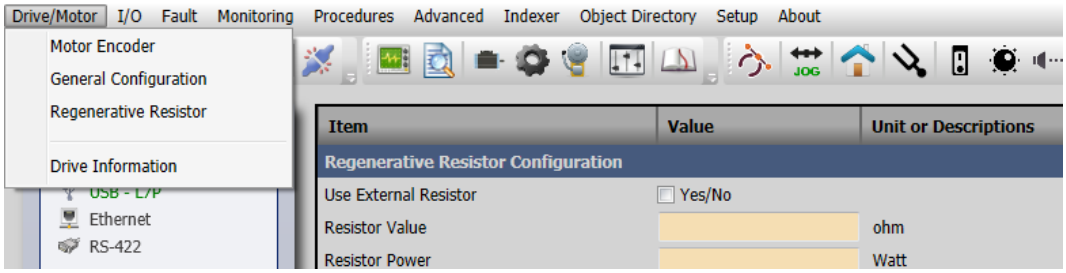


Figure 3-2

From the top main menu, select a necessary menu such as Drive/Motor→Motor Encoder or General Configuration.

3.2.1 Motor Encoder (L7NH and L7P only)

■ Motor Setup

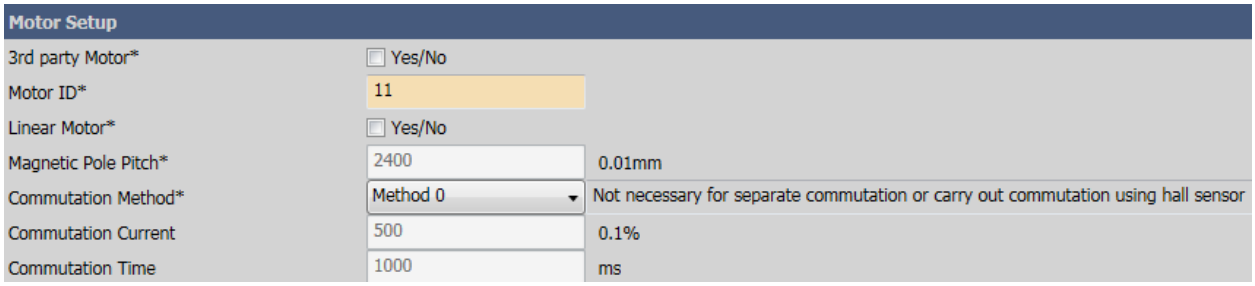


Figure 3-2.1 Motor Setup

(1) 3rd Party Motor

- When this is selected, 9999 is automatically typed in Motor ID to use a third party motor and the options in Figure 3-2.3 are enabled. If not selected, our motor will be used.

Note 2) To drive a third party motor, you should enter correct parameters. Please note that our company neither carried out any test for the combination of our drive and a third party motor, nor gives any warranty for the motor's performance.

(2) Motor ID (0x2000)

- Set the motor ID. Our motor carries the motor ID on the motor nameplate.

(3) Linear Motor (0x2800)

- Select the linear motor to use it. If not, the rotary motor is used.

  If a linear motor is used, the unit of 3rd Party Motor Setup is changed.

(4) Magnetic Pole Pitch (0x2018)

- This specifies the pitch between magnetic poles of linear motor.

(5) Commutation Method (0x201A)

- Select a commutation method to get the information on the initial angle of the motor.

(6) Commutation Current (0x201B)

- Select a commutation current.

(7) Commutation Time (0x201C)

- Set the commutation time.

■ Encoder Setup

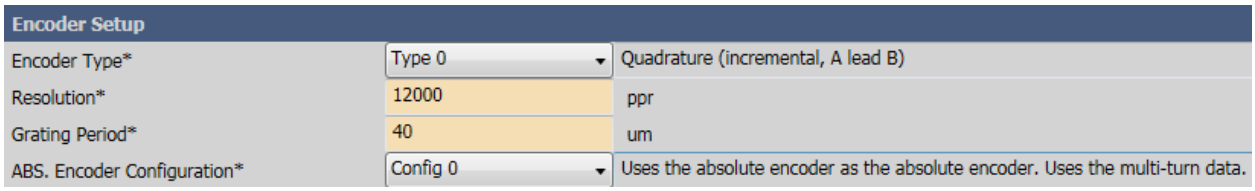


Figure 3-2.2 Encoder Setup

(1) Encoder Type (0x2001)

- Set the encoder type.

(2) Resolution (0x2002)

- Set the encoder resolution in the unit of pulse (count) based on a multiple of 4. You can usually find the encoder's resolution on our motor's nameplate.

(3) Grating Period (0x201D)

- Set sinusoidal curve encoder’s lattice spacing
- When you select Type 7(Sinusoidal) of Encoder Type only, you can set.

(4) Absolute Encoder Configuration (0x2005)

- Set the usage of the absolute encoder

■ 3rd Party Motor Setup

To drive a motor made by other companies or any of our motors without its Motor ID, you should enter the motor's characteristics values.

If you want to use a 3rd party parameter value, enter "9999" for Motor ID (0x2000). When you select a 3rd party motor as shown in Figure 3-2.1, "9999" is automatically entered .

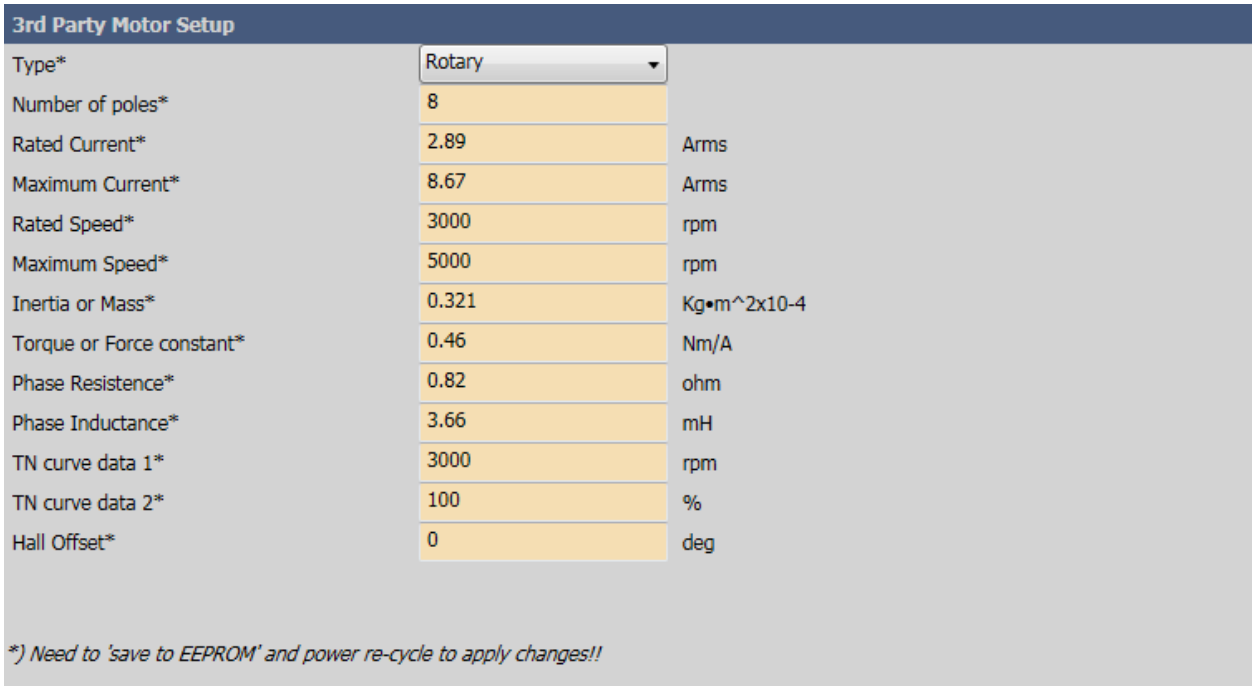


Figure 3-2.3 3rd Party Motor Setup

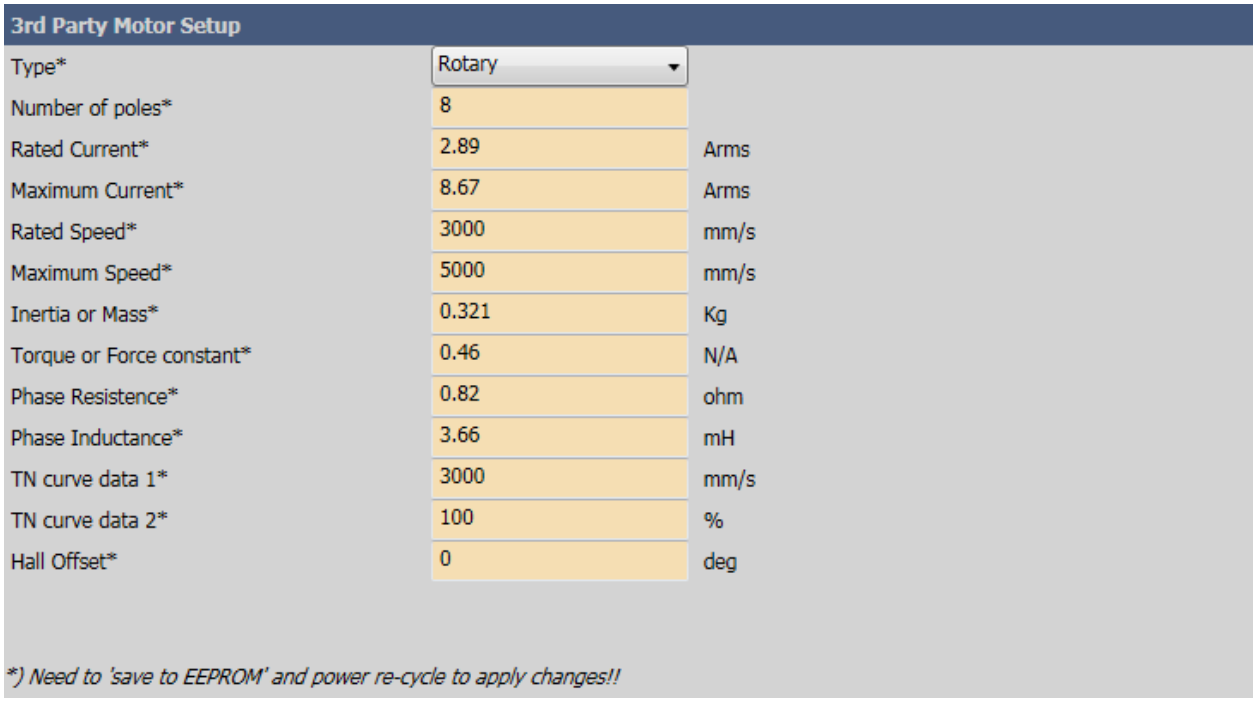


Figure 3-2.4 If you check Linear Motor (0x2800) setting, the units of 3rd Party Motor Setup are changed

(1) Type (0x2800)

- 3rd party motor's type is set.

(2) Number of poles (0x2801)

- 3rd party motor type is set. For linear motor, set it to 2.

(3) Rated Current (0x2802)

- 3rd party motor's Rated Current is set.

(4) Rated Speed (0x2803)

- 3rd party motor's Maximum Current is set.

(5) Maximum Speed (0x2804)

- 3rd party motor's Rated Speed is set. For a linear motor, the unit is mm/s.

(6) Inertia or Mass (0x2806)

- 3rd party motor's Inertia is set. For a linear motor, set the weight of rotor. At the time, the unit is 'kg'.

(7) Torque or Force constant (0x2807)

- 3rd party motor's Torque Constant is set. For a linear motor, set the force constant. The unit is N/A.

(8) Phase Resistance (0x2808)

- 3rd party motor's phase resistance (= resistance between lines ÷ 2) is set.

(9) Phase Inductance (0x2809)

- 3rd party motor's phase inductance (= inductance between lines ÷ 2) is set.

(10)TN curve data 1 (0x280A)

- 3rd party motor's data of the motor speed/torque curve is set. Enter the maximum speed at the time when the maximum torque (for a linear motor, the maximum thrust) is output. For a linear motor, the unit is mm/s.

(11)TN curve data 2 (0x280B)

- 3rd party motor's data of the motor speed/torque curve is set. At maximum speed

(12)Hall Offset (0x280C)

- The offset of the hall sensor attached for initial angle of a 3rd party motor may vary depending on manufacturer. For this case, the hall sensor offset must be checked and correctly set.

3.2.2 General Configuration

■ Motor Direction / Gear Ratio

Item	Value	Unit or Descriptions
Motor Direction		
Rotation Direction*	☐ Reverse	
Gear Ratio		
Motor Revolutions*	1	
Shaft Revolutions*	1	

Figure 3-2.5

(1) Reverse Rotation Direction (0x2004)

- Set the rotation direction of the motor. (If selected, the motor rotates clock-wise according to the Forward command.)

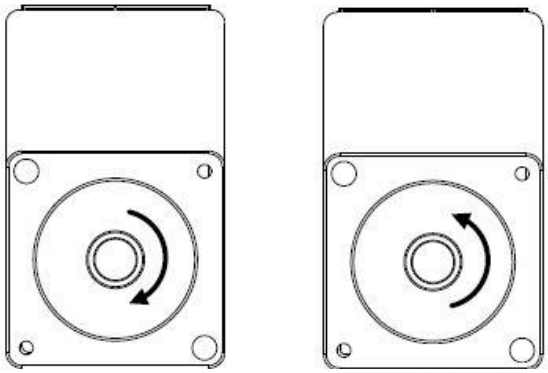


Figure 3-2.6

(2) Motor revolutions (0x6091:1)

- Motor revolutions

(3) Shaft revolutions (0x6091:2)

- Shaft revolutions

Note 3) When using the electric gear function of the drive, you cannot utilize the highest resolution of the encoder. Therefore, use the function of the upper level controller if possible.

■ Brake

Outputs signals to control the brake when the servo is turned on or off.

Brake		
PWM Off Delay Time	10	ms
Dynamic Brake Control Mode	Mode 0	Hold After Stopping the motor using the dynamic brake
Brake Output Speed	100	rpm or mm/s
Brake Output Delay Time	100	ms

Figure 3-2.7

(1) PWM Off Delay Time (0x2011)

- Set the amount of time to delay until the PWM is actually turned off after the servo off command is given.

(2) Dynamic Brake Control Mode (0x2012)

- This specifies the control mode of the dynamic brake when the servo is turned off.

(3) Brake Output Speed (0x2407)

- Set the speed at which the brake signal is output when the motor is stopped by the servo off or servo alarm.

(4) Brake Output Delay time (0x2408)

- Set the amount of time to delay an output signal for braking when the motor is stopped by the servo off or servo alarm control signal.

■ Emergency stop

This specifies the method to stop the drive on emergency stop (when entering POT, NOT, or ESTOP). In torque control mode, the decelerating to stop mode using emergency stop torque is not applied.

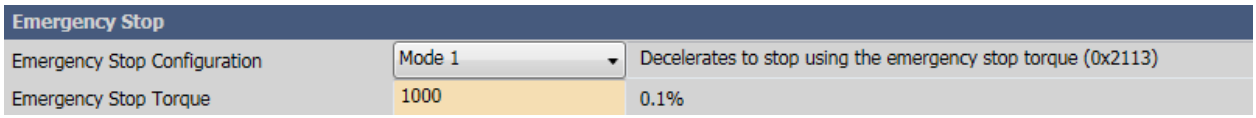


Figure 3-2.8

Setting values	Details
0	The motor will stop according to the method set in the dynamic brake control mode (0x2012)). It will stop using the dynamic brake, and then maintain the torque command at 0.
1	Decelerates to stop using the emergency stop torque (0x2113).

Table3 Emergency Stop Configuration

(1) Emergency Stop Configuration (0x2013)

- This specifies the method to stop the drive on emergency stop (when entering POT, NOT, or ESTOP). In torque control mode, the decelerating to stop mode using emergency stop torque is not applied.

(2) Emergency Stop Torque (0x2113)

- This specifies the stop torque on emergency stop (when entering POT, NOT, or ESTOP).

■ Torque Limit

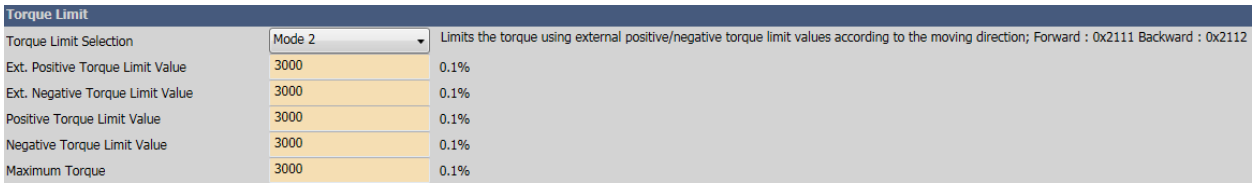


Figure 3-2.9

(1) Torque Limit Selection (0x2110)

- This specifies the function to limit the output torque of the drive.

(2) Ext. Positive Torque Limit Value (0x2111)

- This specifies the external positive torque limit value according to the torque limit function setting (0x2110).

(3) Ext. Negative Torque Limit Value (0x2112)

- This specifies the external negative torque limit value according to the torque limit function setting (0x2110).

(4) Positive Torque Limit Value (0x60E0)

- This sets the limit of positive torque values.

(5) Negative Torque Limit Value (0x60E1)

- This sets the limit of negative torque values.

(6) Maximum Torque (0x6072)

- This sets the maximum torque that the motor can output in 0.1% increments of the rated torque.

■ Index Configuration (L7P only)

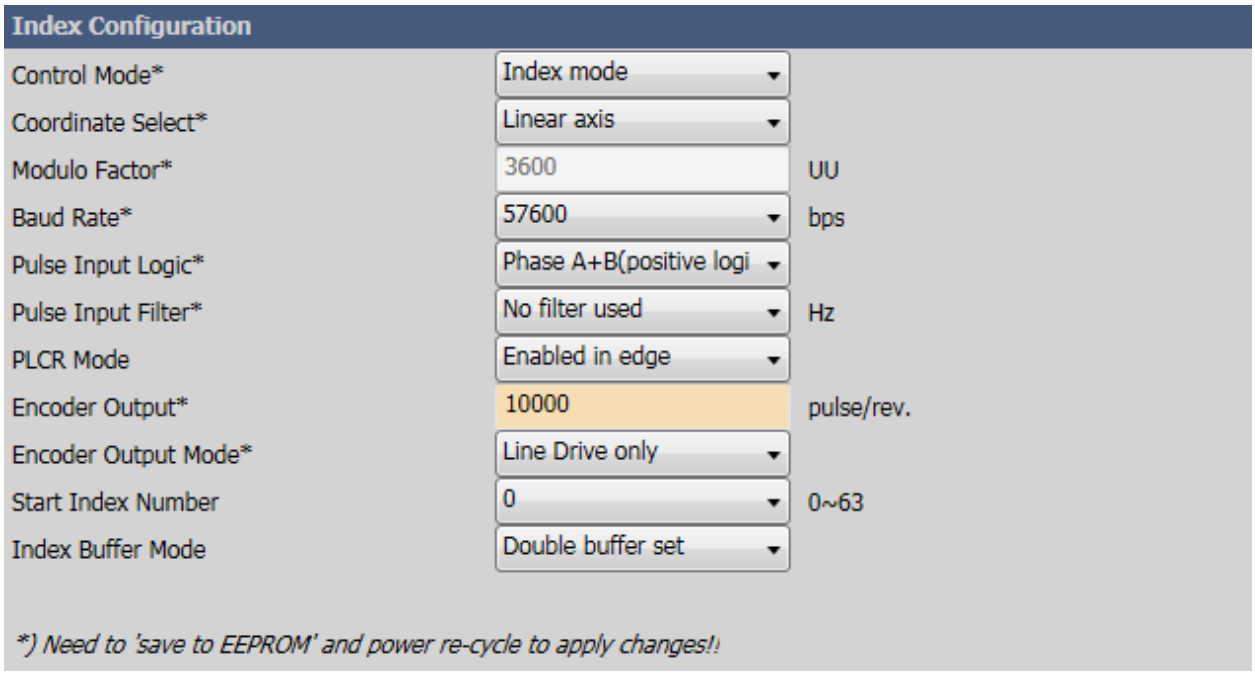


Figure 3-2.10

(1) Control Mode (0x3000)

- This specifies the position control mode in the drive.

(2) Coordinate Select (0x3001)

- This specifies a coordinate system to be used for indexing position control of the drive.

(3) Modulo Factor (0x240C)

- This specifies the factor for using the Modulo function. The user has to set the position value corresponding to one revolution during motor drive.

(4) Baud Rate (0x3002)

- This specifies the serial communication speed between the upper level controller and drive through RS-422.
- 9600, 19200, 38400, 57600[bps]

(5) Pulse Input Logic (0x3003)

- This specifies the logic of the position control input pulse when the upper level controller uses the positioning module.

Setting values
0: Phase A+B (positive logic) Phase A + B positive logic
1: CW+CCW (positive logic) CW+CCW positive logic
2: Pulse+Direction (positive logic) Pulse+sign positive logic
3: Phase A+B (negative logic) Phase A + B negative logic
4: CW+CCW (negative logic) CW+CCW negative logic
5: Pulse+Direction (negative logic) Pulse+Sign negative logic

Table 4 Rotation direction by type and logic of position command input pulses

(6) Pulse Input Filter(0x3004)

- This specifies the filter frequency band corresponding to the pulse input. The determination of the frequency bands is based on the input pulse width in accordance with digital filter's characteristics.

(7) PCLR Mode (0x3005)

- Select operation type for position pulse clear mode.
- Enable in edge or Enable in Level

(8) Encoder Output (0x3006)

- This specifies the pulse input logic when the upper level controller's positioning module is used.

(9) Encoder Output Mode (0x3007)

This specifies whether to output also in the open collector method in addition to the default line drive method when servo outputs the encoder signal to the outside.

(10) Start Index Number (0x3008)

- This specifies the index number (0~63) for operation when starting Indexing Position operation.

(11) Index Buffer Mode (0x3009)

- This specifies how many times the START (operation start) signal is remembered during Indexing Position operation.

3.2.3 Regenerative Resistor (L7NH and L7P only)

Item	Value	Unit or Descriptions
Regenerative Resistor Configuration		
Use External Resistor	☐ Yes/No	
Resistor Value	100	ohm
Resistor Power	50	Watt
Resistor Peak Power	100	Watt
Duration Time at Peak Power	5000	ms
Derating Factor	100	%

Figure 3-2.11

(1) Use External Resistor (0x2009)

- If not selected, the regenerative resistance embedded in the drive is used. If selected, the regenerative resistance separately fitted on the exterior of the drive is used.

(2) Resistor Value (0x200B)

- Use the ohm unit to set the value of the regenerative resistance separately fitted.

(3) Resistor Power (0x200C)

- Use the watt unit to set the value of the regenerative resistance separately fitted.

(4) Resistor Peak Power (0x200D)

- Use the watt unit to set the max capacity allowed for the regenerative resistance separately fitted.

(5) Resistor Time at Peak Power (0x200E)

- Use the ms unit to set the time allowed for the max capacity (Resistor Peak Power value) of the regenerative resistance separately fitted.

(6) Derating Factor (0x200A)

- This specifies the derating factor which checks for regenerative resistance overloads.

3.2.4 Drive Information

Displays the basic information on the drive, including the version.

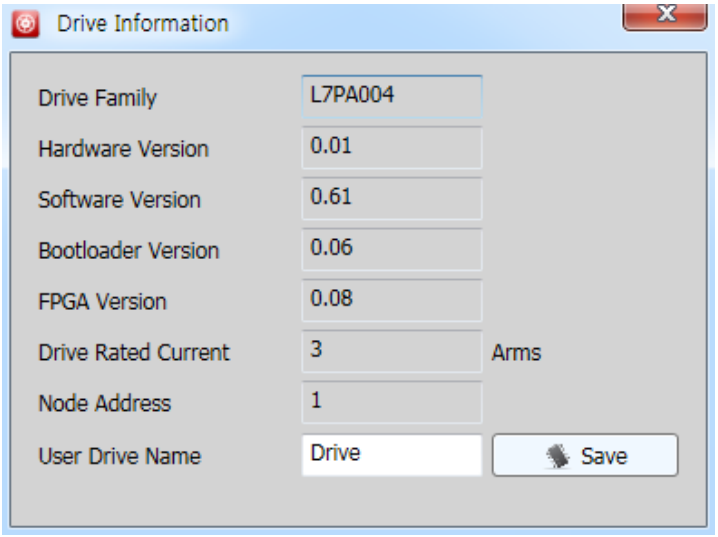


Figure 3-2.12 Drive Information

(1) Drive Family (0x1008)

- Displays the drive name.

(2) Hardware Version (0x1009)

- Displays the hardware version.

(3) Software Version (0x100A)

- Displays the software or firmware version.

(4) Bootloader Version (0x2613)

- Displays the bootloader version.

(5) FPGA Version (0x2611)

- Displays the FPGA version.

(6) Drive Rated Current (0x2610)

- Displays the rated current.

(7) Node Address (0x2003)

- Displays the node ID configured for the node setting switch.

(8) User Drive Name (0x240D)

- The user can customize the drive name. The name can contain up to 16 characters. Push the Save button to save the name in the internal memory of the drive.

3.3 IO CONFIG

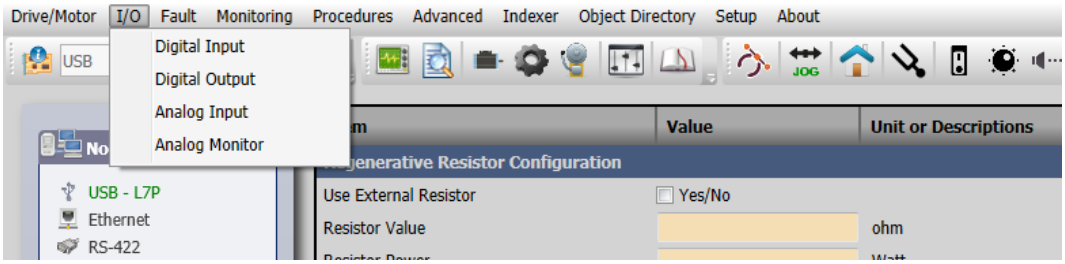


Figure 3-3

From the main menu on the top, select a necessary menu such as IO→ Digital Input or Digital Output.

3.3.1 Digital Input

Use digital input signal pin of the drive I/O connecter to select from 28 input functions and input signal levels Four input contacts are assigned to PEGASUS (Input 1 to 4), 8 input contacts to L7NH (Input 1 to 8) and 16 input contacts to L7P (Input 1 to 16). The digital inputs are automatically activated according to the number of contacts of the drive as shown in Figure 3-3.1 (L7P).

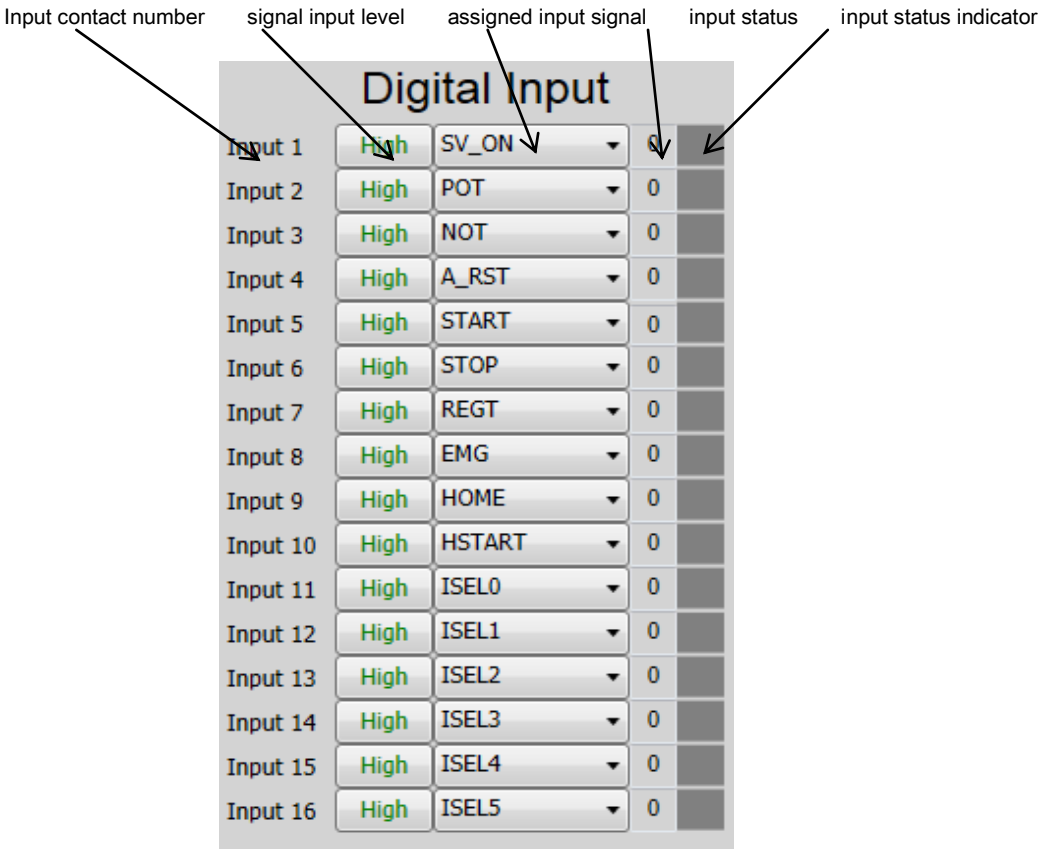


Figure 3-3.1 Digital Input

(1) Input contact number (Input 1 to 16)

- Indicates the number of the input contact of the drive.

