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AX-3 Series Quick Start

A NELTA AX-308E

*We reserve the right to change the information in this catalogue without prior notice.







AX-3 Series Quick Start

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	 Chapter 2: Updated the system requirement table in section 2.1.2. 	
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1.1 Related Manuals

The related manuals for AX-3 Series programmable logic controllers are listed below.

• AX-3 Series Quick Start (this manual)

This quick start helps you create and use the system in a short time. Besides presenting you with basic system framework, this quick start uses example to demonstrate how to design, write programs, use variables as well as function blocks (FB) and download the PLC program to the PLC. Refer to Appendix A Troubleshooting of AX-3 Series Operation Manual, if any error occurs.

- AX-3 Series Operation Manual This manual introduces CPU functions, devices, module tables, electrical specifications, appearances and dimension, basic concept of motion control, basic configurations, troubleshooting, and so forth.
- AS Series Hardware Manual This manual introduces electrical specifications, wirings of CPU modules and modules, appearances, dimensions, and so forth.
- AS Series Module Manual This manual introduces special I/O modules such as network modules, analog I/O modules, temperature measurement modules, and so forth.
- AX Series Motion Controller Manual This introduces single-axis and multi-axes instructions for programming the AX Series Motion Controllers.
- AX Series Standard Instructions Manual This introduces standard instructions for programming the AX Series Controllers.
- DIADesigner-AX User Manual

This manual introduces the use of the software, programming languages, including Ladder Diagram (LD), Sequential Function Chart (SFC), Structured Text (ST), and Function Block Diagram (FBD), as well as Program Organization Unit (POU), tasks and editing techniques for motion control programs.

Graph	Significance
	Click the left mouse button
	Click the right mouse button
2	Double-click the left mouse button
	Press and hold the left mouse button, and then move the mouse without releasing the button
	Use a keyboard
1	Operating sequence. This is used when the operating sequence is mentioned. For example,
1	Number used with a picture

Graphics used in the manual



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1.2 System Framework

The AX-3 Series PLC is a small-to-medium programmable logic control system. Execution speed and memory capacity are increased. Complete program development using function blocks is also supported. In order to meet more advanced application requirements, the AX-3 programmable logic controllers provide more flexible system extension frameworks. Under such system frameworks, you do not need to use multiple CPU modules to control the system because of too many I/O points or the equipment being too far away. System completeness has been retained, and you can be more efficient in project development.

Minimum framework requirements for the AX-3 system:

To create the AX-3 Series system, you need one CPU module and one power supply module to operate the CPU module.



Power supply module + AX-3 series PLC (AS-PS02 + AS308E-A)

The following are the limits for setting up a common framework for the AX-3 Series PLC system.

Exceeding any of the following limits triggers an error message:

Limit 1: Up to 32 extension modules can be connected to the PLC. The power module and CPU module are not included.

Limit 2: The maximum data capacity for inputs is 8192 bytes and for outputs is 8192 bytes.



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1.3 CPU Operation

The CPU module is the heart of the AX Series system. It is responsible not only for the execution of the logic program, but also the data exchange and processing of communication data. The relation between the AX system and external devices is shown below.



Here shows a simplified system procedures related to initialization, diagnosis, communication, and program procedures related to external interrupts and timed interrupts. Refer to the other manuals for more information. Check the following sections for the task of CPU operation.

1.3.1 Task

You define one or more tasks for controlling and executing the program blocks (POUs) in the PLC. You define a task with a name, a priority, and a type, which determines which condition triggers the start of the task. You can define this condition either by time (cyclic-interval, freewheeling) or by the occurrence of an internal or external event to process the task. A task calls one or more program blocks (POUs). With the combination of priority and condition, you define the order in which the tasks are processed. You can configure a watchdog for each task.

Rules for the processing order of the defined tasks:

- If the task condition is satisfied, then the system processes the task.
- If several tasks satisfy the condition for processing at the same time, then the system processes the tasks with the highest priority first.
- If several tasks with the same priority level satisfy the condition for processing at the same time, then the system processes the longest waiting task first.
- The program calls are processed in the order they appear in the configuration dialog of the task.
- If a called program has the same name in the device tree of the application and in a library or project-global in the POU window, then the application program is used.

Note: Set the priority level from 0 to 31. If the set number is closer to 0, it has higher priority.



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1.3.2 Task Types

There are five types of task types:

• Cyclic Task :

The system processes the task in cycles. The cycle time of the task is defined in the input field Interval.

• Event Task :

The system starts processing the Event Task as soon as the global variable defined in the input field Event contains a rising edge. The variable must be a Boolean value.

• Freewheeling Task :

The system starts processing the Freewheeling Task again automatically in a continuous loop at program start and at the end of a complete pass.

• Status Task :

The system starts Status Task processing as soon as the variable defined in the Event input field yields the Boolean value TRUE.

1.3.3 Bus Cycle Task

If the task condition is satisfied, then the system processes the task. Set the priority level from 0 to 31. If the set number is closer to 0, it has higher priority. The system processes the task in the order of Task Group in Task Configuration.



Task 1: Priority = 1, Bus cycle Task, Cyclic Task Task 2: Priority = 3, Event Task Task 3: Priority = 5, Freewheeling Task



- 1 The condition for starting Task 1 is met; Task 1 starts.
- 2 Task 1 completes and the I/O data from buffer is exchanged with the I/O channel (physical hardware.) Task 3 starts.
- 3 The condition for starting Task 2 is met and Task 2 has higher priority than Task 3 does. Thus Task 2 starts and Task 3 halts.
- The condition for starting Task 1 is met and Task 1 has higher priority than Task 2 does. Thus Task 3 starts and Task 4 halts.
- Task 1 completes and the I/O data from buffer is exchanged with the I/O channel (physical hardware.) Task 2 starts again.
- 6 Task 2 completes and the Task 3 starts again.

Note ①: The messages are normally sent on the bus in this task. Other tasks copy only the I/O data from an internal buffer that is exchanged only with the physical hardware in the bus cycle task.

1.3.4 Watchdog

If the task exceeds the time set for the watchdog, then the task is halted with an error status.

File Edit View Project Build	Dnline Debug Tools Window Help
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Devices 👻 🕈 🗙	PLC_PRG Device StanTask x
🖻 🎒 Untitled1	Configuration
Device (AX-308EA0MA1T)	
- 🔏 Hardware Configuration	Priority (031): 1
A Network Configuration	
E I PLC Logic	Туре
C Application	Cyclic Interval (e.g. t#200ms)
Library Manager	*1
PLC_PRG (PRG)	Watchdog
	☐ Enable
	Time (e.g. t#200ms) 500
Delta LocalBus Master (Delta Local	
EtherCAT Master SoftMotion (Eth	
SoftMotion General Axis Pool	

• Several consecutive timeouts:

Sensitivity: 0, watchdog timeout = time *1 Sensitivity: n, watchdog timeout = time *n





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MEMO





Chapter 2 Creating a Standard PLC Project

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2.1 Preparations

2.1.1 Hardware







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2.1.2 Software

• System requirements

Project	System Requirement			
Runtime System	DIADesigner-AX V1.00 or later			
Operating System	Windows 7 / 8.1 / 10 (32/64 bits)			
CPU	Intel Celeron 540 1.8 GHz (min.), Intel Core i5 M520 2.4 GHz (min.)			
Memory	2 GB or more (recommend to use 4 GB or more)			
Hard Disk Drive	10 GB or more			
Monitor	Resolution 1920 x 1080 Pixels recommend			
Keyboard/Mouse	General Keyboard Mouse or Windows compatible device			
PC interface	Ethernet, USB, Serial port (depends on product interface)			
Software	Need to install .Net Framework 4.6.2			

2.1.3 Tools and Materials

The required tools and the materials are listed below.

- A personal computer on which the software mentioned above is installed
- A 100-240 VAC and 50/60 Hz power supply socket
- A 24 VDC power supply
- A power cable
- A pin type terminal arranging kit
- At least 20 pin terminals
- A screwdriver
- A USB cable or a network cable.
- Prepare accessories such as a switch and a bulb to simulate the activity of external equipment if necessary.



2.2 Installation

2.2.1 Installing Modules

The illustration below is AS300 CPU NOT AX-308E. It is for illustration purposes only.

- 1. Install the PLC onto the power supply module, and then insert the module hooks into the DIN rail mounting slot.
- 2. Link the I/O modules on the right side of the PLC and make sure they are hooked together. Push the modules into the DIN rail until you hear a clic. (The following illustration demonstrates with AS300 CPU, not AX-324N.)



If there is a vibration source near the installation site, install anti-vibration baffles on the sides of the AX Series modules for better stabilization, such as the gray baffles show below.





• Install the baffles:

Hook the baffle onto the DIN rail and press it down as the directional arrow shows below.



Use screws to secure the baffle.



The completed baffle installation is as shown below.





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2.2.2 Installing / Removable Terminal Blocks

2.2.2.1 Installing/Removing the Removable Terminal Block on the CPU

• Installation



Removal

COM port (on the left): Push the clips inward as the arrow 1 shown to release the terminal block and then pull it up as the arrow 2 shown.

I/O port (on the right): Pull the clips backward as the arrow 1 to release the terminal block and then pull it up as the arrow 2 shown.





2.2.2.1 Installing/Removing the Removable Terminal Block on the Module • Installation



Removal





2.3 Wiring

After installation is done, you can start wiring. For your own safety, remember to turn off the power supply before wiring. Connect the power module and analog module first. You can also connect the signal cables to the switches and bulbs for testing. The example framework is as shown below.



Find the detailed wiring descriptions in the following sections. You may also refer to the AS Series Module Manual for more information.

2.3.1 Wiring the Power Supply Module

- The alternating-current input voltage must be between 100–240 VAC. Connect the power supply to terminals L and N. Please note if you connect the 110 VAC or the 220 VAC power supply to the input terminals +24V and 24G, it will damage the PLC.
- If power is interrupted for less than 10 milliseconds, the PLC keeps running without being affected. If power is
 interrupted for more than 10 milliseconds, or if the voltage of the power supply decreases, the PLC stops running,
 and there is no output. When the power supply returns to normal, the PLC resumes. Notice that there are latched
 auxiliary relays and registers in the PLC when you write the program.
- For power supply cables (L and N) and ground cable (LG), use single-wire cables or twin-wire cables with a diameter of 22 AWG–18 AWG and with less than 2mm pin terminals. Only use copper conducting wires with a temperature of 60/75°C.



2.3.2 Supplying Power

After you complete the wiring, supply power to the CPU module. Make sure the CPU module is set to STOP before you supply power to the CPU module. The CPU module starts initializing once it is supplied with power. Since there is no program or hardware configuration in the CPU module, only the power indicator will be ON. This is normal.



2.4 Example

After you install the hardware, wire the modules, and supply power to the CPU module, you can then write the program. This manual provides users with an example program to show you how to create a new project and how to download the program to the CPU module step by step.

2.4.1 System Framework



Control action

This example is the basic design of the water supply of a multi-story building. Tap water is automatically supplied from the underground pool, and the water in the underground pool can be transported to the water tower on top of the building by the pump. The water is distributed by gravity to every story in the building, and the action of the pump is controlled by the level switches in the underground pool and in the water tower. To monitor the water supply, the level meter is installed in the underground pool. The water storage capacity of the underground pool is monitored at all times.

• Devices connected to the I/O modules:

1. A single-point level switch (contact A)

The single-point level switch is installed in the underground pool, and the signal (Low) contact is connected to the digital input module.

2. A two-point level switch (contact A)

The two-point level switch is installed in the water tower on top of the building, and the signal (Low & High) contact is connected to the digital input module.

3. A pump

The pump is installed near the underground pool. The device to which the PLC actually connects is the control panel, not the pump. For common uses, there are three digital inputs and one digital output: remote control x 1 (DI) & Run x 1 (DI) & Trip x 1 (DI) & Start x 1 (DO) are connected to the digital input/output module.



4. A level meter

The level meter is installed in the underground pool, and the signal (Level) contact is connected to the analog input module. 0–10V corresponds to 0–10M. 0 V means that the water is 0.0 meters deep, and 10 V means that the water is 10.0 meters deep.

• The control condition of the pump:

- 1. Start: If the water level inside the water tower is low and that inside the underground pool is not low, the pump refills the water tower.
- 2. Stop: If the water level inside the water tower is high, or if the water level inside the underground pool is low, the pump stops running.

2.4.2 Creating a New Project

After you complete the hardware installation and know a thing or two about how a controller works, you can start creating a new project and writing programs.

Double-click the DIADesigner-AX icon to open DIADesigner-AX. Click **New Project** 1 on the Start Page or select *File > New Project (Ctrl+N)* to create a new project.

File	Edit View P	roject	Build	Online	Debug	Tools	Window	Help	
睝	New Project			Ctrl	+N	用制	1 1 1	袖- 6 圖 🥵 🤇	ÿ → i
2	Open Project			Ctrl	+0				
	Close Project						Start Page	×	
	Save Project			Ctrl	+S			Decigner AV 1 2	
	Save Project As							Designer-AX 1.2	
	Project Archive				•				
	Source Upload					E	Basic opera	ations	
	Source Download.						Ne Ne	w Project	
4	Print						🚅 Op	en Project	
	Print Preview						👔 Op	oen Project from PLC	
	Page Setup								
	Recent Projects					F	Recent pro	ojects	
	Exit			Alt+	-F4				

Next you will see a window with two sections, Categories and Templates. Click **Projects** in the Categories section and click **Standard project** in the Templates section. After that create a Name and specify a location for the project and then click **OK**.

管 New Pro	oject			×
Categories		Templates		
Lib	raries piects	AX		
	,	Empty project	Standard project	
A project co	ontaining one device, one ap	plication, and an e	mpty implementation for PLC_PRG	
Name	Untitled1			
Location	C:\Documents\AX_3			×
			OK	Cancel



And a Standard Project dialog appears. You can select the device and the programming language from the drop-down list. Click **OK**, the system generate a cyclic task with a default PLC_PRG.



After a new project is successfully created, you can see a project management area in the left side of the window. All the options are listed in nodes. Click View -> Devices (Alt+0) on the tool bar, if nothing appears in the project management area.

201000		Testler
Untiled: ntiled: Until	3	4

The operation interface of the software:

• Function area: The main functions of the software are in this area. Many frequently used functions are placed on the toolbar, and other functions are placed on the menus.



- Project management area: The framework of the project is displayed in this area. You can see the relations among the objects in the tree structure, which increases project management efficiency.
- **3** Work area: The editing work is in this area.
- **4** Output area: Information resulting from the execution of the function is displayed in this area.
- **5** Status area: The project and communication information are displayed in this area.

2.4.3 Hardware Configurations

After the project is created, you can configure the hardward. Suppose you set the following configurations.

- The digital input addresses of the CPU (16 inputs): %IX0.0 ~ %IX0.7 & %IX1.0 ~ %IX1.7
- The digital output addresses of the CPU (8 outputs): %QX0.0 ~ %QX0.7
- The analog input addresses of the 06XA (4 channels): %ID2 ~ %ID5
- The analog output addresses of the 06XA (2 channels): %QD1 ~ %QD2
- The low point of the water level inside the underground pool: %IX0.0
- The low point of the water level inside the water tower: %IX0.1
- The high point of the water level inside the water tower: %IX0.2
- Remote control of the pump: %IX0.3
- The RUN of the pump: %IX0.4
- The TRIP of the pump: %IX0.5
- The START of the pump: %QX0.0
- The value of the watrer level inside the underground pool: %ID2

With the information above, you can configure the hardware now. Double-click **Hardware Configuration** on the Device section to open the Hardware Configurate (Device) window as the image shown below.

Devices • # ×	A Hardware Configuration [Device] X	+ Product List Editor	- # X
Contended Control of the configuration Network (M-3244M/04.0P) Rec. Configuration Rec. Configuration		Product Las © Discloy All Product Las © Display © Display © Position	Versions NO Module O Module No Module Module
		Properties	- + ×
		V Filter + 15	iont by • 2 Sont order •
		Property	Value
		Description	
Convers 2 Pola		Toollox 20	roperties 🕘 Youstaston Toollos
	Last build: O 0 • 0 Precomple	2 28 Prote	ct user: (nobody)

Hardware Configuration (Device): This is the main work area for system configuration and settings.

Product List Editor: Here listed out all supported modules for the selected CPU.

Click to see all the supported modules on the right window (Product List Editor).

Click \triangleright to unfold the list. Click the module name to see a short module description.



Double-click or drag and drop the extension module (06XA) that you'd like to add from the Product List. Newly added extension modules will apper on the right-side of the AX-3 Series PLC. And the device names will also show up on the left-side under Delta_LocalBus_Master.





2

In order to complete the basic setting, set the relation between the signals and the conversion values for the analog module. Double-click the module to open the **Parameter** window.

AS06XA_A ×						
AS06XA-A Parameters	Parameter	Туре	Value	Default Value	Unit	Description
	- Format	Enumeration of UINT	Integer	Integer		
AS06XA-A I/O Mapping	■ Input CH1~CH4 Mode Setting		5	5		
· · · · · ·	Input CH1 Mode Setting	Enumeration of WORD	-10V~+10V	-10V~+10V		
Status	Input CH2 Mode Setting	Enumeration of WORD	-10V~+10V	-10V~+10V		
	✓ Input CH3 Mode Setting	Enumeration of WORD	-10V~+10V	-10V~+10V		
Information	Input CH4 Mode Setting	Enumeration of WORD	-10V~+10V	-10V~+10V		
	= [•] Input CH1~CH4 Calibration					
	Input CH1 Cal. Offset	INT(-3276832767)	0	0		
	Input CH2 Cal. Offset	INT(-3276832767)	0	0		
	→ Input CH3 Cal. Offset	INT(-3276832767)	0	0		
	Input CH4 Cal. Offset	INT(-3276832767)	0	0		
	Input CH1 Cal. Gain	INT(-3276832767)	1000	1000		
	Input CH2 Cal. Gain	INT(-3276832767)	1000	1000		
	Input CH3 Cal. Gain	INT(-3276832767)	1000	1000		
	Input CH4 Cal. Gain	INT(-3276832767)	1000	1000		
	Input Average Filter					
	Input CH1 Average Times	WORD(1100)	10	10		
	Input CH2 Average Times	WORD(1100)	10	10		
	Input CH3 Average Times	WORD(1100)	10	10		
	Input CH4 Average Times	WORD(1100)	10	10		
	Input CH1 Filter Proportion	Enumeration of WORD	10%	10%		
	Input CH2 Filter Proportion	Enumeration of WORD	10%	10%		
	Input CH3 Filter Proportion	Enumeration of WORD	10%	10%		
	Input CH4 Filter Proportion	Enumeration of WORD	10%	10%		
	😑 🖗 Input Sampling Time					
	Input sampling time	Enumeration of WORD	2ms	2ms		
	😑 🌳 Input Channel Detect and Alarm Settings	WORD	0			

Use the drop-down list to select a suitable value.

AS06XA-A Parameters	Parameter	Туре	Value	Default Value	Unit	Description
	🕈 Format	Enumeration of UINT	Integer	Integer		
AS06XA-A I/O Mapping	■ Input CH1~CH4 Mode Setting					
	Input CH1 Mode Setting	Enumeration of WORD	0V~+10V	-10V~+10V		
Status	Input CH2 Mode Setting	Enumeration of WORD	-10V~+10V	-10V~+10V		
	Input CH3 Mode Setting	Enumeration of WORD	-10V~+10V	-10V~+10V		
Information	Input CH4 Mode Setting	Enumeration of WORD	-10V~+10V	-10V~+10V		

Click AS06XA-A I/O Mapping to see the auto-assigned address of each input/output channels.

dia				
<u>_fff</u>	A\$06YA	۸	~	
	ASUUAA	~	~	

AS06XA-A Parameters	Find	Find Filter Show all							
AS06XA-A I/O Mapping	Variable ⊫-*	Mapping	Channel AS06XAIN	Address %ID1	Туре	Unit	Description		
Status			Error code	%ID1	DWORD				
Status	* >		CH1 Input	%ID2	DINT				
Information			CH2 Input	%ID3	DINT				
Inormation	*		CH3 Input	%ID4	DINT				
	L*		CH4 Input	%ID5	DINT				
	÷-**		AS06XAOUT	%QD1					
			CH1 Output	%QD1	DINT				
	····· **		CH2 Output	%QD2	DINT				



2.4.4 Creating Global Symbols

In order to make the program more readable, the I/O addresses are accompanied by global symbols. Use these symbols when you write the program. The global symbols are as follows.

	Global symbol table									
Bit (Hardware: I/O on the PLC)										
Identifier	Address	Data type								
Tank_B1F_LSW	%IX0.0	BOOL								
Tank_RF_LSW	%IX0.1	BOOL								
Tank_RF_HSW	%IX0.2	BOOL								
SPP01_Remote	%IX0.3	BOOL								
SPP01_Run	%IX0.4	BOOL								
SPP01_Trip	%IX0.5	BOOL								
SPP01_Start	%QX0.0	BOOL								
Tank_B1F_LT	%ID2	DINT								
	Bit (Software)									
SPP01_Auto		BOOL								
SPP01_Man_SW		BOOL								

With the information above, now we can create the global symbols.

1. Right-click Application under the node of PLC Logic to open a context menu. Select Add Object to see another context menu. Select Global Variable List to open the Add Global Variable List window.

Device (AX-324NA0PA1P)		Communicatio	on Settings
Hardware Configuration A Network Configuration A EtherCAT Filter DEC Logic	n	Applications Backup and Re	testore
Application Application Application Application PLC_PRG (PR PATAR Configur SetherCAT_ SetherCAT_ SetherCAT_	Cut Copy Paste Delete Refactoring		
创 PLC_PRC	Properties		
BuiltIn_IO (BuiltIn DIO (DIO) Delta_LocalBus_Ma	Add Object Add Folder Edit Object Edit Object with Login		 Alarm Configuration Application Axis Group Cam table CNC program CNC program
	Delete application	from device	Data Sources Manager
		Task Deploym	
		Status	🗊 Image Pool



2. Click **Add** on the Add Global Variable List window to add a new global variable list. A default name "GVL" is shown automatically. You can define a new name for the new gloval variable list.

Add Global Vanable List	×	Devices • # ×	 GVL	×						
Crede snew (plote variatie lot	¢		~	Scope	Name	Address	Data type	Initialization	Comment	Attribute

3. When shown in the tabular view, you can see the cursor below the column "Name". You can click if for the textual view or click it to switch back to the tabular view. When shown in the textual view, you can find two varialbes, including VAR_GLOBAL and END_VAR.

	GVL	_ ×	•
	1	{attribute 'qualified_only'}	lini ^r
r i	2	VAR_GLOBAL	
L	3	END_VAR	

4. Right-click on the blank space of GVL window or click the with button to insert a new variable. The default scope of the added variable is global and default data type is BOOL. You can define the name for the added variables.



5. Double-click the value in the column of Data Type and the drop-down list button ⊵ appears.

SVL	×								
	×								
^	Scope	Name	Address	Data t	ype	Initialization	Comment	Attributes	
1	VAR_GLOBAL	ABC		BOOL	>				



6. Click **D** to see two options, **Input Assistant** and **Array Wizard**, for configurations: Input Assistant for the data type of the varialbes; Array Wizard for the array configurations.



7. You can enter a value for initialization for the variable.

SVL 🖉	×						
2 1. +.	X						
	Scope	Name	Address	Data type	Initialization	Comment	Attributes
1	VAR_GLOBAL	ABC		LREAL	123.45		

8. Follow the steps above to add more global variables and set the corresponding IO addresses for the variables. And then you will have a global variable list as the example image shown below.

	Scope	Name	Address	Data type	Initialization	Comment
1,	VAR_GLOBAL	Tank_B1F_LSW	%IX0.0	BOOL		Tank_B1F Level Switch-Low
2	VAR_GLOBAL	Tank_RF_LSW	%IX0.1	BOOL		Tank_RF Level Switch-Low
3	VAR_GLOBAL	Tank_RF_HSW	%IX0.2	BOOL		Tank_RF Level Switch-High
4	VAR_GLOBAL	SPP01_Remote	%IX0.3	BOOL		Supply Water Pump-SPP01 Remote
5	VAR_GLOBAL	SPP01_Run	%IX0.4	BOOL		Supply Water Pump-SPP01 Run
6	VAR_GLOBAL	SPP01_Trip	%IX0.5	BOOL		Supply Water Pump-SPP01 Trip
7	VAR_GLOBAL	SPP01_Start	%QX0.0	BOOL		Supply Water Pump-SPP01 Start
8	VAR_GLOBAL	Tank_B1F_LT	%ID2	DINT		Tank B1F Level Meter
9	VAR_GLOBAL	SPP01_Auto		BOOL		Supply Water Pump-SPP01 Auto Mode
10	VAR_GLOBAL	SPP01_Man_SW		BOOL		Supply Water Pump-SPP01 Manual Comman



2

2.4.5 Creating Function Blocks

The procedure in this example is to create a function block first. You can create the main program first if you prefer. There is no relation between the function block and the main program, and they run separately. However, you should create a function first when the function is used repeatedly.

The control relation among the underground pool, the water tower, and the pump can be represented by function blocks. There are usually two water systems in a multi-story building. If you create the function blocks, you only need to change the variables of the input and output pins to complete the second water system.

With the information above, now we can create the function block.

1. Right-click **Application** under the node of **PLC Logic** to open a context menu. Select **Add Object** to see another context menu. Select **POU** to open the Add POU window.



2. You can define a new name for the function block. Select **Function block** in the Type section and click **Add** to add a function block.

Add POU	×
Create a new POU (Program Orga	nization Unit)
Name	
FB_SPP_Sys	
Туре	
() Program	
Function block	
Extends	
Implements	100
Final Abstract	
Accessspecifier	
	~
Method implementation language	
Continuous Punction Chart (CFIC)	
O Function	
Return type	
Implementation language	
Ladder Logic Diagram (LD)	v



3. After that you can find the newly created FB under the node of **Application** on the tree view. And the FB editing window is on the right side.

Devices	*	1 FB_SPP_Sys x	ToolBox • * ×
3 Untitled1		FUNCTION_BLOCK FB_SPP_Sys	General
Dekind (K-324(ADPA1P) Ji Hardware Configuration A Network Configuration A Network Configuration A Network Configuration Configuration Proceeding Proceedi		Scope Name Address Data type Initialization Comment Attributes	Control C
		A + 9. 100 % A	-

Create the local symbols. The way to create the local symbols is the same as to creat global symbols. You can use the global symbols in the internal program, but by doing so, the protability and convenience of using the function block are decreased. The local symbols and global symbols can bear the same name. But the local symbol has a higher priority.

Declaration type	Identifier	Data type
VAR_INPUT	Tank_B_LSW	BOOL
VAR_INPUT	Tank_R_LSW	BOOL
VAR_INPUT	Tank_R_HSW	BOOL
VAR_INPUT	Pump_Remote	BOOL
VAR_INPUT	Pump_Run	BOOL
VAR_INPUT	Pump_Trip	BOOL
VAR_IN_OUT	Pump_Auto	BOOL
VAR_IN_OUT	Pump_Man_SW	BOOL
VAR_OUTPUT	Pump_Start	BOOL
VAR	Pump_Out	BOOL

The local symbols used in this example are as follows.

You can double-click the variables below the Scope tab and reselect a new scope type.





VAR_INPUT

When you run the program, the value of the external variable is brought into the internal variable. If the value of the corresponding internal variable is changed, it is not transmitted to the external variable. VAR_INPUT is often used if the value of the external variable should not be modified. Most of the inputs in this example are digital inputs, and these should not be modified. The modifying the values of these variables affects the execution of the program or the use of the function block. In order to prevent the values of these variables from being modified in the program, use the declaration type VAR_INPUT.

VAR_IN_OUT

When you run the program, the value of the external variable is brought into the internal variable. After the program comes to an end, the value is transmitted to the external variable. VAR_IN_OUT is often used if the value of the variable should be modified. Generally speaking, Pump_Auto and Pump_Man_SW in this example are used in the SCADA system to set the control mode of the pump. It may seem that this type of variable, VAR_INPUT, meets the requirement. However, you need to switch the control mode of the pump from automatic mode to manual mode to stop the command from being output when the pump trips. Therefore, declare these two variables to the type of VAR_IN_OUT.

VAR_OUTPUT

When you run the program, the value of the external variable is not brought into the internal variable, but the previous stored value is used instead. After the program comes to an end, the value is transmitted to the external variable. Generally speaking, this type of variable appears in the output of the instruction. The variable Pump_Start used in this example belongs to this type of usage.

VAR

When the program is run, VAR is evaluated as an internal variable. Just like VAR_OUTPUT, the previous stored value is used instead. Generally speaking, with no transmission function, the variable is used as a register when it is used in the program. The variable Pump_Out used in this example belongs to this type of usage.

After the creation of function blocks is done, the table should look like this:

2 7 4		×						
^		Scope	Name	Address	Data type	Initialization	Comment	Attributes
1	1	VAR_INPUT	Tank_B_LSW		BOOL		Tank BF Level Switch-Low	
1	2	* VAR_INPUT	Tank_R_LSW		BOOL		Tank RF Level Switch-Low	
3	3 VAR_INPUT Tank_R_HSW				BOOL Tank RF Level Switch-High			
1.1	4	VAR_INPUT	Pump_Remote		BOOL		Pump-Remote	
1	5	VAR_INPUT	Pump_Run		BOOL		Pump-Run	
	б	VAR_INPUT	Pump_Trip		BOOL		Pump-Trip	
3	7	VAR_IN_OUT	Pump_Auto		BOOL		Pump-Auto	
- 8	8	VAR_IN_OUT	Pump_Man_SW		BOOL		Pump-Manual Switch	
13	9	VAR_OUTPUT	Pump_Start		BOOL		Pump-Start	
1	ò	* VAR	Pump_Out		BOOL		Pump-Out	



Now you can start editing the contents of the function blocks. If you need to add comments while editing the function block, you need to go to *Tools -> Options -> FBD, LD and IL editor* to select the option **Show network comment** and then click **OK** to confirm the setting.



Double-click the upper space of the network section to add comments. Press the Enter key on your keyboard to go to the next line.