  (Numbers of input contacts for each drive are PEGASUS: 4, L7NH: 8, L7P: 16)

(2) Signal input level setup (High or Low)

- For a high level signal, contact A is used. For a low level signal, contact B is used.

(3) Allocation of input signals (28 types)

- Select one of 28 input signals from the list box.

(4) Input status (0 or 1)

- The current input status is indicated as 0 or 1.

(5) Input status indicator (Gray or Green)

- The current input status is indicated as gray (0) or green (1).

3.3.2 Digital Output

You can select from 19 input functions and input signal levels using the digital output signal pin of the drive I/O connecter. Two output contacts are assigned to PEGASUS (Output 1 to 2), four output contacts to L7NH (Output 1 to 4) and 8 output contacts to L7P (Output 1 to 8).

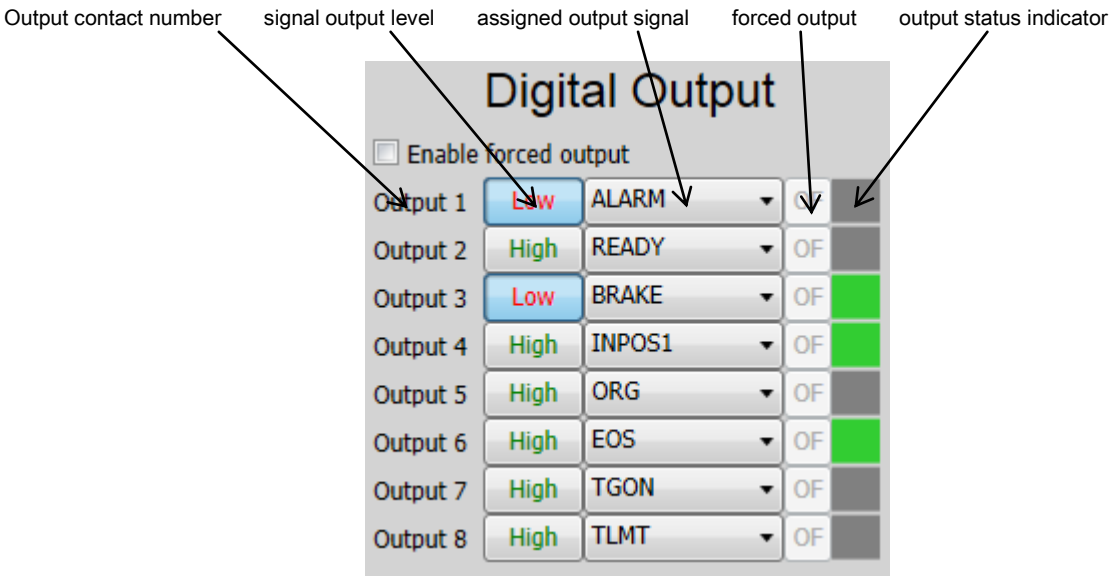


Figure 3-3.2 Digital Output

(1) Enable forced output

- If selected, ON/OFF of the forced output is activated. You can force the output contact to turn it on or off.

(2) Output contact number (Output 1 to 8)

- This indicates the number of the output contact of the drive. (Number of input contacts per drive: PEGASUS: 2, L7NH: 4, L7P: 8)

(3) Signal output level setup (High, Low)

- For a high level signal, contact A is used. For a low level signal, contact B is used.

(4) Allocation of input signal (19 types)

- Select one of the 19 output signals from the list box.

(5) Forced output (ON or OFF)

- Force the contact output to turn ON or OFF. (only when Enable forced output is selected)

(6) Output status indicator (Gray or Green)

- The current output status is indicated as gray (0) or green (1)

3.3.3 Analog Input (L7NH: CH1 and L7P : CH1 and CH2 only)

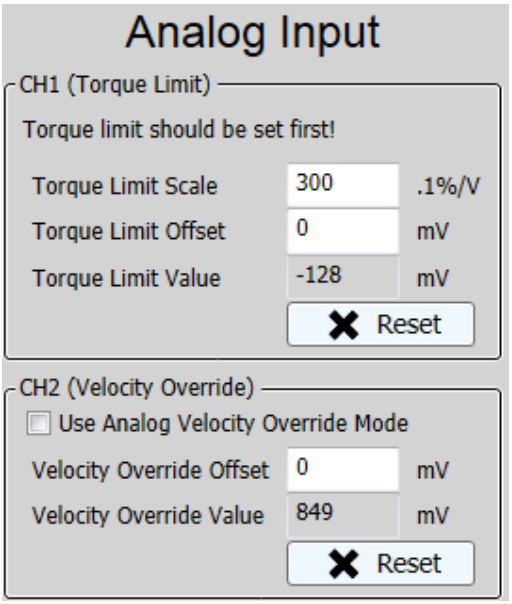


Figure 3-3.3

■ CH1 (Analog Torque Limit)

You can limit the drive output torque to protect the machine. It can be set by the torque limit function (0x2110).

(1) Analog Torque Limit Scale (0x221C)

- This specifies the scale of the analogue input value.

(2) Analog Torque Limit Offset (0x221D)

- This specifies the analogue voltage offset controlled by the analogue torque limit

(3) Current Torque Limit Value (0x2615)

- This indicates the voltage in mV, which is inputted to the analogue input channel 1.

■ CH2 (Analog Velocity Override)

You can use the analogue voltage to override the velocity.

(1) Use Analog Velocity Override Mode (0x221E)

- This specifies whether to use the function that uses the analogue voltage to override the velocity.

(2) Analog Velocity Override Offset (0x221F)

- This specifies the analogue voltage offset inputted to the analogue velocity override.

(3) Current Velocity Override Value (0x2616)

- This indicates the voltage in mV, which is inputted to the analogue input channel 2.

3.3.4 Analog Monitor (PEGASUS: CH1 and L7NH, L7P: CH1 and CH2 only)

You can specify the output of the analogue monitor in order to monitor the gain tuning or the internal state variables of the drive.

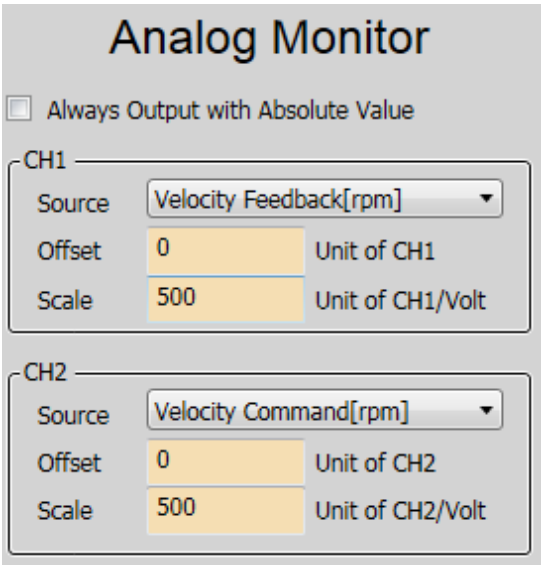


Figure 3-3.4

(1) Always Output with Absolute Value (0x2220)

- Specify the output mode of the analogue monitor. If selected, +/- values are output. If not selected, only + values are output.

(2) Channel 1 Select (0x2221)

- Configure the monitoring variables to be output to the analog monitor output channel 1.

(3) Channel 1 Offset (0x2223)

- Subtract the offset value from the monitoring variable of the analog monitor output channel 1 to determine the final output. The unit will be that of the variable configured in "Channel 1 Select" of the Analog Monitor.

(4) Channel 1 Scale (0x2225)

- This specifies the scaling of the variable to be output per 1 V when outputting the monitoring variable configured as the analog output channel 1. The unit will be that of the variable configured in "Channel 1 Select" of the Analog Monitor per 1 V.

(5) Channel 2 Select (0x2222)

- Configure the monitoring variables to be output to the analog monitor output channel 2.

(6) Channel 2 Offset (0x2224)

- Subtract the offset value from the monitoring variable of the analog monitor output channel 2 to determine the final output. The unit will be that of the variable configured in "Channel 2 Select" of the Analog Monitor.

(7) Channel 2 Scale (0x2226)

- When outputting the monitoring variable configured as the analog monitor output channel 2, this function will set the scaling of the variable to be output per 1 V. The unit will be that of the variable configured in "Channel 2 Select" of the Analog Monitor per 2 V.

3.4 FAULT

You can set up the servo alarm and warning.

3.4.1 Fault

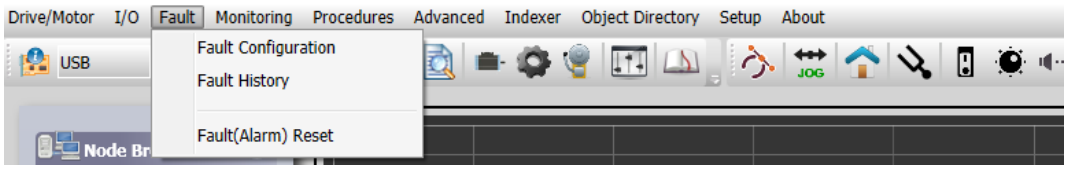


Figure 3-4.1

From the main menu on the top, select a necessary menu such as Fault → Fault Configuration or Fault History.

Drive CM's Fault function can specify various levels and masks related to the drive alarms and uses the Alarm History to display the most recent 16 alarm codes and their messages.

■ Fault Configuration

Item	Value	Unit or Descriptions
AL-51 (POS following)		
Following Error Window		UU
Following Error timeout		ms
AL-50 (Over Speed Limit)		
Over Speed Detection Level		rpm or mm/s
AL-53 (Excessive SPD deviation)		
Error Detection Level		rpm or mm/s
AL-42 (Main Power Fail), W-01		
Main power fail check mode	Single-phase power input Process the phase loss as (AL-42)	
Main power fail check time		ms
AL-21 (Continuous overload), W-10		
Overload check level		%
Overload warn level		%
Warn Mask		
RST power fail	☐ Yes/No	W-01h
Encoder low battery	☐ Yes/No	W-02h
Software position limit	☐ Yes/No	W-04h
Overload exceed warn limit	☐ Yes/No	W-08h
DB current	☐ Yes/No	W-10h
Wrong setup	☐ Yes/No	W-20h
Under voltage	☐ Yes/No	W-40h
Emergency switch	☐ Yes/No	W-80h
Safe Torque Off(STO)		
Set fault bit	☐ Yes/No	Set fault bit of StatusWord when unplugged
AL-34 (Encoder Z-phase open)		
Not use index(z) signal	☐ Yes/No	Check Yes when not using encoder index(z) signal

Figure 3-4.2

■ AL-51 (POS following)

Alarm for excessive positional error

(1) Following Error Window (0x6065)

- Set the positional error range for checking the following errors.

(2) Following Error Timeout (0x6066)

- Set the excess of time for checking the following errors.

■ AL-50 (Overspeed Limit)

Overspeed alarm

(1) Overspeed Detection Level (0x230F)

- This specifies the level to detect overspeed alarms (AL-50).

■ AL-53 (Excessive SPD Deviation)

Alarm for excessive speed errors

(1) Excessive Speed Error Detection Level (0x2310)

- This specifies the level to detect excessive speed error alarms (AL-53).

■ AL-42 (Main Power Fail), W-01

Alarm for a main power failure. Alarm for main power phase loss.

(1) Main Power Fail check mode (0x2006)

- This specifies the main power input mode and the processing method if phase loss occurs.

(2) Main Power Fail check time (0x2007)

- This sets the time to check the phase loss in the main power system.

■ AL-21 (Continues overload)

Alarm for continuous overload

(1) Overload check level (0x200F)

- This sets the load factor where the continuous overload begins to accumulate.

(2) Overload warn level (0x2010)

- This specifies the output level of the continuous overload warning (W10).

■ Warn Mask (0x2014)

If selected, the warning is masked. A masked warning will not be triggered.

■ Safe Torque Off(STO) (15 bit of 0x2014)

When you use this function (if it is not connected in STO), statusword fault bit is set, you can reset by using fault reset bit of controlword

When you use not this function (if it is not connected in STO), statusword fault bit isn't set.

■ AL-34 (Encoder Z-phase open) (14 bit of 0x2014)

If you use this function, AL-34(Z open) will not be triggered.

When you operate motor like as Step motor, you can use it.

■ Alarm History

(1) Read

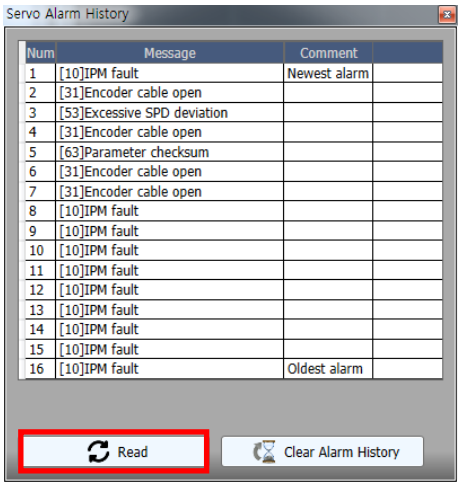


Figure 3-4.3

- Pressing the Read button in the alarm history displays the most recent alarms (up to 16) that have occurred to the drive. Number one is the latest alarm.

(2) Clearing Alarm History

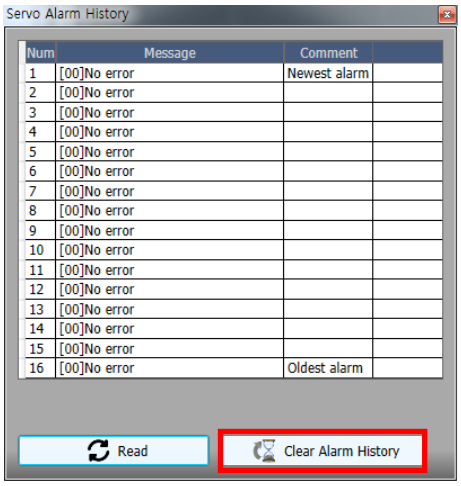


Figure 3-4.4

(3) You can reset the Alarm History. After resetting, the alarms show "[00]No error", as shown in the figure. Fault(Alarm) Reset

- If an alarm occurs, the alarm can be reset to clear it.

- Please click on Fault (Alarm) Reset or figure 3-4.5 ‘Reset Servo Alarm’ shortcut icon.

Figure 3-4.5

(When an alarm occurs) (After the alarm has been reset)

Figure 3-4.6

3.5 MONITORING

Drive CM provides Real-Time Data Trace, Trigger and Cyclic Monitor functions that display the information in two graphs and one text format. In particular, the Trigger monitor supports FFT, through which you can find the resonance frequency of the drive to be used for setting up the Notch Filter. In addition, the monitored graph data can be saved as a text or image file.

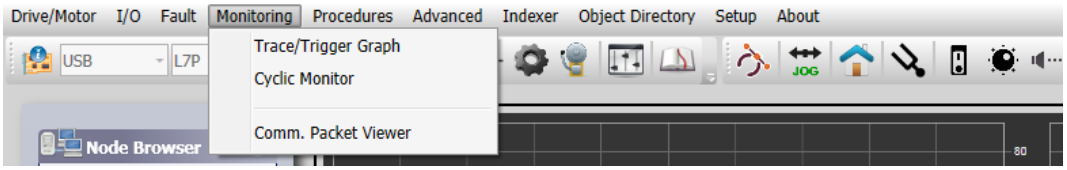


Figure 3-5

From the top main menu, select a necessary menu such as Monitoring → Trace/Trigger Graph or Cyclic Monitor.

3.5.1 Trace / Trigger Graph

Figure 3-5.1

Drive CM can use Tracer or Trigger Monitor for up to four channels as shown in Figure 3-5.1. In the Procedures menu, you can select Procedures → Manual Jog, Program Jog, PTP Move or other options while monitoring the operating state.

■ Y-Axes (Channels)

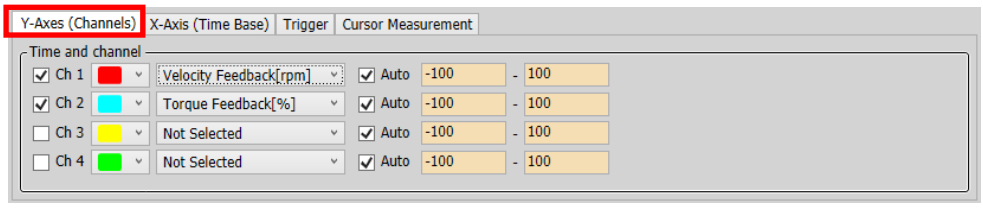


Figure 3-5.2

(1) Ch1, Ch2, Ch3 and Ch4

- The channel check box only specifies whether to display the graph on the screen; for a channel that you don't trace or trigger, select "Not Selected" in (3).

(2)

- Select the line colors (15 in total) of the channel graph.

(3) Select the monitoring variable for each channel (Velocity Feedback[rpm])

- Select the items of the channel graph to be monitored.

(4) Auto

- This selects the range of Y axis of the channel graph automatically. (If unchecked, Y axis is determined by manual setting in (5).)

(5) Ymin and Ymax

- This is the range of Y axis of the channel graph that the user has to set manually. Use the unit according to the monitoring variable set up in (3). If Velocity Feedback[rpm] is selected, Ymin and Ymax will have the range of -100[rpm] to 100[rpm] in Figure 3-5.2.

■ X-Axis (Time Base)

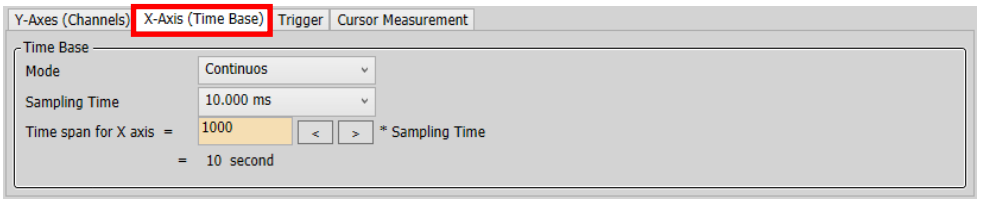


Figure 3-5.3

(1) Mode

- For Trace, select "Continues". For Trigger, select "Triggered".

(2) Sampling Time

- When all of four channels are used, the default is 20ms. (Each channel needs at least 5msec. If a lower sampling time is set, the graph may be distorted.)

(3) Time span for X axis

- This specifies the time span for X axis of the graph. (The number of time spans can be set by 100 units for Trace but, for Trigger, it should be 256, 512, or 1024.)

The X axis of the graph indicates the time (sec). In the above Figure 3-7.2, if the sampling time for one channel is 20ms and the time span is 250, the length of X axis is 0.02 * 250 = 5 seconds. It means that 250 data pieces sampled in every 20ms will be displayed on the X axis.

■ Trigger

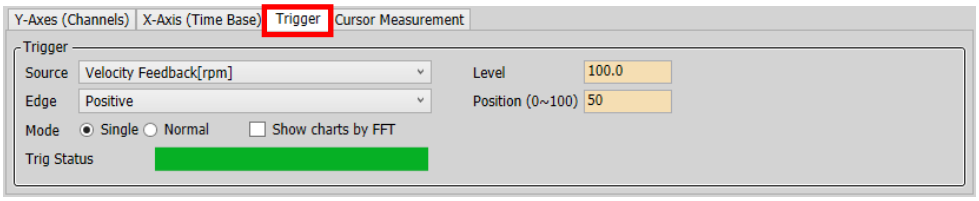


Figure 3-5.4

(1) Source

- Select a source channel to trigger ("Immediate Trigger" can be activated instantly).

(2) Edge

- Select the edge to trigger; positive or negative.

(3) Level

- Set the trigger level. (Use the unit according to the source type.)

(4) Position

- Select somewhere between the trigger point 0 and 100% (If 0 is selected, the trigger point is located at the left end of the graph. If 100 is selected, it is located at the right end).

(5) Mode

- Select a trigger mode: "Single" for one time; "Normal" for continuous.

(6) Show charts by FFT

- When the trigger is completed and checked, an analysis graph converted to FFT is displayed. (Refer to Figure 3-5.5) Set up Notch Filter properly to reduce the vibration by detecting the resonance frequency in the normal time and analyzing the results.

  (You can access and set up Notch Filter by using 'Gain Window' in Figure 3-7.4, or 'Advanced' →'Controls' → 'Current Loop' from the top menu.)

(7) Trig Status

- Trigger progress is displayed by using Progress Bar.

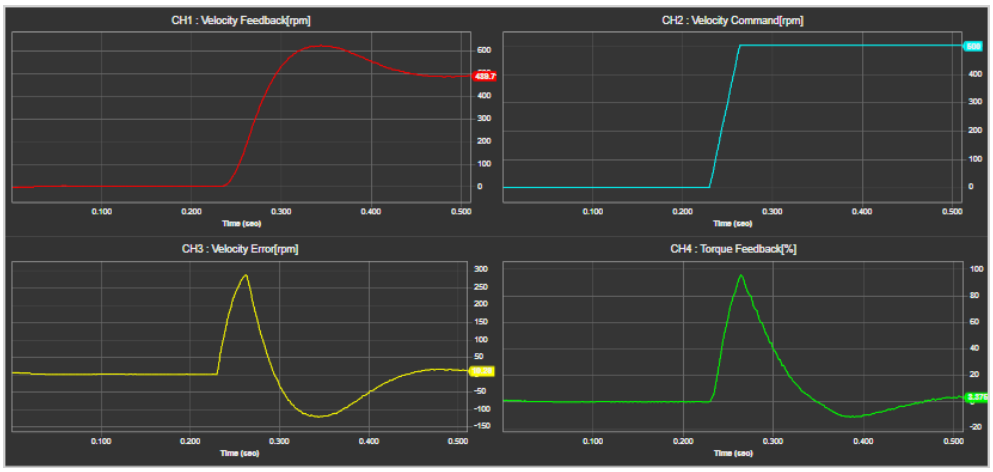
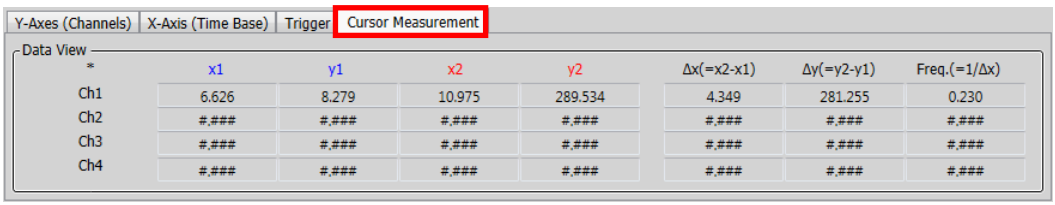


Figure 3-5.5

Figure 3-5.5 shows an example of a single trigger as presented in Figure 3-5.4, where the source channel is "Velocity Feedback[rpm]"; Trigger Level is 100[rpm] at the positive edge; and the graph's Trigger Position is located at 50% (center).

■ Cursor Measurement



*	x1	y1	x2	y2	Δx(=x2-x1)	Δy(=y2-y1)	Freq.(=1/Δx)
Ch1	6.626	8.279	10.975	289.534	4.349	281.255	0.230
Ch2	#.###	#.###	#.###	#.###	#.###	#.###	#.###
Ch3	#.###	#.###	#.###	#.###	#.###	#.###	#.###
Ch4	#.###	#.###	#.###	#.###	#.###	#.###	#.###

Figure 3-5.6

- Check Cursor Enabled on the right side in figure 3-5.1. At the time, vertical bars are displayed in each channel-specific graph. In the channel graph to be measured, click and move the blue vertical bar by using the left mouse button to measure X1 and Y1 values. Then, click and move the orange vertical bar by using the left mouse button to measure X2 and Y2 values. This way, you can get the difference between the two points (ΔX and ΔY) and Freq.

■ Start and Stop of Trace / Trigger Monitor

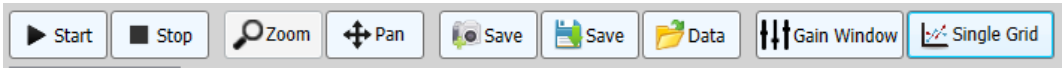


Figure 3-5.7

Once Trace / Trigger Monitor setup is completed, you can monitor the operation state in graph after pressing the Start button as shown in Figure 3-5.7. Pressing the 'Stop' button will stop the movement of the graph.

(1) Zoom

- Select the Zoom button. Press the left mouse button and drag on the channel graph to be zoomed to specify the zoom area and release the button. If you double click, zoom setting is initialized.

(2) Pan

- Select the Pan button. Press the left mouse button (hand shaped icon shown) on the channel graph and move left and right to view it in a panorama format. If you double click, zoom setting is initialized.
- Place the mouse cursor on the channel graph and roll the mouse wheel forward or backward to zoom in or out the X axis.

(3) Save(Save Image)

- Save the current graph as an image file in PNG format.

(4) Save(Save as Data)

- Save the current graph as a text file with extension ".lsm".

(5) Data(Open Data)

- Read and display a file that is saved as an ".lsm" text file.

(6) Gain Window

- Pressing this button displays the window as shown in Figure 3-5.8. You can use the Trace / Trigger graph displayed to set up Position Loop, Velocity Loop and Current Loop.

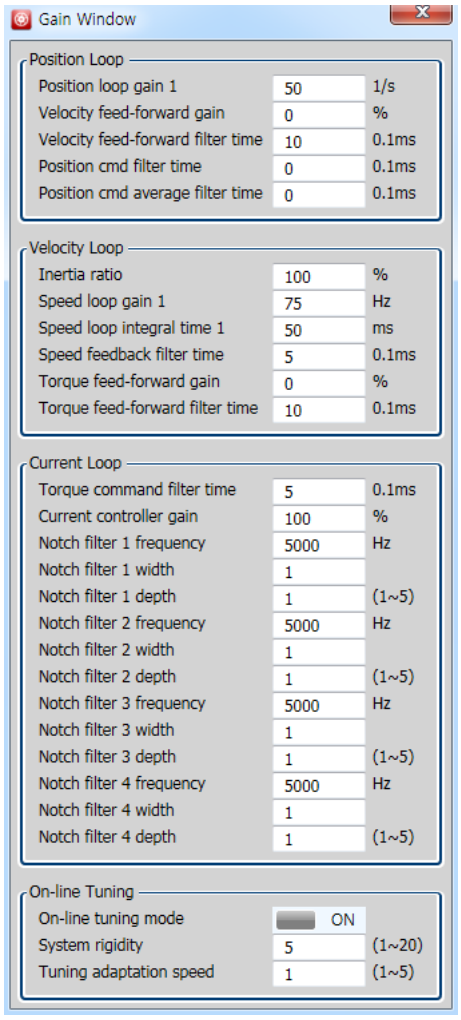

Gain Window
Position Loop
Position loop gain 1 50 1/s
Velocity feed-forward gain 0 %
Velocity feed-forward filter time 10 0.1ms
Position cmd filter time 0 0.1ms
Position cmd average filter time 0 0.1ms
Velocity Loop
Inertia ratio 100 %
Speed loop gain 1 75 Hz
Speed loop integral time 1 50 ms
Speed feedback filter time 5 0.1ms
Torque feed-forward gain 0 %
Torque feed-forward filter time 10 0.1ms
Current Loop
Torque command filter time 5 0.1ms
Current controller gain 100 %
Notch filter 1 frequency 5000 Hz
Notch filter 1 width 1
Notch filter 1 depth 1 (1~5)
Notch filter 2 frequency 5000 Hz
Notch filter 2 width 1
Notch filter 2 depth 1 (1~5)
Notch filter 3 frequency 5000 Hz
Notch filter 3 width 1
Notch filter 3 depth 1 (1~5)
Notch filter 4 frequency 5000 Hz
Notch filter 4 width 1
Notch filter 4 depth 1 (1~5)
On-line Tuning
On-line tuning mode ON
System rigidity 5 (1~20)
Tuning adaptation speed 1 (1~5)

Figure 3-5.8

■ Position Loop

(1) Position loop gain 1 (0x2101)

- This specifies position loop gain 1. This specifies the whole responsiveness of the position controller. As the setting increases, the responsiveness gets higher. Too large setting value may cause vibration depending on the load.