Now you can start programming. Here we use the Ladder Logic Diagram (LD) as the programming language in this example. You can either click where you'd like to add the element and then click the **1** on the tool bar above to add. Or find **1** Contact in the Ladder Elements of the ToolBox on the right side of the window. (ToolBox -> Ladder Elements -> **1** Contact). Select the element and drag it to where you'd like to add the coil. Once you see the green box appears, drop

it there.

who up	* * * X	- FB_:	SPP_Sys ×								ToolBox	
3 Untitled1		2.1.1	X			FUNCTIO	N_BLOCK FB_SP	PP_Sys		1	* General	
Device (AX-324NAOPA1P) Hardware Configuration KNetwork Configuration DLC Logic O Application GVL			Scope VAR_INPUT VAR_INPUT VAR_INPUT VAR_INPUT	Name Tank_B_LSW Tank_R_LSW Tank_R_HSW Pump_Remote	Address	Data type BOOL BOOL BOOL BOOL	Initialization	Comment Tark BF Level Switch-Low Tark RF Level Switch-Low Tark RF Level Switch-High Pump-Remote	Attributes	~	Boolean Operators Math Operators Other Operators Function Blocks Ladder Elements Envers	
illibrary Manager		101	Control Mo	de - Auto			4.7				e Contact	

Click the ??? section to type a new name, for example, Pump_Remote and then press the Enter key.





You can use the shortcut Ctrl+K to quickly add several in.



If you need the condition of with water in the underground pool and no water in the water tower, the state of Tank_R_LSM should be False. Right-click the contact of Tank_R_LSM and select **Negation** from the drop-down list.

	Re Copy Re Paste
	Browse
	 Insert Box Insert Empty Box Insert Empty Box with EN/ENO Insert Execute Box
	 Insert Contact Insert Negated Contact Insert Contact (right) Insert Contact Parallel (below) Insert Negated Contact Parallel (below) Insert Contact Parallel (above) Paste contacts
	Negation
	Edge Detection Insert Branch
Pump Remote Pump Auto Tank B LSW	Tank B LSW

You can add a coil by either clicking where you'd like to add a coil and then clicking **C** on the tool bar above to add or finding **C** in the Ladder Elements of the ToolBox on the right side of the window (ToolBox -> Ladder Elements -> **C**). Select the element and drag it to where you'd like to add the coil. Once you see the green box appears, drop it there.







Click the ??? section to type a new name, for example, Pump_Out and then press the Enter key. Right-click the contact of Pump_Out and select **Set/Reset** from the drop-down list.

Three methods for you to insert a new network.

- 1. Click where you'd like to add a network above and then click *the click content of the cli*
- Find in the Ladder Elements of the ToolBox on the right side of the window. (ToolBox -> Ladder Elements ->
); select the element and drag it to where you'd like to add the network, once you see the green box appears, drop it there.
- 3. Right-click the created network and select Insert Network or Insert Network (below) from the drop-down list.





2				
	Pump_Remote	Pump_Auto	Tank_R_HSW	Pump_Out

A new network has been created, you can start programming in the same way as mentioned before.

1

parallel negated contact and then click Parallel negated contact on the tool bar above to add. Or find Parallel negated contact in the Ladder Elements of the ToolBox on the right side of the window (ToolBox -> Ladder Elements -> Parallel negated contact), select the element and drag it to where you'd like to add the parallel negated contact. Once you see the green obtrangular form appears, drop it there. Click the ??? section to type a new name, for example, Tank_B_LSW and then press the Enter key.

If you need the condition of no water in the underground pool or the pump trips, you can click where you'd like to add a



Write the following program in the same way.






Now you have complete an automatic control program. Write the following program in the same way.

You have created the function block POU. Save the project.



2.4.6 Creating Main Programs

After we created the function block, we can now create main programs.

1. Right-click ^(C) Application under the node of PLC Logic to open a context menu. Select Add Object to see another context menu. Select POU to open the Add POU window.

Devices	- 4 ×			
Untitled1				
Application Application Application Application FB_SPP_Sys (FB) PIC_PRG (PRG) Application Task Configuration SetherCAT_Tas SetherCAT_Tas	Cut Copy Paste Celete Refactoring Properties			
PLC_PRG BuiltIn_IO (BuiltIn_IO DIO (DIO) Delta_LocalBus_Maste	 Add Object Add Folder Edit Object Edit Object with Login Delete application from device 	•		Alarm Configuration Application Axis Group Cam table CNC program CNC settings
				Data Sources Manager DUT External File Global Variable List Image Pool Interface Network Variable List (Receiver) Network Variable List (Sender) Persistent Variables POU
			đ	POU for implicit checks

2. You can define a new name for the function block. Select **Program** in the Type section and click **Add** to add a function block.

me	
C_PRG	
ype	
Program	
U Function block	-
Extends	
Implements	
Final Abstract	
Accessspecifier	
	-
Method implementation language	
Function	-
Return type	adar
Ketum type	ada
plementation language	
dder Logic Diagram (LD)	



3. After that you can find the newly created PLC_PRG (PRG) under the node of **Application** on the tree view. And the main program editing window is on the right side.

Devices	• 4 ×	PLC_PRG ×		ToolBox	* *
 Winthed1 Brevice (AX-32-RIAOPA1P) Hardware Configuration A Network Configuration A Network Configuration DPLC Logic O Application Ubray Manager B R.SD P.sc. (FB) PLC, PRG (PRG) Task Configuration WiniTask PLC_PRG Builtin_10 (Builtin_10) B UO (DIO) 		Scope Nam	PROGRAM PLC_PRG he Address Data type Initialization Comment Attributes	General The Network Book Mit EN/ENO Assignment Anno Return Return Enanch Enanch Enanch Booken Operators Math Operators Other Operators Other Operators Conten Blocks	
IDelta_LocalBus_Master (Delta LocalBus Master)		1		 Lader Elements. POUs 	

The difference between the function block and the main program is that the function block has to be called before it runs, whereas the main program runs when it is added in the Task. This example omits creating local symbols for the main program. Use what we have learned from the function block section to write the following program.



Two methods to call the function block.

Method 1:

Click any blank space in the network to have the functional buttons on the toolbar activated. Click the functional button **Insert Box with EN/ENO** on the toolbar to open the **Input Assistant** window. Select **Funciton blocks** under the

Categories tab. Unfold the node of Application and select FB_SPP_Sys and then click OK.

File Edit View Project FBD/LD/IL E	imput Assistant						×	
File Edit View Project FB0/LD/L E Edit View Project FB0/LD/L E Devices	Text Search Catego Function blocks Module Calls Keywords Conversion Operat	toris +	Name Academication (1) [RS, SPP, Sys (1) IoDiv(thercatLb) (1) SM3_Basic (1) SM3_Basic (1) SM3_CNC (1) SM3_Math (1) SM3_Robotics (1) SM3_Robotics (1) Standard	Type Application We TLON, IL Ubrary Ubrary Ubrary Ubrary Ubrary	Origin IOOnvetherC SN1, Basic, 4 SN1, Naih, 4 SN1, Naih, 4 SN3, Rabolic Stanslard, 3.5			work with EN/ENO gament of ut nch cute (Operators verators erators Blocks Elements
	Structured view							
	Documentation				Insert with arguments	Insert with na	imespace prefix	
	FUNCTION_BLO	OCK FB_SPP_Sys					^	
	Tank_B_LSW	BOOL VAR_INPUT	Tank BF Level Switch-	Low				
	Tank_R_LSW	BOOL VAR_INPUT	Tank RF Level Switch-	Low				
	Tank_R_HSW	BOOL VAR_INPUT	Tank RF Level Switch-	High				
	Pump_Remote	BOOL VAR_INPUT	Pump-Remote	_				
<	Pump_Run	BOOL VAR INPUT	Pump-Run	_				
	Dump Trip	IROOLIVAR INPUT	Pump, Trip				~	



Method 2:

Click Box with EN/ENO in the General of the ToolBox on the right side of the window (ToolBox -> General ->

Box with EN/ENO
). Select and drag it to where you'd like to add the FB_SPP_Sys. Once you see the green

obtrangular form appears, drop it there. Click the ??? section to type the name of the function block. You can also click **...** after clicking the ??? section to select **Funciton blocks** under the **Categories** tab. Unfold the node of **Application**

and select **FB_SPP_Sys** and then click **OK**.



After that the system will declare a data block for this function block automatically. Its POU name is the same as the name of the function block. If you need to change the POU name, click the function block name and then press the Enter key once or twice on your keyboard to open an **Auto Declare** window. Redefine the POU name and click **OK**.

Here the data block is created as a local symbol in the main program. The way to create a data block is the same as the way you create a local symbol. The only difference is that you do not need to specify the data type. The system will auto fill the name of the data type to be the same as the name of the function block.

Scope		Name	 Туре	
VAR	*	FB_SPP_Sys_1	FB_SPP_Sys	~ >
Object		Initialization	Address	
PLC_PRG [Application]	×			
Flags		Comment		
CONSTANT				*
PERSISTENT		1		1





Refer to the followings and type the corresponding name of the global symbol in the contacts. After you save the file, the program is complete.

FB SPP Sys 0 TRUE FB_SPP_Sys 11 EN ENO GVL.Tank_B1F_LSW Tank B LSW Pump_Start - GVL.SPP01_Start GVL.Tank RF LSW Tank R LSW GVL.Tank RF HSW-Tank R HSW GVL.SPP01_Remote -Pump_Remote GVL.SPP01_Run-Pump_Run GVL.SPP01 Trip-Pump Trip GVL.SPP01_Auto --- Pump_Auto GVL.SPP01_Man_SW - Pump_Man_SW

You can click if the project to check if the syntax of the current program is correct. Compiling the project involves not only checking the syntax, but also compiling all programs as well as the contents of the function block.

File	Edit	View	Project	FBD/LD/IL	Build	Online	Debug	Tools	Window	Help		
1	1 🕘 🛛	o ⊂i ∦ I	🖻 🛍 🗙 🎼	N 🕼 🐴 🛀 🔳	% IV X	🛱 🛅 🕇 [f 🔛 👒	0ğ → =	🖋 CI eI e	a *≣ \$ 4		
<u>-</u> (**)	UAR € ♪ €S)	03-11-1	ne añs la d'hund			er 🕾 🛛 🖉 🖪		- 掘 乾 卞				
					$\mathbf{\nabla}$	/						
Messag	es - Tota	l 0 error(s	s), 0 warning((s), 0 message(s))							- ₽ X
Build				• 0 error(s)) 💿 0 wa	rning(s) 🗕	0 message	(s) 🗙 🕷				
Descri	ption							Pro	ject (Object	Position	
··	Build st	tarted: Ap	plication: De	vice.Application -								
Тур	ify code											
Con	npile com	plete 0	errors, 0 wa	rnings								

Note: In order to help you understand the control program, the example provided here is simple. The actual control program is much more complex because the functions related to checking for start failure and conversion from the local control to remote control must be taken into account. You can make use of the tools in the ToolBox on the right side of the window and instructions in the **Input Assistant** to write programs.

If you need to create a second system, you only need to call "FB_SPP_Sys" again. Type the name of the function block to have the same function block as the one used in the first system. Note that do NOT use the same function block in two systems if the values of VAR_OUTPUT and VAR of the two systems can affects each other. In that case, create a new function block for the second system, as shown below.

	So	соре	Name			Address	Data type	Init	ialization	Comment	
1	\$	VAR	FB_SP	_Sys_0	1		FB_SPP_Sys			SPP01 Data B	lock
2	۲	VAR	FB_SPI	_Sys_1			FB_SPP_Sys			SPP02 Data B	lock
1							A 7				
						FB_SI	PP_Sys_0				
		т	RUE			FB_	SPP_Sys				
			┨ ┠───		EN			ENO			
		GVL.T	ank_B11	F_LSW -	Tar	nk_B_LSW	Pump_S	tart	- GVL.SP	P01_Start	
		GVL.	Tank_R	F_LSW -	Tar	nk_R_LSW					
		GVL.	Tank_R	F_HSW-	Tar	nk_R_HSW					
		GVL.S	PP01_Re	emote -	Pun	np_Remote	•				
		GV	L.SPP0:	L_Run -	Pun	up_Run					
		GVL	.SPP01	Trip-	Pun	np_Trip					
		GVL	DD01 M	_Auto -	e Pun	ID_AUCO					
		GVL.5	PPOI_M	an_sw -	Pull	up_Man_Sw	·				
2	۰.										
			DITE			FB_SPP	_Sys_1	_			
		1		,	- NT	FB_SPI	?_Sys	NO			
		Tanko	2 B1F 1	SW	Fank	BISW	Rump Star		SPP02 St	art	
		Tank	02 RF 1	SW -	Fank	B LSW	ramp_bour		02202_00		
		Tank	02 RF 1	ISW -	lank	R HSW					
		SPP	02 Rem	te —	Pump	Remote					
			SPP02 H	Run —	Pump	- Run					
		s	PP02_T	ip —	Pump_	Trip					
		S	PP02_A	ito 😅	Pump_	Auto					
		SPP	02_Man	_ sw -⇔:	Pump_	Man_SW					



MEMO





Chapter 3 Creating Motion Control Projects

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3.1 Preparation

Chapter 3 provides users with the example, which is the most commonly used with AX series products, to create basic projects of motion control, as well as the required software, hardware, and tools explained in this section.

3.1.1 Hardware

The hardware needed in the example is as follows.





3.1.2 Software

The software needed in the example is as follows.

• DIADesigner-AX V1.0.0 and above.

3.1.3 Tools and Materials

The tools and the materials needed in the example are as follows:

- Personal computer (with software DIADesigner-AX installed)
- A 100~240VAC 50/60Hz power supply socket
- A 24VDC power supply
- A cable
- A pin type terminal arranging kit
- At least 20 pieces of pin type terminals
- A screwdriver
- An USB cable or a network cable

3.2 Setup Servo Axis Projects via EtherCAT

The example is a dual-axis servo drive project which controls moving back and forth.

3.2.1 System Hardware Configuration

AX-308 connects to two servo drivers (ASDA-A2-E) directly through EtherCAT communication ports to control the positioning of dual-axis servo motors.





Numbering	Item	Model Number	Q'ty
1	AS Series Power Module	AS-PS02A	1
2	AX-3 Series CPU Module	AX-308EA0MA1T	1
3	Power supply	DVP-PS02	1
4	Servo drive (EtherCAT)	ASDA-A2-0421-E	2
5	Servo motor	ECMA-C10604ES	2
6	Servo power cable	ASD-ABPW0003	2
7	Servo encoder cable	ASD-ABEN0003	2
8	EtherCAT communication cable (1 meter)	UC-EMC010-02A	2

• Tools and materials

• Configuring hardware limits

Configure the hardware limit on CN1 or CN7 which CN7 connector is used in the following example.

Use external power DC24V and set Reverse/ Forward limit switches. Then configure DI9~DI10 pin functions of ASDA-A2-E Servo with same parameter setting.



CN7 Extension DI

Pin No.	Signal Name	Terminal Symbol	Function and Description
1	VDD	COM+	VDD (24 V) power is the same as the voltage of Pin11
	24 V power	00mr	in CN1.
2	Extension DI9	EDI9-	Digital input pin 9-
3	Extension DI10	EDI10-	Digital input pin 10-
4	Extension DI11	EDI11-	Digital input pin 11-
5	Extension DI12	EDI12-	Digital input pin 12-
6	Extension DI13	EDI13-	Digital input pin 13-
7	Extension DI14	EDI14-	Digital input pin 14-



■ Limit switch in ASDA-A2-E



*Note: For more information regarding signal configuration in ASDA-A2-E, please refer to the user manuals of Delta ASDA-A2 Series.

3.2.2 Create New Projects and POUs

3.2.2.1 Create a New Project

1. First, open the programming software DIADesigner-AX.





- Diddespeed XX

 Re Dati Verw Project Build Online Delay Tools Window Help

 Image: Status of the Status
- 2. The display of DIADesigner-AX is shown as below.

3. Click on "File".





4. To create a new project, select "New Project" from the drop-down menu for DIADesigner-AX V1.0.0 or select "Standard Project" from the drop-down menu for DIADesigner-AX V1.1.0 or later.

Close Project Close Project Save Project As Project Archive Source Upload Source Download Print
Save Project Ctrl+S Save Project As Project Archive Source Upload Source Download
Save Project Ctrl+S Save Project As Project Archive Source Upload Source Download Print
Save Project As Project Archive Source Upload Source Download Print
Project Archive Source Upload Source Downlaad Print
Source Upload Source Downlaad Print
Source Downlaad
Print
Print Preview
Page Setup
Recent Projects
Exit Alt+F4

5. Select "Project AX-308EA0MA1T" after entering New Project page. Name the project in the field of Name and choose a path to the archive location, then click OK to move to the next page.

Categories		Templates	-		
Lib	ojects	Project AX-308EA0	Project SxxE	Standard project	
A project o Name Location	Untitled 1 C: \Users \admin \D	, one application, two em	pty implementati	ons for PLC_PRG and	I Motion_
			-	CY	anal.



6. After entering the project page, double click the target object in the project tree on the left side of the page to open a certain program or configure settings of relating modules.



7. Double click on "Network Configuration" to create servo axes in the system.





3-9

8. After entering "Network Configuration" page, select the servo drive slave based on EtherCAT and double click on it to add new axes.



9. Move the cursor onto o, then click and hold the left mouse button and drag the yellow line to connect with the line of EtherCAT_1.





3

10. After connecting with EtherCAT_1, the slave device is displayed in the project tree (fields with red borders) which also means it is successfully configured with EtherCAT communication.



11. Double click on "EtherCAT_Master_SoftMotion".





12. On the EtherCAT_Master_SoftMotion page, set "Cycle time" and "Sync offset" as 2ms and 50 respectively.

General	Autoconfig Master/Slaves			EtherCAT.
Sync Unit Assignment	EtherCAT NIC Setting			
Log	Destination address (MAC) FF-FF-FF	-FF-FF-FF	Broadcast	Enable redundancy
EtherCAT I/O Mapping	Source address (MAC) 00-00-00 Network Name	-00-00-00	Browse	
EtherCAT IEC Objects	Select network by MAC	Select netwo	ork by name	
Status	Distributed Clock		D Options	
Information	Cycle time 2000 + µs Sync offset 50 + %	← Ì		
	Sync window monitoring			
	Sync window 1 🗘 µs			

3.2.2.2 Axis Parameter Settings

1. Select the first servo axis "SM_Drive_ETC_Delta_ASDA_A2" and double click on it.





2. In this example, choose "Ball Screw" as the mechanism type after entering "SM_Drive_ETC_Delta_ASDA_A2" page.

General Setting	Axis Type and Limits		Motion Parameter			
foming Setting	Uinear Axis Rotary Axis Activat	s Software Limits ed	Quick Stop	Deceleration [u/s ²]: 100	-	
Commissioning	Negative [[u]: 0	Velocity Ramp Type		dentificant all h	
SM_Drive_ETC_Delta_ASDA_A2: IEC Objects	Positive [u	1]: 1000	• Trapezoid ()	Sin- O Quadratic O Quad	orabc(smooth)	
Status	Modulo va	lue [u]: 360	Position Lag Supervis Position Lag Reaction	n Deactivated ~	Lag Limit [u]: 1	4
Information	Transmission Mechanism					
	Mechanism Type Ball Scree	w ×	Mechanism Setting	per motor rotation: 131072	A [Dulce]	
	(2)	(4)	(4) Pitch: 1	Unit]	(Puise)	
		in a	20			
			Gear Box			
	V	(3)	Gear Ratio =	(2) Gear ratio numerator	1	
				(3) Gear ratio denominator	1	

3. Then configure the mechanism setting, which is related to the result of gear rato, with input of 1,280,000 for "Command pulse per motor rotation" and 1mm for "Pitch".

Seneral Setting	Axis Type and L	imits	Motion Parameter				
loming Setting	Virtual mode Linear Axis Potani Axis	Linear Axis Software Limits	Error Reaction	Deceleration [u/s ²]: 100	4		
Commissioning SM Drive ETC Delta ASDA A2:		Negative [u]: 0	Velocity Ramp Type Trapezoid	e Sin² () Quadratic () Quadr	ratic(smooth)		
IEC Objects Status		Rotary Axis Modulo Setting Modulo value [u]: 360	Position Lag Supervi Position Lag Reactio	sion Deactivated Y	Lao Limit [u]:	1	
Information	Transmission Me	chanism	1 Frankrike				2.49
	Mechanism Typ	e Ball Screw ···	Mechanism Setting (1) Command pulse (4) Pitch: 1	per motor rotation: 1280000	V [Pulse	•1 🔶 📜	IJ
		CO	Gear Box	(2) Gear ratio numerator	1		
		(3)	Gear Ratio =	(3) Gear ratio denominator	10	•	



4. Since the gear reducer ratio is 10:1, input 1 for the numerator and 10 for the denominator.

eneral Setting	Axis Type and Limits		Motion Parameter				
loming Setting	Intear Axis Control Axis Control Ax	ftware Limits	Quick Stop De	eceleration [u/s ²]: 100	۲		
Commissioning	Negative [u]:	0	Velocity Ramp Type				
M_Drive_ETC_Delta_ASDA_A2: EC Objects	Positive [u]:	1000	Trapezoid O S	in ² O Quadratic O Quad	lratic(smooth)		
tatus	Rotary Axis Mo	ful: 360	Position Lag Supervisi	ion		1	Tal
	110000 1000	rei: [500 [4]	Position Lag Reaction	Deactivated *	Lag Limit [u]:	1	Ŧ
	(1) (2) (2) (2) (2) (2) (2) (2) (2) (2) (2		(1) Command pulse ; (4) Pitch: 1	e]			
			Gear Box	Sector and sector sector			
		3)	Gear Ratio =	(2) Gear ratio numerator	1	1	
				(3) Gear ratio denominator	10	-	
			-			-	

5. When finished the configuration of gear ratio, click "Homing Setting" to enter the page. •

eneral Setting	Axis Type and Li	mits	Motion Parameter			
oming Setting	Linear Axis Rotary Axis	Linear Axis Software Limits	Quick Stop	Deceleration [u/s ²]: 100	•	
ommissioning	0,1110,111	Negative [u]: 0	Velocity Ramp Typ	e		
1_Drive_ETC_Delta_ASDA_A2: C Objects		Positive [u]: 1000	Irapezoid	Sin* () Quadratic () Quad	ratic(smooth)	
atus		Nodulo value [u]: 360	Position Lag Supervi	ision Deactivated ~	Lag Limit [u]:	*
formation	Transmission Med	hanism				
	Mechanism Type	Ball Screw	Mechanism Setting	per motor rotation: 1280000	A [Dulca]	
	(1)		(4) Pitch: 1	[Unit]	[♥] [Puse]	
	Â		Gear Box			
	V	(3)		(2) Gear ratio numerator	1	8
			Gear Ratio =	(3) Gear ratio denominator	10	



6. Choose the "Homing mode" corresponded to the hardware limit configuration, which the detailed descriptions of all homing modes are shown on the lower half of the page.





3

7. Set the proper homing speed which should match with the mechanism. If the speed is too fast, the hardware limit would possibly be exceeded.

	Homing Mode Mode 14 v
loming Setting	Homing speed during search for switch 100 🛊 [0.1 rpm]
ommissioning	Homing speed during search for z phase pulse 50 🕼 [0.1 rpm]
, and a second	Homing Acceleration 100 🚔 [ms]
M_Drive_ETC_Delta_ASDA_A2: EC Objects	Description Mode 14 : Depending on the home switch and negative limit switch and Z pulse
atus	CASE 1 The homing instruction is executed and the axis moves in the negative direction at the first-phase speed
nrormation	second-phase speed (Homing speed during search for Z phase pulse) once the home switch is ON. And
	where the first Z pulse is met is the home position while the home switch is OFF
	CASE 2: The homing instruction is executed and the axis moves in the negative direction at the second-phase speed (Homing speed during search for Z phase pulse) while the home switch is ON. Where the first Z and a inmet is the home service with the home surface service service and the second service s
	pulse is met is the nome position while the nome switch is OFF.
	CASE 3 The homing instruction is executed and the axis moves in the negative direction at the first-phase speed (Homing speed during search for switch) while the home switch is OFF. The motion direction changes
	and the axis moves at the first-phase speed (Homing speed during search for switch) while the home switch is OFF and the negative limit switch is ON. The motion direction changes again and the axis
	moves at the second-phase speed (Homing speed during search for Z phase pulse) when the home
	switch is ON. Where the first Z pulse is met is the home position while the home switch is OFF.
	Case 1 Negative direction a Stop point Start point
	Case 2 Negative direction
	Case 2 Negative direction



After finish the settings of gear ratio and homing mode, the parameters on the servo drive need to be tested for DI9 and DI10 inputs placed on the servo as a result of hardware limit. To configure the pin functions of DI9 and DI10, double click on "ASD_A2_E".



9. Click "Startup Parameters" tab on the ASD_A2_E page.

General	Address	(a		Addi	tional -		EtherCAT
Process Data	AutoInc address EtherCAT address	0	-		Enable e Optional	xpert settings	
Startup Parameters	Distributed Clock						
EtherCAT I/O Mapping	Select DC	DC-Synch	ronous			~	
EtherCAT IEC Objects	🖂 Enable	2000	Sync u	init cycle (µ	5)		
Status	Sync0:						
Information	Sync unit cycle	x 1	-14	2000	*	Cycle time (µs	;)
	O User-defined			0	*	Shift time (µs))
	Sync1:						
	Enable Sync 1						
	Sync unit cycle	× 1	~	2000	-	Cycle time (µs	;)
	O User-defined			0	*	Shift time (µs))



10. Click "Add" to add new parameters on "Startup parameters" page.

Process Data	Line	Jubindex	Name	Value	Bit Length	Abort on Error	Jump to Line on Error	Next Line	Comme
	-1	16#00:16#00	Op mode	8	8			0	Op mode
Startup Parameters	2	16#60C2:16#01	Interpolation time period	4	8			0	Interpola
	- 3	16#60C2:16#02	Interpolation time index	-3	8			0	Interpola
EtherCAT I/O Mapping	-4	16#6098:16#00	Homing method	14	32			0	
	- 5	16#609A:16#00	Homing acceleration	100	32			0	
EtherCAT IEC Objects	- 6	16#6099:16#01	Speed during search for switch	100	32			0	
	7	16#6099:16#02	Speed during search for zero	50	32			0	
Information									

11. Select "P2-36" and hold the Shift button to select multiple parametres. Then click OK to add the selected parameters.

SubIndex: 16#	0	4	Value	0		4	Cancel
Index: 16#	2224	;	Bit length	16		* *	ок
Name	DRV's	Parameter P2-3	6				
16#222D:16#0	0 0	RV's Parameter	P2-45	RW	UINT		
16#222C:16#0	0 D	RV's Parameter	P2-44	RW	UINT		
16#2228:16#0	0 0	RV's Parameter	P2-43	RW	UINT		
16#2229:16#0	0 D	RV's Parameter	P2-41	RW	UINT		
16#2228:16#0	0 D	RV's Parameter	P2-40	RW	UINT		
16#2227:16#0	0 D	RV's Parameter	P2-39	RW	UINT		
16#2226:16#0	0 D	RV's Parameter	P2-38	RW	UINT		
16#2225:16#0	0 D	RV's Parameter	P2-37	RW	UINT		
16#2224:16#0	0 D	RV's Parameter	P2-36	RW	UINT		
16#2223:16#0	0 0	RV's Parameter	P2-35	RW	UDINT	· · · · ·	
16#2222:16#0	0 D	RV's Parameter	P2-34	RW	UINT		
16#2221:16#0	0 D	RV's Parameter	P2-33	RW	UINT		
16#2220:16#0	0 D	RV's Parameter	P2-32	RW	UINT		
16#221F:16#0	0 D	RV's Parameter	P2-31	RW	UINT		
16#221E:16#0	0 D	RV's Parameter	P2-30	RW	UINT		
16#221D:16#0	0 D	RV's Parameter	P2-29	RW	UDINT		
ndex:Subindex	1	Name		Flags	Туре	Default	



General	- Add	Edit 🗙 Delete 😗	Move Up 🐥 Move Down						
Process Data	Line	Index:Subindex 16#6060:16#00	Name Op mode	Value 8	Bit Length 8	Abort on Error	Jump to Line on Error	Next Line	Comme Op mode
Startup Parameters	- 2	16#60C2:16#01	Interpolation time period	4	8			0	Interpola
	- 3	16#60C2:16#02	Interpolation time index	-3	8			0	Interpola
EtherCAT I/O Mapping	- 4	16#6098:16#00	Homing method	33	32			0	
	- 5	16#609A:16#00	Homing acceleration	100	32			0	
EtherCAT IEC Objects	- 6	16#6099:16#01	Speed during search for switch	100	32			0	
	- 7	16#6099:16#02	Speed during search for zero	50	32			0	
Status	- 8	16#2224:16#00	DRV's Parameter P2-36		16			0	
	- 9	16#2225:16#00	DRV's Parameter P2-37		16			0	

12. The selected parameters you've just added will be displayed on the list.

13. Set the value of P2-36 to 34 and P2-37 to 35 in deximal mode. (DI9 is set to negative limit (B pin); DI10 is set to positive limit (Normally Closed pin) (All the setting values on this parameter list will be downloaded to the servo drive once the EtherCAT communication is established.)

					1.2.2.2				
Process Data	Line	Index:Subindex	Name	Value	Bit Length	Abort on Error	Jump to Line on Error	Next Line	Comme
	- 1	16#6060:16#00	Op mode	8	8			0	Op mode
Startup Parameters	- 2	16#60C2:16#01	Interpolation time period	4	8			0	Interpola
	- 3	16#60C2:16#02	Interpolation time index	-3	8			0	Interpola
EtherCAT I/O Mapping	- 4	16#6098:16#00	Homing method	33	32			0	
	5	16#609A:16#00	Homing acceleration	100	32			0	
EtherCAT IEC Objects	- 6	16#6099:16#01	Speed during search for switch	100	32			0	
and the second	- 7	16#6099:16#02	Speed during search for zero	50	32			0	
Status	- 8	16#2224:16#00	DRV's Parameter P2-36	34	16	a 🗆		0	
	- 9	16#2225:16#00	DRV's Parameter P2-37	35	16			0	

14. Use the same operation to configure the following parameters as well as setting the DI4~DI7 input status to be OFF and the gear ratio on the servo drive to be 1:1.

Dracana Data	Line	Index:Subindex	Name	Value	Bit Length	Abort on Error	Jump to Line on Error	Next Line	Comn
Process Data	- 1	16#6060:16#00	Op mode	8	8			0	Op mor
Startup Parameters	- 2	16#60C2:16#01	Interpolation time period	4	8			0	Interpo
	- 3	16#60C2:16#02	Interpolation time index	-3	8			0	Interpo
EtherCAT I/O Mapping	- 4	16#6098:16#00	Homing method	33	32			0	
	- 5	16#609A:16#00	Homing acceleration	100	32			0	
EtherCAT IEC Objects	- 6	16#6099:16#01	Speed during search for switch	100	32			0	
	- 7	16#6099:16#02	Speed during search for zero	50	32			0	
Status	- 8	16#2224:16#00	DRV's Parameter P2-36	34	16			0	
To Barrowski and	- 9	16#2225:16#00	DRV's Parameter P2-37	35	16			0	
Information	10	16#220D:16#00	DRV's Parameter P2-13	256	16			0	
	- 11	16#220E:16#00	DRV's Parameter P2-14	256	16			0	
	12	16#220F:16#00	DRV's Parameter P2-15	256	101111			0	
	- 13	16#2210:16#00	DRV's Parameter P2-16	256	16			0	
	- 14	16#212C:16#00	DRV's Parameter P1-44	1	32			0	
	15	16#212D:16#00	DRV's Parameter P1-45	1	32			0	
	16	16#230C:16#00	DRV's Parameter P3-12	256	16			0	

15. Continue to configure the second servo axis with the same setting operation as the first axis.



Servo parameters

The following parameters and values are used for this example on the Startup Parameter page.

Parameter	Function	Setting Value
P1-44	Gear ratio numerator	1
P1-45	Gear ratio denominator	1
P2-13	DI4 digital input pin function	256
P2-14	DI5 digital input pin function	256
P2-15	DI6 digital input pin function	256
P2-16	DI7 digital input pin function	256
P2-36	DI9 digital input pin function	34
P2-37	DI10 digital input pin function	35
P3-12	Remain unchanged with the parameters before the drive power being cut off.	256

*Note: Please refer to the user manuals of Delta ASDA-A2 Series for more detailed information of parameters.

3.2.2.3 Programming for New Projects

- Operating process in the example
 - "MC_Power" will be triggered and enable two servo axes (Servo ON) after executing "Step 1".
 - "MC_Home" will be triggered after executing "Step 2" to command both axes back to the home position.
 - Execute "Step 3" to trigger "MC_MoveRelative" so as to automate the action of two axes performing once for both positive and negative rotation, which means that the second axis will be triggered to rotate in positive direction after the first axis finishes its positive rotary. When the second axis finishes doing so, the first axis is triggered to perform negative direction of travel. Once the first axis finishes, the second axis starts moving in the negative direction to the end.) Finally, turn the "Step 3" to OFF.
 - The value of Counter_1 will be increased by 1 for each time positive and negative rotary completed.



Programming with newly-created POUs



1. First, create a new POU by right-clicking "Application" to choose "Add Object" and select "POU".

2. Input the name of the new POU in the "Name" field and choose LD language for "Implementation language". When finished, click "Add" to add the new POU.

lame OU		•
Туре		
Program		
O Function bloc	k	
Extends		
Implements		
Final	Abstract	
Accessspecifie	r	
		ч
Method implem	ction Chart (CEC)	12
Orecetter	contentie (en ey	
Return type		
mplementation lang	uage	
Ladder Logic Diagram	(LD)	*



3. The newly added POU would be shown in the project tree, which needs to be added in Task by double-clikcing "EtherCAT_Task". (Function blocks related to axis motion needs to be established in EtherCAT_Task to ensure normal operation of axes.)

Devices	• 4 X • POU X	ToolBox 🔹 🗭
 Chottled J Chottled J Chottled J Chottled J Chottled J Chotter Configuration A tetrack Configuration C program C p		 ToolBox • • • • • • • • • • • • • • • • • • •

4. Click "Add Call" on the EtherCAT_Task page.

evices	- ₽ X	POU 🖉 EtherCAT_Task 🗙	•	ToolBox	+ 4 ×
Vroted: Vroted: Vroted: Vroted: Vroted: Vroted: Vroted: Vroted: Vroted: Vrote: Vrote:	* # X * * * * * * * * * * * * *	POU SettherCAT_Task x Configuration Priontry (0.31): Type Cyclic Interval (e.g. t#200ms) Brable Time (e.g. t#200ms) Sensitivity Add Call Pou Comment Comment Comment	n POU	ToolBox	~ 4 >

3-22

5. Click "OK" after choosing the newly-created POU.

fext Search Categories				
Programs	Name Application PLC PRG POU	Type Apolation MODEAN PROBRIN	Origin	
Structured view		😔 Insert v	with arguments	Insert with namespace prefix
ocumentation				
-				

6. After adding the POU in EtherCAT_Task, "POU" will be shown on the lower half of the EtherCAT_Task page as well as in the project tree. Then click the POU from the tree, which is under the category of EtherCAT_Task.

evices	- 4 X	POU SEtherCAT_Task X
 Unbided I Unbided I Device (AX-308EA0MA1T) Hardware Configuration A EtherCAT Filter PLC Logic Application Ubrary Manager PLC LPRG (PRG) POU (PRG) EtherCAT Take POU (PRG) EtherCAT Take PLC PRG Builtin, JO (Builtin, JO) Dota LocaBus Master (Delta LocaBus Ma EtherCAT (Delta ASDA-A2E EtherCAT, Son A2, 2, 1) (Delta ASDA-A2E EtherCAT, Son A2, 2, 2) SoftMoton General Axis Pool 	aster) pries EtherCAT Master SoftMol 17(CoE) Drive Rev4_SM) (SM_Drive_ETC_Delta_ASDA) (CAT(CoE) Drive Rev4_SM) _1 (SM_Drive_ETC_Delta_ASD	Configuration Priority (0.31): Type Cyclic Interval (e.g. t#200ms) H Watchdog Enable Time (e.g. t#200ms) Sensitivity Add Call X Remove Call Z Change Call Move Up Move Down * Open POU POU Comment POU FOU Comment



7. With ladder logic programming language, add new commands by using the red-circled field marked with 1, while field 2 is for adding required Function or Function Block.

POU x 😒 EtherCAT_Task		ToolBox • #
1 PROGRAM FOIT 2 VAR 3 BID_VAR 4	100 % 🕵	General Kit Network Box Box Box Box Network Dox Box Box Network Dox Dox Dox Dox Dox Dox Dox Dox Dox Do

8. Click on the desired place to add new commands on POU page, then select .

Image: State of the state o	_] [] [200 %] [] (\$ -
Image: State of the state o	200 v. (A) -
Statistic Image: Statistic Statistics Image: Statistic Statistics Image: Statistic Statistics Image: Statistic Statistics Image: Statistics Image: Statistic Statistics Image: Statistics Image: Statistics Image: Statistics	×] □ □ 200 %] @ ~ -
Control () Control () <th>200 N. (R) -</th>	200 N. (R) -
<pre>gl unered:</pre>	- 18 200 % (\$\$) -
	[205 W.]@Q
Image: Configuration	100 % (K) ~
A the Codystain A the Cody A the	100 % (R ~
A creation free A creation free C Application C Application C Entered Types C The Contraction C Entered Types C Entere	100 % (保 ~
Image: Close Clos	
 Application Applicat	
Image: Configuration	
C.c.rea preci C.c.rea preci C.c.rea preci C.c.rea preci C.c.rea preci C.c.rea preci C.c.rea	
End Configuration End Configuratio	
■ Add _ PAC ■ Add	
(a) (b) (b) <td></td>	
Implementation Implementation Implementation Implement	
[10] Della, Joshu, Joshu (Reitor Cella Joshu) [2] March, J. Jane and K. And Theorem Staffendow) [2] March, J. Jane and K. And Theorem Staffendow) [2] March, J. Jane and K. And Theorem Staffendow) [2] March, J. Jane and K. And Theorem Staffendow) [3] March, J. Jane and And Theorem Staffendow) [4] March, J. Jane and March Staffendow (Discovership) [4] March, J. Jane And And Theorem Staffendow) [4] March, J. J. Jane And And Theorem Staffendow) [4] March, J. Jane And And Theorem Staffendow) [4] March, J. J. Jane And And Theorem Staffendow) [4] March, J. J. Jane And And Theorem Staffendow) [4] March, J. J. Jane And Jane And Theorem Staffendow) [4] March, J. J. Jane And Theorem Staffendow) [4] March, J. J. Jane And Theorem Staffendow) [4] March, J. J. Jane And Jane And Theorem Staffendow) [4] March, J. J. Jane And Theorem Staffendow) [4] March, J. J. Jane And Theorem Staffendow)	
III do 1,21 (Deta 100-14) (Bene 11,00 (Deta 11,	
 By SHOWER JET, Denis A, KOLA, KOLANDE JET, Denis JAKA, ANJ By ADJ, LEJ, Denis A, KOLA, ANJ (Denis JET, Denis A, KOLA, ANJ By SHOWER JET, Denis A, KOLA, ANJ (SH, Dime, JET, Denis A, KOLA, ANJ Statistication General Axis Real 	
 (j) do July_j Denk AGM-Add StarterAll((ad University)) (d) ad July_j Eng Adm Add Add StarterAll (ad University) Software General Asis Peat 	
16g ² α(Dine_ETC.Dela,ACOLAC,LON,Dine_ETC.Dela,ACOLAC) 3 Software Aver Pol	
A Software since an ext	
	And and a second se
4	



9. After the selected command is shown in the POU, click "???" to enter the name of instruction variable then press ENTER key to continue with the "Auto Declare" page. Click "OK" after checking whether "Type" is correct.

1 Step1 Step1 Step2 Step		Step time = t=0s	
Auto Declare Scape VAR Step1 Object Pic SR [Acekator] Files Connect Pices Connect Pices Connect Connect Pices Pices Connect Pices	X Type BOOL Address		
EtherCAT_Task IP POU X PROGRAM POU VAR Scep1: BOOL; END_VAR	L L		
1 Stepl	**-		100 78 SV 4

10. Then add the ouput instruction by clicking on the desired place and choosing

	1.22 月19月1日(1997)(199			
erices	- 9 X 🔂 EmerCAT_Task 🗿 POU X		TooBox	+ 5
Chooled I Insert CAX-300 CAX-300 CAX-300 CAX-300 CAX-300 CAX-100 CAX-	 ■ PRODUKE POT ■ 9 Sept: BOOL; ■ 8 Sept: BOOL; ■ 8 BOOL; 	▲ □ 100 % 飲 ~	General Ketwork Box Box Box Assignment	
Application Application Drary Manager P.C. PRG (PRG) Drary Corps (PRG)			- Jump eer Return 44 Input C Branch	



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11. Click "???" to enter the name of instruction variable then press ENTER key to continue with the "Auto Declare" page. Click "OK" after checking whether "Type" is correct.



12. The instruction names you have added previously will be displayed as well as the instruction types, where the name and type of the instruction can also be added directly. (Same operation for the examples in later discussion.)

1 PROGRAM FOU		*
a VAR 3 Step1: BOOL:		
Servo ON: BOOL; BID_VAR	~~~~	100% 殿、
1		





Click "???" and insert the name of function block then press ENTER to display the function block. Insert the name and press ENTER key again, then "Auto Declare" window will pop up. Click "OK" after confirming the "Type" of function block is correct.



15. Continue to click "???" and insert "TRUE", then press the ENTER key.

PROGRAM POU	
VAK	
Stept: DUL;	
MC Barar D. MC Barar	
nu_rower_o: nu_rower;	100 %
NUL VAR	
Court I	Serve O
	Jervo_or
	()
MC_POwer_Q	
.222 MC Power	
ENO	
Status - 272	
nable bBemilatorBealState	
- DRegulatorun DDriveStartRealState -	
-bDriveStart Busy-	
Error	
ErrorID	
~	
therCAT_Task)) POU x	
therCAT_Task: PROGRAM FOU VAR	
therCAT_Task 1 PROGRAM FOU VAR	
therCAT_Task PROUX PROUX VAR Step1: BOOL;	
therCAT_Task IP POU X PROGRAM FOU VAR Srep1: BOOL; Servo_DN: BOOL;	
therCAT_Task PROCAT_Task PROCAT_Task W POU X VAR Step1: BOOL; Serv_ON: BOOL; MC_Power_0: MC_Power;	100 %
therCAT_Task: PPOCRAM FOU VAR Step1: EOOL; Servo_011: EOOL; MC_FOwer_0: MC_FOwer; RND VAR	100 % 🕅
therCAT_Teak PROGRAM FOU VAR Scepi: BOOL; Servo_ON: BOOL; MC_Power(): MC_Power; PRD_VAR	100 %
therCAT_Task POU X PROGRAM FOU VAR Step1: BOOL; Servo_DX: BOOL; RUD_VAR Step1	100 % @ Servo_O
BitherCAT_Task: IPOU x PROGRAM FOU VAR Step1: BOOL; Servo_DN: BOOL; MC POWer_0: MC POWer_0: PUT VAR Step1	
therCAT_Task PROCRAM FOU VAR Step1: EOOL; EOOL; KD_Power_0: MC_Power; EDIT_VAR Step1	
therCAT_Task PROCRAM FOU VAR Step1: BOOL; Servo_OX: BOOL; MC_Power_0: MC_Power; NUT VAR Step1	
therCAT_Task POU X PROCRAM FOU VAR Step1: ROOL; Servo_ON: BOOL; NC_POWEr_O: NC_POWEr; PUT. VAR Step1	[100 % [@
therCAT_Task POU x PROCRAM FOU VAR Step1: BOOL; Servo_DX: BOOL; MC_Power_0: MC_Power; MD_VAR Step1 Step1 TRDE MC_Power	
therCAT_Task POU X PROCRAM FOU VAR Scepi : ROOL; Servo_ON: BOOL; MC_Power; PUT_VAR Stepi TRUE MC_ROMER_0 MC_Power END	
therCAT_Task POU x PROCRAM FOU VAR Step1: BOOL; Scrop.01: BOOL; KD_Power_0: MC_Power; RUD. VAR Step1 Step1 Step1 MC_Power ENO Statua - 222	100 % @ Servo_O ()
therCAT_Task POU X PROCRAM FOU VAR Ssepi POUL; Servo 00; BOOL; Servo 00; BOOL; Stepi TRUE MC_POWER; MC_POWER Stepi Latin Statu 727 Enable DRegulatorResistate	
therCAT_Task POU X PROCRAM FOU VAR Step1: BOOL; Servo_ON: BOOL; MC_Power_0: MC_Power; RUN_VAR Step1 Step1 MC_Power EN0 KC_Power EN0 Statua - 227 Enable bRegulatorOn bDriveStatte	100 % @ <u>Servo_</u> 08
therCAT_Task POU X PROCRAM FOU VAR Scepi FOOL; Serve_O: MC_Power; RIN VAR Stepi TROE KC_Power C_POWER KC_POWER KC_POWER KC_POWER KC_POWER KC_POWER KC_POWER	100% @ Servo_OS ()
therCAT_Task POU X PROCRAM FOU VAR Step1: BOOL; Servo_ON: BOOL; NC_Power_O: NC_Power; RUD. VAR Step1	100 % @ Servo_08
therCAT_Task POU X PROCRAM FOU VAR Scepi FOOL; Scrup O: KC_FOWer; MC_FOWEr_0: MC_FOWEr; ND VAR Stepi TROE MC_FOWER KC	
therCAT_Task POU X PROCRAM FOU VAR Step1: BOOL; SERVO_ON: BOOL; NC_POWER_O: MC_POWER; PUT. VAR Step1 TRUE MC_POWER Step1 MC_POWER Enable DRegulatorRealState - DBregulatorRealState - DDriveStart Busy Error D	100 % @ Servo_OX ())



16. Insert the name of servo drive to the Axis input pin of the function block and delete "???" of other pins, since the mark "???" does not represent any variables and errors may occur while parsing.





- 17. Complete the following programming example with the same operation process.
- Create function blocks of MC_Power for both servo axis.



 Continue to create MC_Home function blocks with additional condition for Execute, which MC_Home can be executed only if the axis status is Servo ON.





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• Then create MC_MoveRelative function blocks to let both axes able to be switched between the left and right positions.



• Create program to perform positive rotation of axis 1 & 2 then change to negative direction by means of the function blocks (MC_MoveRelative) created earlier.

~
100 % 🔍 🗸
Auto
()
MC_MoveRelative_0.Execute
MC_MoveRelative_2.Execute
()
MC_MoveRelative_1.Execute
()
MC_MoveRelative_3.Execute
()

18. The value of Counter_1 will be returned to zero when execute AUTO. As soon as the positive and negative rotation being performed once, increase the value by one automatically.




3.2.3 Program Monitoring

This section is concerned with the monitoring operation via the software DIADesigner-AX. When running a program, the current control status of system can be monitored and part of the device values are allowed to be modified for system testing as well.

3.2.3.1 Setup Connection between Devices

1. Double click on "Device". (The default IP address for AX-308E is 192.168.1.5)



2. Choose "Scan Network" after entering the "Device" page.

Communication Settings Scan Network	Gateway - Device -		
Applications	n Netw		
Backup and Restore		1	
Files		· · · · ·	
og	Gateway	[0002.005.005] (arthur)	
PLC Settings	IP-Address:	Device Name:	
PLC Shell	localhost Port:	AX-308EA0MA1T Device Address:	
Jsers and Groups	1217	0003.A00E.A005	
Access Rights		16F7 0313	
Symbol Rights		Target Type: 4102	
Runtime Clock Configuration		Target Vendor: Delta Electronics	
Bystem Parameters		Target Version: 3.5.15.11	
Fask Deployment			
Status			
information			



3. After the "Select Device" window pops up, choose "AX-308E" and click "OK".

🖹 💑 Gateway-1 (scanning)	Device Name:	^	Scan Network
AX-308EA0MA1T [0003.A00E.A005]	AX-308EA0MA1T	1	Wink
	Device Address	4	6 2 2 2 2
	0003.A00E.A005		
	Block driver:		
	UDP		
	Number of channels:		
	4	1.8	
	Serial number		
	RTS-c7a8ccc74852337c		
	Target ID:		
	16F7 0313		
		~	

4. Once the connection between the PC and the device is established, information of the device will be displayed as shown in the following figure marked by the red box.

Communication Settings	can Network Gateway + Device +	
pplications		
ackup and Restore		
iles		· · · · ·
og	Gateway	F0003, A00E, A0051 (active)
LC Settings	IP-Address: localhost	Device Name: AX-308EA0MA1T
LC Shell	Port	Device Address:
Isers and Groups	1217	Target ID:
ccess Rights		16F7 0313
ymbol Rights		4102
tuntime Clock Configuration		Target Vendor: Delta Electronics
ystem Parameters		Target Version; 3.5.15.11
ask Deployment		
tatus		
nformation		



3.2.3.2 Process Monitoring and Control

1. The correctness of EtherCAT communication should be checked before program monitoring starts. After confirmation, double click on "EtherCAT_Master_SoftMotion".



2. Choose "Browse" after entering the EtherCAT_Master_SoftMotion page.

General	Autoconfig Master/Slav	es		EtherCAT.
Sync Unit Assignment	EtherCAT NIC Setting			
Log	Destination address(MAC)	FF-FF-FF-FF-FF	Broadcast	Enable redundancy
EtherCAT I/O Mapping	Source address (MAC) Network Name	00-00-00-00-00	Browse	
EtherCAT IEC Objects	Select network by MAC	⊖ Select netwo	rk by name	0
Status	Jistributed Clock		D Options	<u></u>
Information	Cycle time 2000	😫 µs		
	Sync offset 50	\$ %		
	Sync window monitoring			
	Sync window 1	‡ µs		



3. Select EtherCAT port "cpsw1" and click "OK".

MAC address 4006A0D651B4	Name cpsw0	Description			
4006A0D651B6	cpsw1	CPSW END			

4. After finish choosing network adaptor, the setting value of Source address (MAC) is displayed.

General	Autoconfi	g Master/Sl	aves			EtherCAT.
Sync Unit Assignment	EtherCAT NIC	Setting				
Log	Destination a	ddress(MA	C) FF-F	F-FF-FF-FF-FF	Broadcast	Enable redundancy
EtherCAT I/O Mapping	Source addre Network Nam	ss (MAC) Ie	40-0	06-A0-D6-51-B6	Browse	
EtherCAT IEC Objects	 Select net 	work by MA	c	O Select netwo	ork by name	
Status	J Distributed 0	Clock —			D Options	
Information	Cycle time	2000	-	μs		
	Sync offset	50	+	%		
	Sync windo	w monitorin	g			
	Sync window	1	4 T	μs		



5. Click on the Compile button to verify the correctness of program.



6. Upon completion of compiling, a report message of programming errors and warnings is displayed.

Build	•	O error(s)	O warning(s)	0 message(s)	XX
Description Build started: Application: Device.App	lication				
Typify code					
Compile complete 0 errors, 0 warnings					

7. And then click on 🥵 to perform online monitoring.





8. The program needs to be downloaded after monitoring action is performed. When the download is completed, the status of PLC shows STOP until you click on
and the status would shift to RUN.

	A X Device A Aster_SoftMotion POU X	
🖓 Untitled1	Device-Application.POU	
😑 😏 📆 Device [connected] (AX-308EA0MA1T)	Encoder Tage Value Descendulus Addres Comment	A 1
- 🔏 Hardware Configuration	Expression type value Prepared value Address Comment	
A Network Configuration	Sano DN BOOL FALSE	
A EtherCAT Filter	MCDwarf D MCD Mac	
= EL PLC Logic		v
= () Application [stop]		
Dibrary Manager	13	
PLC_PRG (PRG)	MC MoveRelative 1.Done MC Mc	veRelative 3.Execute
• POU (PRG)		
- Re Configuration		
AT DOLL	14	
C C C C C C C C C C C C C C C C C C C	Auto MOVE	
- All ac and	EN ENO	
	0 Counter_1 0	
Delta (coalBus Master (Delta LocalBus Master)		
Gran Stranger (Constant Constant C	15	
S G R ASD A2 E (Delta ASDA.A2 E Ether CAT/CoE) Drive Revé SM)	MC_MoveRelative_0.Execute ADD	
AR SM Drive FTC Delta ASDA A2 (SM Drive FTC Delta ASDA A2)	EN L ENO	
= Co fild ASD A2 E 1 (Delta ASDA-A2-E Ether CAT(CoE) Drive Rev4 SM)	Counter_1 0 - Counter_1 0	
SM Delta ASDA-A2-E EtherCAT(CoE) Drive Rev4_SM)	Counter_1 0 - Counter_1 0	
Softwater Series (Control and Control	2) Counter_1 Counter_1 Counter_1	
G M ASD A2_E_1 (Delta ASDA-A2-E Ether CAT(CoE) Drive Rev4_SM) Asd SM Drive_ETC_Delta_ASDA_A2_1 (SM_Drive_ETC_Delta_ASDA_A2) So Softwaton General Axis Pool	2)	
G	Counter_1 0 Counter_1 0	
G G	2) Counter_1 0 Counter_1 0	
ASD A2 E 1 (Meta ASDA A2 E Ether CAT(CAE) Drive Rev4 SM) Add SM Drive ETC Delta ASDA A2 1 (SM Drive ETC Delta ASDA A2) Softwoton General Axis Pool Softwoton General Axis Pool	2) Counter_1 O Counter_1 O	
G 3 ASD A2 E_1 (Delta ASDA A2 E Ether CAT(CoE) Drive Rev4 SM) ABD A2 E_1 (Delta ASDA A2 E Ether CAT(CoE) Drive ETC_Delta ASDA A2) SoftWoton General Axis Pool	2) Counter_1 0 Counter_1 0	×+Q 100 % &
G G	2) Counter_1 0 16 13 20 4	▶+Q 100 % @
Softwoon General Asis Pool Softwoon General Asis Pool	2) Counter_1 0 Counter_1 0 C	▶++Q 100 % Q >
G	0) Counter_1 0 Cou	▲+Q 100 % & 3 - 4
G	2) Counter_1 0 Counter_1 0	▶+Q 0055 3 • 4 • 8 • 8 • 8
G	0 1 Counter_1 Count	▶+Q 100% @ > > > > > > > > >
ASD ALE _1 (Delta ASD ALE Ether CAT(CAE) Drive Rev4_SM) Att get and the _TC_Delta_ASDA A2_1 (SM_Drive_ETC_Delta_ASDA_A2) SoftWoldon General Axis Pool	2) Counter_1 0 Counter_1 0 1 Counter_1 Counter_1 0 1 Counter_1 0 1 Counter_1	▶ + 00 % ● >
G G	20 1 Counter_1	Image: Weight of the second
ASD ALS EL DUBIN ASDA ALSE ENERCATIONED Drive Rever SM)	2) Counter_1 O 1 Counter_1 O Counter_1 O	
Soft ASD_AZ_E_I Owita ASDA A2 E Ether CAT(CAE) Onive Revis SA(ASDA Saf_Drive_ETC_Delta_ASDA A2_1 (SM_Drive_ETC_Delta_ASDA A2) Soft Astronon General Axis Pool	0 1 1 <td>Image: Weight of the second /td>	Image: Weight of the second
G ASD, A2J, E,1 (Delta ASDA A2E EtherCAT(CoE) Drive Rev4_SM) At S A1_E1 (Delta ASDA A2_E (SM_Drive_ETC_Delta ASDA A2) ASD A32_1 (SM_Drive_ETC_Delta ASDA A2) S offMotion General Axis Pool	0 1 1 <td>Image: 100 mg/mg/mg/mg/mg/mg/mg/mg/mg/mg/mg/mg/mg/m</td>	Image: 100 mg/mg/mg/mg/mg/mg/mg/mg/mg/mg/mg/mg/mg/m

9. When the PLC is in the RUN mode, the status would be displayed as **RUN** at the bottom of the page and the program is ready to be executed.

s - 4 X	Device	EtherCAT_Master_SoftMotion	POU X					
Untitled1	Device Application PO	1						_
G 🛐 Device [connected] (AX-308EA0MA1T)						7.4.11		
- 😹 Hardware Configuration	Expression	Ty	pe	Value	Prepared value	Address	Comment	
* 🙏 Network Configuration	Step1	BO	OL	FALSE				_
B I PLC Logic	Servo_ON	BO	OL	FALSE				
S O Application [run]	B MC_Power_0	MC	Power					
Library Manager								
PLC_PRG (PRG)	-		MC_Ho	ne_0				
POU (PRG)	TRUE		MC_H	ome				
a 🐺 Task Configuration		EN		ENO	-			
😑 😏 🍪 EtherCAT_Task	SM_Drive	ETC_Delta_ASDA_A2 Ax	15	Done	FALSE			
B) POU		Homing ON BAASSA Ex	ecute	Busy	FALSE			
🖘 😏 🍪 MainTask		0 - PO.	sition co	mmandaborted	FALSE			
B PLC PRG				Error	PMC NO PDD			
* 😏 📶 Builtin IO (Builtin IO)				Errorib	DING ING DAM			
Delta LocalBus Master (Delta LocalBus Master)								
EtherCAT Master SoftMotion (AX-308 Series EtherCAT Master SoftM	6		MC_	Home_1				
S G M ASD A2 E (Delta ASDA-A2-E EtherCAT(CoE) Drive Rev4 SM)	TRUE		MC	Home				
SM Drive FTC Delta ASDA 42 (SM Drive FTC Delta ASI			EN	EN	0			
ASD A2 E 1 (Delta ASDA-A2-E EtherCAT(CoE) Drive Rev4 SM)	SM_Drive	ETC_Delta_ASDA_A2_1	Axis	Done	FALSE			
SM Drive ETC Delta ASDA A2 1 (SM Drive ETC Delta	1	Homing_ON SALASS	Execute	Busy	FALSE			
SoftMation General Avis Pool		0	Position	CommandAborted	I - FALSE			
				Erroi	FALSE			
				ErrorII	D - SMC_NO_ERR			
	7		10 Marca	nalasina A				MG Married
	TRUE		MC_Move	Relative_0	_			MC_MOVER
	10	EN.	MC_MOV	exerative	ENO.			PN MC_MOVES
	SM Drive	ETC Delta ASDA A2 - Ax	ia	De	ne - FALSE	SM Drive	ETC Delta ASDA A	2 HAXIS
	and a second	FALSE - Ex	ecute	Bi	ISY - FALSE		PALS	Execute
		10 - Di.	stance	CommandAbort	ed - FALSE		-1	0 - Distance
		1 Ve	locity	Eri	or - FALSE			1 Velocity
		1 - Ac	celeration	Erros	ID - SMC_NO_ERR			1 - Acceleration
		1 - De	celeration		A			1 - Deceleration
		0 Je	rk				0	
								T +++ L 100 %



Device EtherCAT_Master	er_SoftMotion POU X					
Expression	Туре	Value	Prepared value	Address	Comment	^ I
Step1	BOOL	FALSE	TRUE			
Servo_ON	BOOL	FALSE				
MC_Power_0	MC Power	1.				~
1 Step1 <true></true>						Servo_ON
2		MC Power 0				
TRUE		MC Power				
	EN	ne_rower	ENO			
SM_Drive_ETC_Delta	ASDA A2 - Axis		Status - FALS	2		
	TRUE Enable	bRegulato	orRealState - FALS	5		
Servo O	N FALSE bRegulatorOn	bDriveSta	tRealState - FALS	5		
	TRUE bDriveStart		Busy TRUE			
	and the second se		Error - FALS	5		
			ErrorID - SMC_N	O_ERR		
3		MC_Power_1				
TRUE		MC_Power				
	EN		ENO			
SM_Drive_ETC_Delta_	ASDA_A2_1 - Axis		Status - FA	LSE		
and the second se	TRUE Enable	bRegula	atorRealState - FA	LSE		
Servo	ON FALSE bRegulatoro	n bDriveS	tartRealState - 54	LSE		
	TRUE bDriveStart		Busy TR	RUE		
			Error FA	LSE		

10. Double click on "Step 1" and the icon **CTRUE>** will be shown.

11. Right click on "Step 1" to select "Write All Values of 'Device.Application" and all the corresponding status will be written in, which can also be performed by using the shortcut key **Ctrl + F7**.

	1.00					
ssion	Туре	Value	Prepared value	Address	Comment	^
Step1	BOOL	FALSE	TRUE			
MC Power 0	MC Power	TALSE				
1 Step1 <true></true>						Servo_ON
Cut						
TRI IRI, Paste		wer				
X Delete			ENO			
SM_Driv Browse		+ egulato	Status - FALS: rRealState - FALS:			
👼 New Breakp Toggle Brea	oint kpoint	iveStar	tRealState FALSE Busy TRUE Error FALSE			
* Run to Curso	or		ErrorID - SMC_N	OERR		
🖇 Set next Stat	ement					
3 Write All Val	ues of 'Device.Applicatio	ower_1				
Force All Val SM_Driv Unforce All V	ues of 'Device.Application /alues of 'Device.Application	ation'	ENO Status - FA	LSE		
Display Mod	le	bRegula	torRealState - DA	LSE		
	TRUEbDriveSt	art	Busy - TR	UE		



12. After activating "Step 1", axis 1 and 2 are under Servo ON mode. (Same operation to execute on the following programs.)