(2) Velocity feed-forward gain (0x210C)

- This specifies the Velocity Feed-forward Gain. This specifies the feedforward gain for the speed command during position control. The larger the setting is, the less the positional error is. If you set a too large value depending on the load, vibration or overshoot may occur. When adjusting the gain, increase the setting gradually.

(3) Velocity feed-forward filter time (0x210D)

- This specifies the Time Constant of the Velocity Feed-forward Filter. This applies low pass filter to the compensated amount added to the speed command by the speed feedforward gain. You can enhance the system stability by using it when you set a large speed feedforward gain or when there is excessive change in position command.

(4) Position cmd filter time (0x2109)

- Sets position command filter time constant. This applies a low pass filter for position command to smoothen the position command. Especially, this can be used for setting a higher gear ratio.

(5) Position cmd average filter time (0x210A)

- Sets position command average filter time constant. This applies a moving average filter for position command to smoothen the position command.

■ Velocity Loop

(1) Inertia Ratio (0x2100)

- Sets inertia ratio. This specifies the ratio of the load inertia to the motor's rotor inertia in %.

  Inertia ratio = Load inertia / Motor's rotor inertia x 100

  The inertia/load ratio is an important control parameter for the operation of the servo. It is crucial to set the correct inertia ratio for optimal servo operation. You can estimate the inertia ratio by auto gain tuning. The ratio will be continuously estimated during operation if you carry out real-time gain tuning.

(2) Speed loop gain 1 (0x2102)

- This specifies speed loop gain 1. This specifies the whole responsiveness of the speed controller. To make the whole responsiveness of the system higher, you have to set the speed loop gain large as well, along with the position loop gain. Too large setting value may cause vibration depending on the load.

(3) Speed loop integral time 1 (0x2103)

- This specifies speed loop integral time constant 1. This specifies the integral time constant of the speed controller. If you set it larger, error will be reduced at the steady state (stopped or driving at constant speed), but vibration may occur at a transient state (while accelerating or decelerating).

(4) Speed feedback filter time (0x210B)

- This specifies the Time Constant of the Speed Feedback Filter. This applies a low pass filter to the speed feedback signal calculated from the encoder. In case that system vibration occurs or vibration occurs when a gain load with too large of an inertia is applied, you can suppress the vibration by setting appropriate value.

(5) Torque feed-forward gain (0x210E)

- This specifies the Torque Feed-forward Gain. This specifies the feedforward gain for the torque command during speed control.

(6) Torque feed-forward filter time (0x210F)

- This specifies the Time Constant of the Torque Feed-forward Filter. This applies low pass filter to the compensated amount added to the torque command by the torque feed-forward gain.

■ Current Loop

(1) Torque command filter time (0x2104)

- This specifies Torque Command Filter Time Constant 1. This applies a low pass filter for torque command. You can improve the system stability by setting an appropriate value to smoothen the torque command. If you set it too large, the delay for the torque command will be longer, reducing the system responsiveness.

(2) Current controller gain (0x2514)

- This specifies the current controller gain. Lowering the setting value will reduce the noise, but the drive's responsiveness decreases as well.

(3) Notch Filter 1 Frequency (0x2501)

- This specifies the frequency of the notch filter 1.

(4) Notch filter 1 width (0x2502)

- This specifies the width of the notch filter 1.

(5) Notch filter 1 depth (0x2503)

- This specifies the depth of the notch filter 1.

(6) Notch filter 2 frequency (0x2504)

- This specifies the frequency of the notch filter 2.

(7) Notch Filter 2 width (0x2505)

- This specifies the width of the notch filter 2.

(8) Notch filter 2 depth (0x2506)

- This specifies the depth of the notch filter 2.

(9) Notch filter 3 frequency (0x2507)

- This specifies the frequency of the notch filter 3.

(10) Notch Filter 3 width (0x2508)

- This specifies the width of the notch filter 3.

(11)Notch filter 3 depth (0x2509)

- This specifies the depth of the notch filter 3.

(12)Notch filter 4 frequency (0x250A)

- This specifies the frequency of the notch filter 4.

(13)Notch Filter 4 width (0x250B)

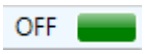
- This specifies the width of the notch filter 4.

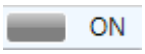
(14)Notch filter 4 depth (0x250C)

- This specifies the depth of the notch filter 4.

■ On-line Tuning

(1) On-line tuning mode (0x250D)

- Set Real-time gain tuning mode.
- 

Real-time gain tuning-use. 

Real-time gain tuning –disuse

(2) System rigidity (0x250E)

- Set the stiffness of the system to be applied during gain tuning. The overall gain will be set greatly or small after tuning according to the setting. Automatically changeable gain is as follow after tuning gain.
- Inertia ratio(0x2100), Position loop gain 1(0x2001), Speed loop gain 1(0x2102), Speed integral time constant 1(0x2103), Torque command filter time constant 1(0x2104), Notch filter 3 frequency(0x2507), Notch filter 4 frequency (0x250A)

(3) Tuning adaptation speed (0x250F)

- Set speed reflected change of gain during Real-time gain tuning. The higher setting value, the faster change of gain reflects.

3.5.2 Cyclic Monitor

■ Velocity

Item	Value	Unit	Descriptions
Velocity			
Feedback Speed	-499	rpm or mm/s	
Command Speed	-500	rpm or mm/s	
Velocity Actual Value	-4372762	UU/s	
Velocity Demand Value	-4369067	UU/s	

Figure 3-5.9

(1) Feedback Speed (0x2600)

- This shows the current rotation speed of the motor.

(2) Command Speed (0x2601)

- This represents the speed command input to the speed control loop of the drive.

(3) Velocity Actual Value (0x606C)

- This displays the actual speed value in user-defined units.

(4) Velocity Demand Value (0x606B)

- This displays the output speed of the position controller or the command speed input to the speed controller.

■ Position

Item	Value	Unit	Descriptions
Position			
Following Error	0	pulse	
Position Actual Value	21845203	UU	
Position Demand Value	187	UU	
Following Error Actual Value	0	UU	
Position Actual Internal Value	21845203	pulse	

Figure 3-5.10

(1) Following Error (0x2602)

- This represents the positional error of position control.

(2) Position Actual Value (0x6064)

- This displays the actual position value in the user-defined position unit (UU).

(3) Position Demand Value (0x6062)

- This displays the position value required in the user-set position unit (UU).

(4) Following Error Actual Value (0x60F4)

- This displays the actual position error during position control.

(5) Position Actual Internal Value (0x6063)

- This displays the actual internal position value in encoder pulses.

■ Torque (Force)

Item	Value	Unit	Descriptions
Torque (Force)			
Torque Actual Value	1.8	%	
Torque Demand Value	1.6	%	

Figure 3-5.11

(1) Torque Actual Value (0x6077)

- This displays the actual torque value generated by the drive in 0.1% increments of the rated torque.

(2) Torque Demand Value (0x6074)

- This displays the current torque demand value in 0.1% increments of the rated torque.

■ Overload

Overload		
Accumulated Operation Overload		%
Instantaneous Max. Operation Overload		%
RMS Operation Overload		%
Accumulated Regeneration Overload		%

Figure 3-5.12

(1) Accumulated Operation Overload

- This represents the accumulated operation overload rate. When the value of the accumulated operation overload rate reaches the overload warning level setting (0x2010), the operation overload warning (W10) will occur; when it reaches 100%, the operation overload alarm (AL-21) will occur.

(2) Instantaneous Max. Operation Overload (0x2604)

- This represents the maximum value of the operation overload rate output instantaneously from the drive. This value can be initialized by the initialization of the instantaneous maximum operation overload.

(3) RMS Operation Overload

- This represents average value of operation overload rate for 15 seconds.

(4) Accumulated Regeneration Overload (0x2606)

- This represents the accumulated overload rate of the regenerative resistor due to regenerative operation. In case that the value of the accumulated regenerative overload rate reaches 100%, a regenerative overload alarm (AL-23) will be generated.

■ Encoder

Item	Value	Unit	Descriptions
Encoder			
SingleTurn Data	504491	pulse	
Mechanical Angle	34.3	degree	
Electrical Angle	-113.4	degree	
MultiTurn Data	40	revolutions	

Figure 3-5.13

(1) SingleTurn Data (0x2607)

- This represents the single-turn data of the motor. Values ranging from 0 to (encoder resolution-1) are displayed.

(2) Mechanical Angle (0x2608)

- This represents the single-turn data of the motor, ranging from 0.0 to 359.9.

(3) Electrical Angle (0x2609)

- This represents the electrical angle of the motor, ranging from -180.0 to 180.0.

(4) MultiTurn Data (0x260A)

- This represents the multi-turn data of multi-turn encoder.

■ General

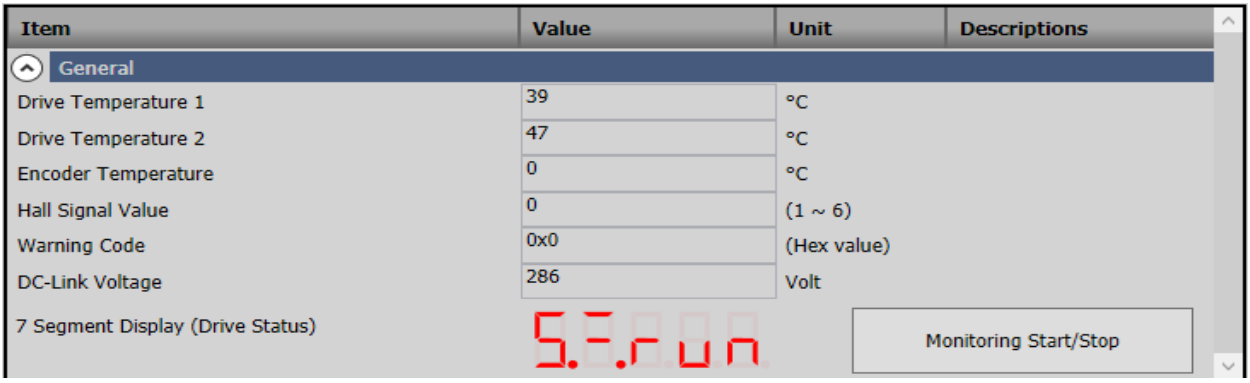


Figure 3-5.14

(1) Drive Temperature 1 (0x260B)

- It indicates Drive Internal Temperature 1. It is the temperature measured by the temperature sensor integrated onto the drive power board. If the measurement is higher than 95℃, the drive overheat alarm 1 (AL-22) will be generated.

(2) Drive Temperature 2 (0x260C)

- It indicates Drive Internal Temperature 2. This represents the temperature measured by the temperature sensor integrated onto the drive control board. If the measurement is higher than 90℃, the drive overheat alarm 2 (AL-25) will be generated.

(3) Encoder Temperature (0x260D)

- It indicates Encoder Internal Temperature. This represents the temperature measured by the temperature sensor integrated into serial encoder provided by LS Mecapion (if the setting values of the encoder type (0x2001) are 3, 4, 5, and 6). If the measured temperature is higher than 90℃, the encoder overheat alarm (AL-26) will be generated.

(4) Hall Signal Value (0x2612)

- This represents the signal of the hall sensor installed in the encoder (or motor). This can be used to verify the connection status of the hall sensor signal or compare the U-/V-/W-phases of the motor with the direction of the hall sensor signal.

(5) Warning Code (0x2614)

- It indicates a Warning Code which has occurred in the Drive.

(6) DC Link Voltage (0x2605)

- This represents the DC link voltage by the main power input.

(7) 7 Segment Display (0x2008)

- It indicates a 7-Segment for indicating servo status.

Setting value	Display Item	Unit	Description
0	Operation Status	-	
1	Speed Feedback	rpm, mm/s	
2	Speed Command	rpm, mm/s	
3	Torque Feedback	0.1%	
4	Torque Command	0.1%	
5	Accumulated Operation Overload	0.1%	
6	DC Link Voltage	V	
7	Accumulated Regenera-tion Overload	0.1%	
8	Machine Degree	0.1deg	
9	Electrical Degree	0.1deg	
10	Inertia Ratio	%	
11	Drive Temperature 1	℃	Surrounding of near drive power module
12	Drive Temperature 2	℃	Drive Internal Temperature
13	Encoder Temperature 1	℃	Encoder Internal Temperature
14	Node ID	-	
15	Overload Max. value		
16	Overload average value		

3.5.2 Comm. Packet Viewer

This is a window for debugging the communication status between Drive CM and the servo drive.

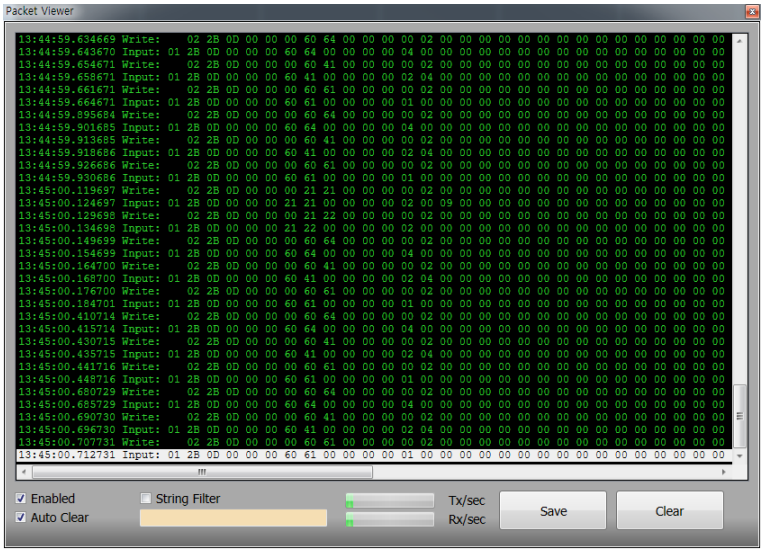


Figure 3-5.15 Comm. Packet Viewer

In the window, the packets are composed of transmission time, I/O (write and input) status and transmission data. "Write" indicates the packet that is output from Drive CM to the servo drive. "Input" indicates the packet that is returned from the servo drive to Drive CM.

Figure 3-5.16 Comm. Packet Viewer

(1) Enabled

- Enables the packet communications.

(2) Auto Clear

- Automatically clears when the packet data exceeds 2000 lines in the display window.

(3) String Filter

- When String Filter is selected, only the packet that includes the text in the Editor on the right is displayed on the debugging window.

(4) Save

- Save the packet data in the display window as a text file.

(5) Clear

- Clears the packet data in the display window.

(6) Tx/sec, Rx/sec

- Rates of the packet data written or input per second are displayed by using the progress bar.

3.6 PROCEDURES

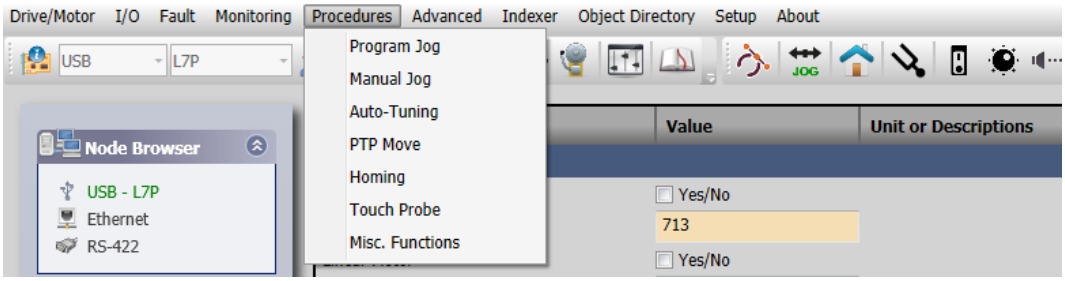


Figure 3-6

From the top main menu, select a necessary menu such as Procedures→ Manual Jog or Program Jog.

3.6.1 Program Jog

Programmed jog operation is a function to verify a servo motor's operation with a speed control function by presetting the operation speed and time, without an upper level controller.

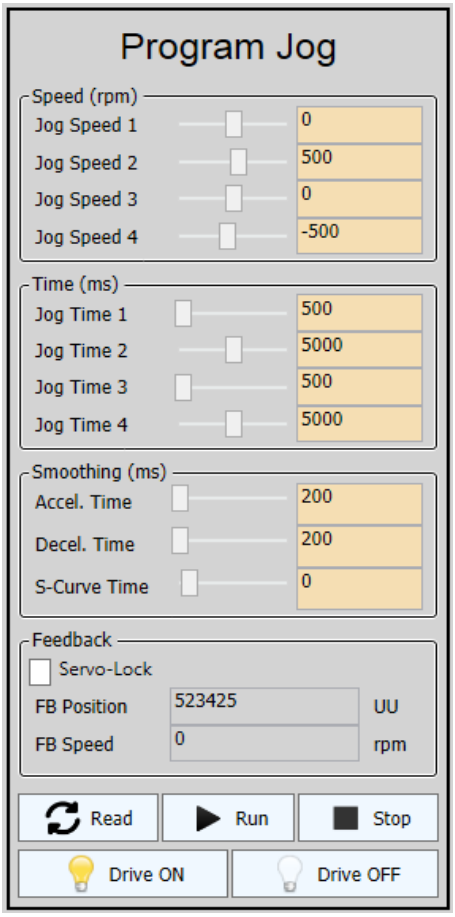


Figure 3-6.1

(1) Speed (Jog Speed 1, 2, 3, and 4) (0x2304, 0x2305, 0x2306 and 0x2307)

- Use the scroll bar or text to select 1, 2, 3 or 4 to set the speed of the programmed jog operation.

(2) Time (Jog Time 1, 2, 3, and 4) (0x2308, 0x2309, 0x230A, and 0x230B)

- Use the scroll bar or text to select 1, 2, 3 or 4 to set the time of the programmed jog operation.

(3) Acceleration Time (0x2301)

- Use the scroll bar or text to set the Speed Command Acceleration Time.

(4) Deceleration Time (0x2301)

- Use the scroll bar or text to set the Speed Command Deceleration Time (0x2302).

(5) S-curve Time (0x2302)

- Use the scroll bar or text to set the Speed Command S-curve Time.

(6) Feedback Speed (0x2600)

- This shows the current rotation speed of the motor.

(7) Feedback Position (0x6064)

- This displays the actual position value in the user-defined position unit (UU).

(8) Servo-Lock (0x2311)

- During the speed control operation, the servo position will not be locked even when 0 is entered for a speed command. This is due to the characteristic of speed control; at this moment, you can lock the servo position by using the servo-lock function.

When the setup is finished, press "Drive Enable" and then "Run" button to start operation.

3.6.2 Manual Jog

Manual Jog is a function to check the servo motor's operation using the speed control, without the help of an upper level controller.

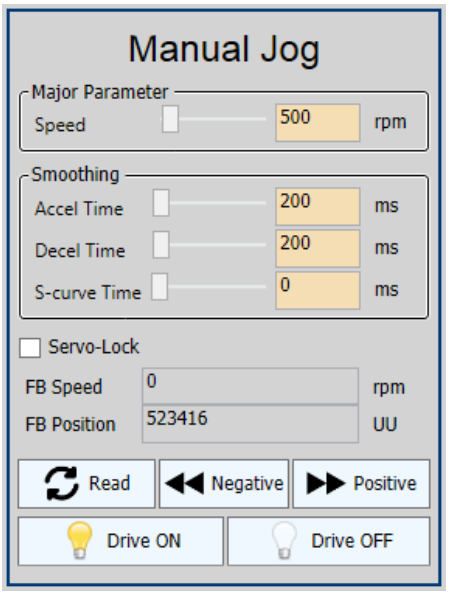


Figure 3-6.2

(1) Speed (0x2300)

- Use the scroll bar or text to set the jog operation speed.

(2) Acceleration Time (0x2301)

- Use the scroll bar or text to set the Speed Command Acceleration Time.

(3) Deceleration Time (0x2302)

- Use the scroll bar or text to set the Speed Command Deceleration Time.

(4) S-curve Time (0x2302)

- Use the scroll bar or text to set the Speed Command S-curve Time.

(5) Feedback Speed (0x2600)

- This shows the current rotation speed of the motor.

(6) Feedback Position (0x6064)

- This displays the actual position value in the user-defined position unit (UU).

(7) Servo-Lock (0x2311)

- During the speed control operation, the servo position will not be locked even when 0 is entered for a speed command. This is due to the characteristic of speed control; at this moment, you can lock the servo position by using the servo-lock function.

When the setup is finished, press "Drive Enable" and then select "Reverse" or "Forward" to start operation.

3.6.3 Auto-Tuning

Use the command generated by the drive itself to automatically set the gain according to the load condition.

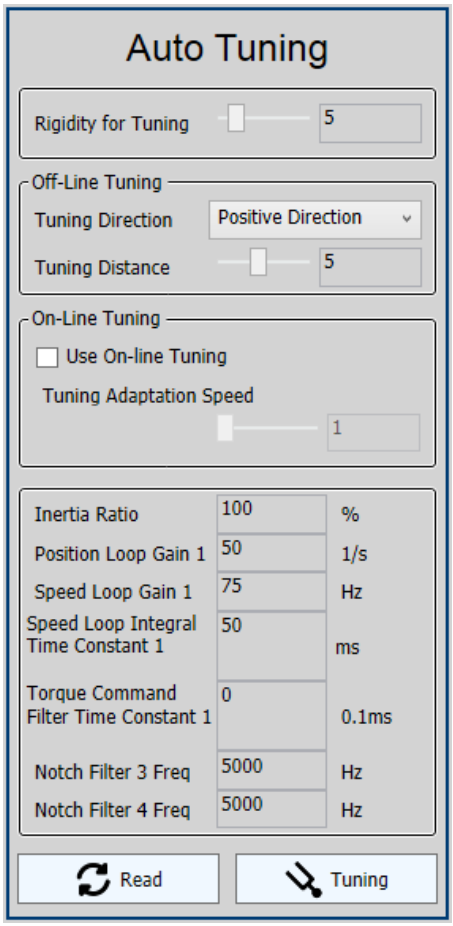


Figure 3-6.3

(1) System Rigidity for Tuning (0x250E)

- The system rigidity value is set during the gain tuning to get the entire gain higher or lower. Set the appropriate value depending on the rigidity of the driven load.

(2) Tuning Direction (0x2510)

- This specifies the operation direction (CW or CCW) of the off-line gain tuning and generates a Sinusoidal command.

(3) Tuning Distance (0x2511)

- This specifies the movement distance of offline gain tuning; the larger the value is, the longer the distance is. Set the distance according to the current conditions.

(4) Use On-line tuning (0x250E)

- If selected, the online gain tuning is used. (When you use this option, set "Tuning Adaptation Speed" in the following.)

(5) Tuning Adaptation Speed (0x250F)

- This specifies the speed reflecting the changes of gain when performing an on-line gain tuning. The larger the setting value is, the faster the gain change is reflected.

(6) Tuning

- When all the settings are completed, press the tuning button to start tuning. As shown in Figure 3-8.3, the variations after tuning are displayed in the following order: the Inertia ratio, position loop gain, speed loop gain, speed integral time constant, torque command filter time constant, notch filter 3 frequency, and notch filter 4 frequency.

3.6.4 PTP Movement

You can use the Profile Position (PP) mode to set the profile speed (0x6081), profile acceleration (0x6083) and deceleration (0x6084) to generate a position profile in the drive, and move up to the target location (0x607A). You can also set your target location 2 to repeat movements between the two locations.

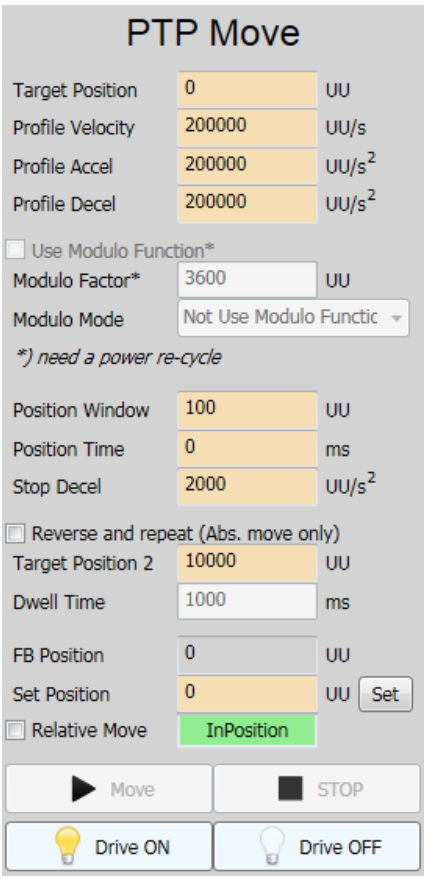


Figure 3-6.4

■ Target Position Mode

(1) Target Position (0x607A)

- This specifies the target position for PP (Profile Position) mode.

(2) Profile Velocity (0x6081)

- This specifies the profile speed for the PP mode operation.

(3) Profile Acceleration (0x6083)

- This specifies the profile acceleration for the PP mode operation.

(4) Profile Deceleration (0x6084)

- This specifies the profile deceleration for the PP mode operation.

■ Modulo Mode

(1) Use Modulo Function

- If selected, it enables the appropriate panel to allow Modulo setting.

(2) Modulo Factor (0x240C)

- This specifies the factor for using the Modulo function.

(3) Modulo Mode (0x240B)

- This specifies whether to use the Modulo function.

Setting values
Not Use Modulo Function: Does not use the Modulo function.
Always Positive Move With Modulo Function: Uses the Modulo function to move forward.
Always Negative Move With Modulo Function: Uses the Modulo function to move backward.
Move Shortest With Modulo Function: Uses the Modulo function to move via the possible shortest distance.
Move Absolute With Modulo Function: Uses the Modulo function to move to the absolute value.
Move Relative With Modulo Function: Uses the Modulo function to move to the relative val-ue.

Table 5 Modulo Mode Setting

■ Position Window

(1) Position Window(0x6067)

- This sets the position reached range for the target.

(2) Position Time (0x6068)

- This sets the time it takes to reach the target position.

(3) Stop Deceleration (0x6085)

- This specifies the deceleration for Quick Stop.

■ Reverse and Repeat

(1) Reverse and Repeat (Abs, move only)

- If selected, the appropriate panel is enabled.

(2) Target Position 2 (0x607A)

- This specifies Target Position to be repeated.

(3) Dwell Time (0x3100~313F :09)

- This specifies the waiting time after having reached Target Position 1 or 2.

■ Relative Move

(1) FB Position (0x6064)

This displays the actual position value in user-defined position unit (UU).

(2) Set Position (0x607C)

- This sets the offset value for the origin of the absolute encoder or absolute external scale and the zero position of the actual position value (0x6064).

(3) Relative Move

- If checked, movement is performed to the position which is equal to the current FB Position plus Target Position setting. If unchecked, movement is performed to the Target Position.

(4) Drive ON or Drive OFF

- Turns Servo ON or OFF.

(5) Move or Stop

- Start or Stop PTP operation.

3.6.5 Homing

Each drive provides its own homing function. The user can set the speed, acceleration, off-set and homing method according to the I/O parameters for the homing mode.

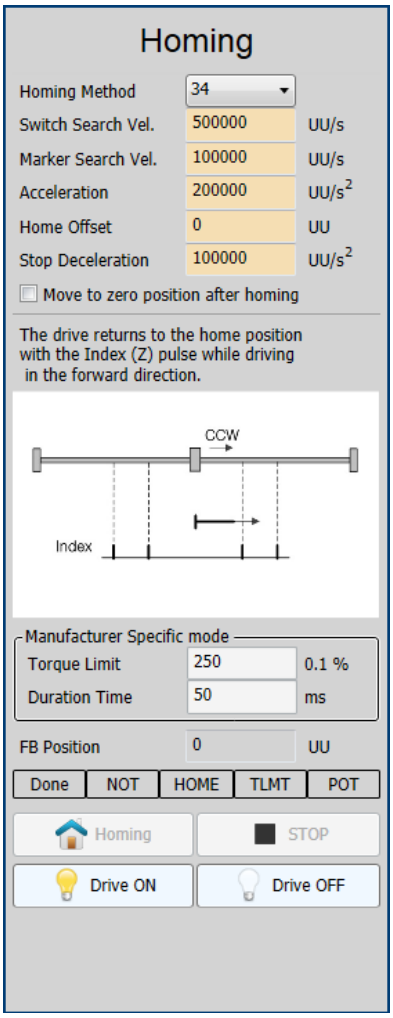


Figure 3-6.5

Figure 3-6.6

(1) Homing Method (0x6098)

- This specifies the homing methods: select 1, 2, 7, 8, 9, 10, 11, 12, 13, 14, 24, 28, 33, 34, 35, -1, -2, -3 or -4. (For the information on the method numbers, refer to the drive manual.)

Methods	Details
1	Homing using the index pulse and reverse limit contact
2	Homing using the index pulse and forward limit contact
7~14	Homing using the index pulse and home contact
24	Same as method 8 (does not use the index pulse)
28	Same as method 12 (does not use the index pulse)
33, 34	Homing to the index pulse
35	Homing to the current position
-1	Homing using the negative stopper and index pulse
-2	Homing using the positive stopper and index pulse
-3	Homing using the negative stopper only
-4	Homing using the positive stopper only
Not support	If you didn't select the support mode of Homing Method (Figure 3-6.6)

(2) Switch Search Vel. (0x6099:01)

- This specifies switch search velocity for Homing.

(3) Marker Search Vel. (0x6099:02)

- This specifies Zero search velocity for Homing.

(4) Acceleration (0x609A)

- This specifies acceleration of operation speed for homing.

(5) Home Offset (0x607C)

- This sets the offset value for the origin of the absolute encoder or absolute external scale and the zero position of the actual position value (0x6064).

(6) Stop Deceleration (0x6085)

- This specifies the deceleration for Quick Stop.

(7) Move to zero position after homing (0x201E)

- This specifies whether to move to Zero Position by Home offset[0x607C] after homing is complete.

3.6.6 Touch Probe

This function rapidly captures the position value of the encoder by using external input (PROBE 1 and 2) signals or the Index (Z) pulse of the encoder.

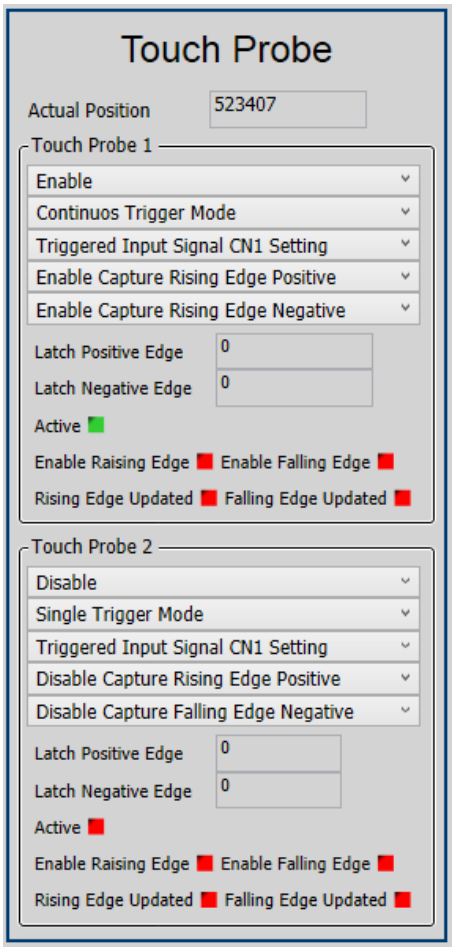


Figure 3-6.7

(1) Enable or Disable (Bit 0 of 0x60B8)

- This specifies whether to use the touch probe.

(2) Trigger Mode (Bit 1 of 0x60B8)

- Select the trigger mode: Single or Continues.

(3) Triggered Input Signal CN1 Setting (Bit 2 of 0x60B8)

- Enables triggers by using the touch probe input that is set at the Connector CN1 (I/O).

(4) Trigger Z Signal Encoder (Bit 2 of 0x60B8)

- Enables triggers by using Z signal indexer input through the encoder

(5) Enable Capture Raising Edge Positive (Bit 4 of 0x60B8)

- Captures the position value of the rising edge.

(6) Disable Capture Raising Edge Positive (Bit 4 of 0x60B8)

- Does not capture the position value of the rising edge.

(7) Enable Capture Falling Edge Negative (Bit 5 of 0x60B8)

- Captures the position value of the falling edge.

(8) Disable Capture Falling Edge Negative (Bit 5 of 0x60B8)

- Does not capture the position value of the falling edge.

(9) Latch Positive Edge (0x60BA)

- This specifies the position value of latched rising edge.

(10) Latch Negative Edge (60BB)

- This specifies the position value of latched falling edge.

■ Touch Probe Status

(1) Active (Bit 0 of 0x60B9)

- When the touch probe is used, the green color is displayed. When it is not used, the red color is displayed.

(2) Enable Raising Edge (Bit 1 of 0x60B9)

- Green when the position value of the rising edge is saved; red when it is not saved.

(3) Enable Falling Edge (Bit 2 of 0x60B9)

- Green when the position value of the falling edge is saved; red when it is not saved.

(4) Raising Edge Update (Bit 6 of 0x60B9)

- Turns green when the position value of the rising edge is updated.

(5) Falling Edge Update (Bit 7 of 0x60B9)

- Turns green when the position value of the falling edge is updated.

3.6.7 Motor/Hall Phase Correction

Checking the motor wiring and hall sensor wiring in case of 3rd party motor and setting the Sequence of hall sensor UVW, polarity of hall sensor signal and motor rotation direction.

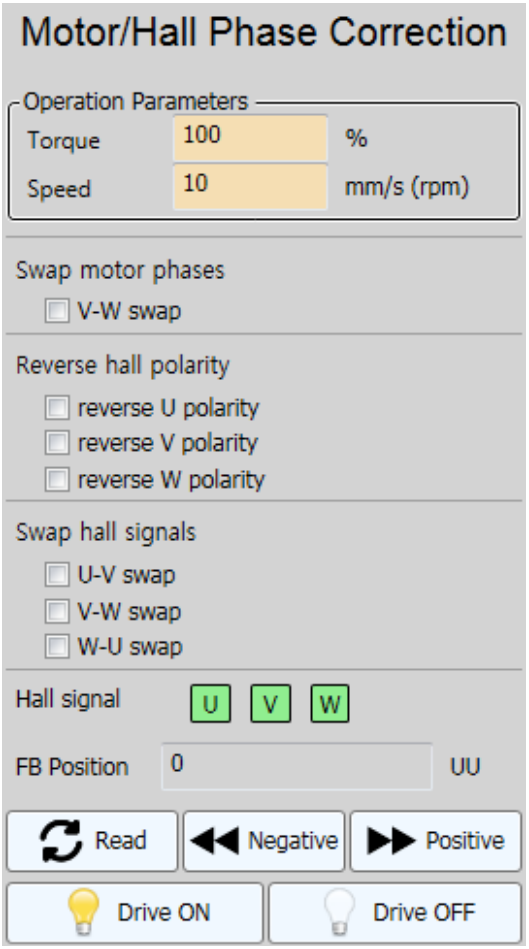


Figure 3-6.8 Motor/Hall Phase Correction

■ Operation Parameters

(1) Torque

- Set loading rate during operating.
- Minimum Value : 1, Maximum value : 300

(2) Speed

- Set speed during operating.

- Minimum Value 1, Maximum value 100

■ Swap motor phases

(1) V-W swap(0 bit of 0x2020)

- Set motor rotation direction
- Calculating setting value of 0x2004 Exclusive OR

■ Reverse hall polarity

(1) Reverse U polarity(8 bit of 0x2020)

- Hall U polarity reversal

(2) Reverse V polarity(9 bit of 0x2020)

- Hall V polarity reversal

(3) Reverse W polarity(10 bit of 0x2020)

- Hall W polarity reversal

■ Swap hall signals

(1) U-V swap(12 bit of 0x2020)

- Replace Hall U, Hall V

(2) V-W swap(13 bit of 0x2020)

- Replace Hall V, Hall W

(3) W-U swap(14 bit of 0x2020)

- Replace Hall W, Hall U

■ Hall signal

It represents hall signal on the installed encoder (or Motor)

(1) U (2 bit of 0x2612)

(2) V (1 bit of 0x2612)

(3) W (0 bit of 0x2612

3.6.8 Misc. Function

■ Absolute Encoder Reset

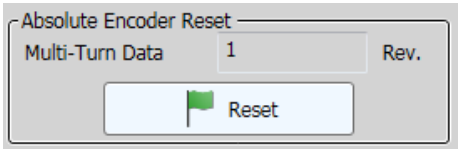


Figure 3-6.9 Absolute Encoder Reset

(1) MultiTurn Data(0x260A)

- Indicates the multi-turn data.

(2) Reset

- Resets SingleTurn Data and MutiTurn Data to 0.

Calibrate Current Offset

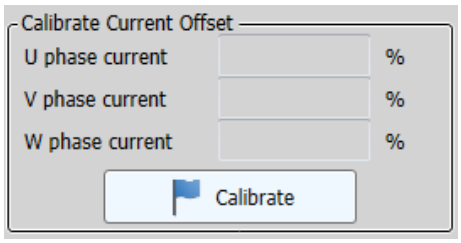


Figure 3-6.10 Calibrate Current Offset

(1) U phase current offset (0x2015)

- Displays the offset value of phase U current.

(2) V phase current offset (0x2016)

- Displays the offset value of phase V current.

(3) W phase current offset (0x2017)

- Displays the offset value of phase W current.
- For a drive with small to medium capacity (7.5 KW or less), this parameter is not used since the W phase current is not separately measured.

(4) Calibrate

- This function is to automatically tune the current offsets of U, V and W phases. The measured values are displayed in (1), (2) and (3), respectively.
- If you don't know the exact settings, do not set up the parameters in (1), (2) and (3) manually.

■ Software Reset

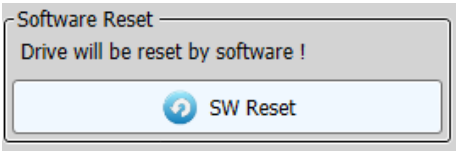


Figure 3-6.11 Software Reset

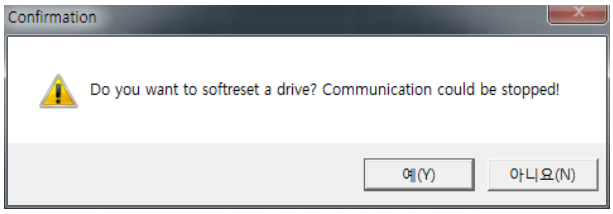


Figure 3-6.12 Software Reset

(1) SW Reset

- Soft-resets the drive.

3.7 Advanced

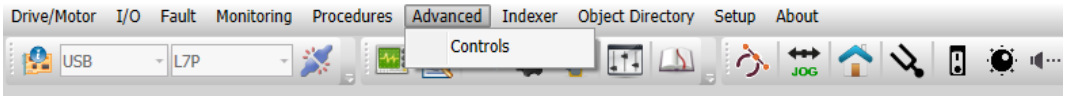


Figure 3-7

3.7.1 Controls

The Controls is composed of five block diagrams. For more information for setting up the blocks, refer to the drive manual.

■ Overall Block Diagram

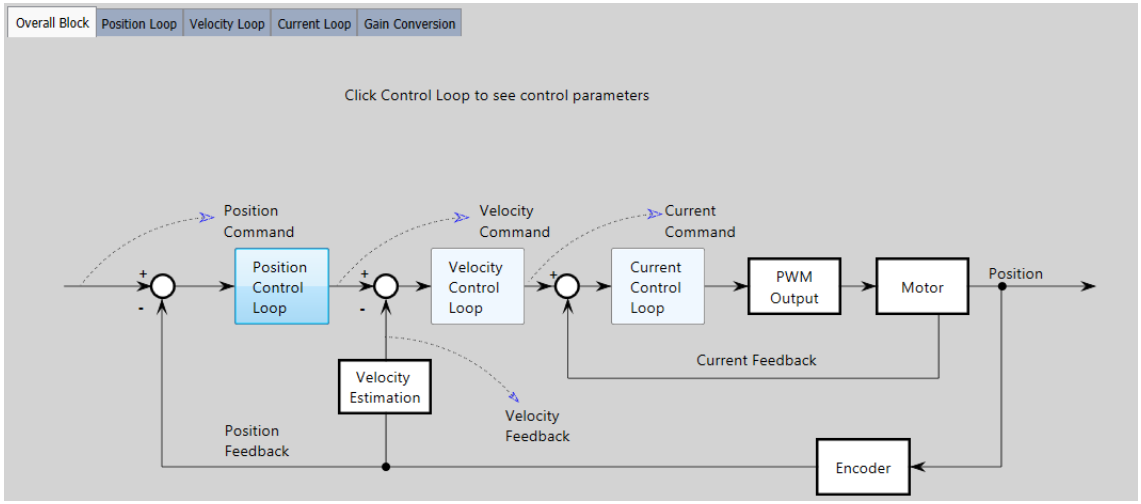


Figure 3-7.1

■ Position Loop

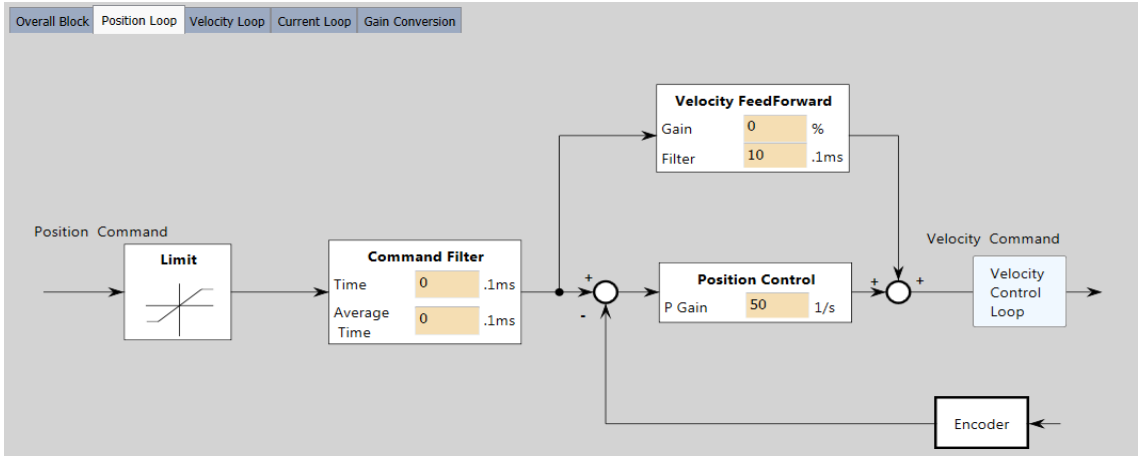


Figure 3-7.2

To set up Position Loop, enter the values in the blocks.

■ Command Filter

(1) Time (0x2109)

- This is the Time Constant of the Position Command Filter.

(2) Average Time (0x210A)

- This is the Time Constant of the Position Command Average Filter.

■ Velocity Feed Forward

(1) Gain (0x210C)

- This indicates the Velocity Feed-forward Gain.

(2) Filter (0x210D)

- This is the Time Constant of the Velocity Feed-forward Filter.

■ Position control

(1) P Gain (0x2101)

- This is the Position Loop Gain. This specifies the whole responsiveness of the position controller.

■ Velocity Loop

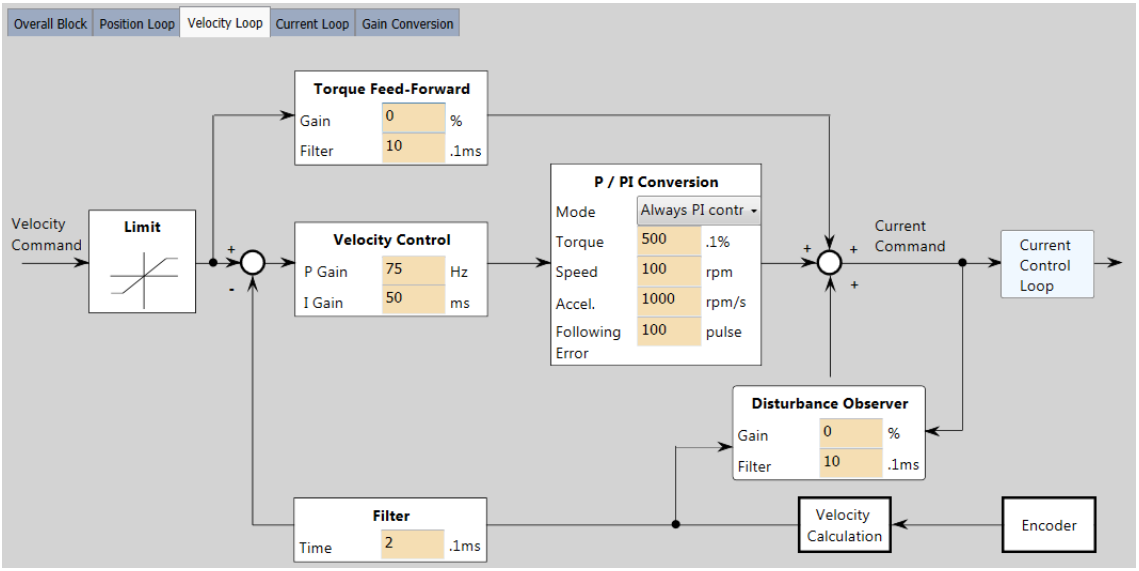


Figure 3-7.3

■ Torque Feed-Forward

(1) Gain (0x210E)

- This indicates the Torque Feed-forward Gain.

(2) Filter (0x210F)

- This is the Time Constant of the Torque Feed-forward.

■ Velocity Control

(1) P Gain (0x2102)

- This is the Speed Loop Gain. This specifies the whole responsiveness of the speed controller.

(2) I Gain (0x2103)

- This is the Integral Time Constant of the Speed Loop. This specifies the integral time constant of the speed controller. If you set it larger, error will be reduced at the steady state (stopped or driving at constant speed), but vibration may occur at a transient state (while accelerating or decelerating).

■ Filter

(1) Time (0x210B)

- This is the Time Constant of the Speed Feedback Filter. This applies a low pass filter to the speed feedback signal calculated from the encoder.

■ P/PI Conversion

(1) Mode (0x2114)

- P/PI control switching mode. This specifies the switch mode between PI control and P control.

(2) Torque (0x2115)

- This is the P control switching torque.

(3) Speed (0x2116)

- This is the P control switching torque.

(4) Accel (0x2117)

- This is the P control switching position error.

(5) Following Error (0x2118)

- This is the P control switching position error.

■ Disturbance Observer

(1) Gain (0x2512)

- This is the Disturbance Observer Gain.

(2) Filter (0x2513)

- This is the Disturbance Observer Filter Time Constant.

■ Current Loop

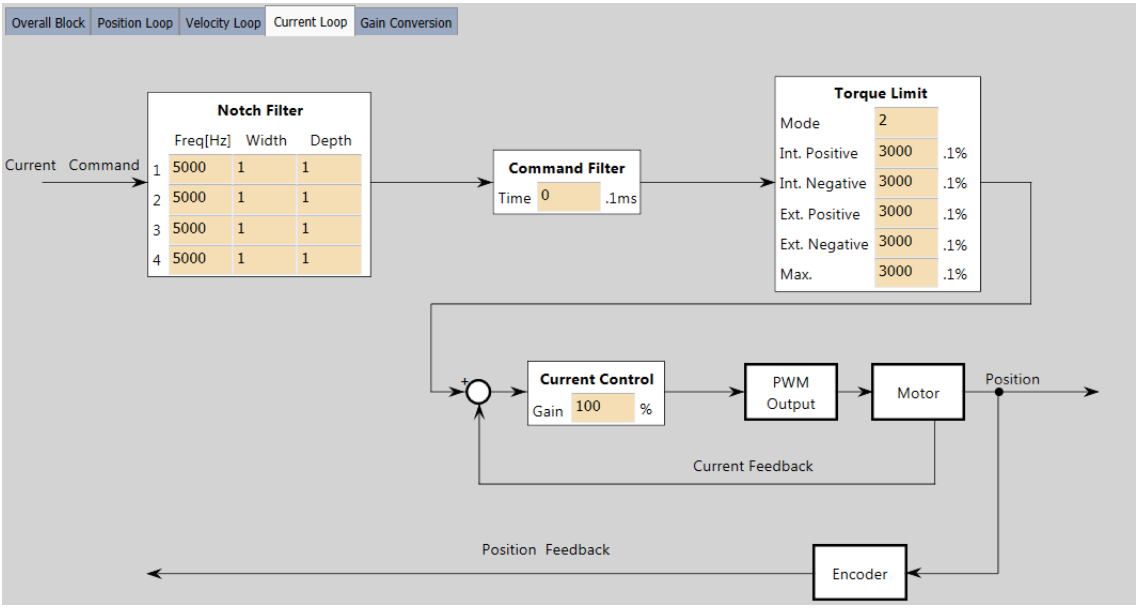


Figure 3-7.4

■ Notch Filter

This is a filter that decelerates suddenly at certain frequencies.

(1) Notch Filter 1 Frequency (0x2501)

- This specifies the frequency of the notch filter 1.

(2) Notch Filter 1 Width (0x2502)

- This specifies the width of the notch filter 1.

(3) Notch Filter 1 Depth (0x2503)

- This specifies the depth of the notch filter 1.

(4) Notch Filter 2 Frequency (0x2504)

- This specifies the frequency of the notch filter 2.

(5) Notch Filter 2 Width (0x2505)

- This specifies the width of the notch filter 2.

(6) Notch Filter 2 Depth (0x2506)

- This specifies the depth of the notch filter 2.

(7) Notch Filter 3 Frequency (0x2507)

- This specifies the frequency of the notch filter 3.

(8) Notch Filter 3 Width (0x2508)

- This specifies the width of the notch filter 3.

(9) Notch Filter 3 Depth (0x2509)

- This specifies the depth of the notch filter 3.

(10) Notch Filter 4 Frequency (0x250A)

- This specifies the frequency of the notch filter 4.

(11) Notch Filter 4 Width (0x250B)

- This specifies the width of the notch filter 4.

(12) Notch Filter 4 Depth (0x250C)

- This specifies the depth of the notch filter 4.

■ Command Filter

(1) Torque Command Filter Time Constant 1 (0x2104)

- This applies a low pass filter for torque command.

■ Torque Limit

(1) Mode (0x2110)

- This is the Torque limit function setup. This specifies the function to limit the output torque of the drive.

(2) Int. Positive (0x60E0)

- This is the Positive Torque Limit Value. This sets the limit of positive torque values.

(3) Int. Negative (0x60E1)

- This is the Negative Torque Limit Value. This sets the limit of negative torque values.

(4) Ext. Positive (0x2111)

- This is the External Positive Torque Limit Value. This sets the limit of external positive torque values according to the torque limit setup.

(5) Ext. Negative (0x2112)

- This is the External Negative Torque Limit Value. This sets the limit of external negative torque values according to the torque limit setup.

(6) Max (0z6072)

- This sets the maximum torque that the motor can output in 0.1% increments of the rated torque.

■ Gain Conversion

This function is to switch between gain groups 1 and 2, as one of the gain adjustment methods and the positioning time may be reduced depending on the load conditions.

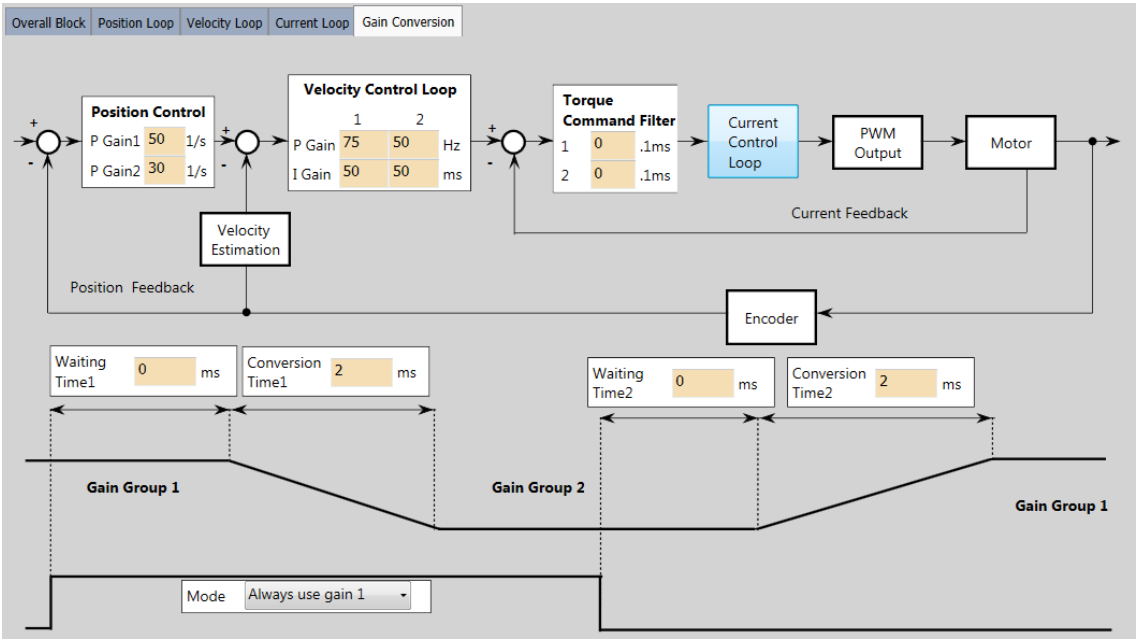


Figure 3-7.5

■ Position Control

(1) P Gain1 (0x2101)

- This is the Position Loop Gain. This specifies the whole responsiveness of the position controller.

(2) P Gain2 (0x2105)

- This specifies the position loop gain used as gain group 2 for gain switching.

■ Velocity Control Loop

(1) P Gain 1 (0x2102)

- This is the Speed Loop Gain. This specifies the whole responsiveness of the speed controller.

(2) P Gain 2 (0x2106)

- This specifies the speed loop gain used as gain group 2 for gain switching.

(3) I Gain 1 (0x2103)

- This specifies the integral time constant of the speed controller.

(4) I Gain 2 (0x2107)

- This specifies the integral time constant of the speed loop used as gain group 2 for gain switching.

■ Torque Command Filter

(1) 1 (0x2104)

- This is the Time Constant of the Torque Command Filter. This applies a low pass filter for torque command.

(2) 2 (0x2108)

- This specifies the time constant of the torque command filter used as gain group 2 for gain switching.

■ Gain Conversion

(1) Waiting Time1 (0x211C)

- This specifies the waiting time before switching from gain group 1 to gain group 2.

(2) Conversion Time1 (0x211A)

- This specifies the time to switch from gain group 1 to gain group 2.

(3) Waiting Time2 (0x211D)

- This specifies the waiting time before switching from gain group 2 to gain group 1.

(4) Conversion Time2 (0x211B)

- This specifies the time to switch from gain group 2 to gain group 1.

(5) Mode (0x2119)

- Sets gain switching mode. You can enhance the performance of the entire system by switching between two gain groups. According to the switching mode, manual switch or automatic switch can be done depending on the external input or output signal, respectively.