13. Start homing for axis 1 and 2 by activating "Step 2".





14. After starting "Step 3", axes rotate in positive direction then reverse, axis by axis. In addition, the value of Counter_1 will be increased by 1 for each time positive and negative rotary completed, until "Step 3" being turned off.







3.2.3.3 Monitor with Trace Tool

 A Trace makes it possible to record the value history of variables on the PLC, just like a digital sampling oscilloscope. To monitor the status of input/ output pins and axes with Trace function while executing the program, navigate to "Application" > "Add Object" > "Trace". Then you'll open the "Add Trace" window.





2. Insert the name of Trace then click "Add" on "Add Trace" window.

Add Trace	×
A tool to mo	onitor variables graphically.
Name of the Trace	
Trace	← 📖
	The second s
	Add Cancel

3. After the Trace is successfully added, it will be shown in the project tree on the left side of the screen. Then double click on "Trace" to open the Trace page.







4. Click on "Configuration" on the Trace page to open the Trace Configuration window.

5. Select "EtherCAT_Task" from the drop-down list of Task on the Trace Configuration window.

Trace Record	Record Settings	
Trace	Enable Trigger	
	Trigger variable *	
	Trigger edge	
	Post trigger (samples	
	Trigger Level	
	Task	×
Presentation (diagrams)	Record condition	
- Time axis	Comment	
Diagram 1 Y avis		
Shown variables	Resolution ms ~	
	Automatic restart	
	Advanced	
dd Variable	Reset Display settings	OK Cancel





6. After finishing configuration, click "Add Variable" on the Trace page to open the Trace Configuration window.

7. Click the button is on the Trace Configuration page to add the required trace variables or traceable parameters. After the Input Assistant window is opened, expand POU on the tree and select "Step 1" then click on "OK".





8.	Make sure the chosen	variable is shown in	he variable field of	f variable settings and then	click "OK".
----	----------------------	----------------------	----------------------	------------------------------	-------------

Trace Record	Variable settings	-	
- Trace	Variable -	POU.Step1	
POU.Step1	Graph color	Blue	~
	Line type	/ Line	~
	Point type	• Dot	~
	Activate minimum warning		
	Critical lower limit	0	
Presentation (diagrams)	Warning minimum color	Black	~
☐ Time axis ☐ Diagram 1	Activate maximum warning		
Y axis	Critical upper limit	0	
POU.Step1	Warning maximum color	Red	~
100 111			

9. Afterwards, the added variable will be shown on the right side of the Trace page.

Trace X	•
	Configuration Add Variable
10-	POU.Step1
	•





10. Right click on the Trace and select "Download Trace" to start monitoring.

11. In case that there're more than one variable or parameter need to be monitored, you can just right click on the scope and select "Convert to multi channel".





12. After choosing "Convert to multi channel", two data-recording oscilloscope will be displayed on the page for the two chosen variables added on the right.



13. Repeat the above steps to add more required trace variables and traceable parameters.







14. While a program is running, you can observe trigger events and the current position of axis as well as the velocity via the data-recording oscilloscope.

Introduction of the process shown on the scope:

- ① Execute "Step1" to activate the servo axes via EtherCAT.
- 2 Execute "Step2" to make axes perform homing.
- ③ Execute "Step3" to trigger "MC_MoveRelative" to activate the axis 1 & 2 for rotating in positive and negative directions.
- ④ Axis 1 starts moving in the positive direction.
- (S) Axis 2 is activated for rotating in the positive direction right after axis 1 stopped.
- [©] Axis 1 is activated for rotating in the negative direction right after axis 2 stopped.
- ⑦ Axis 2 is activated for rotating in the negative direction right after axis 1 stopped.



3

3.3 Setup Projects with Pulse Output Features

The example here demonstrates using positioning function to abort the previous instruction with single-axis servo drive after the servo motor finishes rotating at constant velocity.

3.3.1 System Hardware Configuration

The servo motor (ASDA-A2-M) is controlled with a servo drive in between the PLC and the motor with the emphasis on the pulse train signals output from the PLC controller.



Tools and materials

Numbering	Item	Model Number	Q'ty
1	AS Series Power Module	AS-PS02A	1
2	AX-3 Series CPU Module	AX-308EA0MA1T	1
3	Power supply	DVP-PS02	1
4	Pulse output type Servo drive	ASDA-A2-0421-M	1
5	Servo motor	ECMA-C10604ES	1
6	Servo power cable	ASD-ABPW0003	1
7	Servo encoder cable	ASD-ABEN0003	1
8	CN1 Terminal board t	ASD-BM-50A	1

PLC Controller combining ASDA-A2-M hardware configuration

The wiring and hardware limit need to be configured on the controller so as to feature pulse outputs.



(1) CN1 pin connector ; (2) CN1 connector pin diagram.



Si	gnals	Pin No	Features
		43 41	Position pulse can be sent by the open collector (single-phase max.
Position	SIGN	36	requercy 200 kHz). Three command types, which are CW/CCW pulse, pulse and direction, and A/B pulse, can be selected with the parameter.
pulse	/SIGN	37	P1-00
(Input)		30	If open collector type is used when sending position pulses. CN1 should be
	PULL HI S	35	connected to an external power supply for pull high.
Position pulse (Output)	OCZ	48	Encoder Z output (Open collector).
	VDD	17	VDD is the +24 V power provided by the drive and is for Digital Input (DI) and Digital Output (DO) signal. The maximum current is 500 mA.
Power	COM+ COM-	11 45 47 49	COM+ is the common input of Digital Input (DI) and Digital Output (DO) voltage. When using VDD, VDD should be connected to COM+. If not using, it needs to apply the external power (+12 V \sim + 24 V). Its positive end should connect to COM+ and the negative end should connect to COM
	VCC	20	VCC is the +12V power provided by the drive. It is used for providing the simple analog command (speed or torque command). The maximum current is 100 mA.
	GND	12 ,13 ,19 , 44	VCC voltage is based on GND.
DI1	SON	9	When the DI.SON is ON and the motor servo circuit can operate smoothly, this DO is ON.

Introduction to CN1 signals



*Note: Please find ASDA-A2 Series User Manual for more detailed information about the signal configuration of ASDA-A2-M.



3.3.2 Create New Projects and POUs

3.3.2.1 Create a New Project

1. First, open the programming software DIADesigner-AX.



3

2.

The display of DIADesigner-AX is shown as below.

Devices	• • X Start Page X	• 2
	DIADesigner-AX	
	Basic operations	
	In New Project	
	Open Project	
	Open Project from PLC	
	Recent projects	
TON .	Close page after project load	



3. Click on "File".

ras	 Start Dane V	
	DIADesigner-AX	
	Basic operations	
	😰 New Project	
	Gen Project	
	gen Project from PLC	
	Recent projects	
	Contraction of the second sector of the second sector of the second sector of the second sector of the second seco	

4. To create a new project, select "New Project" from the drop-down menu for DIADesigner-AX V1.0.0 or select "Standard Project" from the drop-down menu for DIADesigner-AX V1.1.0 or later.





5. Select "Project AX-308EA0MA1T" after entering New Project page. Name the project in the field of Name and choose a path to the archive location, then click OK to move to the next page.

Categories		Templates
Lit	oraries ojects	Project AX-308EA0
A project c	ontaining one device,	one application, two empty implementations for PLC_PRG and Motion
Name	Untitled1	

6. After entering the project page, double click the target object in the project tree on the left side of the page to open a certain program or configure settings of relating modules.



- Unduled I project DAD eigner-AX

 Fie Edit View Project Build Online Debug Tools Window Help

 Depice

 Depice
- 7. Double click on "BuiltIn_IO" to enter the I/O configuration page.

8. Start configuring the I/O devices settings in AX-308EA0MA1T on the BuiltIn_IO page.





3.3.2.2 Axis Parameter Settings

1. Select the checkbox of Pulse Output Axis 0 on the lower left side of the Configuration area. Then click "PoAxis Configuration" tab on the left to enter the page.



2. Select the pulse output mode from the drop down list of "Mode" on PoAxis Configuration page.

vare IO Configuration	Axis 0	
kis Configuration	Pulse Output Setting Mode Setting Axis Type an	nd Limits
Objects	Mode A/B Ulinear Ax	node _{kis} – Linear Axis Software Limits
JS	Positive Command Rotary Av	xis Activated
mation	(a)	Positive [u]: 1000
	Reverse OFF	Rotary Axis Modulo Setting Modulo value [u]: 360
	CCW CW Motion Parar	meter
	Error React	tion
	O Reverse On OPT. Quick St	top Deceleration [u/s ²]: 1000
	CW CCW Trapezo	Imp Type Did 🔘 Sin² 🔵 Quadratic 🔘 Quadratic(smooth)
	Transmission Mechanism Mechanism Setting	
	Mechanism Type Ball Screw (1) Command pulse per mo	otor rotation: 1 🕴 [Pulse]
	(1) (2) (4) Pitch: 1	🔹 [Unit]
	Carl Bay	
	Geal DOX	
		Gear ratio numerator



3

Hardware IO Configuration	Axis 0	
PoAxis Configuration	Pulse Output Setting Mode Setting	Axis Type and Limits
IEC Objects	Mode A/B v	Virtual mode Uinear Axis Linear Axis Software Limits
Status	Positive Command Regative Comman	Rotary Axis Activated Negative [u]: 0
Information		Positive [u]: 1000 €
	Reverse OFF	Rotary Axis Modulo Setting Modulo value [u]: 360
	ccw cw	Motion Parameter
	(A) (A)	Error Reaction ☐ Quick Stop Deceleration [u/s ²]: 1000
	Reverse On	Velocity Ramp Type
	CW COW	Irapezoid
	Transmission Mechanism	
	Mechanism Type Ball Screw	echanism Setting
		i) Pitch: 1 🔮 [Unit]
		aar Boy
		(2) Gear ratio numerator 1
	- ()	Cons Datio -

3. In this example, choose "Ball Screw" as the mechanism type.

4. Continue with gear setting, set 2,500 for "Command pulse per motor rotation" (This parameter should be 10000, which is four times the setting value 2500, as a result of the phase AB on the servo drive.) Set 10 for the screw pitch (Gear ratio set on the servo motor with P1-44 = 128, P1-45 = 1) and the user unit in this example is "mm".

BuiltIn_IO X		
Hardware IO Configuration	Axis 0	
PoAxis Configuration	Pulse Output Setting	Avic Tune and Limite
	Mode A/B v	Virtual mode
IEC Objects	Positive Command Negative Command	Linear Axis Linear Axis Software Limits Artivated
Status		Negative [u]: 0
Information	(and an	Positive [u]: 1000
	Reverse OFF	Rotary Axis Modulo Setting
		Modulo value [u]: 360
		Motion Parameter
	$(\square (\square)$	Error Reaction
	O Reverse On	
		Velocity Ramp Type Trapezoid Sin ² Quadratic Quadratic(smooth)
	CW CCW	
	Transmission Mechanism	
	Mechanism Type Ball Screw Y Mecha	anism Setting
	(1) Co	ommand pulse per motor rotation: 2500 😫 [Pulse]
	(2) (4) Pi	itch: 10 🛊 [Unit]
	Gear B	Box
		(2) Gear ratio numerator 1
	(3)	Gear Ratio =



Hardware IO Configuration	Axis 0	
PoAxis Configuration	Pulse Output Setting Mode Setting	Axis Type and Limits
IEC Objects	Mode A/B Positive Command Negati	Virtual mode Linear Axis Linear Axis Software Limits Ve Command
Status		Negative [u]: 0
Information	Reverse OFF	Positive [u]: 1000
	cow	CW Modulo value [u]: 360
		Motion Parameter Error Reaction Quick Stop Deceleration [u/s ²]: 1000
	CW CW	CCW Velocity Ramp Type © Trapezoid Sin ² Quadratic Quadratic(smooth)
	Transmission Mechanism	
	Mechanism Type Ball Screw v (1)	Mechanism Setting (1) Command pulse per motor rotation: 2500 (4) Pitch: 10 (5) [Unit]
	1 600	Gear Box (2) Gear ratio pumerator 1
	(3)	Gear Ratio *

5. Since the mechanism is not equipped with a gearbox, the gear ratio for gearbox would be 1:1.

6. After finish configuring gear ratio parameters, set the homing mode in homing setting. The homing mode should match the hardware configuration, which the descriptions of each mode in different cases are listed below.

Hardware IO Configuration	Homing Setting
PoAxis Configuration	Homing Mode 14
	Homing speed during search for switz
IEC Objects	Homing speed during search for z phase pulse 5 🕴 🗍 [Unit/s]
Status	Homing Acceleration 10
Information	Mode 14 : Depending on the home switch and negative limit switch and Z pulse
	CASE 1: The homing instruction is executed and the axis moves in the negative direction at the first-phase speed (Homing speed during search for switch) while the home switch is OFF. The axis moves at the
	second-phase speed(Homing speed during search for Z phase pulse) once the home switch is ON. And where the first Z pulse is met is the home position while the home switch is OFF.
	CASE 2: The homing instruction is executed and the axis moves in the negative direction at the second-phase speed (Homing speed during search for Z phase pulse) while the home switch is ON. Where the first Z pulse is met is the home position while the home switch is OFF.
	CASE 3. The homing instruction is executed and the axis moves in the negative direction at the first-phase speed (Homing speed during search for switch) while the home switch is OFF. The motion direction changes and the axis moves at the first-phase speed (Homing speed during search for switch) while the home switch is OFF and the negative limit switch is ON. The motion direction changes again and the axis moves at the second-phase speed (Homing speed during search for Z phase pulse) when the home switch is ON. Where the first Z pulse is met is the home position while the home switch is OFF.
	Case 1 Negative direction
	Case 2 Negative direction

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7. For homing speed, set 10 for the speed during search for switch and set the homing speed to 5 mm/s during search for z phase pulse, then adjust the homing acceleration to 10 mm/s. (User unit: mm)

Hardware IO Configuration	Homing Setting					
PoAxis Configuration	Toring House Front AT					
IEC Objects	Homing speed during search for switch 10 [Unit/s] Homing speed during search for z phase pulse 5 [Unit/s]					
Status	Homing Acceleration 10					
Information	Mode 14 : Depending on the home switch and negative limit switch and Z pulse					
	CASE 1 The homing instruction is executed and the axis moves in the negative direction at the first-phase speed (Homing speed during search for switch) while the home switch is OFF. The axis moves at the second-phase speed (Homing speed during search for Z phase pulse) once the home switch is ON. And					
	where the first Z pulse is met is the home position while the home switch is OFF.					
	CASE 2 The homing instruction is executed and the axis moves in the negative direction at the second-phase speed (Homing speed during search for Z phase pulse) while the home switch is ON. Where the first Z					
	pulse is met is the home position while the home switch is OFF.					
	CASE 3 The homing instruction is executed and the axis moves in the negative direction at the first-phase speed (Homing speed during search for switch) while the home switch is OFF. The motion direction changes					

3.3.2.3 Configure Parameters for Servo Drive

There're two ways to set the servo parameters. First is via the control panel on the servo drive while the second is to use the software called "ASDA_SOFT".



The display after activating the software ASDA_SOFT is shown as below.

🖳 🖸 🖉 🙏 🗐 🗛 🖓 🕼 🐙 🖓 🖓 🔮 🛑 017 1.007	12AAM	
	ADA/Soft-Seeing CONFET Lagge CONFET Lagge Select Device : ASDA-A2 A2-E Acobect Insud Serry Insud Serry Cancel CON, Q Into	



3-57

1. After choosing the target COM port used to connect the servo drive under "On-Line" mode, click on "Start Auto Detect".

	• On-	Line	00	ff-Line	e	
Sele	ct Devi	ce: A	SDA-A2	¥	A2	~
luto D	etect					
	18] : Port_#	#0003.Hub	#0004			~
-		SLATEA	uto Det	ect	-	
∟]Manu	ual Setting		uto Det	ect		

2. A message window will pop up if the detection is successful.

	on cinc	0 011	-Line	
Select D	evice : A	SDA-A2	~ A2	~
Auto Detect				
[COM18] : F	Port_#0003.Hu	b_#0004		~
SDA-A2 Serv	0			
Ita ASDA-S	oft(V5)			×
uto Detect	on Success!			OK
			-	-



3. Click "OK" after confirming the communication is normal.



4. The status is shown as on LINE which means the PC is connecting to the servo drive's com port.





5. Click () in the tool bar to enter the servo parameter page.

Delta ASDA-Soft(V5) - ASDA-A2 Servo
File Setting Tools Parameter Function Tuning Window Help
🔣 🖾 🖉 🛓 🖳 🛕 🕝 🖾 🧶 Jr 🞯 🥥 🖢 💿 on line

3

6. As shown in the following figure, the field being circled by the red box on the upper part of the page displays all the servo parameters in groups.

P0-XX P1-XX V 1.038	P 2 - XX	P3-XX P4		* 🗗 🥹 🔰				
V 1.038	P 2 - XX	P3-XX P4			0.7 VV			
1,030	Cada	Ivalue	-XX PS-	XX P6-XX	Max.	Default	Description	1
27.00	PDEESO	0x0000000	Unic	0×00000000	OVEREFERE	0x00000000	PATH#50 Definition	
27-01	PDAT50	0	-	-2147483648	2147493647	0	PATH#50 Deta	
27.02	PDEE51	0×0000000	-	0x00000000	OVEFFFFFFF	0×00000000	PATH#50 Data	
7-02	PDAT51	0	-	-2147483648	2147483647	0	PATH#51 Data	
27-04	PDEE52	0_0000000	-	0x00000000	OVEFFFFFFF	0×0000000	PATH#51 Data	
7-04	PDAT52	0	-	-2147483648	2147493647	0	PATH#52 Deta	
27-06	PDEE53	0x0000000		0x0000000	OVERFERE	0x00000000	PATH#53 Definition	
27-07	PDAT53	0		-2147483648	2147483647	0	PATH#53 Data	
27-08	PDEE54	0x00000000	-	0x00000000	OVEREFERE	0x0000000	PATH#54 Definition	
27-09	PDAT54	0	-	-2147483648	2147483647	0	PATH#54 Data	
27 - 10	PDEESS	0x0000000	-	0x00000000	OVERFEFE	0x00000000	PATH#55 Definition	
7-11	PDATSS	0	-	-2147483648	2147483647	0	PATH#55 Data	
7-12	PDFF56	0x00000000		0x00000000	OXFEFEFEF	0x00000000	PATH#56 Definition	
7-13	PDAT56	0		-2147483648	2147483647	0	PATH#56 Data	
7-14	PDEE57	0x00000000		0x00000000	OXEFFFFFFF	0x00000000	PATH#57 Definition	
27 - 15	PDAT57	0		-2147483648	2147483647	0	PATH#57 Data	
27 - 16	PDEE58	0x00000000		0x00000000	OXFEFFFFFF	0x00000000	PATH#58 Definition	
27 - 17	PDAT58	0		-2147483648	2147483647	0	PATH#58 Data	
7 - 18	PDEF 59	0x00000000		0x00000000	0xFFFFFFFF	0x00000000	PATH#59 Definition	
7-19	PDAT59	0		-2147483648	2147483647	0	PATH#59 Data	
27 - 20	PDEF60	0x00000000		0x00000000	0xFFFFFFFF	0x00000000	PATH#60 Definition	
27-21	PDAT60	0		-2147483648	2147483647	0	PATH#60 Data	
7-22	PDEF61	0x00000000		0x00000000	0xFFFFFFFF	0x00000000	PATH#61 Definition	
7-23	PDAT61	0		-2147483648	2147483647	0	PATH#61 Data	
7-24	PDEF62	0x00000000		0x00000000	0xFFFFFFFF	0x00000000	PATH#62 Definition	
7-25	PDAT62	0		-2147483648	2147483647	0	PATH#62 Data	
7 76	PDEF63	0x00000000		0x00000000	0xFFFFFFFF	0x00000000	PATH#63 Definition	
-/-20			-		2147402647	0	PATH+62 Data	



- 🔄 Delta ASDA-Soft(V5) ASDA-A2 Servo [Parameter Editor1 : [ASDA-A2 Servo] From Drive] G File Setting Tools Parameter Function Tuning Window Help 🖾 🖉 🛓 🛄 🛕 😳 🖾 🎘 5 Jr 🛛 🖓 📳 ON LINE 🔏 🖶 🗖 11 88 💁 📮 🕗 💕 📕 8 P 3 - XX P7-XX PO-XX P1-XX P 4 - XX P 5 - XX P6-XX XX Value V 1.038 * Unit Min Default ode Max 0x00000000 0x00000000 0x00000000 P7-00 PDEF 50 **OxFFFFFFFF** P7-01 -2147483648 2147483647 PDAT50 0 0 P7-02 PDEF51 0x00000000 0x00000000 0xFFFFFFFF 0x00000000 P7-03 PDAT51 -2147483648 2147483647 0 0 P7-04 PDEF52 0x00000000 0x00000000 0xFFFFFFFF 0x00000000 P7-05 PDAT52 n -2147483648 2147483647 0 P7-06 0x00000000 0x00000000 PDEF53 0x00000000 **OxFFFFFFFF** P7-07 PDAT53 -2147483648 2147483647 0 0 P7-08 0x00000000 PDEF54 0x00000000 0xFFFFFFFF 0x00000000 P7-09 2147483647 PDAT54 -2147483648 0 0 P7 - 10 PDEF55 0x00000000 0x00000000 **OxFFFFFFF** 0x00000000 P7 - 11 PDAT55 0 -2147483648 2147483647 0 P7 - 12 0xFFFFFFFF PDEF56 0x00000000 0x00000000 0x00000000 2147483647 PDAT56 P7 - 13 -2147483648 0 0+00000000 D7-14 DDEE57 0×00000000 0VECEEEEE 0×00000000
- 7. Click **Gran** to upload all the servo drive's parameters.

8. Click "P2-XX" after the upload is completed, then click on the value of P2-XX parameter.

🐓 Delta ASDA	-Soft(V5) - ASDA	A-A2 Servo - [F	Parameter Edit	tor1 : [ASDA-A	A2 Servo] From	n Drive]		-		×
G File Settin	ng Tools Para	ameter Functio	on Tuning	Window Hel	р				-	- 5 X
🖪 🔤 🧭	2 💻 🛕 🤇	9 🖪 🗶 🍐	Jr 🛛 🖓) 📲 🔵 on i	LINE		080			
🗃 📰 📲	1 82	i 🗖 🛛 🐣	A 8	a 🛛 🛛						
PO-XX P1	- XX P 2 - XX	P XX I	P 4 - XX P 5	- XX P 6 - XX	(P 7 - XX					
V 1.038	Code	De	* Unit	Min	Max	Default	Description			1 ^
P2-00	KPP	35	rad/s	0	2047	35	Position Loop Gain			
P2-01	PPR	100	%	10	500	100	Switching Rate of Position Loop Gain			
P2-02	PFG	50	%	0	100	50	Position Feed Forward Gain			
P2-03	PFF	5	ms	2	100	5	Smooth Constant of Position Feed Forward Gain			
P2-04	KVP	500	rad/s	0	8191	500	Speed Loop Gain			
P2-05	SPR	100	%	10	500	100	Switching Rate of Speed Loop Gain			
P2-06	KVI	100	rad/s	0	1023	100	Speed Integral Compensation			
P2-07	KVF	0	%	0	100	0	Speed Feed Forward Gain			
P2-08	PCTL	36		0	501	0	Special Parameter Write-in			
P2-09	DRT	2	2ms	0	20	2	DI Debouncing Time			
P2 - 10	DI1	0x0101		0x0000	0x015F	0x0101	DI1 Functional Planning			
P2 - 11	DI2	0x0104		0x0000	0x015F	0x0104	DI2 Functional Planning			
P2 - 12	DI3	0x0116		0x0000	0x015F	0x0116	DI3 Functional Planning			



9. The setting value here can be modified by inputting the value directly or double-clicking on it to open the "Parameter Setting Helper" window.

🐓 Delta ASDA-S	Soft(V5) - ASDA	-A2 Servo - [l	Parameter Edito	or1 : [ASDA-A	2 Servo] From	n Drive]		-		×
G File Setting	Tools Para	meter Functio	on Tuning V	/indow Hel	p				-	5 X
🖪 🔤 🧟 🛓	s 💻 🗛 G) 🖪 🐲 🍐	Jr 0 0	📲 🔵 on I	INE		080			
🗃 🔚 🛛 📲	1 🐔 🖶		📇 🕹 🕴 🖸							
P0-XX P1-	XX P 2 - XX	P 3 - XX	P4-XX P5-	XX P6-XX	P 7 - XX					
V 1.038 X	Code	Value	* Unit	Min	Max	Default	Description			1 ^
P2-00	KPP	35	rad/s	0	2047	35	Position Loop Gain			
P2-01	PPR	100	%	10	500	100	Switching Rate of Position Loop Gain			
P2-02	PFG	50	%	0	100	50	Position Feed Forward Gain			
P2-03	PFF	5	ms	2	100	5	Smooth Constant of Position Feed Forward Gain			
P2-04	KVP	500	rad/s	0	8191	500	Speed Loop Gain			
P2-05	SPR	100	%	10	500	100	Switching Rate of Speed Loop Gain			
P2-06	KVI	100	rad/s	0	1023	100	Speed Integral Compensation			
P2-07	KVF	0	%	0	100	0	Speed Feed Forward Gain			
P2-08	PCTL	36		0	501	0	Special Parameter Write-in			
P2-09	DRT	2	2ms _	0	20	2	DI Debouncing Time			
P2 - 10	DI1	0x0101	* 🔶 🛙	0x0000	0x015F	0x0101	DI1 Functional Planning			
P2 - 11	DI2	0x0104		0x0000	0x015F	0x0104	DI2 Functional Planning			
P2 - 12	DI3	0x0116		0x0000	0x015F	0x0116	DI3 Functional Planning			
P2 - 13	DI4	0x0117		0x0000	0x015F	0x0117	DI4 Functional Planning			

10. Choose the mode for "Functional Setting" and select for the "Input Contact" on the Parameter Setting Helper window, then click "OK" to finish.

arameter Name	Unit	Minimum & Maximum	Default	16/32 bi
P2 - 10	Unic	0x0000 ~ 0x015F	0x0101	16/ 52 bi
	D) Va	11 Functional Planning		
X : I	unctional Setting	[0x01]Servo On		Ň
		Z : Input Contact		
		O [0] : Normally closed (contact b)		
		[1] : Normally opened (contact a)		
	Γ	Cancel OK	Write to Se	rvo



11. A mark of * would appear next to the setting value when the value is changed. To import the changed value to the servo drive, click on it and press Enter key.

🐳 Delta ASDA-	Soft(V5) - ASDA	-A2 Servo - [Pa	irameter Ec	litor1 : [ASDA-A	2 Servo] From	n Drive]	
G File Setting	Tools Para	meter Function	Tuning	Window Hel	p		
🖪 🔤 🧭 🛓		9 🖪 🗶 🌜	Jr 0	🗿 📲 🔵 on i	INE		080
📽 📰 – 📆	-		8	0 0			
P0-XX P1-	XX P 2 - XX	P 3 - XX P	4-XX P	5-XX P6-XX	P 7 - XX		
V 1.038	Code	Value	* Unit	Min	Max	Default	Description
P2-00	KPP	35	rad/s	0	2047	35	Position Loop Gain
P2-01	PPR	100	%	10	500	100	Switching Rate of Position Loop Gain
P2-02	PFG	50	%	0	100	50	Position Feed Forward Gain
P2-03	PFF	5	ms	2	100	5	Smooth Constant of Position Feed Forward Gain
P2-04	KVP	500	rad/s	0	8191	500	Speed Loop Gain
P2-05	SPR	100	%	10	500	100	Switching Rate of Speed Loop Gain
P2-06	KVI	100	rad/s	0	1023	100	Speed Integral Compensation
P2-07	KVF	0	%	0	100	0	Speed Feed Forward Gain
P2-08	PCTL	36	1	0	501	0	Special Parameter Write-in
P2-09	DRT	2	2ms	0	20	2	DI Debouncing Time
P2 - 10	DI1	0x0101	8	0x0000	0x015F	0x0101	DI1 Functional Planning
P2 - 11	DI2	0x0104		0x0000	0x015F	0x0104	DI2 Functional Planning
P2 - 12	DI3	0x0116		0x0000	0x015F	0x0116	DI3 Functional Planning
P2 - 13	DI4	0x0117		0x0000	0x015F	0x0117	DI4 Functional Planning
P2 - 14	DIS	0x0102		0x0000	0x015E	0x0102	DIS Euroctional Planning

12. After the value being imported, the mark * would disappear. In case that a large number of parameter values have been modified, you are allowed to download all the changed parameters to the servo drive in one time by clicking on .

🐖 Delta ASDA-Sot	ft(V5) - ASDA	-A2 Servo - [F	arame	eter Edite	or1 : [ASDA-A	2 Servo] Fron	n Drive]	
File Setting	Tools Para	meter Functio	n Tu	uning V	Vindow Help)		
🖪 🖾 🧭 👗		9 🖪 🗶 🍐	Jr	00	🔮 🔵 ON L	INE		
¥ 📰 🚽 🚽			a 8	3 6				
P0-XX P1-XX	x	P 3 - XX F	4 - XX	P 5 -	XX P6-XX	P 7 - XX		
V 1.038 X	Code	Value	*	Unit	Min	Max	Default	Descriptio
P2-00	KPP	35		rad/s	0	2047	35	Position L
P2-01	PPR	100		%	10	500	100	Switching
P2-02	PFG	50		%	0	100	50	Position F
P2-03	PFF	5		ms	2	100	5	Smooth C
P2-04	KVP	500		rad/s	0	8191	500	Speed Los
P2-05	SPR	100		%	10	500	100	Switching
P2-06	KVI	100		rad/s	0	1023	100	Speed Int
P2-07	KVF	0		%	0	100	0	Speed Fe
P2-08	PCTL	36			0	501	0	Special Pa
P2-09	DRT	2		2ms	0	20	2	DI Debou
P2 - 10	DI1	0x0101			0x0000	0x015F	0x0101	DI1 Funct
P2 - 11	DI2	0x0104			0x0000	0x015F	0x0104	DI2 Funct

Introduction of servo parameters

Parameter	Function	Setting value
P1-00	External pulse train input type	0x0000
P1-44	Gear Ratio (Numerator)	128
P1-45	Gear Ratio (Denominator)	1
P2-10	DI1 Functional Planning	0x0101
P2-15	DI6 Functional Planning	0x0100
P2-16	DI7 Functional Planning	0x0100
P2-17	DI8 Functional Planning 0x0100	

*Note: Please find ASDA-A2 Series User Manual for more detailed information about the parameters.



3.3.2.4 Programming for New Project

- Operating process in the example
 - "MC_Power" will be triggered and enable the servo axis (Servo ON) after executing "Step 1".
 - "MC_Home" will be triggered after executing "Step 2" to command the axis back to the home position 0.
 - Execute "Step 3" to trigger "MC_MoveVelocity". Then "MC_MoveAbsolute" will be triggered once the position of 300 is reached. At the same time, the axis is commanded to move back to position 0. The cycle will be repeatly executed until "Step 3" being turned off.
 - The value of Counter_1 will be increased by 1 for each time the cycle is completed.
- Programming with newly-created POUs
- Change the name of Motion_PRG. Choose "Motion_PRG" and then "Refactoring", to change the name of Motion_PRG to POU, then click on "OK". Meanwhile, a confirmation window will pop up to confirm if you want to automatically adapt all references within the project. Click on "Yes" to complete.





3



2. Double click on "POU" after name changed.



With Ladder Diagram programming, add new commands by using the red-circled field marked with 1, while field
 is for adding required Function or Function Block.

Untitled1.project* - DIADesigner-AX			- 🗆 X
File Edit View Project FBD/LD/IL Build Online Debu 🖻 🖝 🔜 🥌 🖘 🗠 🖇 🛍 🛠 🚧 🍰 📕 ધ	g Tools Window Help 🌂 🌂 🛗 🔛 了 🕮 Application (Device: PLC Logic)	• 05 08 • = 46 [] 11 11 11 11 11 11 11 11 11 11 11 11 11	て (男)可(で)
E (1) war (2) (2) (2) (2) (2) (2) (2) (2) (2) (2)			
Services • 0 × • Untitledf • • Hardware Configuration • • • • • • • • • • • • • • • • • • •	POU X 1 POU X VAR 2 VAR 2 BID_VAR 1		All operators Pound of the angle of the ang
Cevices POUs	c	₹ + 4 100 % BK	
Messages - Total 0 error(s); 0 warning(s); 2 message(s)	Last build:	0 😗 0 Precompile 🗸 🌾 Proj	ect user: (nobody)



3

4. Click on the desired place to add new commands on POU page, then select

File Edit View Project F8D/LD/L Build Online Debug Tools Window Help 한글글을(고 2 8 8 8 X 44 5 4 5 4 1 1 1 1 1 1 1 1 1 1 1 1 1 1	*
🖉 🕅 POU x	ToolBox - 4 X
	TooBox • 9 X General TooBox Bo
< 100 % @	< >

5. After the selected command being shown in the POU, click "???" to enter the name of instruction variable then press ENTER key to continue with the "Auto Declare" page. Click "OK" after checking whether "Type" is correct.

St	ep1 🔶 🛄	
	SMC_AP_STEPOMS	Step time = t=0s
1 1	²⁰ SMC_VP_STEPOMS	
	$\overline{\mathbf{v}}$	
Sten1		
	-	
	Auto Declare X	
	Scope Name Type	
	VAR v Steps put v S	
	PLC_PRG [Application] ~	
	Flags Comment	
	ок	
	·	
CAT Task	Pour x	
PROGRAM PO		
VAR	. 2001	
Step1: END VAR	: BODL;	


6. Then add the ouput instruction by clicking on the desired place and choosing

File Edit View Project FBD/LD/IL Build	Coline Debug Tools Wedow Help 실실 제 11 11 11 12 12 12 12 12 12 12 12 12 12	*
Devices	• 9 X S EtherCAT_Task @ POU X	
Custory Instruct Configuration Device (Automation And Automation Analysis Configuration Alternork Configuration Application Application	To findate for To findate for Strept Strept	
Library Manager ALC_PRG (PRG) PLC_PRG (PRG)		44 Joput T. Branch

7. Click "???" to enter the name of instruction variable then press ENTER key to continue with the "Auto Declare" page. Click "OK" after checking whether "Type" is correct.

Stepi				
		仑		
Step1		•		Servo_ON
		仑		
	Auto Declare		×	
	Scope	Name	Туре	
	VAR 🗸	Servo_QN	BOOL V >	
	Object	Initialization	Address	
	POU [Application]			
	Flags CONSTANT RETAIN PERSISTENT	Comment	14 	
			OK Cancel	

8. The instruction names you have added previously will be displayed as well as the instruction types, where the name and type of the instruction can also be added directly. (Same operation for the examples in later discussion.)





3



10. Click "???" and insert the name of function block then press ENTER to display the function block. Insert the name and press ENTER key again, then "Auto Declare" window will pop up. Click "OK" after confirming the "Type" of function block is correct.





PROCEEM POIL	
PROBABLE FOU	
Step1: BOOL:	
Servo ON: BOOL;	
MC_Power_0: MC_Power;	100.01
RITI VAR	100 %
Stepl	Servo
MC Power	
Thate DregulatorkealState	
DRegulatoron DDrivestartkealstate	
Durivestart Busy	
EITOT	
LITOTID	
₹ 7	
\mathbf{v}	
herCAT_Task 🕘 🗿 POU 🗙	
herCAT_Task)) POU x	
herCAT_Task POU X PROGRAM FOU VAR	
herCAT_Task POU x PROGRAM FOU VAR Step1: BOOL;	
herCAT_Task PROGRAM FOU VAR SUDI: Servo_ON: BOOL;	
herCAT_Taak POU X PROCRAM FOU VAR Step1: BOOL; Servo_0N: BOOL; MC_Power_0: MC_Power;	100 8
herCAT_Task POU x PROCRAM FOU VAR Step1: BOOL; Servo_OX: BOOL; MC_Power_0: MC_Power; RND VAR	100 %
herCAT_Task POU x PROCRAM FOU VAR Step1: BOOL; Servo_ON: BOOL; MC_Fower; END VAR	100 %
herCAT_Taak POU x PROCRAM FOU VAR Step1: BOOL; Servo_ON: BOOL; MC_Power_0: MC_Power; END.VAR Step1 In	100 % Servo ø
herCAT_Task POU x PROCRAM FOU VAR Step1 Step1	100 % Serv: {
herCAT_Task POU x PROCRAM FOU VAR Step1 Step1 Step1	[100 % Serv. ((
herCAT_Taak POU x PROCRAM FOU VAR Step1: BOOL; Servo_ON: BOOL; MC_Power_0: MC_Power; END_VAP Step1 MC_Power_0 MC_Power_0] 100 % Serv (
herCAT_Task POU x PROCRAM FOU VAR Step1 BODL; Servo_Dit: BODL; NC_Power_0: MC_Power_0 TRUE MC_Power MC_Power	100 % Servo
herCAT_Task POU X PROCRAM FOU VAR Step1: BOOL; Step1 Step1 TROE MC_POWER_0 MC_POWER ENO	[100 % Serve
herCAT_Taak POU x PROCRAM FOU VAR Step1 HOOL; Step1 TRUE MC_Power_0 MC_Power_0 MC_Power EN0 Status 227	100 % Serva
herCAT_Task POU x PROCRAM FOU VAR Step1: BOOL; Servo_DX: BOOL; NC_Power_0: MC_Power; RM: VAP Step1 Step1 KC_Power END KC_Power END C_Power END C_Power END C_Power END C_POWER	100 % Serva ()
herCAT_Task: POU x PROCRAM FOU VAR Step1: ROOL: Servo.ON: SOOL: NM: Power_0: MC_Power; RM: VAR Step1 TRUE KM: Rower_0 MC_Power END Step1 TRUE KM: Step1 Ste	 Servo
herCAT_Taak POU X PROCRAM FOU VAR Step1 FOOL; Servo_ON: BOOL; NC_Power_O: MC_Power; FRD_VAR Step1 TRUE KAxis Status FEnable BRegulatorOn bDriveStartRealState bBrgulatorOn bBrgulatorOn bBrgulatorOn bBrgulatorOn bBrgulatorOn bBrgulatorOn bBrgulatorOn bBrgulatorOn bBrgulatorOn bBr	100 % Serva
herCAT_Task POU x PROCRAM FOU VAR Step1: BOOL; Servo_ON: BOOL; NC_Power_0: MC_Power; RMD VAP Step1 TRUE MC_Power END Axis Status -2?? HAxis Status -2?? bBegulatorOn bDriveStartBealState - bDriveStart Busy Error	

11. Continue to click "???" and insert "True", then press Enter key with the newly-added function block.

12. Insert the name of pulse train to the Axis input pin of the function block.

PO	U X	
1	PROGRAM POU	~1
2	VAR	
3	Step1: BOOL;	
14	Servo_ON: BOOL;	7
5	MC_Power_0: MC_Power;	100 % 🔍 🗸
1		
	Step1	Servo ON
2	MC Dover 0	
-	TONT	
	MC Power	
	Enable DregulatorRealState	
	DRegulatoron DDrivestartkealstate	
	-bbrivestart Buay-	
	Error	
	ErrorID -	



13. Navigate to: "BuiltIn_IO" > "IEC Objects" > "Variable", then enter "Pulse_Output_Axis_0" as the name of pulse output type axis. In addition, all the newly-added axes will be displayed on this page.

Devices	• 4 ×	BuiltIn_IO X					ToolBox	# X
Subded: Device (XX-S082A0HAIT) de Hardware Configuration A tetric (XX-S082A0HAIT) de Hardware Configuration A tetric (XX-S082A0HAIT) de Hardware Configuration A tetric (XX-S082A0HAIT) Rec (XX-S082A0HAIT) R	even 2 (1) N. (1) Oher CAT Muster Sof	Hardware 10 Configuration PoAxis Configuration LEC Objects Builtin_10 I/O Mac Ratus Information	Variable Pulse_Output_Avis_0	Type PLISE_AXIS_REF	Configuration Function Pulse Output Asis 0			
POLIS			μ			>		

14. Insert the name of servo axis to the Axis input pin of the function block and delete "???" of other pins, since the mark "???" does not represent any variables and errors may occur while parsing.

1	PROGRAM FOU		
2	VAR		
3	Step1: BOOL;		
4	Servo_ON: BOOL;		
5	MC_Power_0: MC_Power;		100 %
1		* *	
	Step1		Servo ON
			()_()
	u u		<i>d D</i>
2		MC Power 0	
	TRUE	MC Power	
	EN	ENO	
	Pulse Output Axis 0 - Axis	Status -	
	Enable	bRegulatorRealState -	
	bRemilatorOn	bDriveStartBealState	
	-bDriveStart	Busy	
		Error	
		Fronto	
		BIIOIIB	



15. Set the status output of the function block to be Out2. (Later, Out2 would need to be configured to connect with a certain position of the external hardware.)



16. Double click on "DIO" in the project tree.





3

17. Since the contact pins of external hardware are normally-closed, the polarity of IN0, IN1 and IN3 need to be changed to 🕢 on the DIO page.

DIO X			J DIO X		
DIO Configuration	Configuration		DIO Configuration	Configuration	
DIO I/O Mapping	Interrupt	Port Filter (0.01us) Polarity	DIO I/O Mapping	Interrupt	Port Filter (0.01us) Polarity
Ratus	INTERPLE	Point Peaking Peaking 1N 0 100 <t< th=""><th>Satus Information</th><th></th><th>Off Prile COULD Pointry N 0 100 1 1 M N 1 100 1 1 M N 1 100 1 1 M N 3 100 1 1 M N 4 100 1 1 M N 5 100 1 1 M N 6 100 1 1 M N 7 100 1 1 1 M N 8 100 1 1 M M N 9 100 1 1 M M</th></t<>	Satus Information		Off Prile COULD Pointry N 0 100 1 1 M N 1 100 1 1 M N 1 100 1 1 M N 3 100 1 1 M N 4 100 1 1 M N 5 100 1 1 M N 6 100 1 1 M N 7 100 1 1 1 M N 8 100 1 1 M M N 9 100 1 1 M M
	1 N 8 1 1 N 9 1 1 N 10 1 1 N 11 1 1 N 12 1 1 N 13 1 1 N 15 1 1 N 15 1 1 N 15 1 2 N 16 1	IN 10 100 0 H I/I IN 11 100 0 H H/I I/I IN 12 100 0 H H/I I/I IN 12 100 0 H H/I I/I IN 13 100 0 H H/I I/I IN 14 100 0 H H/I I/I Encoder A1 100 0 H H/I I/I Encoder B1 100 0 H H/I I/I Encoder A2 100 H H/I I/I Encoder B2 10 H H/I I/I	57	IN 8 Im Im Im IM 9 Im Im Im IM 10 Im Im Im IM 11 Im Im Im IM 12 Im Im Im IM 13 Im Im Im IM 14 Im Im Im IM 15 Im Im Im Im Im Im Im Im Im Im Im Im Im Im Im Im Im Im Im Im Im Im Im Im Im Im Im I	110 200 4 4/4 111 100 4 6 4/4 121 100 4 6 4/4 131 100 4 6 4/4 141 100 4 6 4/4 151 100 4 6 4/4 151 100 4 6 4/4 100 4 6 4/4 4/4 100 4 6 4/4 4/4 100 4 6 4/4 4/4 100 4 6 4/4 4/4 100 4 6 4/4 4/4 100 4 6 4/4 4/4 100 4 6 4/4 4/4 100 4 6 4/4 4/4 100 4 6 4/4 4/4 100 4 6 4/4 100 4<

18. Click on "DIO I / O Mapping" tab after the polarity setting is completed.

DIO Configuration	Configuration					
DIO I/O Mapping	Interrupt	Port	Filter (0.0)lus)	Pol	arity
itatus		IN O	100	À	41	+1+
		IN 1	100	A V	1+	+1+
Tormación	IN 1	IN 2	100	*	HF	-11-
	IN 2	IN 3	100	+	HF	-11-
	IN 3	IN 4	100		HH	-11-
		IN 5	100	*	11	-11-
		IN 6	100	-	HF	-11-
		IN 7	100	-	HH	-11-
		IN 8	100	*	HF	-11-
		IN 9	100	+	HH	-11-
	IN 8	IN 10	100	-	HH	*
		IN 11	100	-	HF	-11-
		IN 12	100	-	HF	-11-
		IN 13	100	4	HF	-11-
	□ IN 11	IN 14	100	*	HF	-11-
	🗌 IN 12	IN 15	100	-	HF	-11-
	□ IN 13	Encoder A1	100	+	HH	+1+
		Encoder B1	100	-	HH	+1+
		Encoder Z1	100	*	++	-11-
		Encoder A2	100	*	HH	H
	Encoder Z1	Encoder B2	100	4	HH	-11-
	Encoder Z2	Encoder Z2	100	-	HH	-N-
		SSI DATA	100	4	HE	-11-



DIO Configuration	Find		Filter Show	all			 Add FB for IO Channel
DIO I/O Mapping	Variable ⊕_¥≱	Mapping	Channel IN:0-7	Address %IB0	Туре вүте	Unit	Description 8-CH Open Collector Input
Status			IN:8-15	%IB1	BYTE		8-CH Open Collector Input
	······································		Encoder	%IB2	BYTE		2-CH of Incremental Encoder Input
Information	B- 10		OUT:0-7	%QB0	BYTE		8-CH Open Collector Output
			OUTO	%QX0.0	BOOL		OUT 0
	- **		OUT1	%QX0.1	BOOL		OUT 1
	** * *		OUT2	%QX0.2	BOOL		OUT 2
	- 30		OUT3	%QX0.3	BOOL		OUT 3
	-* 1		OUT4	%QX0.4	BOOL		OUT 4
	- %		OUT5	%QX0.5	BOOL		OUT 5
	- 10		OUT6	%QX0.6	BOOL		OUT 6
	- %		OUT7	%QX0.7	BOOL		OUT 7

19. Double click on the variable field of OUT2 then click on DIO I / O Mapping page.

20. Meanwhile, the output pin Out2 of POU needs to be mapped into a physical port (hardware) by expanding POU on the tree and selecting "Out2" then click "OK".

Variables	A Name	Type	Address	Orig
	- O Application	Application		
		PROGRAM		
	IC Power 0	MC Power		
	Out2	BOOL		
	Servo_ON	BOOL		
	Step1	BOOL		
	E {} BPLog	Library		Breakpoint L
	😟 🎑 Io Config_Globals	VAR_GLOBAL		
	🕀 {} IoDrvEthercatLib	Library		IODrvEtherC
	🛞 - {} IoStandard	Library		IoStandard,
	■-{} SM3_Basic	Library		SM3_Basic, 4
	🕀 {} SM3_Math	Library		SM3_Math,
	H () TRAFO	Library		SM3_Transfo
Structured view		Filt	er None	~
		Territoria and		
ocumentation		Insert with arguments	Insert with nar	nespace prefix
Out2: BOOL;				
(VAR)				



21. After the configuration is completed, the words "Application.POU.Out2" will be shown in the variable field. Out2 will connect to the contactor OUT2 of the external hardware if there's an output of POU. (The settings of hardware signals need to be configured here, if required.)

IO Configuration	Find	Filter	Show all				 Add FB for IO Channel
DIO I/O Mapping	Variable ⊕_¥≱	Mapping	Channel IN:0-7	Address %IB0	Туре вүте	Unit	Description 8-CH Open Collector Input
Status	B- *		IN:8-15	%IB1	BYTE		8-CH Open Collector Input
			Encoder	%IB2	BYTE		2-CH of Incremental Encoder Input
nformation	iii 🐪		OUT:0-7	%QB0	BYTE		8-CH Open Collector Output
	-%		OUTO	%QX0.0	BOOL		OUT 0
	- 50		OUT1	%QX0.1	BOOL		OUT 1
	Application.POU.Out2	20	OUT2	%QX0.2	BOOL		OUT 2
	- 30		OUT3	%QX0.3	BOOL		OUT 3
	- 10		OUT4	%QX0.4	BOOL		OUT 4
	- 39		OUT5	%QX0.5	BOOL		OUT 5
	- %		OUT6	%QX0.6	BOOL		OUT 6
	- 39		OUT7	%QX0.7	BOOL		OUT 7

22. Create the function block "DMC_Home_P", mainly used for axes executing homing, with operations according to previous steps.





23. Create the function blocks "MC_MoveVelocity" and "MC_MoveAbsolute" according to previous steps and set one second delay time for activation.

	MC_MoveVelocity_0	MC_MoveAbsolute_0
TRUE	MC_MoveVelocity EN ENO Axis_0 Axis InVelocity Execute Execute Busy 10 Velocity CommandAborted Acceleration 10 Acceleration Error Invelocity 10 Acceleration 10 Jeceleration Jerk Invertion	MC_MoveAbsolute Pulse_Output_Axis_0 Axis Done - Excoute Busy 0 Position CommandAborted 100 Velocity Error 100 Acceleration ErrorID 100 Deceleration ErrorID 100 Deceleration Direction
Step3		
Auto	MC_MoveAbsolute_0.Done	
TRUE Delay Téls	TON_0 EN DENO IN C_MOVEVelocity_0.Execute ET EI	
TRUE Pulse_Output	Axis_0.fActPosition EN ENO	Absolute_0.Execute

24. When "Auto" is executed, the value of "Counter_1" will be cleared and then increased by 1 for each trigger event to MC_MoveRelative.





3.3.3 Program Monitoring

When running a program, the current control status of system can be monitored and part of the device values are allowed to be modified for system testing as well.

3.3.3.1 Setup Connection between Devices

1. Double click on "Device". (The default IP address for AX-308E is 192.168.1.5)



2. Choose "Scan Network" on the Device page.

Applications Backup and Restore File Log PLC Stells Users and Groups Access Rights Symbol Rights Runtime Clock Configuration System Parameters Task Deployment Stats	Communication Settings	an Network Gaterray + Dev	rice •			
Backup allo kestore Files Log PLC Settings Symbol Rights Symbol Rights System Parameters System Parameters Settus Information	Applications	Scan Netw				
Ing Intervery PLC Settings IP-Address: localhost Device Name: AX-308EA0MAIT PLC Shell Port: localhost Device Name: AX-308EA0MAIT Users and Groups Device Address: localhost Device Address: localhost Access Rights Farget ID: 1217 Target Type: 4102 Symbol Rights Target Yupe: 4102 Target Vendor: Delta Electronics System Parameters Target Version: 3.5.15.11 Target Version: 3.5.15.11	Files			8	· · ·	
LC Settings Device Name: AX-308EA0MAIT AX-308EA0MAIT LC Shell Port: Isers and Groups Access Rights wombol Rights tuntime Clock Configuration Aystem Parameters ask Deployment tatus	og	50	Gateway	~	[0003.A00E.A005] (active)	-
LC Shell Ports 1217 Device Address: 0003.A00E.A005 access Rights Infer 0313 Target Type: 4102 Target Vene: 4102 Target Vene: 4102 Target Vene: 4102 Target Vene: 5.515.11	LC Settings	IP-/	Address:		Device Name: AX-308EA0MA1T	
It is and Groups It is a construction of the set of the	LC Shell	Por	t 7		Device Address:	
IbF7 0313 Target Type: 4102 Target Vendor: Delta Electronics rarget Version: 3.5.15.11	sers and Groups	121			Target ID:	
mbol Rights 4102 untime Clock Configuration Delta Electronics vistem Parameters Target Vension: 3.5.15.11	ccess Rights				16F7 0313 Target Type:	
Intime Clock Configuration Delta Electronics Target Version: 3.5.15.11 atus formation	mbol Rights				4102 Target Vendor:	
Ask Deployment atus formation	untime Clock Configuration				Delta Electronics	
atus formation	vstem Parameters				3.5.15.11	
formation	isk Deployment					
formation	atus					
	nformation					



100

Gateway-1 (scanning)	Device Name:	^	Scan Network
AX-308EA0MA1T [0003.A00E.A005]	AX-308EA0MA1T		Wink
	Device Address:		
	0003.A00E.A005		
	Block driver:		
	UDP		
	Number of channels:		
	4	- 51	
	Carial numbers		
	RTS-c7a8ccc74852337c		
	Target ID:		
	107/0313		
	J	*	

3. After the "Select Device" window pops up, select the "AX-308E" device and click on "OK".

4. When the device is connected with your PC, information of the device will be displayed as shown in the following figure marked by the red box.

Communication Settings	Scan Network Gateway + Device +	
Applications		1000
Backup and Restore		
iles		··· •
og	Gateway	[0003.A00E.A005] (active)
LC Settings	IP-Address: localhost	Device Name: AX-308EA0MA1T
PLC Shell	Ports	Device Address:
Jsers and Groups	1217	Target ID:
Access Rights		16F7 0313
Symbol Rights		4102
Runtime Clock Configuration		Target Vendor: Delta Electronics
System Parameters		Target Version: 3.5.15.11
fask Deployment		
Status		
Information		



3

3.3.3.2 Process Monitoring and Control

1. Click on the Compile button it to verify the correctness of program.



2. Upon completion of compiling, a report message of programming errors and warnings is displayed.



3. And then click on 🥵 to perform online monitoring





4. The program needs to be downloaded after monitoring action is performed. When the download is completed, the status of PLC shows STOP until you click on
and the status would shift to RUN.



5. When the PLC is in the RUN mode, the status would be displayed as **RUN** at the bottom of the page and the program is ready to be executed.





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6. Double click on "Step 1" and the icon **CTRUE>** will be shown.

Device.Application.POU						
pression	Туре	Value	Prepared value	Address	Comment	^
Step1	BOOL	FALSE	TRUE			
Servo_ON	BOOL	FALSE				
<pre>MC_Power_0</pre>	MC_Power					
Out2	BOOL	FALSE				v
- 2		2012				0
2	M	C_Power_0				0
2 TRUE	M	C_Power_0 MC_Power				0
		C_Power_0 MC_Power	ENO TAT SE			0
2 TRUE Pulse_Output_Ax	EN is_0 - Axis TRUE Enable	C_Power_0 MC_Power Sta bRegulatorRealSt	ENO ALUS FALSE FALSE			0
Z TRUE Pulse_Output_Ax Servo ON	M EN is_0 — Axis IRUE — Enable AKSE — DRegulatorOn	C_Power_0 MC_Power Sta bRegulatorRealSt bDriveStartRealSt	ENO atus FALSE tate FALSE cate TRUE			0
TRUE TRUE Pulse_Output_Ax Servo_ON	EN is_0 d Axis TRUE Enable ALSE DEFUSEART	C_Power_0 MC_Power Sta bRegulatorRealSt bDriveStartRealSt E	ENO SALUS FALSE SALE FALSE SALE TRUE SUSY TRUE			0
TRUE TRUE Pulse_Output_Ax Servo_ON	EN is_0 Axis TRUE Enable ALSE bRegulatorOn TRUE bDriveStart	C_Power_0 MC_Power Sta bRegulatorRealSt bDriveStartRealSt Er	ENO Satus FALSE FALSE TRUE Susy TRUE Fror FALSE			0
2 TRUE Fulse_Output_Ax Servo_ON	EN is_0 ⁴ Axis TRUE Enable ALSE bRegulatorOn TRUE bDriveStart	C_Power_0 MC_Power Sta bRegulatorRealSt bDriveStartRealSt Erro Erro	ENO atus - FALSE FALSE tate - TRUE Susy - TRUE FALSE prID - SMC_NO_ERR			0
2 TRUE Pulse_Output_Ax Servo_ON	EN is_0 - Axis TRUE Enable ALSE bRegulatorOn TRUE bDriveStart	C_Power_0 MC_Power Sta bRegulatorRealSt bDriveStartRealSt E E Erro	ENO atus FALSE FALSE FALSE TRUE Busy TRUE FALSE or ID SMC_NO_ERR			0
2 TRUE Fulse_Output_Ax Servo_ON	M is_0 Axis TRUE Enable bRegulatorOn TRUE bDriveStart	C_Power_0 MC_Power Sta bRegulatorRealSt bDriveStartRealSt E Erro	ENO atus FALSE state TRUE atus TRUE true susy TRUE state susy SALSE orID SMC_NO_ERR			0

7. Right click on "Step 1" to select "Write All Values of 'Device.Application" and all the corresponding status will be filled in, which can also be performed by using the shortcut key Ctrl + F7.

	Tune	Malua	Despaced value	Addeses	Comment	
ession	Type	FALCE	Thepared value	Address	Comment	
Servo ON	BOOL	FALSE	TRUE			
MC Power 0	MC Power	THESE				
0ut2	BOOL	FALSE				
1 M			~ *			
Step1 <true></true>						Servo_ON
& Cut						
2 D B Copy						
TF R Paste						
Pulae X Delete		5-	ENO			
Browse		+ prRealS	tate - FALSE			
Se 🕅 New Breaks	oint	tRealS	tate - TRUE			
Toggle Brea	akpoint	E	FALSE			
* Run to Curs	or	Err	orID - SMC_NO_ERR			
3 Set next Sta	tement					
3 Write All Va	lues of 'Device.Application'					0
Force All Va	lues of 'Device Application'					
Unforce All	Values of 'Device Application	on'				
4 Display Mo	de					Haming ON
101						
5	DMC_Home_	P_0				
TRUE	DMC_Home	_P				
Pulse Output Avis Or	EN DATE	ENO bDone	FATCE			
ruise_oucput_Anis_o	AAIS	Done	EALISE			



- POU X . Device.Application.POU ^)) Value Prepared value Address Expression Туре Comment Step1 RUE BOOL Servo_ON BOOL # MC_Power_0 MC_Power Ø Out2 BOOL TRUE 1 Servo_ON Step1 MC_Power_0 TRUE MC_Power ENC EN Pulse_Output_Axis_0 - Axis Status TRUE TRUE Enable bRegulatorRealState TRUE Servo_ON TRUE bRegulatorOn bDriveStartRealState TRUE bDriveStart TRUE Busy TR FALSE Error ErrorID - SMC_NO_ERR MC_Power_0.Status Out2 10
- 8. After activating "Step 1", Servo ON will be TRUE. (Same operation method to execute the following programs.)

9. Start homing for the axis by activating "Step 2"

vice J	Application.POU			
1				
	Step2 MC_Power_0.Status			Hpming_C
5	DMC_F	Home_P_0		
	TRUE DMC	Home_P		
	En	ENO bDono		
	Homing ON TRUE DExecute	bBusy FALSE		
	0 - IrPosiction	bCommandAborted - FALSE		
		bError - FALSE		
		ErrorID DFB_HSIO	N	
-	1/2 V		WG 14	
6	MC_Move	Velocity_0	MC_Mov	eAbsolute_0
6	TRUE MC_Move	Velocity_0 veVelocity ENO	MC_Mov MC_Mov	eAbsolute_0 weAbsolute
6	TRUE MC_Move	Velocity_0 reVelocity InVelocity - FALSE	MC_Mov MC_Mov Pulse_Output_Axis_0	eAbsolute_0 veAbsolute ENO Done
6	TRUE MC_Move TRUE MC_Move Pulse_Output_Axis_0	Velocity_0 veVelocity InVelocity = FALSE Busy = FALSE	MC_Mov MC_Mov Pulse_Output_Axis_0	eAbsolute_0 weAbsolute ENO Done Busy
6	TRUE MC_Move TRUE MC_Mov Pulse_Output_Axis_0	Velocity_0 reVelocity InVelocity = FALSE Busy = FALSE CommandAborted = FALSE	MC_Mov. Pulse_Output_Axis_0 - Axis FAMSE Execute 0 - Position	eAbsolute_0 weAbsolute Done Busy CommandAborted
6	TRUE TRUE MC_Move MC_Move MC_Move R Pulse_Output_Axis_0	Velocity_0 reVelocity InVelocity FALSE Busy FALSE CommandAborted FALSE Error FALSE	MC_Mov. Pulse_Output_Axis_0 - Axis PALSE - Execute 0 - Position 100 - Velocity	eAbsolute_0 veAbsolute Done Busy CommandAborted Error
6	TRUE MC_Move TRUE MC_Mov Pulse_Output_Axis_0	Velocity_0 reVelocity InVelocity FALSE Busy FALSE CommandAborted Error FALSE ErrorID SMC_NO_E	MC_Mov MC_Mov Pulse_Output_Axis_0 - Axis FALSE - Execute 0 Position 100 Velocity RR 100 Acceleration	eAbsolute_0 veAbsolute Done Busy CommandAborted Error ErrorID
6	MC_Move TRUE MC_Move Pulse_Output_Axis_0 Axis FAMSE Execute 10 Velocity 10 Acceleration 10 Deceleration 0 Jerk	Velocity_0 reVelocity InVelocity Busy CommandAborted Error FALSE ErrorID SMC_NO_E	MC_Mov MC_Mov Pulse_Output_Axis_0	eAbsolute_0 veAbsolute Done Busy CommandAborted Error ErrorID
6	MC_Move TRUE MC_Move Pulse_output_Axis_0 Axis FXXSE Execute 10 Velocity 10 Acceleration 0 Jerk 1 Direction	Velocity_0 reVelocity InVelocity = FALSE Busy FALSE CommandAborted = FALSE Error = FALSE ErrorID = SMC_NO_EI	Pulse_Output_Axis_0	eAbsolute_0 veAbsolute Done Busy CommandAborted Error ErrorID



10. After starting "Step 3", execute "MC_MoveVelocity " to drive the axis moving to position 300mm at a constant speed, then execute "MC_MoveAbsolute" to reverse the axis back to position 0. In addition, the value of Counter_1 will be increased by 1 for each rotary completed, until "Step 3" being turned off.