3.8 INDEXER (L7P only)

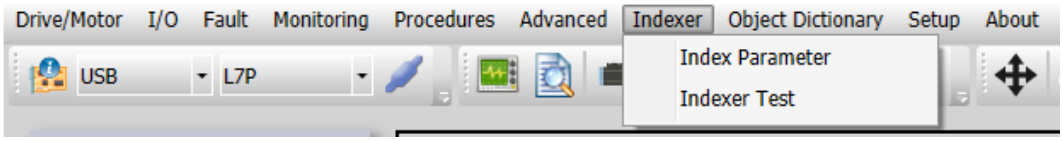


Figure 3-8

From the main menu on the top, select a necessary menu such as Indexer→ Index Parameter or Index Test.

3.8.1 Index Parameter

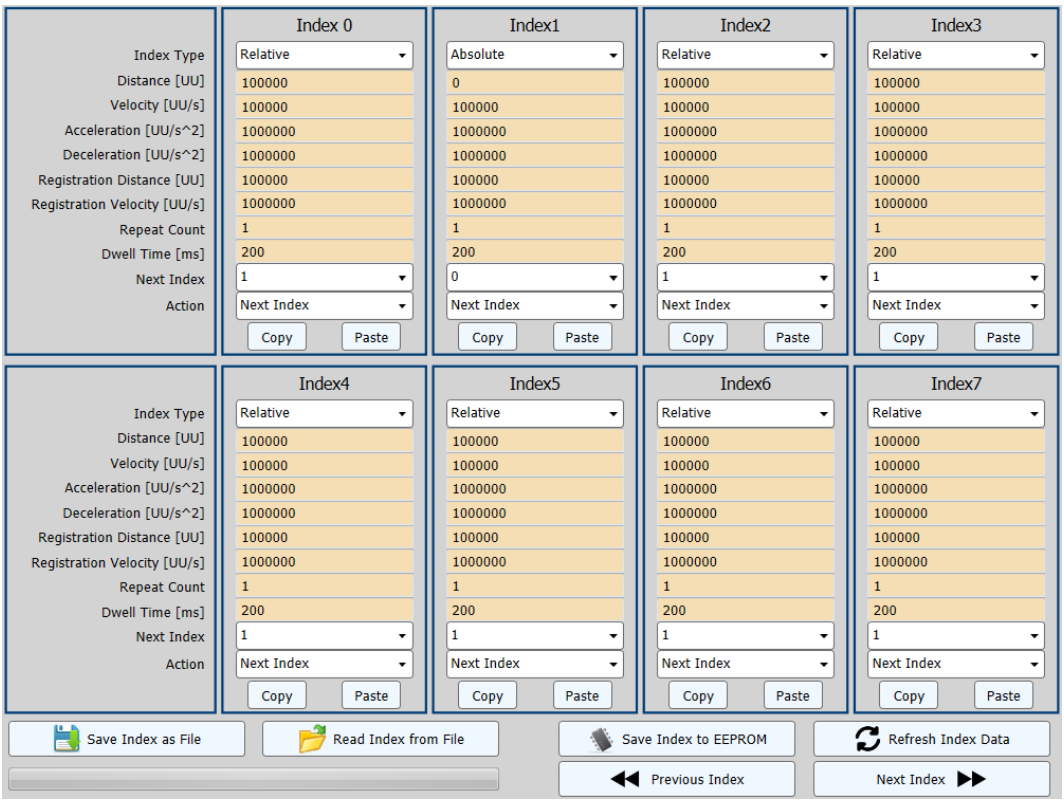


Figure 3-8.1

As shown in Figure 3-8.1, you can edit 8 indices per screen from 64 indices in total. (For information on editing indices, refer to the manual for each index.)

(1) Previous Index

- Displays the previous 8 indices.

(2) Next Index

- Displays the next 8 indices.

(3) Save Index as File

- Saves the current 64 indices as a text file.

(4) Read Index from File

- Reads the index data saved as a text file.

(5) Save Index to EEPROM

- Saves 64 indices in the drive's EEPROM.

(6) Refresh Index Data

- Reads again the index data from the drive.

(7) Copy, Paste

- Copies an index and pastes it to another index.

3.8.2 Indexer Test

Figure 3-8.2

(1) Start Index(0x3008)

- Among the 64 (0 to 63) indices, select an index to start with.

(2) Stop Deceleration (0x6085)

- This specifies the deceleration for Quick Stop.

(3) Current Index

- Displays the number of the current index in operation.

(4) Feedback Speed (0x2600)

- This shows the current rotation speed of the motor.

(5) Feedback Position (0x6064)

- This displays the actual position value in the user-defined position unit (UU).

(6) Drive Enable or Drive Disable

- Turns Servo ON or OFF.

(7) START, STOP, PAUSE

- Starts, stops or pauses the operation of the drive after the servo is on.

3.9 Object Dictionary

This enables you to set up the data structure that includes the parameters, state variables, run commands (procedures), etc.

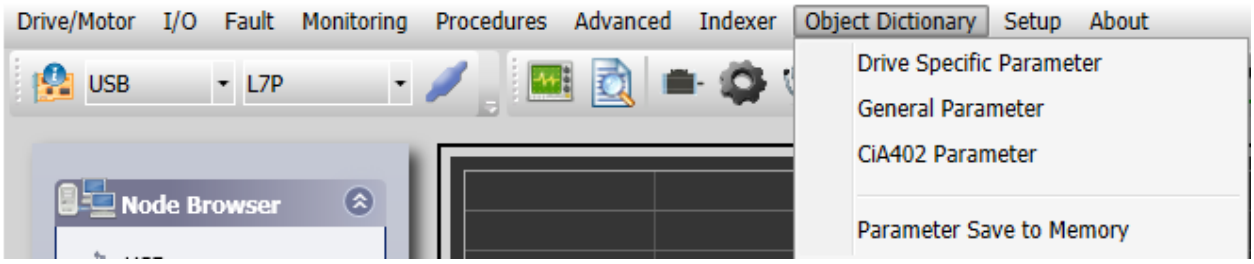


Figure 3-9

From the top main menu, select a necessary menu such as Object Dictionary→ Drive Specific Parameter or General Parameter.

3.9.1 Drive Specific Parameter, General Parameter, Cia402 Parameter

■ Parameter Type

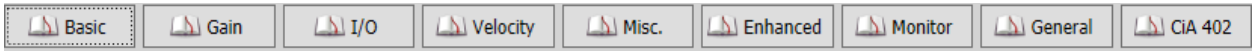


Figure 3-9.1

(1) Basic

- This specifies the basic parameters such as motor ID, encoder type, etc. (0x2000~)

(2) Gain

- This specifies the parameters related to the gain settings. (0x2100~)

(3) I/O

- This specifies the parameters related to I/O such as Digital Input, Digital Output, Analog Input, Analog Monitor, etc. (0x2200~)

(4) Velocity

- This specifies the parameters related to the speed control. (0x2300~)

(5) Misc.

- This specifies various types of parameters. (0x2400~)

(6) Enhanced

- This specifies the parameters related to the tuning and adjustment functions. (0x2500 -)

(7) Monitor

- This specifies the parameters related to monitoring. (0x2600~)

(8) General

- This specifies the general parameters including the communication setup. (0x1000 -)

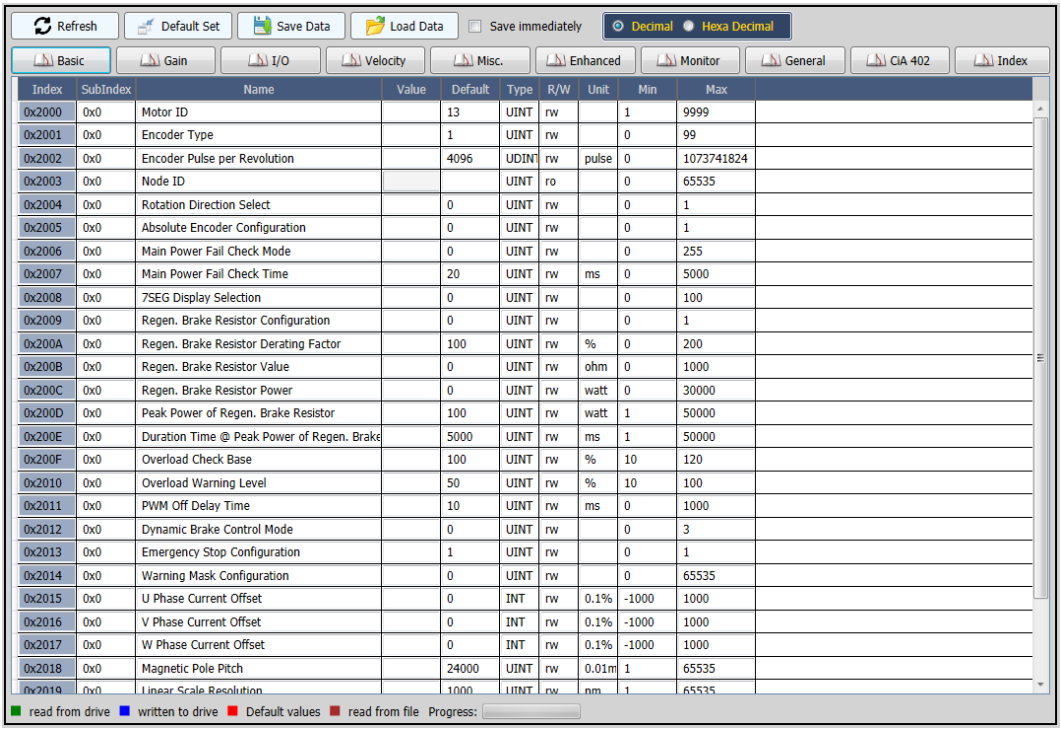
(9) CiA 402

- This specifies the parameters related to CiA 402. (0x6000~)

(10) Index

- This specifies the parameters related to index. (0x3000~)

■ Editing Parameters



Index	SubIndex	Name	Value	Default	Type	R/W	Unit	Min	Max
0x2000	0x0	Motor ID		13	UINT	rw		1	9999
0x2001	0x0	Encoder Type		1	UINT	rw		0	99
0x2002	0x0	Encoder Pulse per Revolution		4096	UDINT	rw	pulse	0	1073741824
0x2003	0x0	Node ID			UINT	ro		0	65535
0x2004	0x0	Rotation Direction Select		0	UINT	rw		0	1
0x2005	0x0	Absolute Encoder Configuration		0	UINT	rw		0	1
0x2006	0x0	Main Power Fail Check Mode		0	UINT	rw		0	255
0x2007	0x0	Main Power Fail Check Time		20	UINT	rw	ms	0	5000
0x2008	0x0	7SEG Display Selection		0	UINT	rw		0	100
0x2009	0x0	Regen. Brake Resistor Configuration		0	UINT	rw		0	1
0x200A	0x0	Regen. Brake Resistor Derating Factor		100	UINT	rw	%	0	200
0x200B	0x0	Regen. Brake Resistor Value		0	UINT	rw	ohm	0	1000
0x200C	0x0	Regen. Brake Resistor Power		0	UINT	rw	watt	0	30000
0x200D	0x0	Peak Power of Regen. Brake Resistor		100	UINT	rw	watt	1	50000
0x200E	0x0	Duration Time @ Peak Power of Regen. Brake		5000	UINT	rw	ms	1	50000
0x200F	0x0	Overload Check Base		100	UINT	rw	%	10	120
0x2010	0x0	Overload Warning Level		50	UINT	rw	%	10	100
0x2011	0x0	PWM Off Delay Time		10	UINT	rw	ms	0	1000
0x2012	0x0	Dynamic Brake Control Mode		0	UINT	rw		0	3
0x2013	0x0	Emergency Stop Configuration		1	UINT	rw		0	1
0x2014	0x0	Warning Mask Configuration		0	UINT	rw		0	65535
0x2015	0x0	U Phase Current Offset		0	INT	rw	0.1%	-1000	1000
0x2016	0x0	V Phase Current Offset		0	INT	rw	0.1%	-1000	1000
0x2017	0x0	W Phase Current Offset		0	INT	rw	0.1%	-1000	1000
0x2018	0x0	Magnetic Pole Pitch		24000	UINT	rw	0.01m	1	65535
0x2019	0x0	Linear Scale Resolution		1000	UINT	rw	nm	1	65535

Figure 3-9.2

(1) Once communication is established, select one item to edit from the table in Figure 3-9.1. (e.g. Figure 3-9.2 shows the basic settings of the PEGASUS drive.)

- The parameter values of the drive connected to the "Value(dec)" of Figure 3-9.2 are displayed in green.

(2) Click and select a value from the index to edit. (An index is editable only when its "R/W" value is "rw".)

- Modify the index value and press the Enter key to update the value in the drive. (It is not yet saved in the internal memory of the drive. When the power is turned off in this state, previous value is restored. For saving to memory, please select 'Save to Memory' button from the shortcut icon in Figure 3-9.3 or 'Parameter Save to Memory' in Section 3.9.2.)

Figure 3-9.3

■ File Management and Other Functions of Parameters

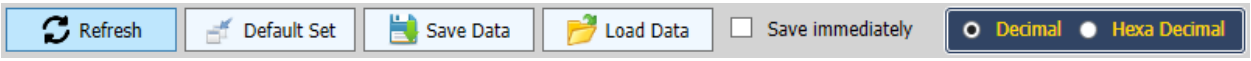


Figure 3-9.4

(1) Refresh

- The values in Figure 3-9.2 is read again from the drive.

(2) Default Set

- The default value in Figure 3-9.2 is restored in the drive.

(3) Save Data

- All the items in Object Dictionary, including Figure 3-9.2, are saved as a text file.

(4) Load Data

- Opens the saved text file. In this case, the data values in the drive are also updated.

(5) Decimal or Hexa Decimal

- In Figure 3-9.2, the values (Default, Max, and Min) can be converted to Decimal or Hexadecimal.

(6) Save immediately

- When you select this option, the edited values in Figure 3-9.2 is updated in the drive and also saved in the internal memory at the same time.

3.9.2 Parameter Save to Memory

All modified parameters are saved in the internal memory of the drive.

Figure 3-9.5

Select Object Dictionary→ Parameter Save to Memory from the top main menu or click on the corresponding shortcut icon.

3.10 Setup

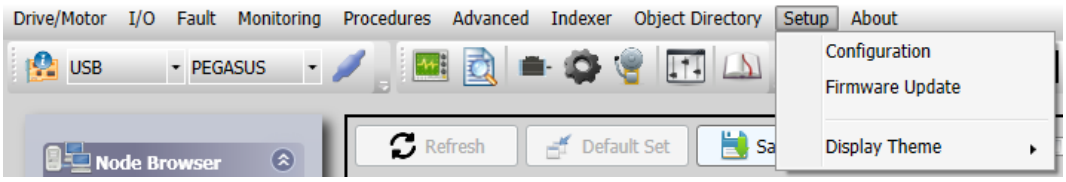


Figure 3-10

It is possible to enter information required for Ethernet communication, update firmware or Parameter factory reset or set the screen theme of Drive CM.

3.10.1 Configuration

■ **Ethernet**

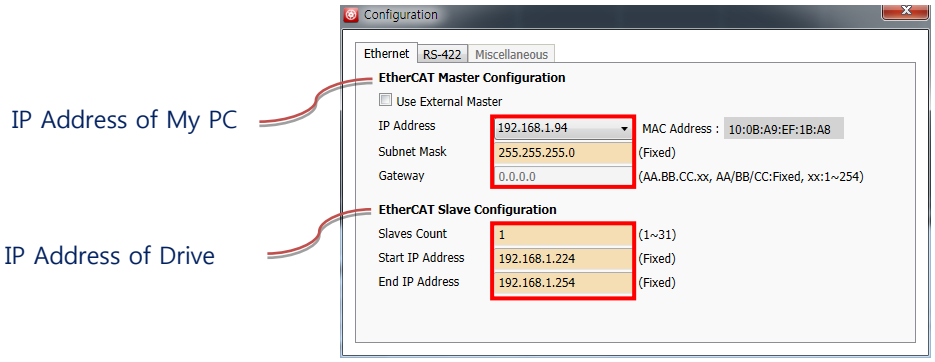


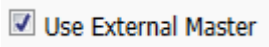
Figure 3-10.1

When Ethernet communication is used, IP Address information of My PC (EtherCAT Master Configuration) and Drive (EtherCAT Slave Configuration) is automatically displayed. Please enter the number of drives to connect to in Slaves Count.

(1) Use External Master

- L7NH and PEGASUS drives support EoE (Ethernet over EtherCAT), one of mailbox protocols. Thanks to this function, multi-axis drives can be set up and monitored without additional wiring by using the EtherCAT wiring which connects multiple axes.

- **If checked**

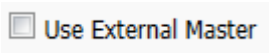


This setting is possible when a separate EtherCAT master (ex. TwinCAT, Codesys…) is used which supports EoE. When operation is being performed by using the EtherCAT master, it is possible to set up and monitor multi-axis drives through EoE by using Drive CM. Please make settings by checking the EoE related details of the master being used.

To use this function, EtherCAT communication status shall be mailbox communication-capable, that is, Pre-Operational or higher. It is possible to operate the drive in Drive CM only if EtherCAT communication status is Pre-Operational. In Safe-Operational or Operational status, operation is only possible through the EtherCAT master.

To use EoE while maintaining EtherCAT communication connection, check Use External Master before using it.

- **If unchecked**



Drive CM can set up and monitor multi-axis drives through EoE by using the internal functions without the external EtherCAT master. Set each connected drive in mailbox communication-capable, EtherCAT communication status and make EoE-related settings in each drive.

At the time, please stop the external master function. To connect with a multi-axis drive without using a separate master, uncheck Use External Master before using it.

■ RS-422

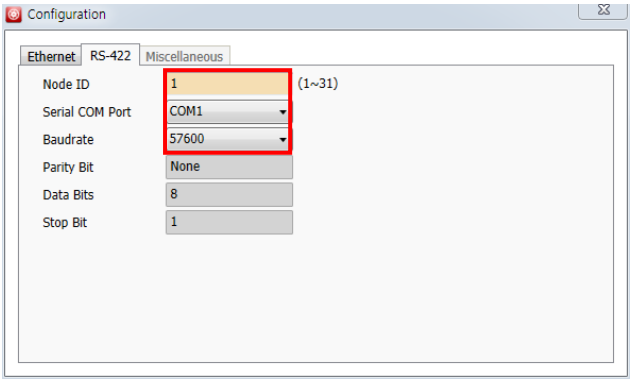


Figure 3-10.2

When RS-422 communication is used, please set Node ID, Serial COM Port and Baudrate. It only applies to L7P.

3.10.2 Firmware Update

Drive CM allows the firmware upgrade through the PC's USB port. The transmission time depends on the PC performance, but it usually takes from scores of seconds to several minutes.

Figure 3-10.3

Select Setup→ Firmware Update from the top main menu or click on the corresponding shortcut icon.

■ Precautions for Firmware Upgrade

- Do not turn off the PC or drive during transmission.
- Do not unplug the USB cable or close the firmware program during transmission.
- Do not run other applications on the PC during transmission.
- Upgrade it after saving parameter setting value. (if you don't, setting value can be reset)

■ Firmware Download

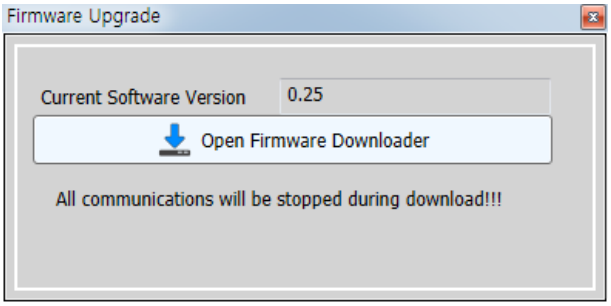


Figure 3-10.5

(1) Click the "Open Firmware Downloader" button.

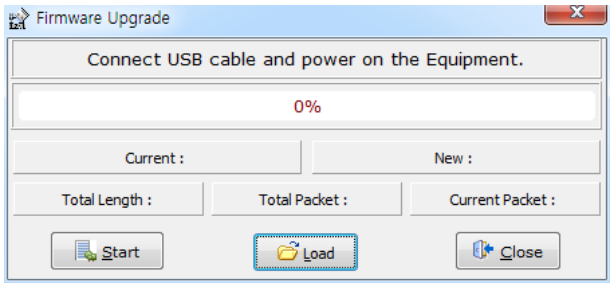


Figure 3-10.6

(2) To load the appropriate firmware file, click the "Load" button.

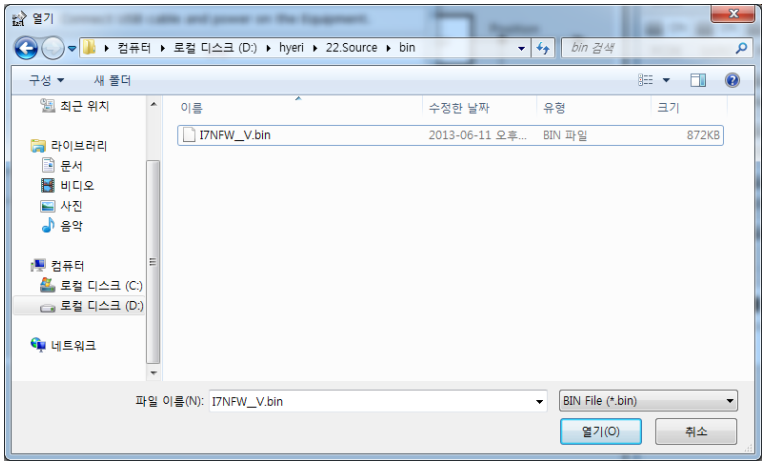


Figure 3-10.7

(3) Select the BIN file of the firmware to transmit and press the Open button.

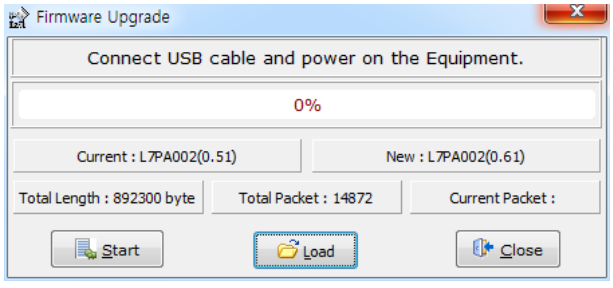


Figure 3-10.8

(4) "Total Length" and "Total Packet" of the loaded firmware are displayed. Please check firmware version the drive type and capacity by comparing Current and New.

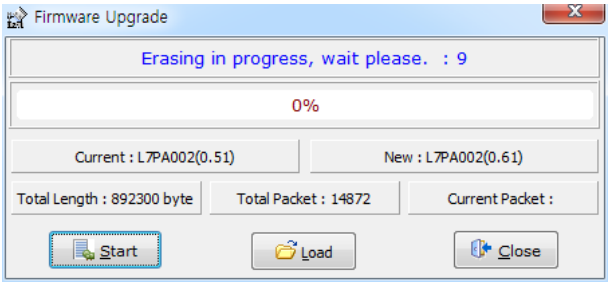


Figure 3-10.9

(5) Press the "Start" button to start transmission. 10 seconds are counted down to clear the internal memory in the drive. (For L7NH and L7P, the segment 7 should display "USB". For PEGASUS, a red "ERR" LED should be illuminated.)

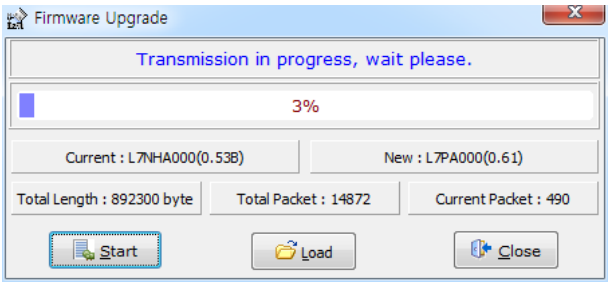


Figure 3-10.10

(6) After clearing, the firmware is transmitted automatically and the progress bar and "Current Packet" display the current transmission status. (The transmission time depends on the PC performance, but it usually takes from scores of seconds to several minutes.)

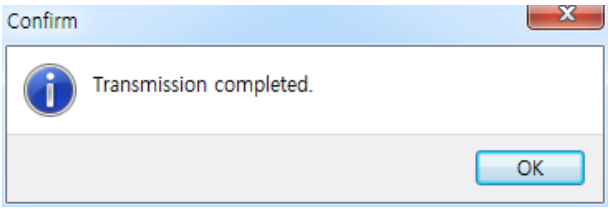


Figure 3-10.11

(7) When transmission is completed, a popup saying "Transmission completed" is displayed. (When transmission to the PC is completed, turn off and on the drive for rebooting.)

■ An Error Occurs During Transmission

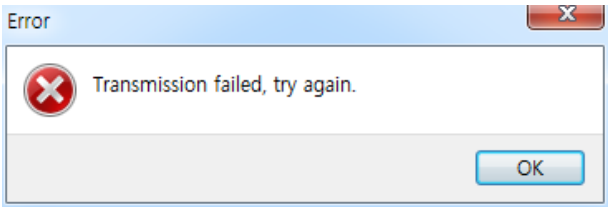


Figure 3-10.12

Turn off and on the drive and repeat the above process from (2) to (7).

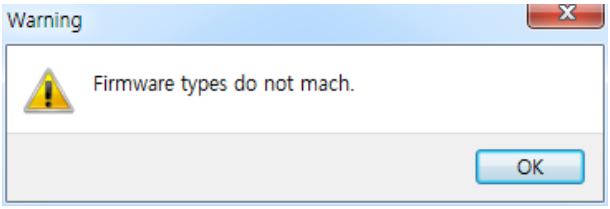


Figure 3-10.13

Check the Drive's type and capacity of the firmware transmitted.

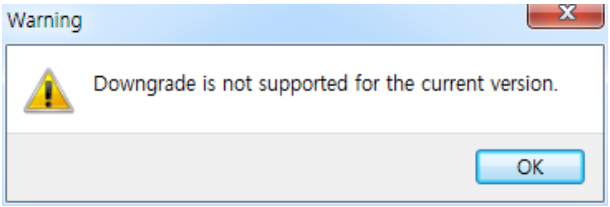


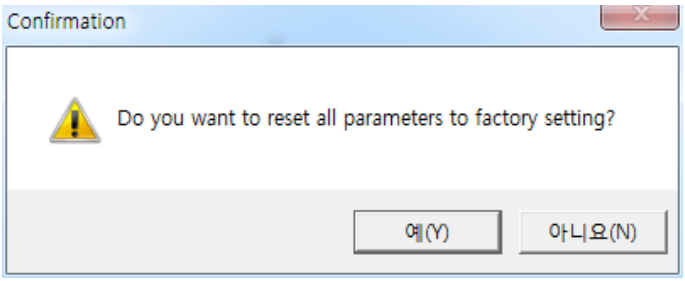
Figure 3-10.14

Check the firmware version. A lower version than the current version will not be downloaded.

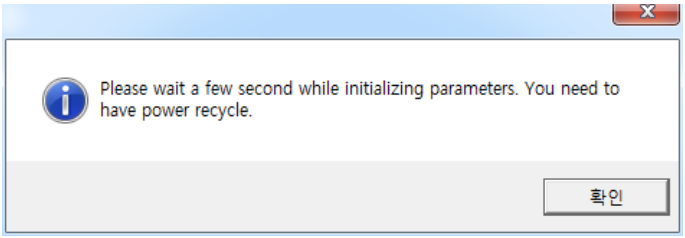
3.10.3 Return to factory set

Factory reset for drive parameters. (But, except for Index Parameters)

Click ‘Setup’→ ‘Return to factory set’ on the menu of the top



(1) When the pop-up window appears to ask whether to initialize, please click Yes (Y)

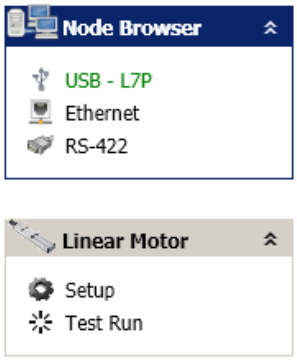


(2) It takes a few seconds during initialization. After the initialization has been completed, please be sure the power is turned or a software reset.

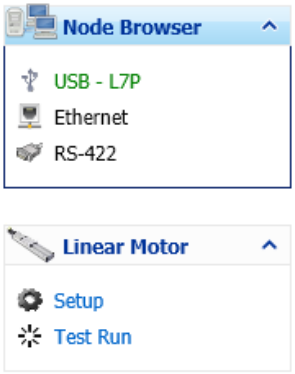
3.10.4 Display Theme

It is possible to change the screen theme of Drive CM.

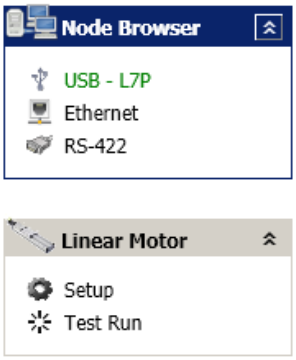
Basic theme



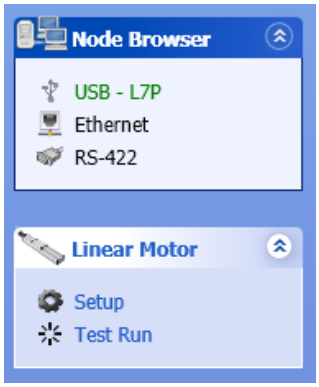
Aero theme (Vista)



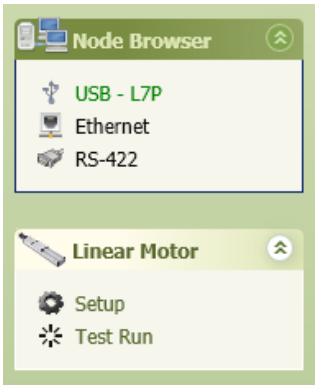
Classic theme (NT)



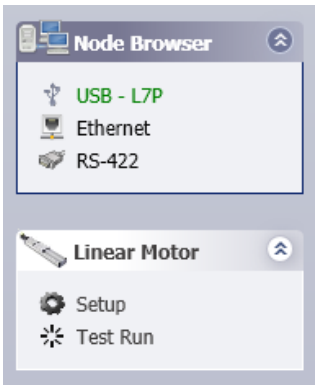
Luna blue theme (XP)



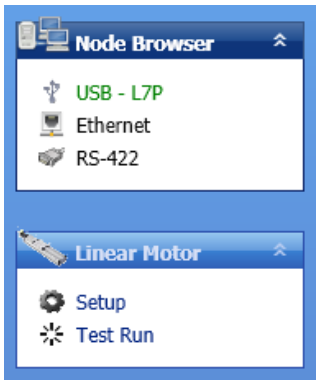
Luna olive green theme (XP)



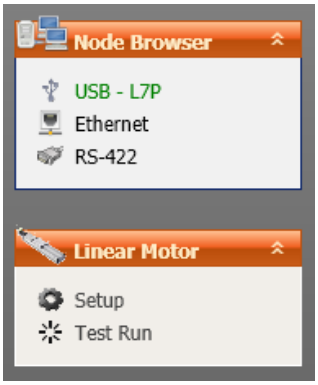
Luna silver theme (Default)



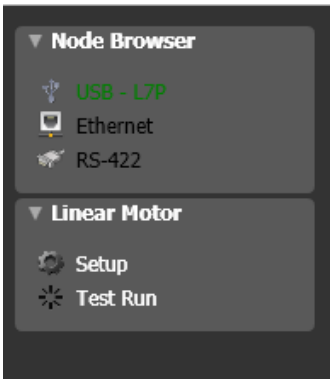
Royale theme (XP Media Center)



Zune theme (XP)



MS Blend theme



3.10.5 About

It is possible to view the version and distribution date of Drive CM.

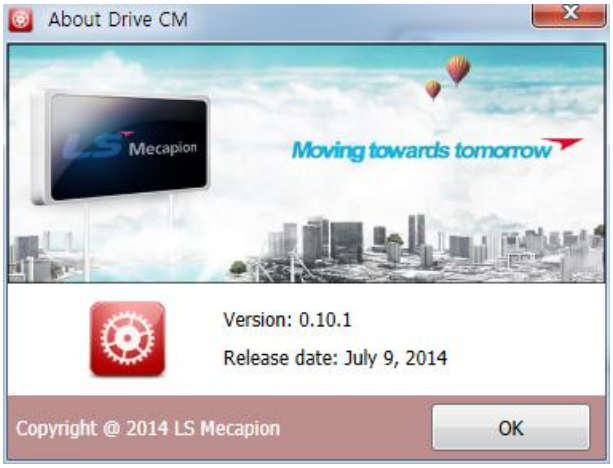
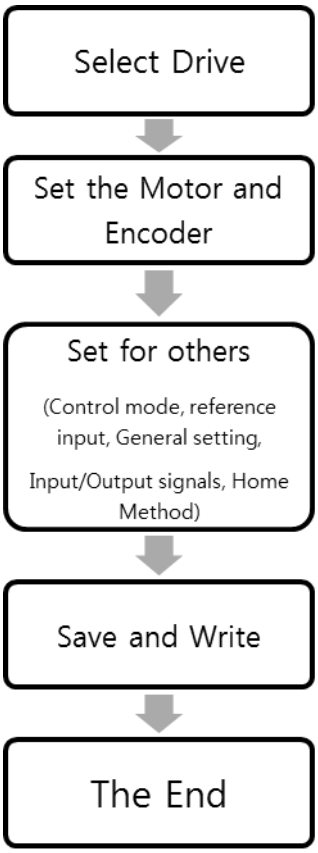


Figure 3-10.5

3.11 Quick Setup

The parameters can be configured interactively. You can complete the basic settings required for operation automatically by selecting the operation method, mechanical specifications and input/out signals. You can switch the operation mode quickly and easily by creating different profiles for different operation modes, storing them in files, and loading the files when necessary. (The setup wizard's online settings support USB communication only)

The flow of the setup wizard is as follows:



The current settings and recommended orders are displayed on the left side of the screen (flow chart).

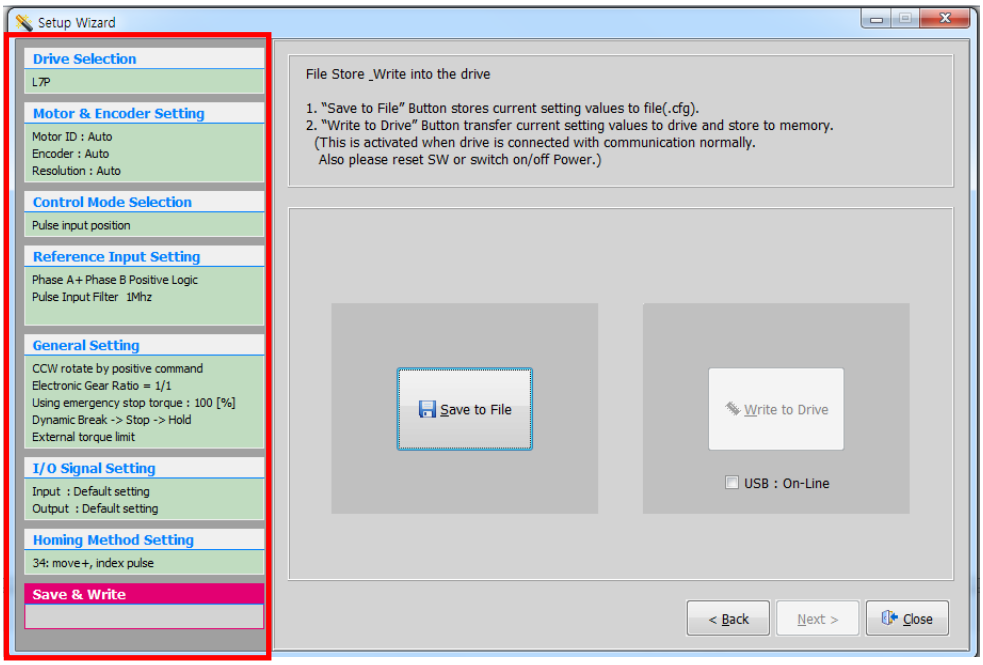


Figure 3-11.1

The setup wizard is executed in the order shown in the section 3.11.1 and the screen layout differs depending on the drive, motor, encoder, and control mode you select.

3.11.1 Selecting Drive

When the setup wizard is executed, the drive selection screen is displayed as the initial screen.

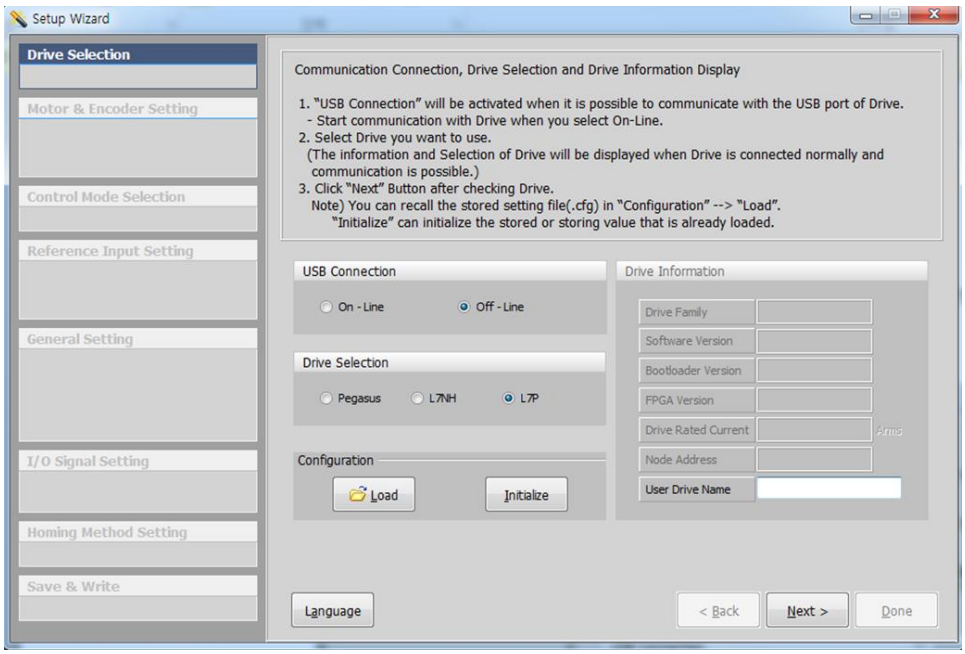


Figure 3-11.2

(1) When ‘USB Connection’ is On-Line, the information on the connected drive is displayed automatically.

(2) When ‘USB Connection’ is Off-Line, select a drive type.

(3) Click ‘Load’ to open the stored configuration file (.cfg).

(4) Click ‘Initialize’ to reset the settings loaded or modified.

3.11.2 Configuring Motors and Encoders(for L7NH and L7P only)

When drive selection is completed, the motor and encoder configuration screen is displayed.

■ Motor Selection

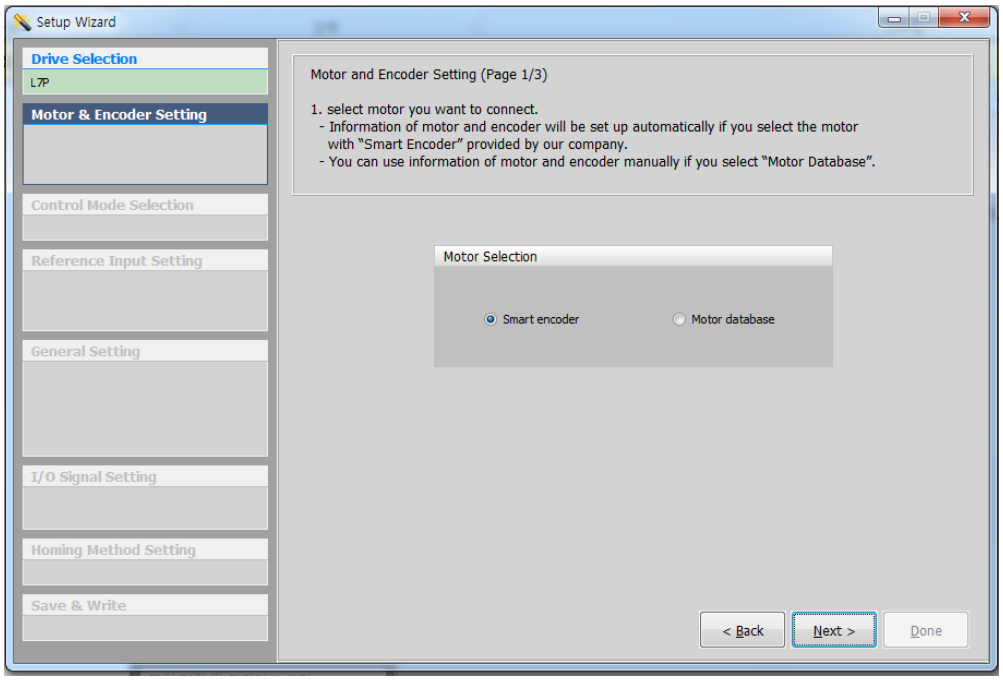


Figure 3-11.3

(1) If a motor which is equipped with our multi-turn encoder is used, select ‘Smart encoder’. The motor information is read automatically.

(2) If a third-party motor or a motor which is not equipped with our smart encoder is used, select ‘Motor database’. Click 'Next' to display the screen for configuring motor parameters manually.

■ Motor Setup

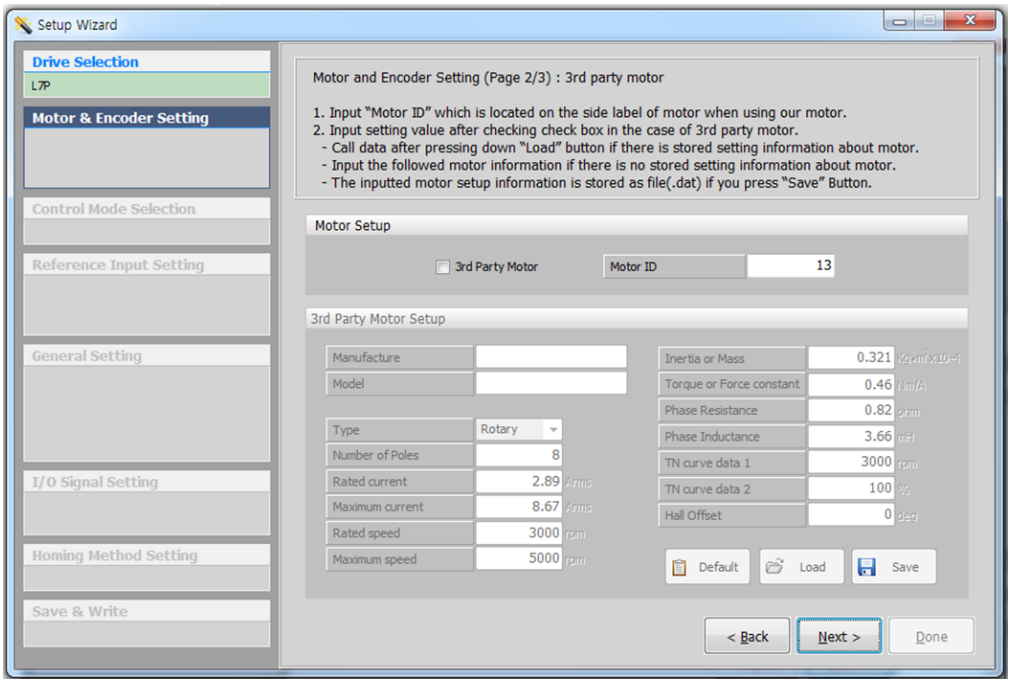


Figure 3-11.4

(1) If our motor is used, check the sticker label on the side of the motor and type the motor ID. Then, motor parameters are automatically configured. If a third-party motor is used, select ‘3rd Party Motor’. ‘9999’ is automatically entered as motor ID and the ‘3rd Party Motor Setup’ screen is displayed. (For detailed parameter settings, refer to the motor manufacturer's data sheet.)

■ 3rd Party Motor Setup

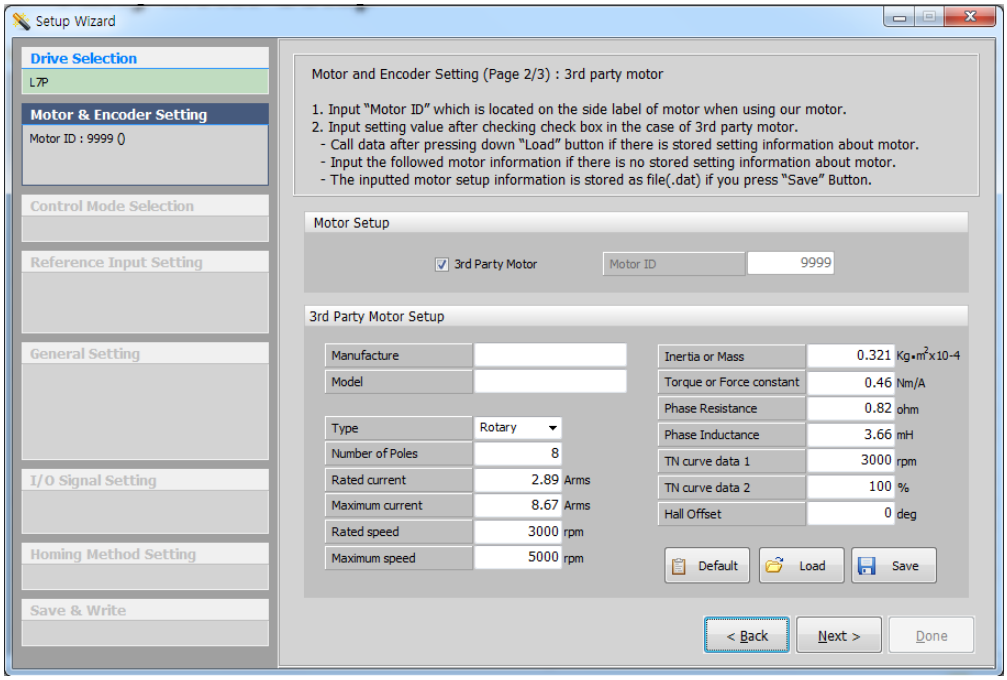


Figure 3-11.5

(1) Manufacture

- Type the motor manufacturer. (It is used as a folder name to save the file.)

(2) Model

- Type the motor model. (It is used as a file name to save the file.)

(3) Type (0x2800)

- This specifies the motor type.

(4) Number of Poles (0x2801)

- This specifies the number of motor poles. For linear motor, set it to 2.

(5) Rated current (0x2802)

- This specifies the rated current of the motor.

(6) Maximum current (0x2803)

- This specifies the maximum current of the motor.

(7) Rated speed (0x2804)

- This specifies the rated speed of the motor. For a linear motor, the unit is 'mm/s'.

(8) Maximum speed (0x2805)

- This specifies the maximum speed of the motor. For a linear motor, the unit is 'mm/s'.

(9) Inertia or Mass (0x2806)

- This specifies the motor inertia. For a linear motor, set the weight of rotor. The unit is 'kg'.

(10) Torque of Force constant (0x2807)

- This specifies the torque constant of a motor. For a linear motor, set the force constant. The unit is N/A.

(11) Phase Resistance (0x2808)

- This specifies the phase resistance (= resistance between lines ÷ 2) of the motor.

(12) Phase Inductance (0x2809)

- This specifies the phase inductance (= inductance between lines ÷ 2) of the motor.

(13) TN curve data 1 (0x280A)

- This specifies the data of the motor speed/torque curve. Enter the maximum speed at the time when the maximum torque (for a linear motor, the maximum thrust) is output. For a linear motor, the unit is 'mm/s'.

(14) TN curve data 2 (0x280B)

- This specifies the data of the motor speed/torque curve. Enter the torque (thrust for a linear motor) which can be output at the maximum speed in percentage (%) relative to the maximum torque.

(15) Hall Offset (0x280C)

- The offset of the hall sensor attached for initial angle of a 3rd party motor may vary depending on manufacturer. For this case, the hall sensor offset must be checked and correctly set.

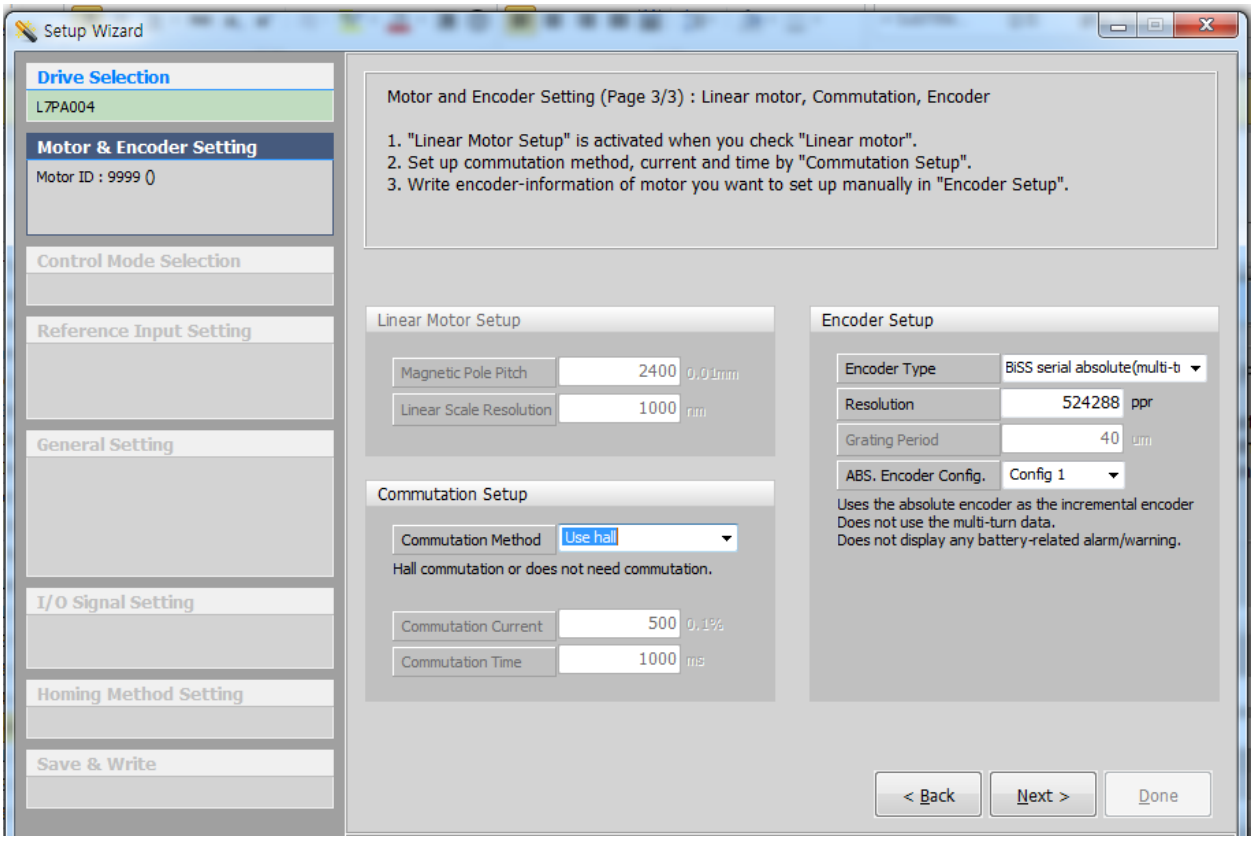


Figure 3-11.6

■ Linear Motor Setup

(1) This pane is enabled when the motor type (0x2800) is set to 'Linear' on the previous screen.

(2) Magnetic Pole Pitch (0x2018)

- This specifies the pitch between the magnetic poles of the linear motor. The pole pitch refers to the distance between the north poles or between the south poles of magnet, corresponding to 360˚ of electrical angle.

(3) Linear Scale Resolution (0x2019)

- Set Linear Scale Resolution in nm. For a linear scale with the resolution of 1 um, set it to 1000 (= 1 um /1 n).

■ Commutation Setup

(4) Commutation Method (0x201A)

- This specifies the commutation method to get the information on the initial angle of motor.

(5) Commutation Current (0x201B)

- Select the commutation current to get the information on the initial angle of the motor.

(6) Commutation Time (0x201C)

- Select the commutation time to get the information on the initial angle of the motor.

■ Encoder Setup

(1) Encoder Type (0x2001)

- Set the encoder type.

(2) Resolution (0x2002)

- This option is enabled when the motor type (0x2800) is set to ‘Rotary’ on the previous screen.

- Set the encoder resolution in the unit of pulse (count) based on a multiple of 4. You can usually find the encoder's resolution on the motor's nameplate.

(3) Grating Period (0x201D)

- This option is only enabled when Encoder Type(0x2001) is ‘Sinusoidal(1Vpp)’.

- Specify the grid size of the sine wave encoder.

(4) ABS. Encoder Config. (0x2005)

- Set the usage of the absolute encoder.

3.11.3 Selecting Control Mode(for L7P only)

It configures the L7P drive control mode.

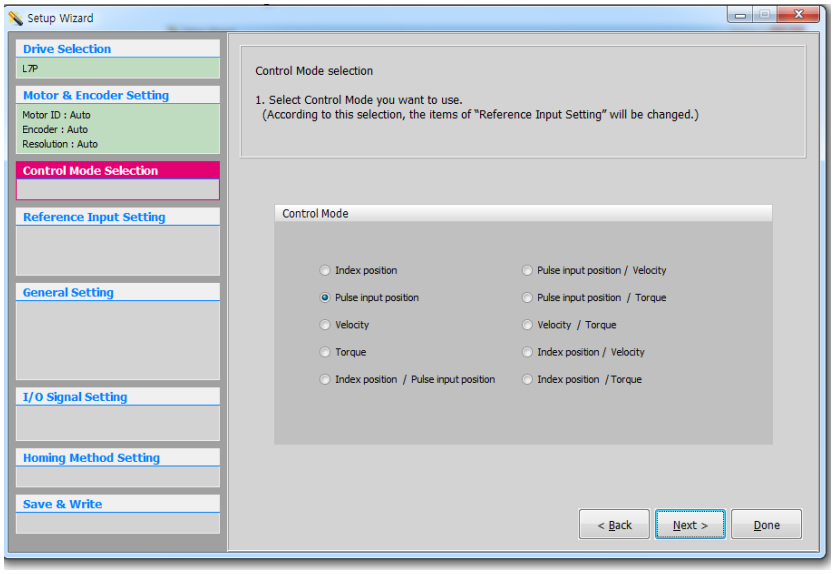


Figure 3-11.7

(1) Select a control mode and click 'Next'.

3.11.4 Configuring Reference Input

For configuring reference input, a relevant configuration window is displayed depending on the control mode you select.

■ Index Position Operation

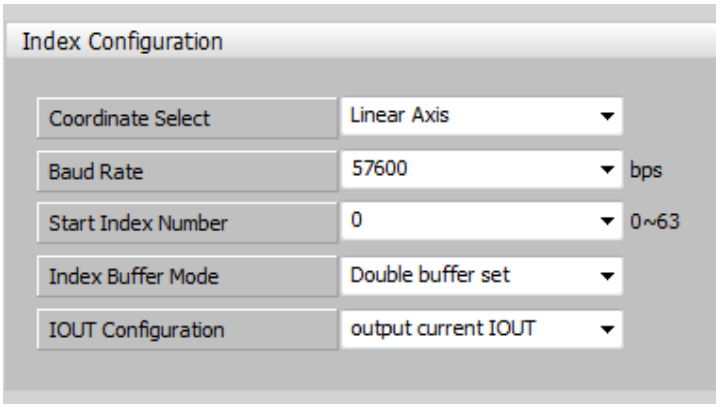


Figure 3-11.8

(1) Coordinate Select (0x3001)

- This specifies a coordinate system to be used for index position control of the drive.

(2) Baud Rate (0x3002)

- This specifies the RS-422 serial communication speed between the upper level controller and the drive.

(3) Start Index Number (0x3008)

- Select an index number (0-63) to begin with. If the selected value is 64, the index number is specified by ISEL0-ISEL5.

(4) Index Buffer Mode (0x3009)

- This specifies how many times the START (operation start) signal is remembered.

(5) IOUT Configuration (0x300A)

- This specifies the IOUT output signal.