3.3.3.3 Monitor with Trace Tool

A Trace makes it possible to record the value history of variables on the PLC, just like a digital sampling oscilloscope. To monitor the status of input/ output pins and axes with Trace function while executing the program, navigate to "Application" > "Add Object" > "Trace". Then you'll open the "Add Trace" window.



3-82

1. Insert the name of Trace then click "Add" on "Add Trace" window.

Add Trace	×
atool to m	onitor variables graphically.
Name of the Trace	
Trace	← 📖
	Add Cancel

2. After the Trace is successfully added, it will be shown on the project tree on the left side of the screen. Then double click on "Trace" to open the Trace page.







3. Click "Configuration" on the Trace page to open the configuration window.

4. Select "EtherCAT_Task" from the drop-down list of Task on the Trace Configuration window.

Trace Record — Trace	Record Settings Enable Trigger	
	Trigger variable *	
	Trigger edge	
	Posttrigger (samples	
	Trigger Level	
	Task 0	
D	Becord condition	
Presentation (diagrams)	Commont (2)	
□ Diagram 1	Comment	
— Y axis		
Shown variables	Resolution ms V	
	Automatic restart	
	Advanced	
dd Variable	Reset Display settings	





5. After finishing configuration, click "Add Variable" on the Trace page to open the Trace Configuration window.

6. Click the button is on the Trace Configuration page to add the required trace variables or traceable parameters. After the Input Assistant window is opened, expand POU on the tree and select "Step 1" then click on "OK".

Input Assistant

		Text Search Categories				
Trace Configuration Trace Record Trace Presentation (diagram) Time aris Diagram 1 Time aris Shown variables	Vanable settings Vanable Graph color Line type Point type Dot Activate minimum vanting Oritical (over line: Warring minisum color: Warring minisum color: Warring minisum color: Warring minisum color: Red	Traceable parameters	Name Application POU Auto Counter_1 Delay Del	Type Application WT BOOL DWT BOOL DWT BOOL DWT BOOL BOOL BOOL BOOL BOOL BOOL BOOL BOO	Address	0
ed Vursela Inite Chevala	Reset Directory Concel	Documentation Step1: BOOL; (VAR)		Insert with arguments	Insert with name	space prefi





×

7.	Make sure the chosen	variable is shown	in the variable	field of variable setting	s and then click "OK".

Trace Record	Variable settings		
- Trace	Variable •	POU.Step1	
POU.Step1	Graph color	Blue	~
	Line type	Line	~
	Point type	• Dot	~
	Activate minimum warning		
	Critical lower limit	0	
Presentation (diagrams)	Warning minimum color	Black	~
☐ Time axis ☐ Diagram 1	Activate maximum warning		
Y axis	Critical upper limit	0	
POU.Step1	Warning maximum color	Red	~
11000000	Den de Dienden ander		

8. Afterwards, the added variable will be shown on the right side of the Trace page.







9. Right click on the Trace and select "Download Trace" to start monitoring.

10. In case that there're more than one variable or parameter need to be monitored, you can just right click on the scope and select "Convert to multi channel"





11. After choosing "Convert to multi channel", two data-recording oscilloscope of the two chosen variables added on the right will be displayed on the page.



12. Repeat the above steps to add more required trace variables and traceable parameters.







13. While a program is running, you can observe trigger events and the current position of axis as well as the velocity via the data-recording oscilloscope

Introduction of the process shown on the scope:

- ① Execute "Step1" to activate the pulse type axis
- ② Execute "Step2" to make the pulse type axis perform homing.
- ③ Execute "Step3" and wait for one second to trigger "MC_MoveVelocity" and perform positive rotation.
- ④ Once the axis passes the position 300, MC_MoveAbsolute will be triggered to reverse the axis back to position 0 as well as aborting the previous function block.



3

3.4 Setup Projects with Virtual Master Axis

In this example, a virtual axis is presented to be the master axis with the servo motor adopting the master-slave control function.

3.4.1 System Hardware Configuration

AX-308 connects to a servo driver (ASDA-A2-E) directly through EtherCAT communication port to control servo motor positioning which follows the virtual master axis.



Tools and materials

Numbering	Item	Model Number	Q'ty
1	AS Series Power Module	AS-PS02A	1
2	AX-3 Series CPU Module	AX- 308EA0MA1T	1
3	Power supply	DVP-PS02	1
4	Servo drive (EtherCAT)	ASDA-A2-0421- E	1
5	Servo motor	ECMA- C10604ES	1
6	Servo power cable	ASD- ABPW0003	1
7	Servo encoder cable	ASD-ABEN0003	1
8	EtherCAT communication cable (1 meter)	UC-EMC010- 02A	1

Configuring hardware limits for ASDA-A2-E

Hardware limit is not required in this example, which features rotary axes.



3.4.2 Create New Projects and POUs

3.4.2.1 Create a New Project

1. First, open the programming software DIADesigner-AX.



2. The display of DIADesigner-AX is shown as below.

Devices	* * X	Start Page X		+ 35
		Mart Pade X DIADesigner-AX Basic operations New Project Cost Project Cost Projects Recent projects		
2 Devices () POLIS		☑ Close page after project load ☑ Show page on startup		



3. Click on "File".

	TORX W.	2.42月後後後後回時,2月回,64日,8月6日,8月1日,4月1日,4月1日,4月1日,4月1日,4月1日,4月1日,4月1日,4	東 ()
invices O	x	Start Page X	
		DIADesigner-AX	
		Basic operations	
		New Destant	
		Den Project	
		Open Project from PLC	
		Description of the second second	
		Recent projects	
		2 Close many after project load	
P Devices D BCL Is		Show page on startup	

4. To create a new project, select "New Project" from the drop-down menu for DIADesigner-AX V1.0.0 or select "Standard Project" from the drop-down menu for DIADesigner-AX V1.1.0 or later.





5. Select "Project AX-308EA0MA1T" after entering New Project page. Name the project in the field of Name and choose a path to the archive location, then click OK to move to the next page.

Categories		Templates
Lit	oraries ojects	Project AX-308EA0 Project AX-308EA0 Project Project Project Project
A project c	ontaining one device,	, one application, two empty implementations for PLC_PRG and Motion_F
vame	Undded1	1
	C: \Users \admin \Do	ocuments Y

6. After entering the project page, double click the target object in the project tree on the left side of the page to open a certain program or configure settings of relating modules

Devices	• 4 ×
evices	r) EtherCAT Master SoftMotion)
<	>



7. Double click on "Network Configuration" to create servo axes in the system.

Devices	- 1	p	×
Cutitled I Cutit			
	Motic	on)	

8. After entering "Network Configuration" page, select the servo drive slave based on EtherCAT and double click on it to add new axes

A Network Configuration Editor 🗙		 Product List Editor 	- 4 X
(Q)	100 🖾	Search Toolbox	
	EtherCAT ModbusTCP/EtherNetiP	Product List Controller	
Vesice	Modbus CANOpen	Servo Device A ASD-A2	
AX-308EA0MA1T		ASD-A2-E	
		ASD-A2-M	
		ASD-B3	
	0		
EtherCAT_1			
		-	
+-+			
		Delta ASDA-A2-E EtherCAT(CoE)	Drive
¢	3		





9. Move the cursor onto 0, then click and hold the left mouse button and drag the yellow line to connect with the line of EtherCAT_1



10. After connecting with EtherCAT_1, the slave device is displayed in the project tree (fields with red borders) which also means it is successfully configured with EtherCAT communication.





11. After created the real axis, continue to build the virtual axis by right-clicking "SoftMotion General Axis Pool" and selecting "Add Device".



12. Expand "Virtual drives" object and choose "SM_Drive_Virtual" then select "Add Device" on the Add Device page.







13. "SM_Drive_Virtual" will be shown in the project tree after the virtual axis is created.

14. Double-click on "EtherCAT_Master_SoftMotion".





15. Set "Cycle time" to 2ms and "Sync offset" to 50 on the "EtherCAT_Master_SoftMotion" page.

General	Autoconfig Master/Slave	s		EtherCAT.
Sync Unit Assignment	EtherCAT NIC Setting			
Log	Destination address (MAC)	FF-FF-FF-FF-FF	Broadcast	Enable redundancy
EtherCAT I/O Mapping	Source address (MAC)	00-00-00-00-00-00	Browse	
EtherCAT IEC Objects	Select network by MAC	Select netwo	ork by name	
Status	J Distributed Clock		D Options	
Information	Cycle time 2000	et us		
	Sync offset 50	€ %		
	Sync window monitoring			
	Sync window 1	* US		

3.4.2.2 Axis Parameter Settings

1. Select the first servo axis "SM_Drive_ETC_Delta_ASDA_A2" and double click on it to open the "SM_Drive_ETC_Delta_ASDA_A2" page.

Devices	-	ą	×
Untitled1			-
E Movice (AX-308EA0MA1T)			
- 🔏 Hardware Configuration			
🗷 🙏 Network Configuration			
PLC Logic			
😑 🧔 Application			
Library Manager			
PLC_PRG (PRG)			
😑 🌃 Task Configuration			
EtherCAT_Task			
🖃 🍪 MainTask			
PLC_PRG			
🗉 🚮 BuiltIn_IO (BuiltIn_IO)			
- 🗊 Delta_LocalBus_Master (Delta LocalBus Master)			
EtherCAT_Master_SoftMotion (AX-308 Series Ethe	CAT	last	er So
ASD_A2_E (Delta ASDA-A2-E EtherCAT(CoE) E	orive R	ev4	_SM)
SM_Drive_ETC_Delta_ASDA_A2 (SM_Drive_ETC_Delta_ASDA_A2 (SM_Drive_ETC_DeltaASDA_A2 (SM_Drive_ETC_DeltaASDA_A2 (SM_Drive_ETC_DeltaASDA_A2 (SM_Drive_ETC_DeltaASDA_A2 (SM_Drive_ETC_DeltaASDA_A2 (SM_Drive_ETC_DeltaASDA_A2 (SM_Drive_ETC_DE)ASDA_A2 (SM_	e_ET	C_De	elta_
🖻 🍐 SoftMotion General Axis Pool	1		-
SM_Drive_Virtual (SM_Drive_Virtual)			



2. Set the axis type to "Rotary Axis" and you will be able to configure the "Rotary Axis Modulo Setting" with a maximum setting value of 360 degrees.



3. Choose "Round Table" to be the mechanism type as a result of rotary axis setting.

General Setting	Axis Type and Limits	Motion Parameter
Homing Setting Commissioning SM_Drive_ETC_Delta_ASDA_A2: EC Objects Status	↓ Virtual mode Linear Axis Software Limits ● Rotary Axis Activated Negative [u]: 0 Positive [u]: 1000 Rotary Axis Modulo Setting Modulo value [u]: 360	Error Reaction Quick Stop Deceleration [u/s ²]: 100 Velocity Ramp Type Trapezoid Sin ² Quadratic Quadratic(smooth) Position Lag Supervision Position Lag Reaction Deactivated Y Lag Limit [u]: 1
information	Transmission Mechanism Mechanism Type Round Table (4)	Mechanism Setting (1) Command pulse per motor rotation: 131072 (4) Movement distance per motor rotation: 1 [Unit]
		Gear Box (2) Gear ratio numerator



4. Then determine the proper gerar ratio by setting "Command pulse per motor rotation" to 1,280,000 and the user unit to 360 degrees. (Servo's electronic gear ratio $\frac{P_{1-44}}{P_{1-45}} = \frac{Motor Pulse per revolution}{Command Pulse per rotation}$)

General Setting	Axis Type and Li	mits	Motion Parameter			
Homing Setting	Virtual mode	Linear Axis Software Limits	Error Reaction	Deceleration [u/s ²]: 100	-	
Commissioning	() Kotary Polis	Negative [u]: 0	Velocity Ramp Typ	e Sin2 — Quadratic — Quad	ratic(month)	
SM_Drive_ETC_Delta_ASDA_A2: IEC Objects		Positive [u]: 1000	Position Lan Sunani		rabc(smooth)	
Status	-	Modulo value [u]: 360	Position Lag Reaction	on Deactivated ~	Lag Limit [u]: 1	
information	Transmission Med	hanism	Machanian Californ			ē.
	Mechanism Typ	e Round Table ~ (4	(1) Command pulse (4) Movement dista	e per motor rotation: 1280000	Pulse]	↓
			Gear Box	(2) Gear ratio numerator		
	1		Gear Ratio =	(3) Gear ratio denominator	1	0

5. Since the mechanism is not equipped with a gearbox, the gear ratio for gearbox would be 1:1.

General Setting	Axis Type and L	imits	Motion Parameter			
Homing Setting Commissioning	 Virtual mode Linear Axis Rotary Axis 	Linear Axis Software Limits Activated Negative [u]: 0	Error Reaction	Deceleration [u/s ²]: 100	X	
SM_Drive_ETC_Delta_ASDA_A2: IEC Objects		Positive [u]: 1000	Trapezoid O	Sin ² 🔿 Quadratic 🔿 Qua	dratic(smooth)	
Status		Modulo value [u]: 360	Position Lag Supervi Position Lag Reaction	n Deactivated 🗸	Lag Limit [u]: 1	
	Mechanism Typ	e Round Table ((Mechanism Setting (1) Command pulse (4) Movement dista	per motor rotation: 1280000 nce per motor rotation: 360	Pulse]	
			Gear Box	(2) Gear ratio numerator	1	-
			Gear Ratio =	(3) Gear ratio denominator	1	



Lag Limit [u]:

1

10

Pulse]

*

\$

Virtual mode	Error Reaction
Linear Axis Linear Axis Software Limits Activated	Quick Stop Deceleration [u/s ²]: 100
Negative [u]: 0	Velocity Ramo Type
	Linear Axis Software Limits Activated Negative [u]: 0

.

(4)

A V

Position Lag Reaction

Mechanism Setting

Gear Ratio =

(4) Pitch: 1

Gear Box

Deactivated

🛊 [Unit]

(2) Gear ratio numerator

(3) Gear ratio denominator

(1) Command pulse per motor rotation: 1280000

6. When finished the configuration of gear ratio, click "Homing Setting" to enter the page.

Modulo value [u]: 360

Transmission Mechanism

(1)

Mechanism Type Ball Screw

Status

Information

7. Choose Mode 33 for rotary axis type mechanism so as to perform homing depending on Z puls. The detailed descriptions of all homing modes are shown below.

n# SM_Drive_ETC_Delta_AS	DA_A2 X
General Setting	Homing Mode Mode 33
Homing Setting	Homing speed during search for switc
Commissioning	Homing speed during search for z phase parse 20 📄 [0.1 rpm] Homing Acceleration 100 👘 [ms]
SM_Drive_ETC_Delta_ASDA_A2:	Description
Status	Mode 33 : Depending on Z pulse in the negative direction
Information	In mode 33, The homing instruction is executed and the axis moves at the second-phase speed (Homing speed
anoniocon	during search for Z phase pulse) in the negative direction. And the place where the axis stands is the home position
	once the first 7 nulse is mat
	Stop point Start point



X

4

8. Then set the proper homing speed which should match with the mechanism.

Seneral Setting	Homing Mode 33 V	
Homing Setting	Homing speed during search for switch 100 😫 [0.1 rpm]	
ommissioning	Homing speed during search for 2 phase public (so 1) (10,1 pm)	
M_Drive_ETC_Delta_ASDA_A2: EC Objects	Description Mode 33 : Depending on 7 pulse in the negative direction	
atus	wode 55 : Depending on 2 pulse in the negative direction	
Information	In mode 33, The homing instruction is executed and the axis moves at the second-phase speed (Homing spee
	during search for Z phase pulse) in the negative direction. And the place where the axis stands is the	e home position
	once the first 7 nulse is mat	
		-
		=0
	Stop pointStart point	
	Stop point Negative direction	=0
	Stop point Negative direction	=0
	Stop point Negative direction	=1
	Stop point Negative direction	=
	Stop point Negative direction	=
	Stop point Negative direction	-

9. After finish the settings of gear ratio and homing mode, the parameters on the servo drive need to be tested for DI9 and DI10 inputs placed on the servo as a result of hardware limit. To configure the pin functions of DI9 and DI10, double click on "ASD_A2_E".

evices	-	ą	×
Untitled 1			•
- Device (AX-308EA0MA1T)			
Hardware Configuration			
🕀 🙏 Network Configuration			
E BI PLC Logic			
😑 😳 Application			
Library Manager			
PLC_PRG (PRG)			
🖹 🎆 Task Configuration			
EtherCAT_Task			
🖻 🍲 MainTask			
PLC_PRG			
🗷 💮 BuiltIn_IO (BuiltIn_IO)			
Delta_LocalBus_Master (Delta LocalBus Master)			
EtherCAT_Master_SoftMotion (AX-308 Series Ether		laste	er So
ASD_A2_E (Delta ASDA-A2-E EtherCAT(Control Delta ASDA-A2-E EtherCAT(Ethe	ive R	ev4	SM)
SM_Drive_ETC_Delta_ASDA_A2	ET(C_De	elta_
😑 🍐 SoftMotion General Axis Pool			
SM_Drive_Virtual (SM_Drive_Virtual)			


10. Click "Startup Parameters" tab on the ASD_A2_E page.

General	Address			- Addi	tional –		
Processo Data	AutoInc address	0	*		Enable ex	xpert settings	Ether CAT
FIOLESS Data	EtherCAT address	1001	*		Optional		
Startup Parameters	J Distributed Clock						
EtherCAT I/O Mapping	Select DC	DC-Synchr	onous			~	
EtherCAT IEC Objects	🖂 Enable	2000	Sync u	nit cycle (µs	5)		
Status	Sync0:						
Information	 Sync unit cycle 	x 1	~	2000	×	Cycle time (µs)	
	O User-defined			0	*	Shift time (µs)	
	Sync1:						
	Enable Sync 1						
	Sync unit cycle	x 1	~	2000	*	Cycle time (µs)	
	O User-defined			0	*	Shift time (µs)	

11. Click "Add" to add new parameters on "Startup parameters" page.

	Line	ubindex	Name	Value	Bit Length	Abort on Error	Jump to Line on Error	NextLine	Comme
Process Data	-1	16====0:16#00	Op mode	8	8			0	Op mode
tartup Parameters	2	16#60C2:16#01	Interpolation time period	4	8			0	Interpola
	- 3	16#60C2:16#02	Interpolation time index	-3	8			0	Interpola
herCAT I/O Mapping	-4	16#6098:16#00	Homing method	14	32			0	
	5	16#609A:16#00	Homing acceleration	100	32			0	
herCAT IEC Objects	- 6	16#6099:16#01	Speed during search for switch	100	32			0	
	7	16#6099:16#02	Speed during search for zero	50	32			0	
formation									



12. Select "P1-44" and hold the Shift button to select multiple parametres. Then click OK to add the selected parameters.

SubIndex: 16#	0	4	Value	0		1		Cancel
Index: 16#	2120		Bit length	32		4	Г	ОК
Name	DRV	s Parameter P1-44	l.					
16#2136:16#0	00	DRV's Parameter	91-54	RW	UDINT			~
16#2135:16#0	00	DRV's Parameter	91-53	RW	UINT			
16#2134:16#0	0	DRV's Parameter	91-52	RW	UINT			
16#2131:16#0	00	DRV's Parameter	91-49	RW	UINT			
16#2130:16#0	00	DRV's Parameter	91-48	RW	UINT			
16#212F:16#0	00	DRV's Parameter	91-47	RW	UINT			
16#212E:16#0	00	DRV's Parameter	91-46	RW	UDINT	-		
16#212D:16#0	00	DRV's Parameter	91-45	RW	UDINT			
16#212C:16#0	00	DRV's Parameter	P1-44	RW	UDINT			
16#212B:16#0	00	DRV's Parameter	91-43	RW	UINT			
16#212A:16#0	00	DRV's Parameter	91-42	RW	UINT			
16#2129:16#0	00	DRV's Parameter	91-41	RW	UINT			
16#2128:16#0	00	DRV's Parameter	91-40	RW	UDINT			
16#2127:16#0	00	DRV's Parameter	91-39	RW	UINT			
16#2126:16#0	00	DRV's Parameter	91-38	RW	UINT			
16#2125:16#0	00	DRV's Parameter	21-37	RW	UINT			
ndex:Subindex		Name		Flags	Туре	Default		^

13. The selected parameters you've just added will be displayed on the list.

General	🕂 Add	🕑 Edit 🔀 Delete	☆ Move Up ♣ Move Down				_		
Process Data	Line	Index:Subindex	Name	Value	Bit Length	Abort on Error	Jump to Line on Error	Next Line	Comment
Floress Data	- 1	16=6060:16=00	Op mode	8	8			0	Op mode
Startup Parameters	- 2	16#60C2:16#01	Interpolation time period	4	8			0	Interpolation time period
	3	16#60C2:16#02	Interpolation time index	-3	8			0	Interpolation time index
EtherCAT I/O Mapping	4	16#6098:16#00	Homing method	33	32			0	
	5	16#609A:16#00	Homing acceleration	100	32			0	
therCAT IEC Objects	- 6	16=6099:16=01	Speed during search for switch	100	32			0	
	7	16#6099:16#02	Speed during search for zero	50	32			0	
Ratus	8	16#212C:16#00	DRV's Parameter P1-44		32			0	
	9	16#212D:16#00	DRV's Parameter P1-45		32			0	





14. Set the values of servo's gear ratio P1-44 and P1-45 to 1, which should match the gear ratio in axis parameters. (All parametres on this page will be downloaded to the servo after EtherCAT communication is established.)

General	🗣 Add	Edit X Delete							
Process Data	Line	Index:Subindex	Name	Value	Bit Length	Abort on Error	Jump to Line on Error	Next Line	Comment
Totess bata	- 1	16#6060:16#00	Op mode	8	8			0	Op mode
Startup Parameters	- 2	16#60C2:16#01	Interpolation time period	4	8			0	Interpolation time period
	3	16#60C2:16#02	Interpolation time index	-3	8			0	Interpolation time index
therCAT I/O Mapping	- 4	16#6098:16#00	Homing method	33	32			0	
	5	16#609A:16#00	Homing acceleration	100	32			0	
therCAT IEC Objects	- 6	16=6099:16=01	Speed during search for switch	100	32			0	
	-7	15=6099:16=02	Speed during search for zero	50	32			0	
tatus	8	16#212C:16#00	DRV's Parameter P1-44	1	32	E.		0	
nformation	9	16#212D:16#00	DRV's Parameter P1-45	1	32	←		0	

15. Use the same operation to configure the following parameters, which the DI4~DI7 should be turned OFF and the retentive parameters should be configured.

General	🖶 Add	🛃 Edit 🗙 Delete	Move Up ■ Move Down		_			_	
Process Data	Line	Index:Subindex	Name	Value	Bit Length	Abort on Error	Jump to Line on Error	Next Line	Comment
	1	16#6060:16#00	Op mode	8	8			0	Op mode
startup Parameters	2	16#60C2:16#01	Interpolation time period	4	8			0	Interpolation time period
	3	16#60C2:16#02	Interpolation time index	-3	8			0	Interpolation time index
therCAT I/O Mapping	- 4	16#6098:16#00	Homing method	33	32			0	
	5	16#609A:16#00	Homing acceleration	100	32			0	
therCAT IEC Objects	- 6	16=6099:16=01	Speed during search for switch	100	32			0	
	7	16=6099:16=02	Speed during search for zero	50	32			0	
tatus	8	16#212C:16#00	DRV's Parameter P1-44	1	32			0	
formation	9	16#212D:16#00	DRV's Parameter P1-45	1	32			0	
nrormation	- 10	16#220D:16#00	DRV's Parameter P2-13	256	16			0	
	11	16#220E:16#00	DRV's Parameter P2-14	256	16			0	
	- 12	16=220F:16=00	DRV's Parameter P2-15	256	16			0	
	13	16=2210:16=00	DRV's Parameter P2-16	256	16			0	
	14	16#230C:16#00	DRV's Parameter P3-12	256	16			0	

Servo parameters

The following parameters and values are used for this example on the Startup Parameter page.

Parameter	Function	Setting Value
P1-44	Gear ratio numerator	1
P1-45	Gear ratio denominator	1
P2-13	DI4 digital input pin function	256
P2-14	DI5 digital input pin function	256
P2-15	DI6 digital input pin function	256
P2-16	DI7 digital input pin function	256
P3-12	Remain unchanged with the parameters before the drive power being cut off.	256

*Note: Please refer to the user manuals of Delta ASDA-A2 Series for more detailed information of parameters.



16. After the configuration of real axes is completed, continue to set the virtual axes by double-clicking on "SM_Drive_Virtual".



17. Change the axis type to "Modulo" and the maximum value of modulo setting is 360.

General	Axis type and limits	CONTRACTOR OF			Velocity ramp type
Commissioning	Virtual mode	Software limits	Nagativa Ivl	0.0	Trapezoid
commissioning	O Modulo		Negative [u]:	0.0	Sin ²
SM_Drive_Virtual: I/O Mapping	Finite		Positive [u]:	1000.0	Quadratic
		Software error rea	ction		O Quadratic (smooth)
SM_Drive_virtual; IEC Objects			Deceleration [u/s ²]:	0	Identification
Status			Max. distance [u]:	0	ID: 1
Information	Dynamic limits				
In ormation	Velocity [u/s]:	Acceleration [u/s ²]	Deceleration [u/s ²] Jer	k [u/s³]:	
	30	1000	1000 10	000	E I
			$\hat{\nabla}$		
SM_Drive_Virtual X	Axis type and limits		¢		Velocity ramp type
	Axis type and limits	Modulo settings	¢		Velocity ramp type (a) Trapezoid
SM_Drive_Virtual X General Commissioning	Axis type and limits Virtual mode Modulo	- Modulo settings Modulo value (u	J: 360.0	-	Velocity ramp type Trapezoid Sin ²
SM_Drive_Virtual ×	Axis type and limits Virtual mode Modulo Finite	- Modulo settings Modulo value (u	J: 360.0	-	Velocity ramp type Trapezoid Sin ² Quadratic
SM_Drive_Virtual X General Commissioning SM_Drive_Virtual: 1/0 Mapping	Axis type and limits Virtual mode Modulo Finite	Modulo settings Modulo value (u Software error rea	↓ .]: 360.0	-	Velocity ramp type Trapezoid Sin ² Quadratic Quadratic (smooth)
SM_Drive_Virtual X General Commissioning SM_Drive_Virtual: I/O Mapping SM_Drive_Virtual: IEC Objects	Axis type and limits Virtual mode Modulo Finite	Modulo settings Modulo value (u Software error rea	Li: 360.0	-	Velocity ramp type Trapezoid Sin ² Quadratic Quadratic (smooth) Identification
SM_Drive_Virtual X General Commissioning SM_Drive_Virtual: I/O Mapping SM_Drive_Virtual: IEC Objects Status	Axis type and limits Virtual mode Modulo Finite	Modulo settings Modulo value (u Software error rea	u]: 360.0 Leceleration [u/s ²]: Max. distance [u]:	- 0	Velocity ramp type Trapezoid Sin ² Quadratic Quadratic (smooth) Identification ID: 1
SM_Drive_Virtual × General Commissioning SM_Drive_Virtual: I/O Mapping SM_Drive_Virtual: IEC Objects Status Information	Axis type and limits Virtual mode Modulo Finite	Modulo settings Modulo value (u Software error rea	u]: 360.0 ction Deceleration [u/s ²]: Max. distance [u]:	- III 0 0	Velocity ramp type (a) Trapezoid (b) Sin ² (c) Quadratic (c) Quadratic (smooth) Identification ID: 1
SM_Drive_Virtual X General Commissioning SM_Drive_Virtual: I/O Mapping SM_Drive_Virtual: IEC Objects Status Information	Axis type and limits Virtual mode Modulo Finite Dynamic limits Velocity [u/s]:	Modulo settings Modulo value [u Software error rea Acceleration [u/s ²]	u]: 360.0 ction Deceleration [u/s ²]: Max. distance [u]: Deceleration [u/s ²] Jer		Velocity ramp type



3.4.2.3 Programming for New Projects

- Operating process in the example
 - "MC_Power" will be triggered and enable two servo axes (Servo ON) after executing "Step 1".
 - "MC_Home" will be triggered after executing "Step 2" to command the real axis back to the home position.
 While "MC_SetPosition" is required for returning the virtual axis to zero position.
 - Execute "Step 3" to trigger "MC_Jog" and the virtual axis starts to move. At the same time, "MC_GernIn" would be executed and the slave axis starts to follow. Once "Step 3" is aborted, "MC_Jog" will be stopped and "MC_GearOut" will be triggered. After the Done output of MC_GearOut becomes TRUE, "MC_Stop" is triggered to stop the slave axis. The whole process will be performed repeatly till the contact singnal of "Step3" is OFF.
 - The value of Counter_1 will be increased by 1 for each time the operation being executed automatically.

- Programming with newly-created POUs
- 1. First, create a new POU by right-clicking "Application" to choose "Add Object" and select "POU".





2. Input the name of the new POU in the "Name" field and choose LD language for "Implementation language". When finished, click "Add" to add the new POU.

ame	
DU	
уре	
Program	
O Function block	
Extends	
Implements	
Final	Abstract
Accessspecifier	
Method implementat	ionlanguage
Continuous Function	Chart (CFC)
O Function	
Return type	
plementation language	

3. The newly added POU would be shown in the project tree, which needs to be added in Task by double-clicking "EtherCAT_Task". (Function blocks related to axis motion needs to be established in EtherCAT_Task to ensure normal operation of axes.)





figuration	Light A	
iority (031): 1		
Type		
Cyclic v	Interval (e.g. t#200ms) 4	ms v
Vatchdog		
Enable		
Time (e.g. t#200ms)		ms
Sancitivitu		

4. Click "Add Call" on the EtherCAT_Task page.

5. Click "OK" after choosing the newly-created POU.

Text Search Categories				
Programs	Name Application H PLC PRG POU	Type Agalastan ROGRAM ROGRAM	Ongin	
Structured view		√ Insert w	vēh arguments	Insert with numespace prefit
PROGRAM POU				



6. After adding the POU in EtherCAT_Task, "POU" will be shown on the lower half of the EtherCAT_Task page as well as in the project tree. Then click the POU from the tree, which is under the category of EtherCAT_Task.