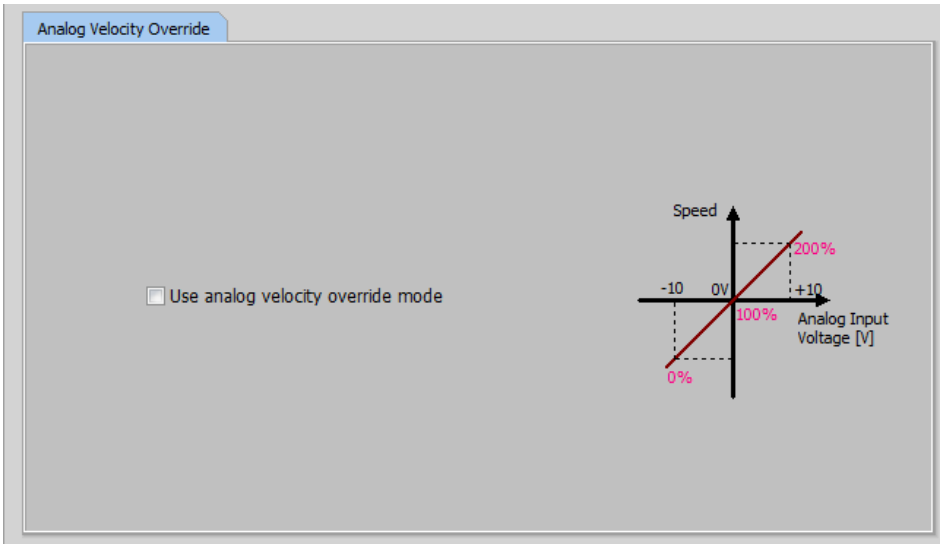


Figure 3-11.9

(6) Analog Velocity Override (0x221E)

- This specifies whether to use the function that uses the analogue voltage to override the velocity.

■ Pulse Input Position Operation

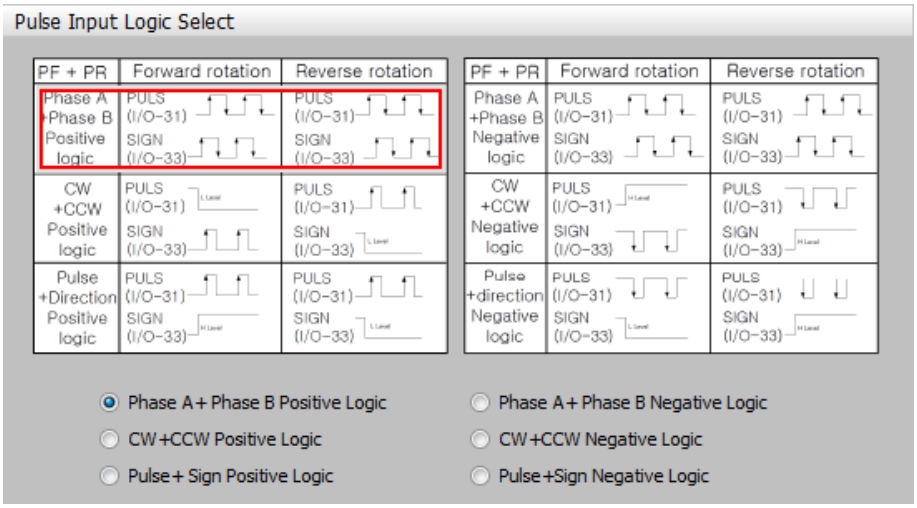


Figure 3-11.10

(1) Pulse Input Logic Select (0x3003)

- This specifies the logic of the pulse row received from the upper level controller.

(2) Pulse Input Filter Select (0x3004)

- This specifies the frequency band of the digital filter defined for the pulse input.

(3) PCLEAR Mode Select (0x3005)

This specifies the operation mode when the position pulse clear (PCLR) signal is received.

■ Velocity Operation

Figure 3-11.11

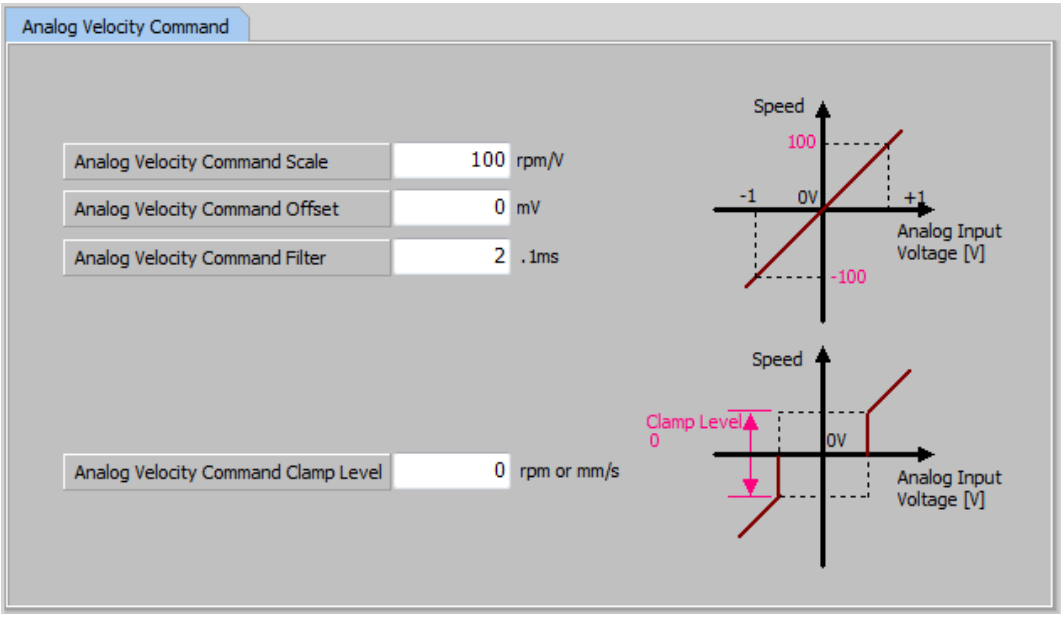


Figure 3-11.12

(1) Velocity Command Switch Select (0x231A)

- This selects the velocity command method when using the velocity operation mode.

(2) Multi-Step Operation Speed (0x2312~0x2319)

- This selects the speeds for multi-operation velocities (1-8).

(3) Analog Velocity Command Scale (0x2229)

- This specifies the analog speed command at analogue voltage of ±10[V] in the unit of [RPM].

(4) Analog Velocity Command Offset (0x221F)

- This specifies the analogue voltage offset sent to the analogue velocity command.

■ Torque Operation

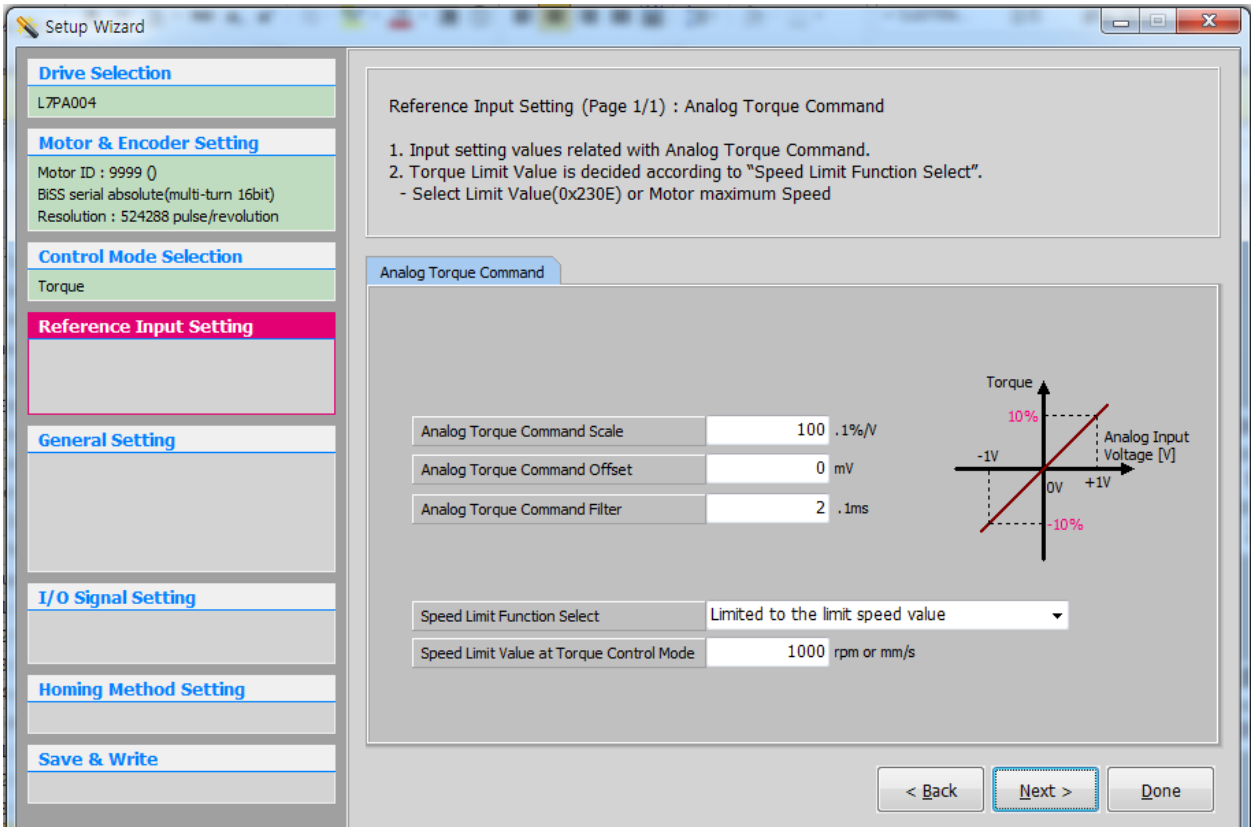


Figure 3-11.13

(1) Analog Torque Command Scale (0x221C)

- This specifies the analogue torque command scale. The selected value sets the torque command at analogue input voltage of ±10[V] in a percentage of the rated torque.

(2) Analog Torque Command Offset (0x221D)

- This specifies the analogue torque command offset.

(3) Analog Torque Command Filter (0x2228)

- This specifies the filter time constant for the analogue torque command. If the filter value is set too high, responsiveness to torque commands will be reduced. It is important to set a value that is appropriate for your system.

(4) Speed Limit Function Select (0x230D)

- This specifies the speed limit function for torque control.

(5) Speed Limit Value at Torque Control Mode (0x230E)

- This specifies the speed limit value for torque control. This is only applicable when the speed limit function (0x230D) is set to 'Limited by speed limit value'.

3.11.5 General Settings

■ Selecting Rotation Direction

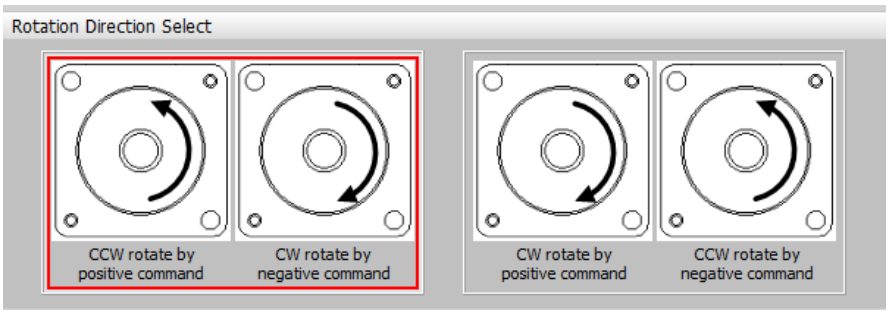


Figure 3-11.14

(1) Rotation Direction Select (0x2004)

- Set the rotation direction of the motor.

■ Configuring Electronic Gear and Encoder Power

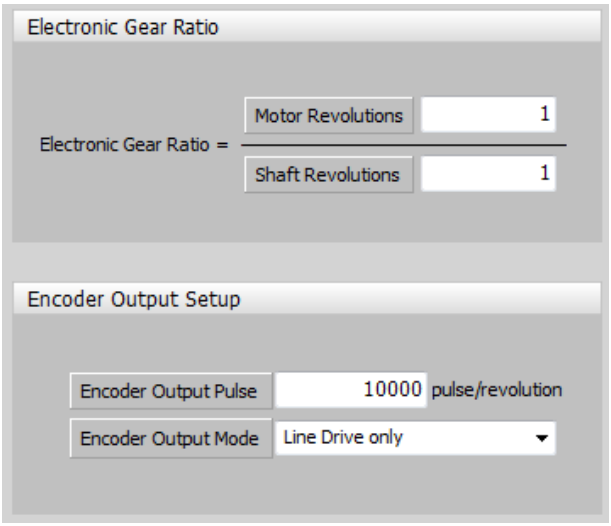


Figure 3-11.15

(1) Electronic Gear Ratio (0x6091)

- Enter the motor RPM and shaft RPM to determine the electronic gear ratio.

(2) Encoder Output Pulse (0x3006)

- Specify the count of pulses to be output per motor rotation when the encoder signal is sent from the drive to the outside.

(3) Encoder Output Mode (0x3007)

- This specifies whether to output also in the open collector method in addition to the default line drive method when servo outputs the encoder signal to the outside.

■ Specifying Emergency Stop Method

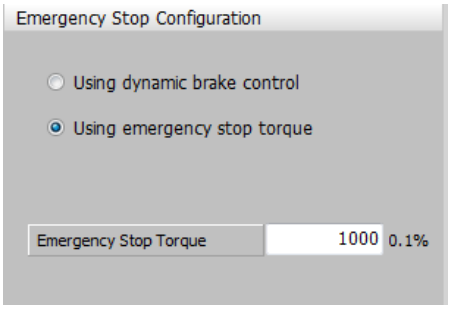


Figure 3-11.16

(1) Emergency Stop Configuration (0x2013)

- This specifies the method to stop the drive on emergency stop (when entering POT, NOT, or ESTOP). In torque control mode, the decelerating to stop mode using emergency stop torque is not applied.

(2) Emergency Stop Torque (0x2113)

- This specifies the stop torque on emergency stop (when entering POT, NOT, or ESTOP).

■ Selecting Dynamic Brake Control Mode

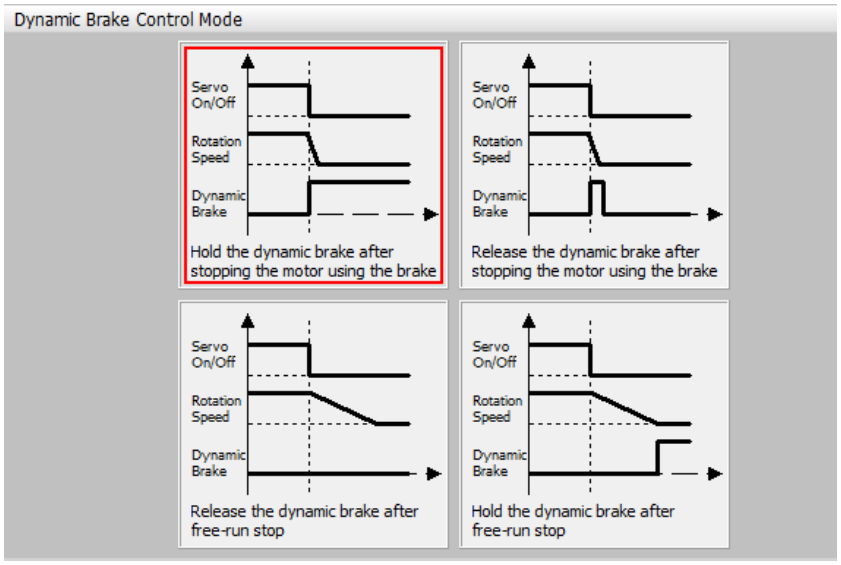


Figure 3-11.17

(1) Dynamic Brake Control Mode (0x2012)

- This specifies the control mode of the dynamic brake on servo off.

■ Setting the Brake Output Signal Function

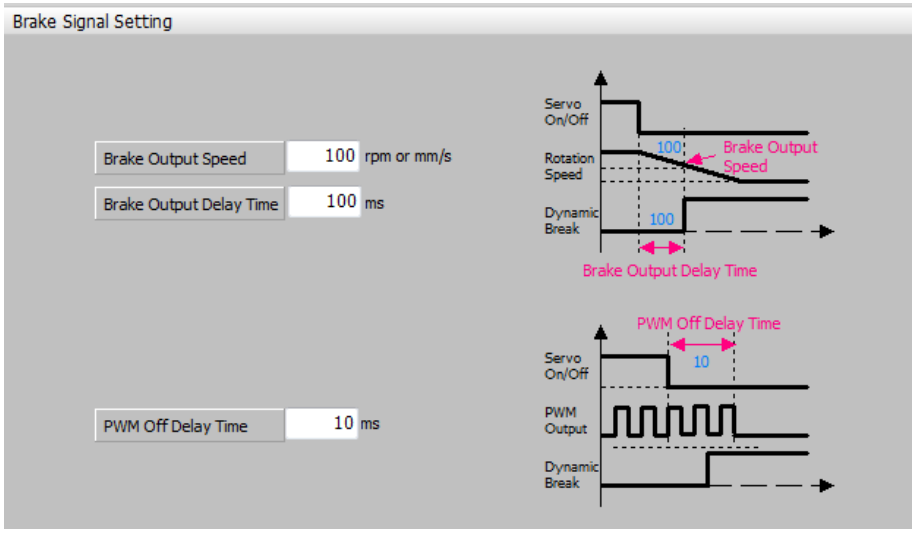


Figure 3-11.18

(1) Brake Output Speed (0x2407)

- If the motor stops due to servo OFF or servo alarm during rotation, you can set the speed (0x2407) and delay time (0x2408) for brake signal output, in order to configure the output timing. The brake signal will be output if the motor rotation speed goes below the set speed (0x2407) or the output delay time (0x2408) has elapsed after the servo OFF command.

(2) Brake Output Delay Time (0x2408)

- Refer to the description in Brake Output Speed (0x2407).

(3) PWM Off Delay Time (0x2011)

- This specifies the delay time until the PWM actually turns off after running servo off command. When using a motor with a brake installed on the vertical axis, you can output the brake signal first, and then turn off the PWM after this set time, in order to prevent it from running down along the axis.

■ Configuring Torque Limit Function

◆ Internal torque limit 1

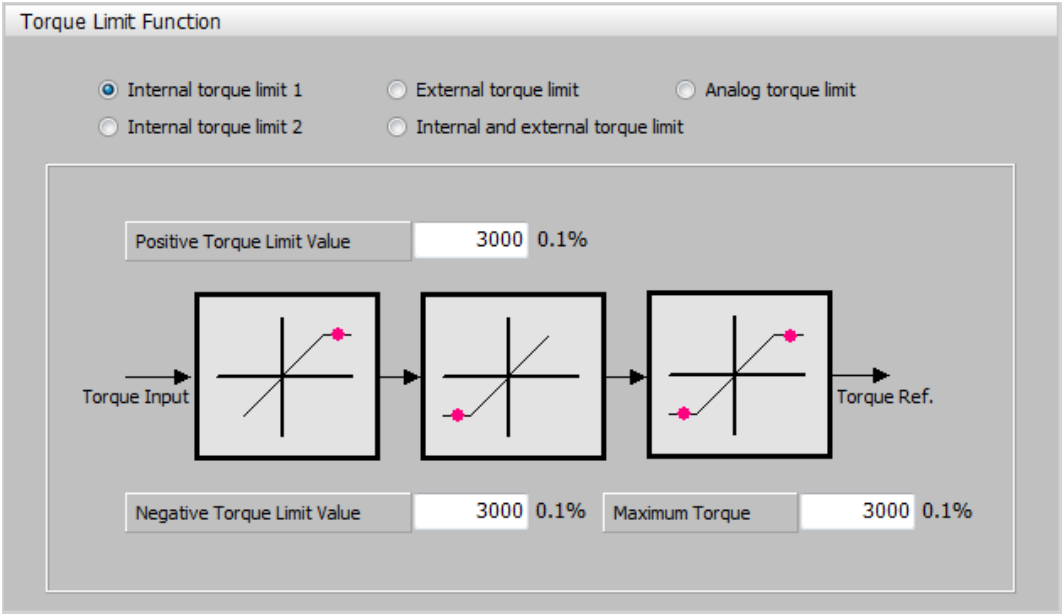


Figure 3-11.19

(1) Positive Torque Limit Value (0x60E0)

- This sets the limit of positive torque values.

(2) Negative Torque Limit Value (0x60E1)

- This sets the limit of negative torque values.

(3) Maximum Torque (0x6072)

- This sets the maximum torque that the motor can output in 0.1% increments of the rated torque.

◆ Internal torque limit 2

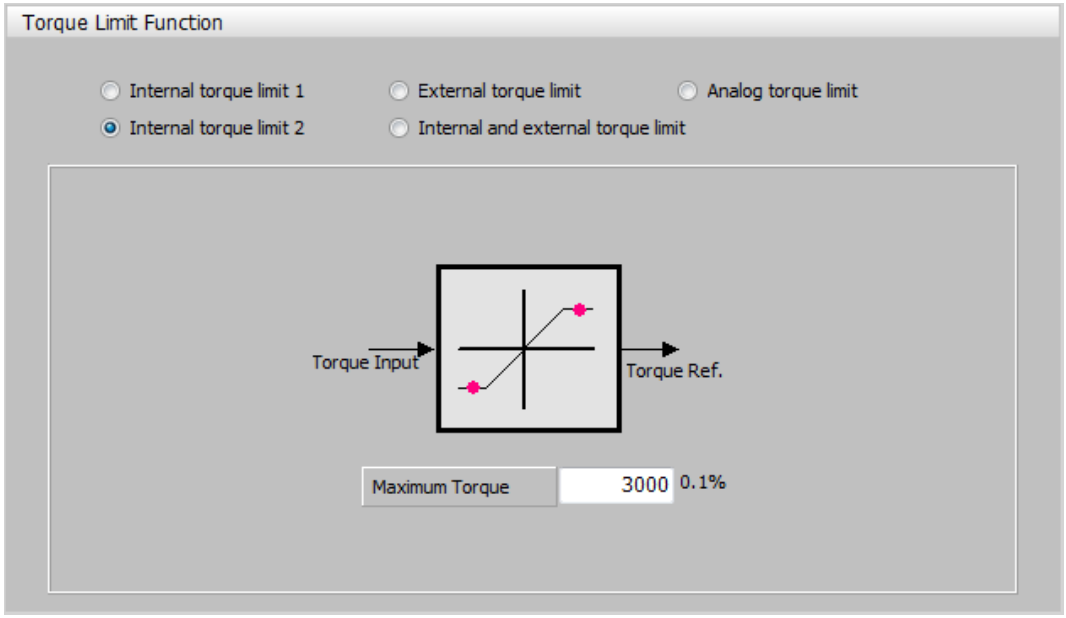


Figure 3-11.20

(1) Maximum Torque (0x6072)

- This sets the maximum torque that the motor can output in 0.1% increments of the rated torque.

◆ External torque limit

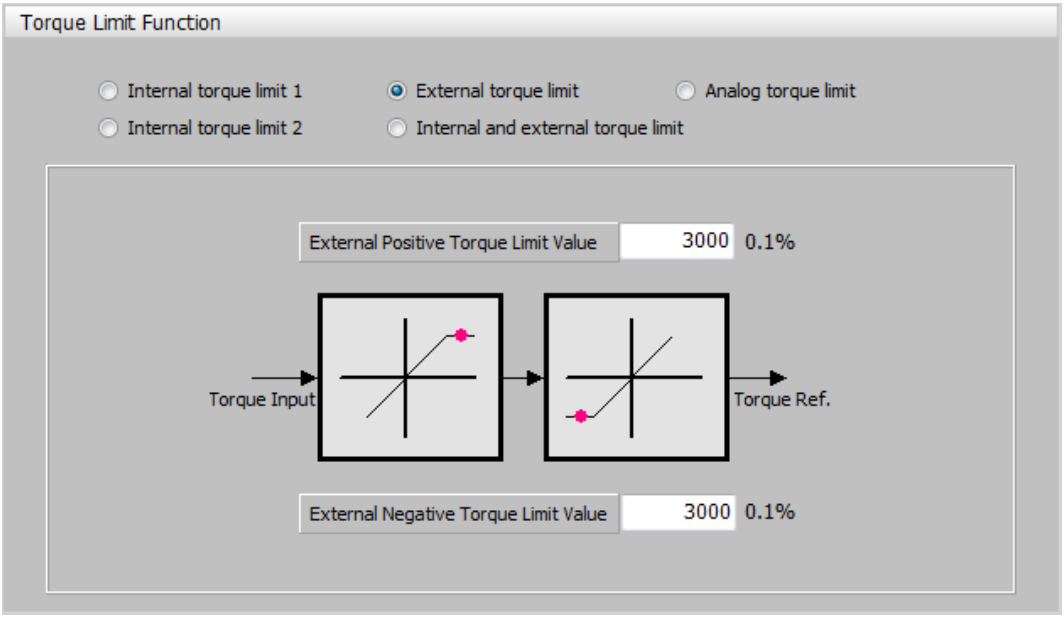


Figure 3-11.21

(1) External Positive Torque Limit Value (0x2111)

- This specifies the external positive torque limit value according to the torque limit function setting (0x2110).

(2) External Negative Torque Limit Value (0x2112)

- This specifies the external negative torque limit value according to the torque limit function setting (0x2110).

◆ Internal and external torque limit

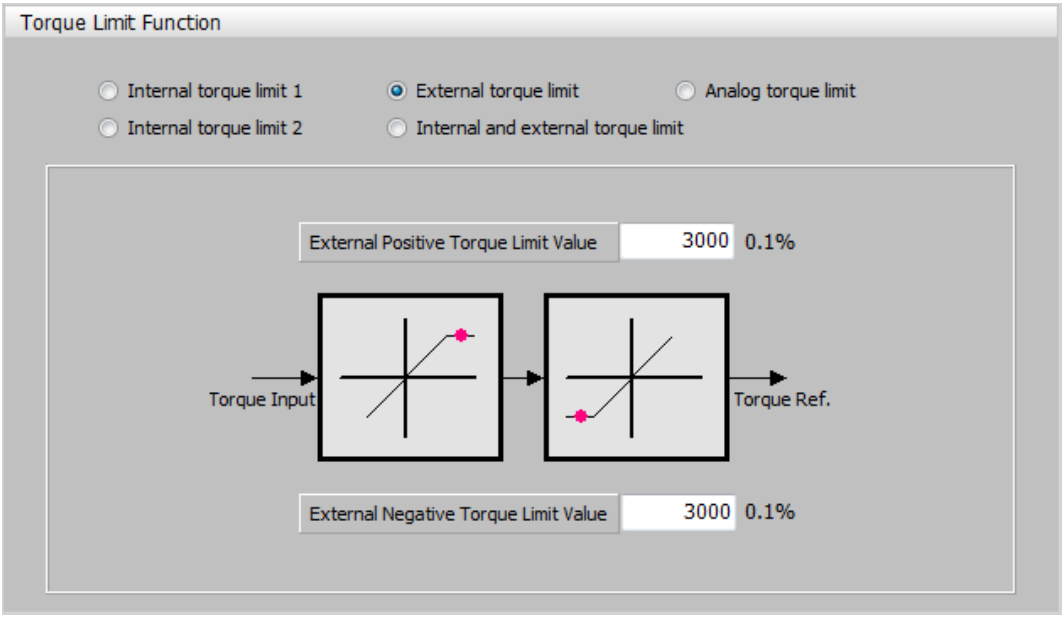


Figure 3-11.22

(1) Positive Torque Limit Value (0x60E0)

- This sets the limit of positive torque values.

(2) External Positive Torque Limit Value (0x2111)

- This specifies the external positive torque limit value according to the torque limit function setting (0x2110).

(3) Negative Torque Limit Value (0x60E1)

- This sets the limit of negative torque values.

(4) External Negative Torque Limit Value (0x2112)

- This specifies the external negative torque limit value according to the torque limit function setting (0x2110).