Devices	- 4 X	EtherCAT_Task 🗙
 Unsted1 Device (AX-308EA0MAIT) Hardware Configuration EtherCAT Filter P.C.Cogic Application P.C.P.RG (PRG) /ul>	laster) ries EtherCAT Master Sof AT(COE) Drive Rev4_SM) 2 (SM_Drive_ETC_Delta_A	Configuration Priority (0.31): 1 Type OCyclic Interval (e.g. t#200ms) 4 Watchdog Enable Time (e.g. t#200ms) Sensitivity Add Call X Remove Call Change Call Move Up Move Dow POU Comment POU POU

With ladder logic programming language, add new commands by using the red-circled field marked with 1, while field 2 is for adding required Function or Function Block.

POU x 😂 EtherCAT_Task		ToolBox -
1 PROFAM FOD 2 VAR 2 END_VAR 4	100 %	 General Network Box Box Box Box Box with Efficiency Junp wr Return Junp wr Return Junp wr Return Toranch Execute Boolean Operators Other Operators Other Operators
		+ Ladder Elements + POUs
		-



8. Click on the desired place to add new commands on POU page, then select



9. After the selected command is shown in the POU, click "???" to enter the name of instruction variable then press ENTER key to continue with the "Auto Declare" page. Click "OK" after checking whether "Type" is correct.

S	tep1	Step time = t=0s	
	all SMC_PP_STEPOMS all SMC_VP_STEPOMS		
Step1	₹		
	-0		
	Auto Declare X		
	Skope Name Type VAR Step1 BOOL >		
	Object Initialization Address PLC_PRG (Application)		
	Flags Comment		
	_		
	$\overline{\mathbf{v}}$		
	-		
erCAT_Task	Pour x		
VAR	1. 8001		
Sten			



10. Then add the ouput instruction by clicking on the desired place and choosing

······································	· ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ● ●	
	• # X (S EfferCAT_Task) POU X	- TooBox -
Chotedr Inser Conce (XX-3000 Hardnare Configuration K EtherCAT Filter		A Direction of the second of t
PLC Lopc Application Application PLC_PRG (RG)		+ Juno eer Ratum Qi Ipoot T Branch

11. Click "???" to enter the name of instruction variable then press ENTER key to continue with the "Auto Declare" page. Click "OK" after checking whether "Type" is correct.



12. The instruction names you have added will be displayed as well as the instruction types, where the name and type of the instruction can also be added directly. (Same operation for the examples in later discussion.)





14. Click "???" and insert the name of function block then press ENTER to display the function block. Insert the name and press ENTER key again, then "Auto Declare" window will pop up. Click "OK" after confirming the "Type" of function block is correct.





15. Continue to click "???" and insert "TRUE", then press the ENTER key.





16. Insert the name of servo drive to the Axis input pin of the function block and delete "???" of other pins, since the mark "???" does not represent any variables and errors may occur while parsing.





3

- 17. Complete the following programming example with the same operation process.
- Create function blocks of MC_Power for both axes.





• The function block "MC_Home" cannot be used with a virtual axis. Instead, MC_SetPosition can command the virtual axis to perform homing function.



Then create "MC_GearIn" to activate a master-slave coupling with MC_Jog to trigger the virtual axis to move.
 "MC_GearOut" will also be executed by stopping the virtual master axis. Once the slave is decoupled, it will retain its velocity and move at a constant speed, which would need MC_Stop to stop the movement.

/ 🍏 E	itherCAT_Task / 🕑 POU 🗙	•
7	MC GearIn 0 MC GearOut 0	^
	TRUE MC GearIn MC GearOut	
	SM_Drive_VirtualMaster InGear SM_Drive_ETC_Delta_ASDA_A2Slave Done	
	SM_Drive_ETC_Delta_ASDA_A2 - Slave Busy - Execute Busy -	
	Execute CommandAborted Error	
	1 — RatioNumerator Error - Error - Error -	
	1 — KALIOUENOMINATOr EFFORID	
	Jerk	
8	MC Jog 0 MC Stop 0	
-	TRUE MC_Jog	
	SM_Drive_Virtual + Axis Busy SM_Drive_ETC_Delta_ASDA_A2 + Axis Done	
	- JogForward CommandAborted - MC_GearOut_0.Done - Execute Busy -	
	-JogBackward Error - 360 Deceleration Error -	
	360 Velocity Errorid Jerk Errorid	
	Jerk	
1	Step3 MC Home 0.Done MC SetPosition 0.Done	Auto
		()
		<i>u p</i>
10		
	Auto	MC_Jog_0.JogForward
		()
	MC Log D LogEoryard	MC Gearla 0 Evecute
	u-u	4.0
12		
	MC_Jog_0.JogForward	MC_GearOut_0.Execute
		()
13	1	🕨 🕂 🔍 🛛 100 % 🔍 🗸
<		>



3.4.3 Program Monitoring

When running a program, the current control status of system can be monitored and part of the device values are allowed to be modified for system testing as well.

3.4.3.1 Setup Connection between Devices

1. Double click on "Device". (The default IP address for AX-308E is 192.168.1.5)



2. Choose "Scan Network" on the Device page.

Communication Settings Scan Netwo	ork Gateway + Device +				
Applications	can Netw	-	· · · · · · · · · · · · · · · · · · ·		
Backup and Restore					
iles			· •		
pg	Gateway-1	/ ~	[0003, A00E, A005] (active)	-	
C Settings	IP-Address: localhost		Device Name: AX-308FA0MA1T		
C Shell	Ports		Device Address:		
sers and Groups	1217		Target ID:		
cess Rights			16F7 0313 Target Type:		
mbolRights			4102		
ntime Clock Configuration			Delta Electronics		
stem Parameters			Target Version: 3.5.15.11		
sk Deployment					
itus					
formation					



- Select Device × Select the network path to the controller: 🖻 💑 Gateway-1 (scanning...) Device Name: ^ Scan Network AX-308EA0MA1T [0003.A00E.A005] AX-308EA0MA1T Wink Device Address: 0003.A00E.A005 Block driver: UDP Number of channels: Serial number: RTS-c7a8ccc74852337c Target ID: 16F7 0313 ~ . .. OK Cancel
- 3. After the "Select Device" window pops up, select the "AX-308E" device and click on "OK".

4. When the device is connected with your PC, information of the device will be displayed as shown in the following figure marked by the red box.

Communication Settings	Scan Network Gateway + Device +	
Applications		1000
Backup and Restore		
iles		··· •
.09	Gateway	[0003.A00E.A005] (active)
LC Settings	IP-Address: localhost	Device Name: AX-308EA0MA1T
PLC Shell	Ports	Device Address:
Jsers and Groups	1217	Target ID:
Access Rights		16F7 0313
Symbol Rights		4102
Runtime Clock Configuration		Target Vendor: Delta Electronics
System Parameters		Target Version: 3.5.15.11
fask Deployment		
Status		
Information		



3.4.3.2 Process Monitoring and Control

1. The correctness of EtherCAT communication should be checked before program monitoring starts. After confirmation, double click on "EtherCAT_Master_SoftMotion".



2. Choose "Browse" after entering the EtherCAT_Master_SoftMotion page.

General	Autoconfi	g Master/Sla	ves			EtherCAT.
Sync Unit Assignment	EtherCAT NIC	Setting -	_			
Log	Destination a	ddress(MAC) FF-F	FFFFFFFF	Broadcast	Enable redundancy
EtherCAT I/O Mapping	Source addre Network Nam	ss (MAC)	00-0	1	Browse	
EtherCAT IEC Objects	 Select net 	work by MA	с	O Select netwo	ork by name	0
Status	J Distributed C	lock —	_		D Options	
Information	Cycle time	2000	\$	μs		
	Sync offset	50	-	%		
	Sync windo	w monitoring	9			



3. Select EtherCAT port "cpsw1" and click "OK".

1AC address 4006A0D651B4	Name cpsw0	Description			
4006A0D651B6	cpsw1	CPSW END			

4. After finish choosing network adaptor, the setting value of Source address (MAC) is displayed.

General	Autoconfig Master/Slaves	EtherCAT
Sync Unit Assignment	EtherCAT NIC Setting	
Log	Destination address (MAC) FF-FF-FF-FF-FF-FF	Broadcast 🗌 Enable redundancy
EtherCAT I/O Mapping	Source address (MAC) 40-06-A0-D6-51-86 Network Name cpsw1	Browse
EtherCAT IEC Objects	Select network by MAC Select network	ork by name
Status	Jistributed Clock	D Options

5. Click on the Compile button it to verify the correctness of program.





6. Upon completion of compiling, a report message of programming errors and warnings is displayed.

Build	•	O error(s)	• 0 warni	ng(s)	0 message(s)	X	×
Description Build started: Application: Device.Application Typify code							
Compile complete 0 errors, 0 warnings							

7. And then click on 🧐 to perform online monitoring.





8. The program needs to be downloaded after monitoring action is performed. When the download is completed, the status of PLC shows STOP until you click on
and the status would shift to RUN.



9. When the PLC is in the RUN mode, the status would be displayed as **RUN** at the bottom of the page and the program is ready to be executed.





10. Double click on "Step 1" and the icon **CTRUE>** will be shown.





- POU X Device.Application.POU Servo ON -0 Cut Сору er_0 B Paste ver X ENG Delete FALSE SM Dri Status Browse . egulatorRealState FALSE iveStartRealState FALSE 调 New Breakpoint ... Busy Toggle Breakpoint Error FALSE ErrorID SMC_NO_ERR Run to Cursor +1 Set next Statement Write All Values of 'Device.Application' Force All Values of 'Device.Application' 1 EN Unforce All Values of 'Device.Application' Status - FALSE SM_Dri alState Display Mode . Serv alState - FALSE TRUE bDriveStart Busy TR Error - FALSE ErrorID - SMC_NO_ERR Step2 MC_Power_0.Status Homing_ON -0 MC_Home_0 TRUE MC_Home EN °NT Done - BANSO ► + Q 100 % SM Drive ETC Delta ASDA A2 - Axis <
- 11. Right click on "Step 1" to select "Write All Values of 'Device.Application" and all the corresponding status will be written in, which can also be performed by using the shortcut key Ctrl + F7.

12. After activating "Step 1", both axes are under Servo ON mode. (Same operation to execute on the following programs.)





13. Start homing for the real and virtual axis by activating "Step 2".

POU	X	•
Device.A	Application.POU	
4	Step2 MC_Power_0.Status	Homing_ON
5	MC_Home_0 TRUE SM_Drive_ETC_Delta_ASDA_A2 - Axis Done TRUE Homing_ON TRUE 0 Position CommandAborted ErrorID FALSE ErrorID SMC_NO_ERR	
6	MC_SetPosition_0 MC_SetPosition EN ENO SM_Drive_Virtual $\stackrel{\leftrightarrow}{\rightarrow}$ Axis Done Homing_ON TRUE Execute Busy 0 Position Error FALSE Mode ErrorID SMC_NO_ERR	

14. After activating "Step 3", "MC_Jog" is triggered to enable the virtual axis to move, which also triggers "MC_GearIn" to perform the following move of slave axis. When "Step3" turns False, "MC_Jog" and "MC_GearOut" are triggered at the same time and the virtual axis stops to move. The slave axis moves at a constant speed after being decoupled, then the function block "MC_Stop" will be executed to command a motion stop to the axis.

D X		
pplication.POU		
MC_Gearin_0 MC_Gearin_0 MC_Gearin MC_GEARIN MC_GEAR	MC_GearDor_0 MC_GEARDOR_0 MC	
INF KC_Jog_0 THE KC_Jog_0 SK_Drive_Virenal = Maris SK_Drive_Virenal = Stars SK_Drive_Virenal = Stars SK_Drive_SK_Drive_Virenal = Stars SK_Drive_SK	MC_Stop_0 M_Drive_ETC_Delta_NDA_NATH MC_GearOut_0.Doos ZANT 0 - Seck Zrooth - TANTS (MC_DO_EDA (MC_DO_EDA (MC_DO_EDA)	
O - Sere Step3 MC_Home_0.Dome MC_SerBostion_0.Dome Auto		ла мс000001_
MC_J0g_0.30gForward		MC_GearIn_0.1



3.4.3.3 Monitor with Trace Tool

1. To monitor the status of input/ output pins and axes with Trace function while executing the program, navigate to "Application" > "Add Object" > "Trace". Then you'll open the "Add Trace" window.





2. Insert the name of Trace then click "Add" on "Add Trace" window.

Add Trace	>	×
A tool to monitor	variables graphically.	
Name of the Trace	(TOTAL)	1
Trace		

3. After the Trace is successfully added, it will be shown in the project tree on the left side of the screen. Then double click on "Trace" to open the Trace page.

File Edit View Project Trace Build	Online Debug	Tools Window
BERGOOLBEXAS	S # 15 1 1 12	1 2 1 1 1 1 1 1 1 1 1 1 1
Devices		X
- Duntitled 1		
E Device (AX-308EA0MA1T)		
a Hardware Configuration		
A Network Configuration		
A EtherCAT Filter		
B I PLC Logic		
= 🙆 Application		
Library Manager		
PLC_PRG (PRG)		
POU (PRG)		
* 🧱 Task Configuration		
GP Trace		
Builtin_IO (Builtin_IO)		
DIO (DIO)		
Delta_LocalBus_Master (Delta cocalBus M	laster)	





4. Click on "Configuration" on the Trace page to open the Trace Configuration window.

5. Select "EtherCAT_Task" from the drop-down list of Task on the Trace Configuration window.

Trace Record Trace	Record Settings Enable Trigger	
	Trigger variable * Trigger edge Posttrigger (samples	
Presentation (diagrams) Time axis Diagram 1	Trigger Level Task Record condition Comment	
Shown variables	Resolution ms ~ Automatic restart Advanced	



3



6. After finishing configuration, click "Add Variable" on the Trace page to open the Trace Configuration window.

7. Click the button is on the Trace Configuration page to add the required trace variables or traceable parameters. After the Input Assistant window is opened, expand POU on the tree and select "Step 1" then click on "OK".

Trace Variable Graph color Line type	
Linetype	
	~
Point type • Dot	~
Activate minimum warning	
Critical lower limit 0	
Presentation (diagrams) Warning minimum color	-
Diagram 1 Activate maximum warning	
Y axis Shown variables Critical upper limit	
Warning maximum color	

Trace Variables	A Name	Туре	Address	Or
Traceable parameters	= C Application	donlesting.		
	e POU	PRIMERAN		
1	Auto	8001		
10	Counter 1	DVT.		
	P Delay	BOOL		
	+ P DMC_Home_P.0	DMC Home P		
	P Hpming_ON	BOOL		
	+ MC_MoveRelative_0	MC_MoveRelative		
	# MC_Power_0	MC_Power		
	🕈 Out2	BOOL		
	# Servo_ON	BQOL		
	9 Step1	BOOL		
	9 Step2	BOOL		
	🛊 Step3	BOOL		
	* * TON_0	TON		
	¢			>
Structured view				
Ocumentation		Insert with arguments	Insert with nam	espace prefix
Step1: BOOL;				
(VAR)				



Trace Record	Variable settings		
- Trace	Variable	POU.Step1	
POU.Step1	Graph color	Blue	~
	Line type	Line	~
	Point type	• Dot	~
	Activate minimum warning		
	Critical lower limit	0	
Presentation (diagrams)	Warning minimum color	Black	~
Time axis Diagram 1	Activate maximum warning		
Y axis	Critical upper limit	0	
POU.Step1	Warning maximum color	Red	~

8. Make sure the chosen variable is shown in the variable field of variable settings and then click "OK".

9. Afterwards, the added variable will be shown on the right side of the Trace page.

Trace X		•
7	Configuration Add Variable	
10-	POU.Step1	-
_		

3





10. Right click on the Trace and select "Download Trace" to start monitoring.

11. In case that there're more than one variable or parameter need to be monitored, you can just right click on the scope and select "Convert to multi channel".







12. After choosing "Convert to multi channel", two data-recording oscilloscope will be displayed on the page for the two chosen variables added on the right.

13. Repeat the above steps to add more required trace variables and traceable parameters.





14. While a program is running, you can observe trigger events and the current position of axis as well as the velocity via the data-recording oscilloscope.



Introduction of the process shown on the scope:

 ${\rm \textcircled{O}}$ Execute "Step1" to activate the real axis and also the virtual axis.

^② Execute "Step2" to make both axes perform homing.

③ Execute "Step3" to trigger "MC_Jog" to activate the master axis. Meanwhile, "MC_GearIn" is also executed to command the slave axis move which follows the master axis.

④ After "Step3" turns False, the master axis will be stopped by "MC_Jog" and "MC_GearOut" is triggered at the same time to stop the virtual axis. Then the slave axis moves at a constant speed after being decoupled. Finally, the function block "MC_Stop" is executed to command a motion stop to the axis.



3.5 Setup Projects with Built-in Encoder as Master

This example presents a servo motor with a master encoder to perform axis coupling.

3.5.1 System Hardware Configuration

AX-308 connects to a servo driver (ASDA-A2-E) directly through EtherCAT communication port to control the positioning of servo motors which follows the virtual axis.



Tools and materials

Numbering	Item	Model Number	Q'ty
1	AS Series Power Module	AS-PS02A	1
2	AX-3 Series CPU Module	AX-308EA0MA1T	1
3	Encoder	ES5-25LN8542	1
4	Power supply	DVP-PS02	1
5	Servo drive (EtherCAT)	ASDA-A2-0421-E	1
6	Servo motor	ECMA-C10604ES	1
7	Servo power cable	ASD-ABPW0003	1
8	Servo encoder cable	ASD-ABEN0003	1
9	EtherCAT communication cable (1 meter)	UC-EMC010-02A	1



- Configuration between encoders and motion controllers
 - Introduction to encoder's function

Numbering	Color	Function
1	Brown	5V
2	Blue	0V
3	Black	А
4	Black/Red	Ā
5	White	В
6	White/Red	В
7	Orange	Z
8	Orange/Red	Z

• Connect the encoder to the controllers

AX-308		ES5-25LN8542
Encoder		
1	A1+	А
2	A1-	Ā
10	B1+	В
11	B1-	B
15	+5V1	DC 5V
8	0V	DC 0V
L		



3.5.2 Create New Projects and POUs

3.5.2.1 Create a New Project

1. First, open the programming software DIADesigner-AX.



2. The display of DIADesigner-AX is shown as below.

日本市(市)ちってたる	·····································	
Devices	- a x i Start Page x	•
	DIADesigner-AX Basic operations Wen Protect. Green Project. Opern Projects	
S Devees 1 POLs	Close page after project land	



3. Click on "File".

levices	👻 4 X 😥 Start Page X	
	DIADesigner-AX.	
	Basic operations	
	New Project	
	Open Project	
	Recent projects	
	Close page after project load	
Devices O POUS	Show page on startup	

4. To create a new project, select "New Project" from the drop-down menu for DIADesigner-AX V1.0.0 or select "Standard Project" from the drop-down menu for DIADesigner-AX V1.1.0 or later.




5. Select "Project AX-308EA0MA1T" after entering New Project page. Name the project in the field of Name and choose a path to the archive location, then click OK to move to the next page.

Categories		Templates
Lit	oraries ojects	Project AX-308EA0 Project BXXE Project
A project c	ontaining one device,	, one application, two empty implementations for PLC_PRG and Motion_F
vame	Undded1	1
	C: \Users \admin \Do	ocuments 🗸 📈

6. After entering the project page, double click the target object in the project tree on the left side of the page to open a certain program or configure settings of relating modules.

De	ices 👻 🗘	×
	Constraint Constraint Image: State of the state	×
<	Devices D POUs	>



7. Double click on "Network Configuration" to create servo axes in the system.

Devices	- 4	×
Ell PLC_PRG BuiltIn_IO (BuiltIn_IO) Delta_LocalBus_Master (Delta LocalBus Master) EtherCAT_Master_SoftMotion (AX-308 Series EtherCAT Mas SoftMotion General Axis Pool	ter SoftMotion	n)

8. After entering "Network Configuration" page, select the servo drive slave based on EtherCAT and double click on it to add new axes.

A Network Configuration Editor 🗙		Product List Editor - 4 X
AX-308EA0MAIT Device	100 C +	Search Toolbox Product List Controller Servo Device ASD-A2: ASD-A2-E A
EtherCAT_1		 ASD-A3 ASD-B3 Drive & Active Front End
4		Delta ASDA-A2-E EtherCAT(CoE) Drive





9. Move the cursor onto o, then click and hold the left mouse button and drag the yellow line to connect with the line of EtherCAT_1.



10. After connecting with EtherCAT_1, the slave device is displayed in the project tree (fields with red borders) which also means it is successfully configured with EtherCAT communication.





11. Then click "BuiltIn_IO" in the project tree to open the BuiltIn_IO page.



12. Select the checkbox of "Counter 0" since the first set is Counter in this example. To start the encoder, it must be configured with an external harware device.



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13. Double click on "EtherCAT_Master_SoftMotion".



14. Set "Cycle time" to 2ms and "Sync offset" to 50 on the EtherCAT_Master_SoftMotion page.

General	Autoconfig Master/Slaves	EtherCAT
Sync Unit Assignment	EtherCAT NIC Setting	
Log	Destination address (MAC) FF-FF-FF-FF-FF	Broadcast 🗌 Enable redundancy
EtherCAT I/O Mapping	Source address (MAC) 00-00-00-00-00	Browse
EtherCAT IEC Objects	Select network by MAC Select network by	name
Status	✓ Distributed Clock → ▷ Op	otions
Information	Cycle time 2000 🗼 µs Sync offset 50 🔄 %	
	Sync window monitoring	
	Sync window 1 🗘 us	



3.5.2.2 Axis Parameter Setting

1. Select the first servo axis "SM_Drive_ETC_Delta_ASDA_A2" and double click on it.



2. Set the axis type to "Rotary Axis" and you will be able to configure the max modulo value for "Rotary Axis Modulo Setting" with a default value of 360 degrees.



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3. Choose "Round Table" for the machanism type as a reault of rotary axis type used in this example.

	Axis Type and Limits		Motion Parameter			
Homing Setting Commissioning SM_Drive_ETC_Delta_ASDA_A2:	Virtual mode Linear Axis Rotary Axis Positiv	Axis Software Limits ivated ve [u]: 0 4 e [u]: 1000 4	Error Reaction	Deceleration [u/s²]: 100 a Sin² () Quadratic () Quad	lratic(smooth)	
EC Objects Status	Rotary Module	Axis Modulo Setting o value [u]: 360	Position Lag Supervis Position Lag Reactio	n Deactivated V	Lag Limit [u]: 1	
	Mechanism Type Roun	d Table	Mechanism Setting (1) Command pulse (4) Movement dista	per motor rotation: 131072 nce per motor rotation: 1	Pulse]	
	(1)		Gear Boy			
	Å		1	(2) Gear ratio numerator	1	

4. Continue with gear setting, set "Command pulse per motor rotation" to 1,280,000 and the user unit to 360 degrees. (Gear ratio $\frac{P1-44}{P1-45} = \frac{Motor Pulse per revolution}{Command Pulse per rotation}$)

General Setting	Axis Type and Limits	Motion Parameter
Homing Setting	Virtual mode Linear Axis Retar Axis Activated	Error Reaction Quick Stop Deceleration [u/s ²]: 100
Commissioning	Negative [u]: 0	Velocity Ramp Type
SM_Drive_ETC_Delta_ASDA_A2: IEC Objects	Positive [u]: 1000	Position Lan Supervision
Status	Modulo value [u]: 360	Position Lag Reaction Deactivated V Lag Limit [u]: 1
Information	Transmission Mechanism Mechanism Type Round Table	(4) Mechanism Setting (1) Command pulse per motor rotation: 1280000
		Gear Box (2) Gear ratio numerator
		Gear Ratio = (3) Gear ratio denominator 1



5. Since the mechanism is not equipped with a gearbox, the gear ratio for gearbox would be 1:1.

General Setting	Axis Type and L	imits	Motion Parameter			
Homing Setting	Virtual model	E Linear Axis Software Limits	Error Reaction	Deceleration [u/s ²]: 100	+	
Commissioning		Negative [u]: 0 ▲	Velocity Ramp Type Trapezoid	e Sin² () Quadratic () Qua	dratic(smooth)	
IEC Objects		Rotary Axis Modulo Setting	Position Lag Supervi	sion		
Status		Modulo value [u]: 360	Position Lag Reaction	n Deactivated ~	Lag Limit [u]: 1	1 T
Information	Transmission Me Mechanism Typ	chanism re Round Table (4)	Mechanism Setting (1) Command pulse (4) Movement dista	per motor rotation: 1280000 nce per motor rotation: 360	♥ [Pulse]	
	(1)		Gear Box	6.0.000. 1.3.		
	•		Gear Patio =	(2) Gear ratio numerator	1	
	1		Geor Ratio -	(3) Gear ratio denominator	1	

6. After finish configuring gear ratio relationship, click "Homing Setting" to enter the tab page.

General Setting	Axis Type and Limits	Motion Parameter
Homing Setting Commissioning	Virtual mode Linear Axis Rotary Axis Rotary Axis Regative [u]:	Error Reaction Quick Stop Deceleration [u/s ²]: 100 Velocity Ramp Type Trapezoid Sin ² Quadratic Quadratic(smooth)
IEC Objects Status	Rotary Axis Modulo Setting Modulo value [u]: 360	Position Lag Supervision Position Lag Reaction Deactivated Lag Limit [u]: 1
intormation	Transmission Mechanism Mechanism Type Round Table	Mechanism Setting (1) Command pulse per motor rotation: (2) (4) Movement distance per motor rotation: (360 (1) (2) (3) (4) (4) (4) (5) (6) (7) (7) (8) (9) (9) (10) (11) (12) (12) (12) (13)
		Gear Box (2) Gear ratio numerator
		Gear Ratio = (3) Gear ratio denominator 1



7. Since the axis type is rotary, choose Mode 33 to execute homing instruction depending on Z pulse. The descriptions of each mode in different cases are listed below.



8. Then configure the proper homing speed settings, which should match with the mechanism.

General Setting	Homing Mode Mode 33 *	
Homing Setting	Homing speed during search for z phase pulse 50 0 [0.1 rpm]	
SM_Drive_ETC_Delta_ASDA_A2: IEC Objects Status Information	Description Mode 33 : Depending on Z pulse in the negative direction In mode 33, The homing instruction is executed and the axis moves at the second-phase speed (Hou during search for Z phase pulse) in the negative direction. And the place where the axis stands is the ho once the first Z pulse is met. Negative direction Stop point Start	ming speed me position



9. After finish the settings of gear ratio and homing mode, the parameters on the servo drive need to be tested for DI9 and DI10 inputs placed on the servo as a result of hardware limit. To configure the pin functions of DI9 and DI10, double click on "ASD_A2_E".



10. Click "Startup Parameters" tab on the ASD_A2_E page.

General	Address			- Additio	nal –		
State Stat	AutoInc address	0	*	Er	able ex	xpert settings	Ether CAT.
Process Data	EtherCAT address	1001	\$		ptional		
Startup Parameters	J Distributed Clock						
EtherCAT I/O Mapping	Select DC	DC-Synch	ronous			~	
EtherCAT IEC Objects	🖂 Enable	2000	Sync u	nit cycle (µs)			
Status	Sync0:		_				
Information	Sync unit cycle	x 1	~	2000	*	Cycle time (µs)	
	O User-defined			0	*	Shift time (µs)	
	Sync1:						
	Enable Sync 1						
	Sync unit cycle	x 1	~	2000	*	Cycle time (µs)	
	O User-defined			0	A. T	Shift time (µs)	



Process Data Line Dubindex Name 1 16+001 (16#00) Op mode Op mode Startup Parameters 2 16#60C2:16#01 Interpolation time period 3 16#60C2:16#02 Interpolation time index	Value 8	Bit Length 8	Abort on Error	Jump to Line on Error	Next Line	Comme
1 16==00:16#00 Op mode Startup Parameters 2 16#60C2:16#01 Interpolation time period 3 16#60C2:16#02 Interpolation time index	8	8				
2 16#60C2:16#01 Interpolation time period -3 16#60C2:16#02 Interpolation time index	4				0	Op mode
3 16#60C2:16#02 Interpolation time index		8			0	Interpola
	-3	8			0	Interpola
therCAT I/O Mapping 4 16#6098:16#00 Homing method	14	32			0	
5 16#609A:16#00 Homing acceleration	100	32			0	
therCAT IEC Objects 6 16#6099:16#01 Speed during search for switch	100	32			0	
7 16#6099:16#02 Speed during search for zero	50	32			0	
Status 7 16#6099:16#02 Speed during search for zero	50	32			0	
information						

11. Click "Add" to add new parameters on "Startup parameters" page.

12. Select "P1-44" and hold the Shift button to select multiple parametres. Then click OK to add the selected parameters.

SubIndex: 16#	0		Value	0				
Index: 16#	212C		Bit length	32		0	0	к
Name	DRV's	Parameter P1-4	4					
16#2136:16#0	00	DRV's Parameter	P1-54	RW	UDINT	1		¥
16#2135:16#0	00	DRV's Parameter	P1-53	RW	UINT			
16#2134:16#0	00	DRV's Parameter	P1-52	RW	UINT			
16#2131:16#0	00	DRV's Parameter	P1-49	RW	UINT			
16#2130:16#0	00	DRV's Parameter	P1-48	RW	UINT			
16#212F:16#0	00	DRV's Parameter	P1-47	RW	UINT			
16#212E:16#0	00	DRV's Parameter	P1-46	RW	UDINT			
16#212D:16#0	00	DRV's Parameter	P1-45	RW	UDINT			
16#212C:16#0	00	DRV's Parameter	P1-44	RW	UDINT			
16#212B:16#0	00	DRV's Parameter	P1-43	RW	UINT			
16#212A:16#0	00	DRV's Parameter	P1-42	RW	UINT			
16#2129:16#0	00	DRV's Parameter	P1-41	RW	UINT			
16#2128:16#0	00	DRV's Parameter	P1-40	RW	UDINT			
16#2127:16#0	00	DRV's Parameter	P1-39	RW	UINT			
16#2126:16#0	00	DRV's Parameter	P1-38	RW	UINT			
16#2125:16#0	00	DRV's Parameter	P1-37	RW	UINT			
ndex:Subindex		Name		Flags	Туре	Default		^



13. The selected parameters you've just added will be displayed on the list.

General	Add 🕂	Edit 🔀 Delete	☆ Move Up ♣ Move Down						
Process Data	Line	Index:Subindex	Name	Value	Bit Length	Abort on Error	Jump to Line on Error	Next Line	Comment
Totess Data	- 1	16=6060:16=00	Op mode	8	8			0	Op mode
Startup Parameters	- 2	16#60C2:16#01	Interpolation time period	4	8			0	Interpolation time period
	3	16#60C2:16#02	Interpolation time index	-3	8			0	Interpolation time index
EtherCAT I/O Mapping	- 4	16#6098:16#00	Homing method	33	32			0	
	5	16#609A:16#00	Homing acceleration	100	32			0	
EtherCAT IEC Objects	- 6	16=6099:16=01	Speed during search for switch	100	32			0	
	7	16#6099:16#02	Speed during search for zero	50	32			0	
Status	8	16#212C:16#00	DRV's Parameter P1-44		32			0	
Information	9	16#212D:16#00	DRV's Parameter P1-45		32			0	
Intornation									

14. Set both values of P1-44 and P1-45 to 1, which should match the gear ratio in axis parameters. (All the setting values on this parameter list will be downloaded to the servo drive once the EtherCAT communication is established.)

General	🗣 Add	Edit 🔀 Delete	🕆 Move Up 🐥 Move Down						
Process Data	Line	Index:Subindex 16#6060:16#00	Name Op mode	Value 8	Bit Length 8	Abort on Error	Jump to Line on Error	Next Line	Comment Op mode
Startup Parameters	- 2	16#60C2:16#01	Interpolation time period	4	8			0	Interpolation time period
	- 3	16#60C2:16#02	Interpolation time index	-3	8			0	Interpolation time index
therCAT I/O Mapping	- 4	16#6098:16#00	Homing method	33	32			0	
	5	16#609A:16#00	Homing acceleration	100	32			0	
therCAT IEC Objects	- 6	16=6099:16=01	Speed during search for switch	100	32			0	
	-7	16#6099:16#02	Speed during search for zero	50	32			0	
tatus	8	16#212C:16#00	DRV's Parameter P1-44	1	32	-		0	
nformation	9	16#212D:16#00	DRV's Parameter P1-45	1	32	-		0	

15. Use the same operation to configure the following parameters, which the DI4~DI7 should be turned OFF and the retentive parameters should be configured.

General	🖶 Add	🛛 Edit 🗡 Delete	Move Up ■ Move Down						
Process Data	Line	Index:Subindex	Name	Value	Bit Length	Abort on Error	Jump to Line on Error	Next Line	Comment
	1	16#6060:16#00	Op mode	8	8			0	Op mode
Startup Parameters	2	16#60C2:16#01	Interpolation time period	4	8			0	Interpolation time period
	3	16#60C2:16#02	Interpolation time index	-3	8			0	Interpolation time index
therCAT I/O Mapping	-4	16#6098:16#00	Homing method	33	32			0	
	5	16#609A:16#00	Homing acceleration	100	32			0	
therCAT IEC Objects	- 6	16=6099:16=01	Speed during search for switch	100	32			0	
	7	16=6099:16=02	Speed during search for zero	50	32			0	
Status	8	16#212C:16#00	DRV's Parameter P1-44	1	32			0	
i	9	16#212D:16#00	DRV's Parameter P1-45	1	32			0	
nformation	- 10	16#220D:16#00	DRV's Parameter P2-13	256	16			0	
	11	16#220E:16#00	DRV's Parameter P2-14	256	16			0	
	- 12	16=220F:16=00	DRV's Parameter P2-15	256	16			0	
	13	16#2210:16#00	DRV's Parameter P2-16	256	16			0	
	14	16#230C:16#00	DRV's Parameter P3-12	256	16			0	



Servo parameter

Use the same operation to configure the following parameters, which the DI4~DI7 should be turned OFF and the retentive parameters should be configured.

Parameter	Function	Setting Value
P1-44	Gear ratio numerator	1
P1-45	Gear ratio denominator	1
P2-13	DI4 digital input pin function	256
P2-14	DI5 digital input pin function	256
P2-15	DI6 digital input pin function	256
P2-16	DI7 digital input pin function	256
P3-12	Remain unchanged with the parameters before the drive power being cut off.	256

*Note: Please refer to the user manuals of Delta ASDA-A2 Series for more detailed information of parameters.

16. After the settings of real axis is completed, double click "BuiltIn_IO" to configure the encoder.





17. Click " Counter Configuration" on the BuiltIn_IO page.

dware IO Configuration	Counter 0
nter Configuration	Counter Mode
inter configuration	Counter Mode Description
Objects us	O UD Occurise Pulse
rmation	PD Putse Putse Direction Counter-dockwise Counter-dockwise
	AB A-Phase Pulse
	0 4AB A-Phase Pulse 5 7 1 7 1 7 1
	External Trigger
	Axis Standard Axis Type Encoder Type: Incremental Encoder Modulo: 360 + (Unit]
	Transmission Mechanism Mechanism Type Ball Screw (1) Command pulse per motor rotation: 1
	Gear Ratio =

18. Select the counter mode. In this example, an encoder with AB two-phase pulse is used.





Axis Standard Encoder Type:	Incremental Encoder	Axis O I Mo	Type inear Axis dulo: 360) Rotary Axis [Unit]
Transmission Mechan Mechanism Type	nism Ball Screw Me (1) (4) (4)	chanism Settin) Command pu) Pitch: 1	ng Ilse per motor rotation: 1 😧 [Unit]	E Puls
	(3) Ge	ar Box	(2) Gear ratio numerator	1
	G	Sear Ratio =	(3) Gear ratio denominato	r 1

19. Choose "Rotary Axis" as the axis type, which the modulo is set to 360 degrees for a circle.

20. "Round Table" is used as the machanism type in this example.

Axis Standard Encoder Type: Incremental Encoder	Axis Type Linear Axis Modulo: 360
Transmission Mechanism Mechanism Type Round Table (4) (1)	Mechanism Setting (1) Command pulse per motor rotation: 1 Q [Pulse] (4) Movement distance per motor rotation: 1 Q [Unit]
	Gear Box Gear Ratio = (2) Gear ratio numerator 1 (3) Gear ratio denominator 1



21. Continue to configure gear ratio settings, set "Command pulse per motor rotation" to 2500, which is for per encoder rotation, and the user unit is set to 360 degrees.

Encoder Type:	Incremental Encoder	O M	Linear Axis F odulo: 360 C 	Rotary Axis Jnit]	
Transmission Mecha	anism				
Mechanism Type	Round Table ~	(4) (4) Movement of	ng oulse per motor rotation: 2500 distance per motor rotation: 360	● [Pulse]	
(1)	ÊC-0	[Unit]			
	ÊÇ, O	[Unit] Gear Box	(2) Gear ratio numerator	1	

22. Since the mechanism is not equipped with a gearbox, the gear ratio for gearbox would be 1:1.

Encoder Type:	Incremental Encoder	Axi	s Type Linear Axis (a odulo: 360 (*	Rotary Axis [Unit]	
Transmission Mech	anism				
Mechanism Type	(4)	(1) Command p (4) Movement d [Unit] Gear Box	ng ulse per motor rotation: 250 istance per motor rotation: [00 *	[Pulse]
			(2) Gear ratio numerator	1	A V
v — 1	(3)	Gear Ratio =	(3) Gear ratio denominato	or 1	



3.5.2.3 Programming for New Projects

- Operating process in the example
 - "MC_Power" will be triggered and enable two servo axes (Servo ON) after executing "Step 1".
 - "MC_Home" will be triggered after executing "Step 2" to command the real axis back to the home position.
 While "MC_SetPosition" is required for returning the virtual axis to zero position.
 - Execute "Step 3" to trigger "MC_Jog" and the virtual axis starts to move. At the same time, "MC_GernIn" would be executed and the slave axis starts to follow. Once "Step 3" is aborted, "MC_Jog" will be stopped and "MC_GearOut" will be triggered. After the Done output of MC_GearOut becomes TRUE, "MC_Stop" is triggered to stop the slave axis. The whole process will be performed repeatly till the contact singnal of "Step3" is OFF.
 - The value of Counter_1 will be increased by 1 for each time the operation being executed automatically.

- Programming with newly-created POUs
- 1. First, create a new POU by right-clicking "Application" to choose "Add Object" and select "POU".





2. Input the name of the new POU in the "Name" field and choose LD language for "Implementation language". When finished, click "Add" to add the new POU.

ame		
DU		
Гуре		
Program		
O Function block	¢	
Extends		***
Implements		. PAR
Final	Abstract	
Accessspecifie		
		<u>u</u>
Method implem	entation language	
Continuous Fun	ction Chart (CFC)	12
O Function		
Return type		474
plementation lang	uage	
adder Logic Diagram	(LD)	*

 The newly added POU would be shown in the project tree, which needs to be added in Task by double-clikcing "EtherCAT_Task". (Function blocks related to axis motion needs to be established in EtherCAT_Task to ensure normal operation of axes.)





nfiguration			
riority (031): 1			
Type			
⊕ Cyclic ~	Interval (e.g. t#200ms) 4		ms 🗸
Vatchdog			
Enable			
lime (e.g. t#200ms)			ms
Sensitivity			
Add Call X Pernove C	all 📑 Change Call 🛊 Move Up 👲 Move	/e Down 👘 Open POU	
NOU NOU	Comment		
\cup			

4. Click "Add Call" on the EtherCAT_Task page.

5. Click "OK" after choosing the newly-created POU.

Text Search Categories				
Programs	Name Application H PLC PRG POU	Type Agalastan ROGRAM ROGRAM	Ongin	
Structured view		√ Insert w	vēh arguments	Insert with numespace prefit
PROGRAM POU				



3_

6. After adding the POU in EtherCAT_Task, "POU" will be shown on the lower half of the EtherCAT_Task page as well as in the project tree. Then click the POU from the tree, which is under the category of EtherCAT_Task.

Devices - 7 X	EtherCAT_Task X
= 🗿 Untitled I	Configuration
 Device (AX-308EA0MA1T) 	
🚜 Hardware Configuration	Priority (0.31):
😑 👗 Network Configuration	
A EtherCAT Filter	Туре
PLC Logic	⊕ Cyclic ∨ Interval (e.g. t#200ms)
= 🔘 Application	
- 📶 Library Manager	Watchdog
PLC_PRG (PRG)	Enable
POU (PRG)	
E Task Configuration	Time (e.g. t#200ms)
EtherCAT_Task	Sensitivity
le POU	autority (
🖻 😂 MainTask	
Dec_prg	
BuiltIn_IO (BuiltIn_IO)	Add Call 🗙 Remove Call 📝 Change Call 🔹 N
DIO (DIO)	POU Con
Delta_LocalBus_Master (Delta LocalBus Master)	al pou
EtherCAT_Master_SoftMotion (AX-308 Series EtherCAT Master SoftMotion)	E 100
ASD_A2_E (Delta ASDA-A2-E EtherCAT(CoE) Drive Rev4_SM)	
SM_Drive_ETC_Delta_ASDA_A2 (SM_Drive_ETC_Delta_ASDA_A2)	
SoftMotion General Axis Pool	

7. With ladder logic programming language, add new commands by using the red-circled field marked with 1, while field 2 is for adding required Function or Function Block.

POU x 😂 EtherCAT_Task		ToolBox - 4 X
1 PROFRAM FOU 2 VAR 3 ERD_VAR 4		General Constraints General Constraints Government Gover
	100 % 🕅	Execute Boolean Operators
		Other Operators Function Blocks Ladder Elements POUs
	▶ + Q. 100 % Ø	



8. Click on the desired place to add new commands on POU page, then select .



9. After the selected command is shown in the POU, click "???" to enter the name of instruction variable then press ENTER key to continue with the "Auto Declare" page. Click "OK" after checking whether "Type" is correct.

	PSMC_AP_STEPOMS		Step time = t=0s	
	MSMC_VP_STEPOMS			
Step1				
	-			
	Auto Declare	×		
	Scope Name Type			
	VAR Step 1 BOOL	~ >		
	Object Initialization Address PLC_PRG [Application] ~			
	Flags Comment			
	0			
	\checkmark			
EtherCAT_Task	POU X			
PROGRAM P	20			^[]
Step1	: BOOL;			L
END VAR				100 96 100
				100 % [94 9



10. Then add the ouput instruction by clicking on the desired place and choosing

File Edit View Project FBD/LD/IL Build	Online Debug Tools Window Help 실 🖡 🐄 🐄 🖄 🔛 🕜 🖂 🕸 🕼 💡 🗃 🖄 (고려 가려 가장 이 📰 전		
🖀 a la la la a a a a a a a a a a a	900+mmili##用新工业在文		
Devices	• 9 X 🔮 EtherCAT_Task 🔮 POU X	- TooBox	- 4
Chatter (Al-Solo Configuration Configuration A National Configuration A National Configuration Conf			al Network Box Box with DN/DNO Assignment
PLC Logic Que	Jiesi	+ 	Jump Return Input Branch

11. Click "???" to enter the name of instruction variable then press ENTER key to continue with the "Auto Declare" page. Click "OK" after checking whether "Type" is correct.

stepi					····
		₽			
Stepi					Servo_ON
		仑			
	Auto Declare	•		×	
	Scope	Name	Туре		
	VAR	Servo_ON	BOOL	~ >	
	Object POLI [Application]	Initialization	Address		
	Flags CONSTANT RETAIN PERSISTENT	Comment		-	
			OK	Cancel	

12. The instruction names you have added previously will be displayed as well as the instruction types, where the name and type of the instruction can also be added directly. (Same operation for the examples in later discussion.)







14. Click "???" and insert the name of function block then press ENTER to display the function block. Insert the name and press ENTER key again, then "Auto Declare" window will pop up. Click "OK" after confirming the "Type" of function block is correct.





15. Continue to click "???" and insert "TRUE", then press the ENTER key.





16. Insert the name of servo drive to the Axis input pin of the function block and delete "???" of other pins, since the mark "???" does not represent any variables and errors may occur while parsing.





3

17. Use the same operation to create "DFB_HCnt" function block after "MC_Power" has been created.

1		
	Step1	Servo_O
		())
2	MC_Power_0	
	TRUE MC Power	
	EN ENO	
	SM_Drive_ETC_Delta_ASDA_A2 - Axis Status -	
	TRUE Enable bRegulatorRealState	
	Servo_ON — bRegulatorOn bDriveStartRealState -	
	INCE	
	ErrorTD	
	ETIGID	
3	DFB_HCnt_0	
	IROL DFB HCnt	
	HCounter bValid 222	
	-bEnable bBusy-	
	bError -	
	ErrorID -	
	diCounterValue -	

18. Navigate to "BuiltIn_IO" > "IEC Objects" > "Variable" and enter the encoder's name "Counter_0". The name of each newly-added encoder axis will be shown here.





19. Insert the name of encoder to the Counter input pin of the "DFB_HCnt" function block and delete "???" of other pins, since the mark "???" does not represent any variables and errors may occur while parsing. (To enable the counter function, the function block "DFB_HCnt" is required.)





20. Add "MC_Home" function block to make real axis performs homing, while "DFB_PresetValue" is required for encoder to return the counter value to zero.



21. When the encoder axis is taken as the master, insert "Encoder_Axis" to the Master input pin of "MC_GearIn".







22. The counter value of DFB_HCnt is converted between unit and pulse counts, according to the parameters set for Encoder_Axis as shown below.

Encoder Type:	Incremental Encoder	M	udulo: 360	Kotary Axis Unit]
Transmission Mechar Mechanism Type	nism Round Table ~	(4) (4) (4) Movement of [Unit]	ng ulse per motor rotation: 2500 istance per motor rotation: 36	(Pulse) 0
1		Gear Box		
		Corre Datio	(2) Gear ratio numerator	1
V V	(3)	Gear Katio =	(3) Gear ratio denominator	1

23. Use MC_GearIn to make the real axis follow the encoder. MC_GearOut is executed when 'Step3" being turned off. Then the slave axis moves at a constant speed after being decoupled. Finally, use the function block "MC_Stop" to command a motion stop to the axis.

/ 💾 P	00	×	
7		MC_GearIn_0	_
		IRUE MC_GearIn	
		EN ENO	
		Encoder_Axis Master InGear	
		SM_Drive_ETC_Delta_ASDA_A2Slave Busy	
		- Execute CommandAborted -	
		360 — Deceleration	
		Jerk	
8		MC GearChit 0 MC Stop 0	
		TRUE MC GearDut MC Stop	
		SM_Drive_ETC_Delta_ASDA_A2 - Slave Done SM_Drive_ETC_Delta_ASDA_A2 - Axis Done	
		-Execute Busy MC_GearOut_0.Done Execute Busy	
		Error - 360 Deceleration Error -	
		ErrorID - Jerk ErrorID -	
9			
		Step3 MC_Home_0.Done Auto	
10			
		Auto MC_Gearin_0.Execut	e
11			
		MC GearIn 0.Execute MC GearOut 0.Execut	e
			-
		u~~u	



3

3.5.3 Program Monitoring

When running a program, the current control status of system can be monitored and part of the device values are allowed to be modified for system testing as well.

3.5.3.1 Setup Connection between Devices

1. Double click on "Device". (The default IP address for AX-308E is 192.168.1.5)



2. Choose "Scan Network" on the Device page.

Communication Settings Scan Netwo	ork Gateway + Device +			
Applications	can Netw		1000	
Backup and Restore				
iles		•		
og	Gateway-1	-	[0003.A00E.A005] (active)	-
LC Settings	IP-Address: localhost		Device Name: AX-308EA0MA1T	
LC Shell	Port		Device Address:	
sers and Groups	1217		Target ID:	
ccess Rights			16F7 0313	
ymbol Rights			4102	
untime Clock Configuration			Delta Electronics	
ystem Parameters			Target Version: 3.5.15.11	
ask Deployment				
tatus				
nformation				



3. After the "Select Device" window pops up, select the "AX-308E" device and click on "OK".

elect Device			
Select the network path to the controller:			
🖻 💏 👝 Gateway-1 (scanning)	Device Name:	^	Scan Network
AX-308EA0MA1T [0003.A00E.A005]	AX-308EA0MA1T		Wink
	Device Address:		Control of
	0003.A00E.A005		
	Block driver:		
	UDP		
	4		
	Serial number:		
	RTS-c7a8ccc74852337c		
	Taunat ID:		
	16F7 0313		
	! · · ·		
		_	
		ОК	Cancel

4. When the device is connected with your PC, information of the device will be displayed as shown in the following figure marked by the red box.

ommunication Settings Scan N	etwork Gateway + Device +	
oplications		
ackup and Restore		1
les		
g	Gateway-1	[0005, 4005, 4005] (active)
.C Settings	IP-Address:	Device Name:
.C Shell	Port	Device Address:
sers and Groups	1217	0003.A00E.A005
ccess Rights		16F7 0313
mbol Rights		Target Type: 4102
untime Clock Configuration		Target Vendor: Delta Electronics
stem Parameters		Target Version: 3.5.15.11
isk Deployment		
atus		
formation		



3.5.3.2 Process Monitoring and Control

1. The correctness of EtherCAT communication should be checked before program monitoring starts. After confirmation, double click on "EtherCAT_Master_SoftMotion".



2. Choose "Browse" after entering the EtherCAT_Master_SoftMotion page.

General	Autoconfig Master/Slave	s		EtherCAT.
Sync Unit Assignment	EtherCAT NIC Setting			
Log	Destination address (MAC)	FF-FF-FF-FF-FF	Broadcast	Enable redundancy
EtherCAT I/O Mapping	Source address (MAC) Network Name	00-00-00-00-00	Browse	
EtherCAT IEC Objects	Select network by MAC	O Select netwo	ork by name	0
Status	Distributed Clock		D Options	



3. Select EtherCAT port "cpsw1" and click "OK".

AC address 4006A0D651B4	Name cpsw0	Description			
4006A0D651B6	cpsw1	CPSW END	5		
			1		

4. After finish choosing network adaptor, the setting value of Source address (MAC) is displayed.

General	Autoconfig Master/Slaves	EtherCAT.
Sync Unit Assignment	EtherCAT NIC Setting	
Log	Destination address (MAC) FF-FF-FF-FF-FF-FF	Broadcast 🗌 Enable redundancy
EtherCAT I/O Mapping	Source address (MAC) 40-06-A0-D6-51-86 Network Name cosw1	Browse
EtherCAT IEC Objects	Select network by MAC Select network	ork by name
Status	Distributed Clock	D Options

5. Click on the Compile button to verify the correctness of program.





6. Upon completion of compiling, a report message of programming errors and warnings is displayed.

Build	*	O error(s)	😗 0 warning(s)	 0 message(s) 	××
Description					
Build started: Application: Device. Application					
Typity code,					
Compile complete 0 errors, 0 warnings					

7. And then click on 🧐 to perform online monitoring.

	·····································	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		※ 〔回 4回 4回 80 φ ■ 100
Devices	• 9	×	0	
Untitled 1		-		
= Device (AX-308EA0MA1T)				
Hardware Configuration				
😑 👗 Network Configuration				
A EtherCAT Filter				
E PLC Logic				
= 🔘 Application				
Library Manager				
PLC_PRG (PRG)				
POU (PRG)				
E 🗱 Task Configuration				
🗏 🍪 EtherCAT_Task				
- DOU				
🖻 🍪 MainTask				
PLC_PRG				
BuiltIn_IO (BuiltIn_IO)				

8. The program needs to be downloaded after monitoring action is performed. When the download is completed, the status of PLC shows STOP until you click on
and the status would shift to RUN.

Control Description Provide status Configuration Description Configuration A record Configuration Description Configuration Description Configuration D record Configuration Description Configuration Description Configuration Description Configuration D record Configuration D reconfiguration D reconfiguration <th< th=""><th>s • • ×</th><th>a) POU x</th><th></th></th<>	s • • ×	a) POU x	
C] ence Second (M-2004/strin	Unesied /	Denice Application (VIII)	
Image: Status Configuration A Technol Configuration Image: Configuration	Device [connected] (AX-308EA0MA1T)	And an one of the second se	
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• (a) Activate • (b) Market Markow • (c) Markow	A EtherCAT Filter	JE 10	noming us
Image: A second states Image: A second stat	= DI PLC Lopic	101	0.0
Istract Nervoe Istrac	= C Application [stop]	MC Roma O	
<pre>B Sc_Dec (Pac) B Sc_Dec (Pac) B Tab Comparison B Tab</pre>	- Drary Manager	TRUT	
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Bonta 2 OF Street Train Bonta 2 OF Street Tra	e) pou (rec)	SM Drive ETC Deits ASDA AZ - Axis Donn - 222	
	- 29 Task Configuration	Reminer ON 277 - Exemption Figure 222	
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CPB_PresetValue_0	(D) PLC PRG		
Image: Solution (No. 200) I	C - Fill B atto 10 (B atto 10)		
0 Image: Subtract Intervent	(100) (100)	. DFB_FFERETVAIUE_0	
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1 490 m MP CommoNALADOPado 777 1 491 m Mana at tar Array = 727 777 1 491 m Mana at tar Array = 727 777 340 Array = 727 777 777 350 Array = 727 777 777 350 Array = 727 777 777 350 7700 7700 7700 7700		SM_Drive_ETC_Delta_ASDA_A2 Slave Susy - 277	
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272 -ver.k 8 HC_664708t_0 75/27 MC_664708t_0 10/27 MC_664708t_0 25 MC_664708t_0 10/27 MC_664708t_0 10/27 MC_664708t_0 10/27 MC_664708t_0 10/27 MC_664708t_0 10/27 MC_664708t_0		360 00000000000	
8 NG_G6451081_0 NG_G6451081_0 NG_G650_0 NG_000_0 NG_000_0 NG_000_0 NG_000_0 NG_000_0 NG_000_0 NG		777 Jexk	
MC_destriat_0 MC_destriat_0 TNUE MC_destriat_0 ZN ZN			
TXXXX MC_Stacpt 200 LL[3] [107:8]		BC_GearOut_0	MC_Stop_0
EN 2300 EN 2300 EN 10 50 EN 10		THUE MC GenerOut	MC_Stop
		EN 230	EN ENO



9. When the PLC is in the RUN mode, the status would be displayed as RUN at the bottom of the page and the program is ready to be executed.



10. Double click on "Step 1" and the icon vill be shown.





11. Right click on "Step 1" to select "Write All Values of 'Device.Application" and all the corresponding status will be filled in, which can also be performed by using the shortcut key **Ctrl + F7**.



12. After activating "Step 1", Servo ON changes to TRUE as well as activating the encoder. (Same operation to execute the following programs.)

e-Application.POU	
Step1	Servo_C
MC_Power_0	
SM PILEONET	
TRUE Enable bRegulatorRealState TRUE	
IBUE bDriveStart Busy TRUE Error ZAISS	
ErrorID - [SMC_NO_ERR]	
DFB_HCnt_0	
Servo_ON_TRUE	
ErrorID DEB_HSIO_N	
dicountervatue 0	


13. Make the axis start homing and change the encoder value to zero by activating "Step 2".

POU		
Device A	Application.POU	
4	Step2 MC_Power 0.Status	Homing ON
5	MC_Home_0 TRUE MC_Home SM_Drive_ETC_Delta_ASDA_A2 Homing_ON TRUE Execute Busy Position CommandAborted Error ExrorID ExrorID ExrorD	
6	MC_SetPosition_0 TRUE MC_SetPosition EN C_SetPosition EN	

14. After activating "Step 3" and just to rotate the encoder, the slave axis will start to follow. Once "Step 3" is aborted, "MC_GearOut" will be triggered. When the Done output of MC_GearOut changes to TRUE, "MC_Stop" is triggered again. (After being decoupled, the slave axis will move at the current velocity, which needs "MC_Stop" to stop its movement.)

tention POU		
upplication.POU		
TOUS	MC_GearIn_0	
INOS	MC_GearIn	
Encoder	Axis Master InGear - TR	E
SM Drive ETC Delta ASD	A A2	E
	RUE Execute CommandAborted - FAN	55
	1 - RatioNumerator Error - DAM	SE
	1 - RatioDenominator ErrorID - SMC	NOERR
	360 — Acceleration	
	360 Deceleration	
0	Jerk	
1.	MC_GearOut_0	MC_Stop_0
TRUE.	MC_GearOut	MC_Stop
SM Deine FTC Deite ASD	EN ENO	EN ENO
SM_DEIVE_EIC_DEICA_ASD	ALSE Evecute Busy FALSE MC	GearOut 0 Done FAISE Evecute Busy - FAISE
	Error - FALSE	360 Deceleration Error FALSE
	ErrorID - SMC_NO_ERR	0 - Jerk ErrorID - SMC NO ERR
Step3 MC_Hom	0.Done	A
2000		NG George O
Auco		MC_Gearin_0.
U		
MC_GearIn_0.Execute		MC_GearOut_0



3.5.3.3 Monitor with Trace Tool

To monitor the status of input/ output pins and axes with Trace function while executing the program, navigate to "Application" > "Add Object" > "Trace". Then you'll open the "Add Trace" window.





1. Insert the name of Trace then click "Add" on "Add Trace" window.

Add Trace	×
atool to m	onitor variables graphically.
Name of the Trace	
Trace	←
	Add Concol
	Add Calicel

2. After the Trace is successfully added, it will be shown on the project tree on the left side of the screen. Then double click on "Trace" to open the Trace page.





3



3. Click "Configuration" on the Trace page to open the configuration window.

4. Select "EtherCAT_Task" from the drop-down list of Task on the Trace Configuration window.

Trace Becord	Record Settings	
Trace	Enable Trigger	
	Trigger variable +	
	Trigger edge	
	nigger edge	
	Posttrigger (samples	
	Trigger Level	
	Task O	×
Descentation (diagrams)	Record condition	
Time avis	Commant	
B Diagram 1	Commenc	
- Y axis		
Shown variables	Resolution ms 🗸	
	Automatic restart	
	Advanced	
dd Variable	Advanced Reset Display settings	





5. After finishing configuration, click "Add Variable" on the Trace page to open the Trace Configuration window.

6. Click the button is on the Trace Configuration page to add the required trace variables or traceable parameters. After the Input Assistant window is opened, expand POU on the tree and select "Step 1" then click on "OK".

			Text Search Categories				
Trace Configuration Trace Record Trace	Variable settings Variable Graph color / Lae	×	Trace Variables Traceable parameters	Name Application POU Auto Counter_1 Delay M OVC	Type Replication PROGRAM BOOL JVT BOOL DMC Home_P	Address	Or ^
Presentation (diagrams) Time axis Diagram 1 Yadis Sovum variables	Une type Point type Point type Point type Point type Point type Point P				BODI MC_MaveRelative MC_Paner BODI BODI BODI BODI BODI BODI TON		
			Structured view				
dd Variabla	Reset Display settings		Documentation		Insert with arguments	Insert with names	pace prefix
Jelete Variable	OK	Cancel	Step1: BOOL; (VAR)				,
						OK J	Sancel



7.	Make sure the chosen	variable is shown	n in the variable field o	of variable settings ar	d then click "OK".

Trace Record	Variable settings			
- Trace	Variable	POU.Step1		
POU.Step1	Graph color	Blue	~	
	Line type	/ Line	~	
	Point type	• Dot	~	
	Activate minimum warning			
	Critical lower limit	0		
Presentation (diagrams)	Warning minimum color	Black	~	
 Time axis Diagram 1 	Activate maximum warning			
Y axis	Critical upper limit	0		
POU.Step1	Warning maximum color	Red	~	

8. Afterwards, the added variable will be shown on the right side of the Trace page.







9. Right click on the Trace and select "Download Trace" to start monitoring.

10. In case that there're more than one variable or parameter need to be monitored, you can just right click on the scope and select "Convert to multi channel".





11. After choosing "Convert to multi channel", two data-recording oscilloscope of the two chosen variables added on the right will be displayed on the page.



12. Repeat the above steps to add more required trace variables and traceable parameters.







13. While a program is running, you can observe trigger events and the current position of axis as well as the velocity via the data-recording oscilloscope.

Introduction of the process shown on the scope:

- ① Activate "Step 1" to enable the axis and the encoder.
- ② Activate "Step 2" to make the real axis perform homing and return the counting value of encoder to zero.
- ③ MC_GearIn will be triggered after activating Step3 and command the axis controlled via EtherCAT to follow the encoder axis. Once the master axis rotates, the slave axis will starts to follow the master axis.
- MC_GearOut is triggered after "Step 3" is deactivated. When the Done output of MC_GearOut shifts to TRUE, MC_Stop
 is triggered to command a deceleration stop to the slave axis.



3

MEMO