–

◆ Analog torque limit (for L7P only)

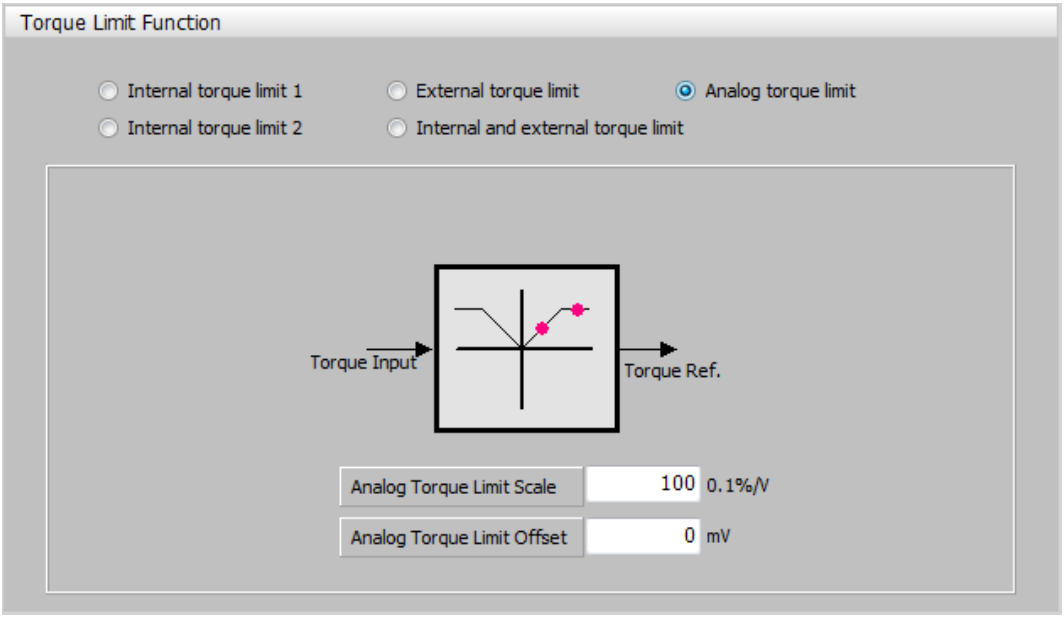


Figure 3-11.23

(1) Analog Torque Limit Scale (0x221C)

- The torque is limited by the torque limit received as an analogue value. Set the scale of the analog input value at this time.

(2) Analog Torque Limit Offset (0x221D)

- This specifies the analogue voltage offset controlled by the analogue torque limit

–

■ Configuring Control-related Signals

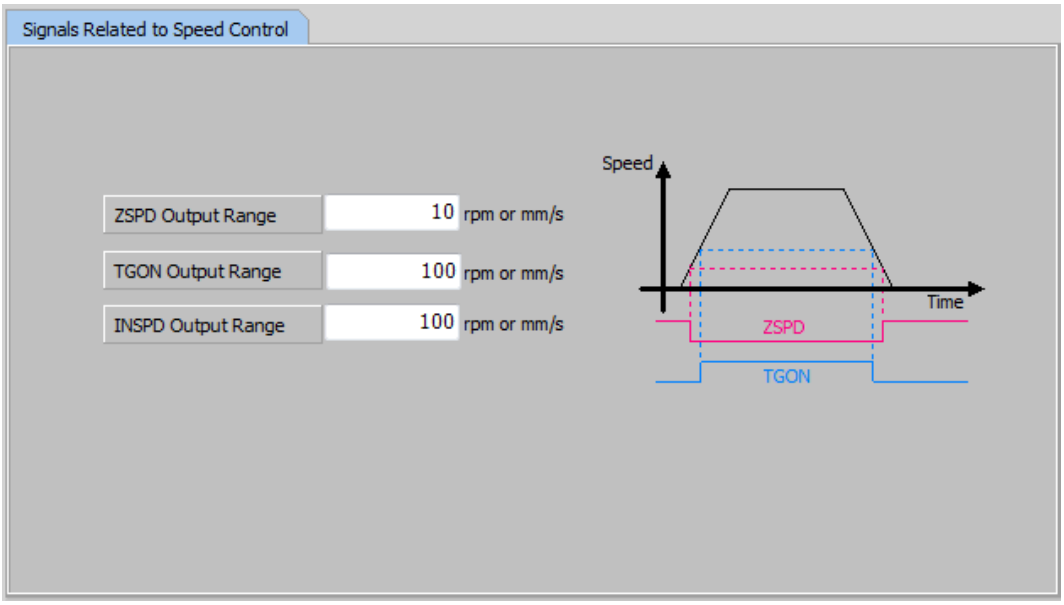


Figure 3-11.25

(1) ZPD Output Range (0x2404)

- Specify the ZSPD output range. When the current speed is less than the setting value, the ZSPD signal is output.

(2) TGON Output Range (0x2405)

- Specify the TGON output range. When the current speed is more than the setting value, the TGON signal is output.

(3) INSPD Output Range (0x2406)

- Specify the INSPD output range. When the speed error is less than the setting value, the INSPD signal is output.

3.11.6 Configuring Input/Output Signals

■ Digital Input

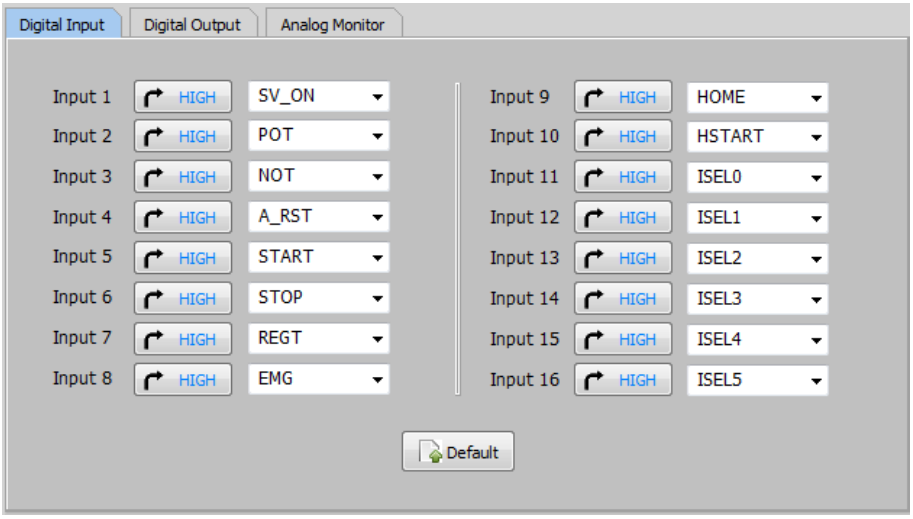


Figure 3-11.26

(1) Digital Input (0x2200~220F)

- Set the digital input signal function and input signal level of the I/O connector.

  (PEGASUS 1-4 points, L7NH 1-8 points, L7P 1-16 points)

■ Digital Output

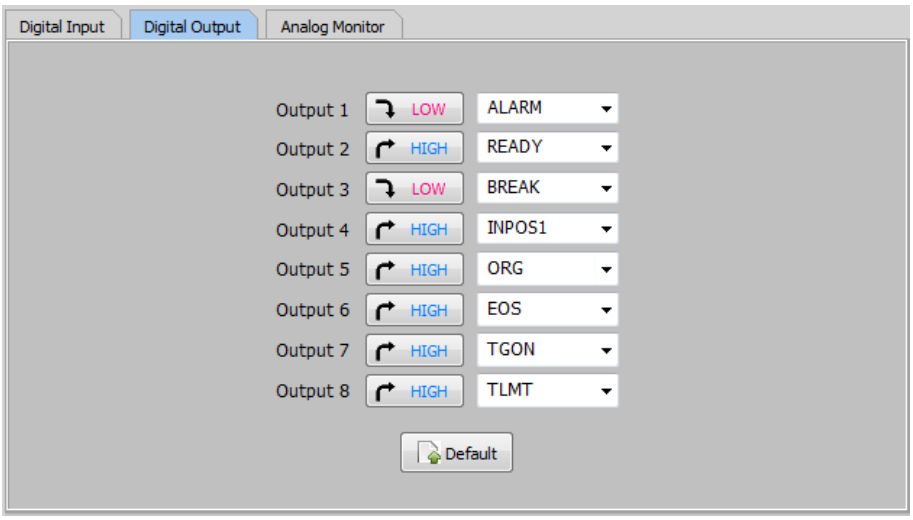


Figure 3-11.27

(1) Digital Output (0x2210~2217)

- Set the digital output signal function and output signal level of the I/O connector.

(PEGASUS 1-2 points, L7NH 1-4 points, L7P 1-8 points)

■ Analog Monitor

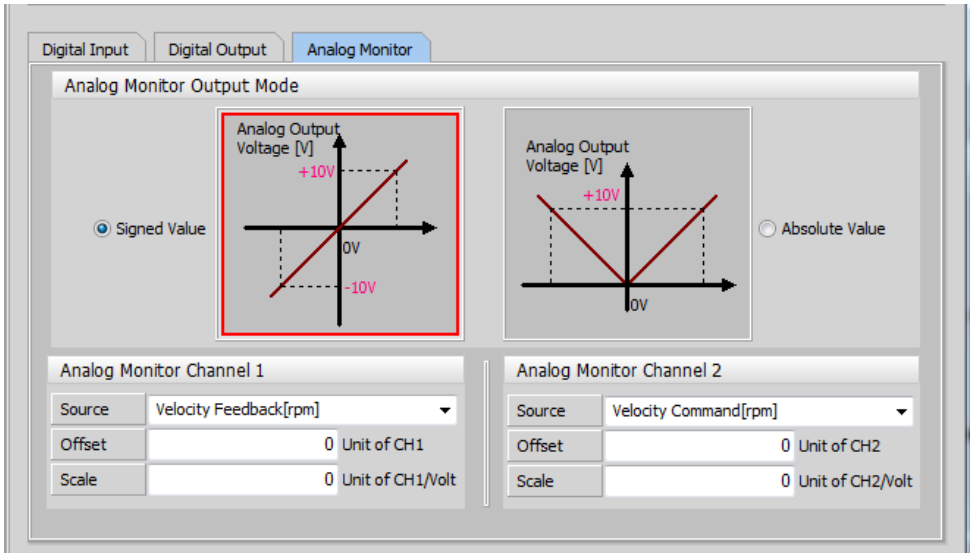


Figure 3-11.28

(1) Analog Monitor Output Mode (0x2220)

- The output range of analog monitor is from -10 V to +10 V.
- If you select '+/- Output', the negative or positive value is displayed. If you select '+ Output', only the positive value is displayed.

(2) Analog Monitor Channel 1 ,2 Source (0x2221,0x2222)

- Specify the monitoring variables to be output to the analog monitor output channel 1 or 2.

(3) Analog Monitor Channel 1 and 2 Offset (0x2223,0x2224)

- Specify the offset of the analogue monitor output channel 1 or 2. Subtract the value specified for the offset from the monitoring variable specified for the analog monitor output channel 1 or 2 to determine the final output.

(4) Analog Monitor Channel 1 ,2 Scale (0x2225,0x2226)

- Specify the scale of the analogue monitor output channel 1 or 2. When outputting the monitoring variable for the analog monitor output channel 1 or 2, this function will set the scaling of the variable to be output per 1 V.
- For example, if you set the speed feedback to the channel 1 or 2 and the scale to 500, up to +/-5000 rpm can be output as +/-10 V.

3.11.7 Configuring Homing Method

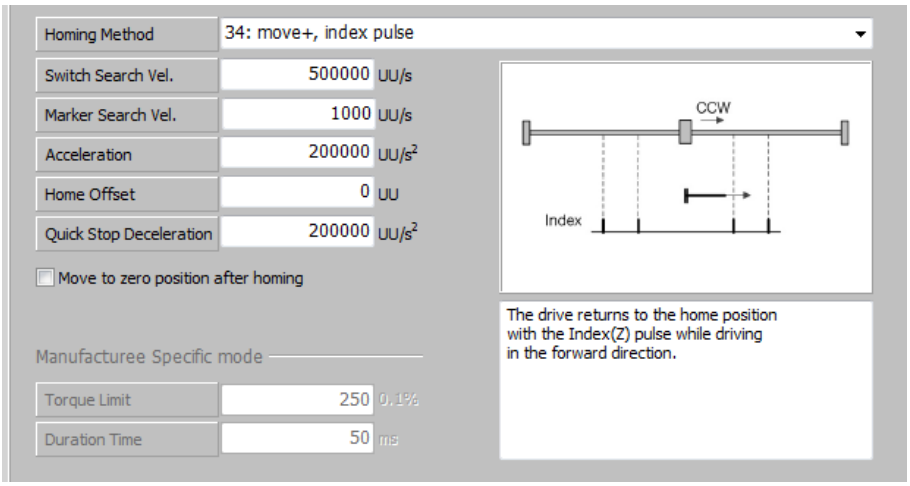


Figure 3-11.29

(1) Homing Method (0x6098)

- This sets the homing method.

(2) Switch Search Vel. (Bit 1 of 0x6099)

- Select the switch search speed.

(3) Maker Search Vel. (Bit 2 of 0x6099)

- Select the zero search speed.

(4) Acceleration (0x609A)

- This specifies the operation acceleration for homing.

(5) Home Offset (0x607C)

- This sets the offset value for the origin of the absolute encoder or absolute external scale and the zero position of the actual position value (0x6064).

(6) Quick Stop Deceleration (0x6085)

- The system uses quick stop deceleration if the quick stop option code (0x605A) is set to 2.

3.11.8 Saving Files and Writing on Drive

Figure 3-11.30

(1) Save to File

- Save the settings as a .cfg file.

(2) Write to Drive

- Send the settings to a connected drive and save it in the memory.
- This option is only enabled when the drive is connected to a USB communication. After writing, power on again or reset the software.

3.12 Auto Motor Phasing

For a third-party motor, use Auto Phasing to check the motor wiring and hall sensor wiring and configure the motor rotation direction, hall sensor polarity, and hall sensor UVW sequence sequentially.

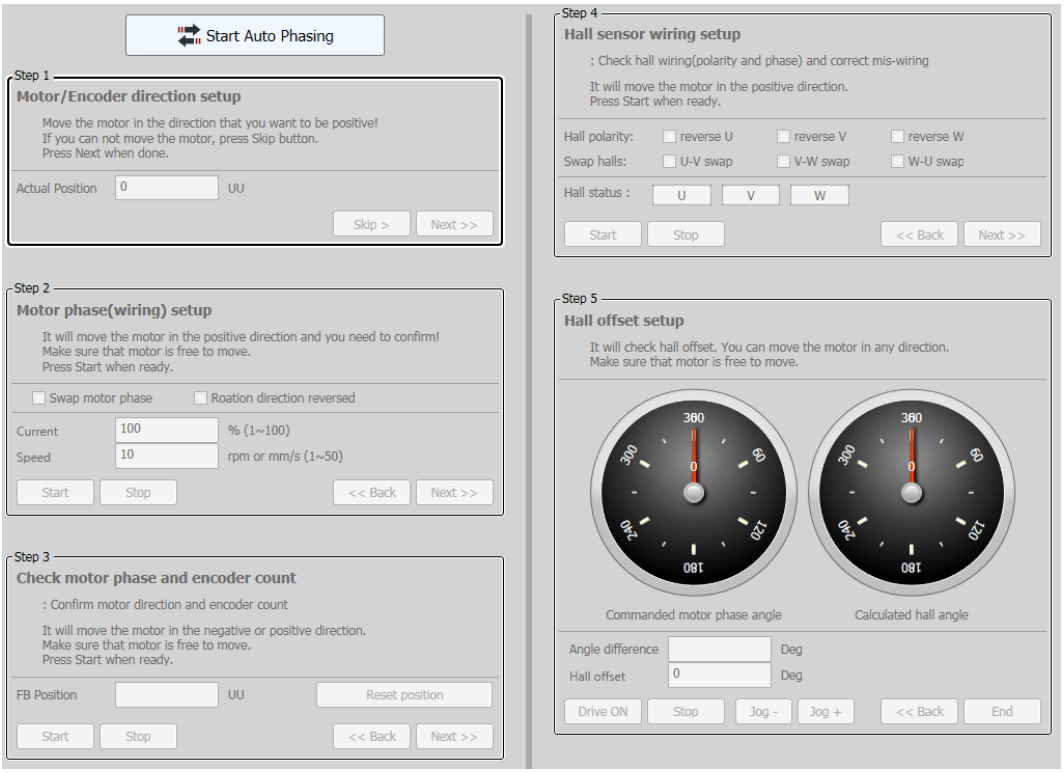


Figure 3-12.1

Press the ‘Start Auto Phasing’ button to get started.

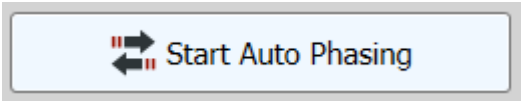


Figure 3-12.2

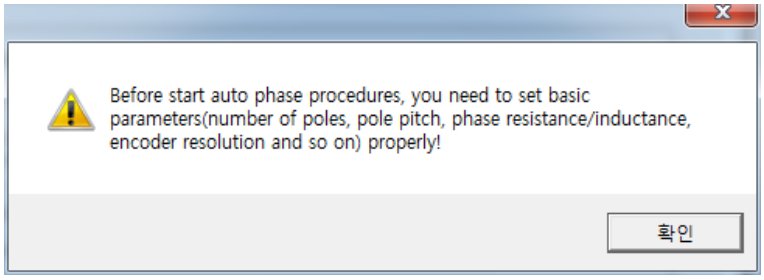
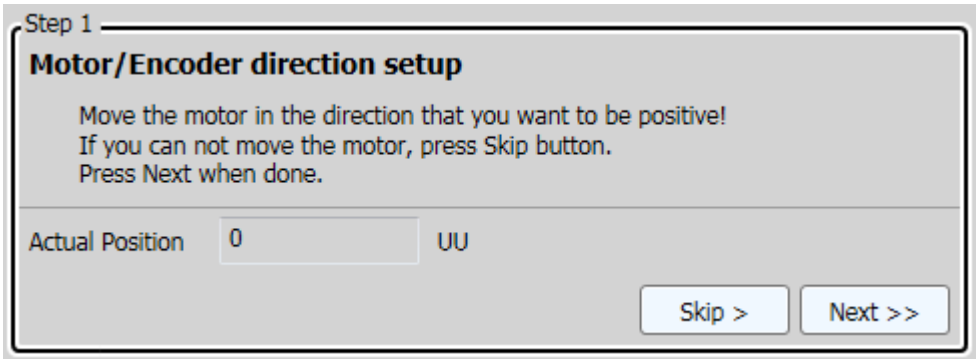


Figure 3-12.3

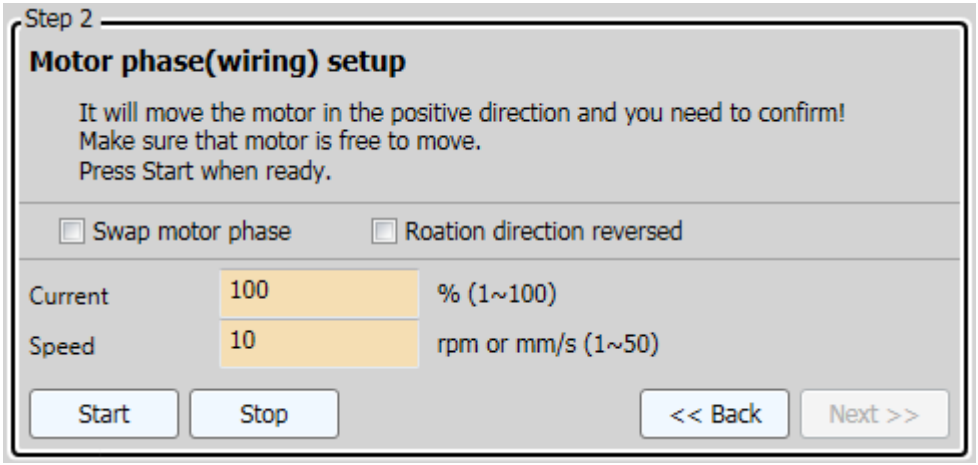
3.12.1 Motor Encoder direction setup

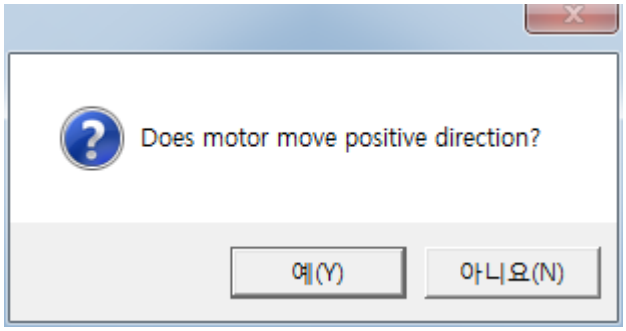
Rotate the motor in the direction that you want and check the changes in the actual position to see if the motor and encoder move in the same direction.



3.12.2 Motor Phase (wiring) setup

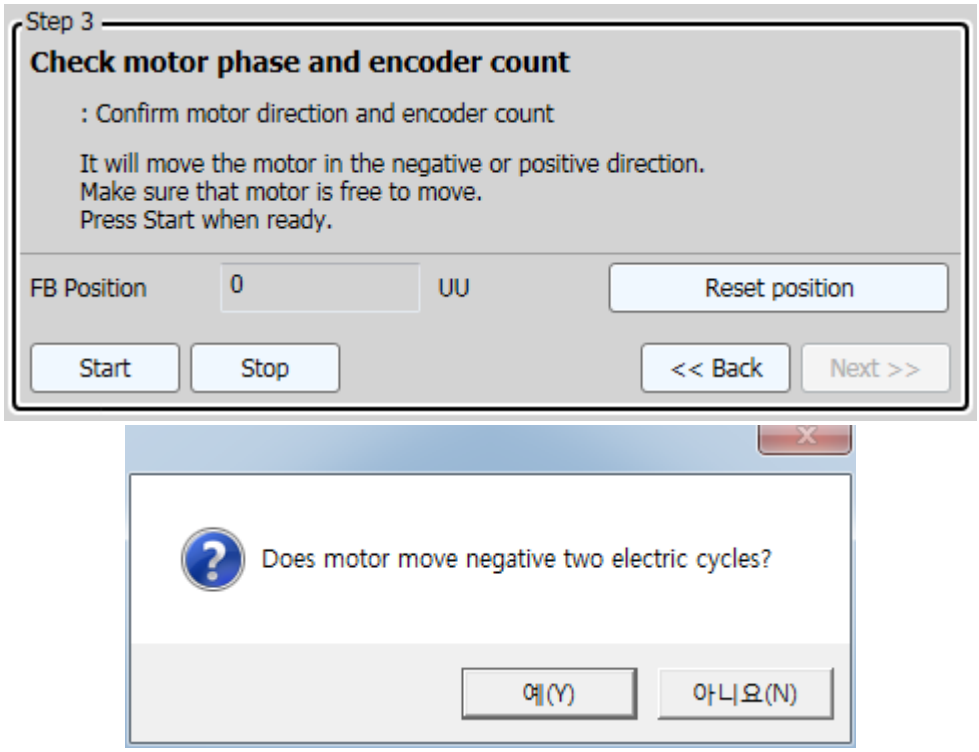
If the directions are not the same, select the Swap motor phase option to make them identical. Enter a proper torque value and speed and use the start/stop button to rotate the motor.





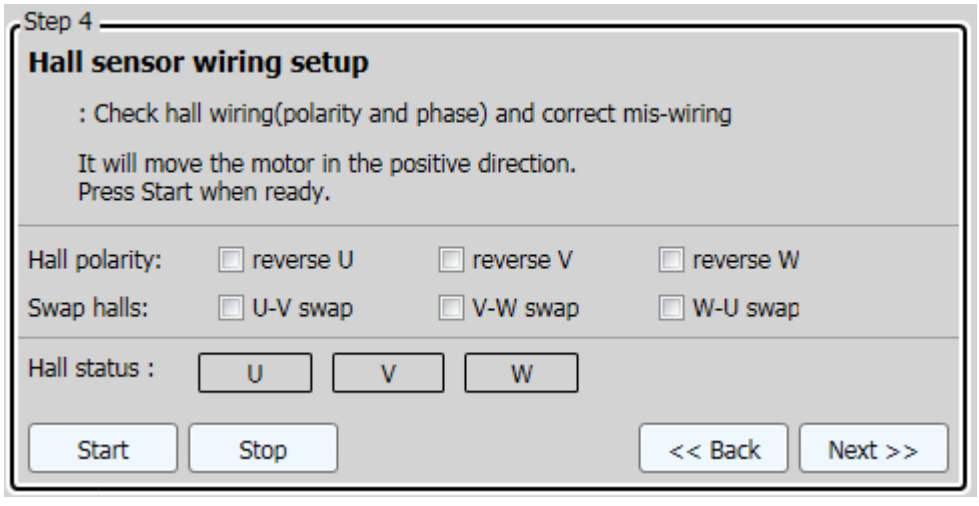
3.12.3 Check motor phase and encoder count

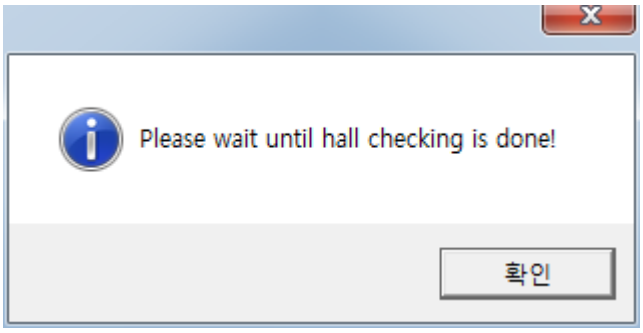
By starting/stopping the motor, check if the FB position increases during forward rotation and if the FB position decreases during reverse rotation.



3.12.4 Hall sensor wiring setup

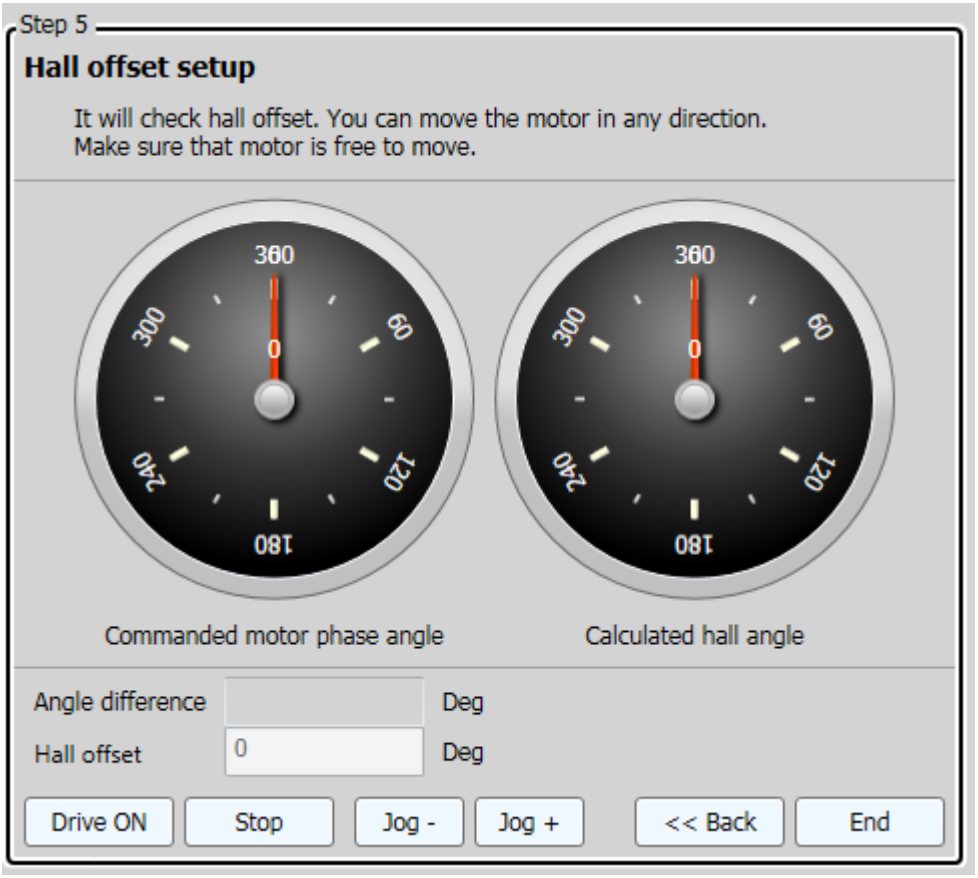
You can see the Hall status option to check the hall sensor signals, and see the Hall polarity/Swap halls options to reverse the signal polarity or swap the order of signals.





3.12.5 Hall offset setup

You can specify Hall offset for compensation. The difference between motor's electronic angle and hall sensor angle is displayed in the Angle difference field. You can use it as a hall offset to compensate for the difference between the motor's electronic angle and hall sensor angle.



User Manual Revision History

Number	Date issued	Revised content	Version number	Notes
1				