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



Delta Robot Automation Studio (DRAS) User Guide

www.deltaww.com



Preface

Thank you for choosing this product. This manual introduces DRAS (Delta Robot Automation Studio) software suite, including the instructions of the software interface and operation.

The screenshots in this manual are mainly captured from version v1.11.0 and v1.11.1 of the software. The screen images may vary with different versions, and please always refer to the latest version.

This manual includes:

- DRAS Software introduction
- User Interface
- Advanced operations

DRAS Features:

DRAS is a controller software suite, which has integrated multiple functions including status monitoring, parameter editing, scope, tuning, jog and DRL script editing. DRAS provides simple operation interface and guided tutorials. Without complicated procedures, it enables the user to master the software more easily and to control the robotic arm more quickly. The software supports Delta controllers as well as multiple models of DELTA robotic arm, allowing the user to create different robot solutions.

How to use this manual:

This manual can be used as reference while learning DRAS. It contains the information about the software installation, interface introduction, and instructions of how to use the software's functions.

DELTA technical services:

Please consult the distributors or DELTA customer service center if any problem occurs.

Safety Precautions

Before installing and using DRAS, please carefully read through following descriptions, which includes alert messages, error messages indicating machine damages etc. In order to ensure the correct use of this software, please thoroughly read this manual and pay close attention to the notes below.

Pay special attention to the following safety precautions anytime during inspection, installation, wiring, operation and examination.

The symbols of **DANGER**, **WARNING** and **STOP** represent:



It indicates the potential hazards. It is possible to cause severe injury or fatal harm if the instructions are not followed.



It indicates the potential hazards. It is possible to cause minor injury or lead to serious damage of the product or even malfunction if the instructions are not followed.



It indicates the absolute prohibited activity. It is possible to damage the product or product malfunction if the instructions are not followed.

Inspection



Please use the controller and servo motor in accordance with the instructions specified in this manual. Otherwise, fire or machine breakdown might occur.

Wiring



- Please turn on the controller's power before connecting the software's communication cables to the controller. It prevents any incorrect operation of the motor that might lead to hazardous accident.
- Use insulating and shielding wiring materials complying with the standard specification as the software's communication cables. Otherwise, signal interference might easily occur.
- It is suggested that the communication cables' length is within 1.5 m (4.92 ft), or signal weakening might occur.
- To avoid danger, please wiring in compliance with the cables' standard specifications.

Operation



- Before operation, please adjust the parameter setting value according to the requirement. If it is not adjusted to the correct setting value, it is possible to lead to malfunction of the machine or the operation might become out of control.
- Before the machine starts to operate, please ensure that the emergency stop can be activated anytime.
- While monitoring via the scope, please ensure the communication cables are correctly connected. Or the oscilloscope results will be affected.



- While using the function of gain adjustment, do not touch the motor's shaft with hand or any other hard item.
- Please ensure that the machine stops running before using Parameter editor or Robot setting. Otherwise, unpredictable hazards might occur.
- When the user is about to use the functions of Jog or Robot setting, please make sure that no people or any unexpected object is around the machine before operating. Or it is possible to cause personnel injuries or machine damages.
- It is strongly suggested that during the software setting or trial run, do not disconnect the communication cable while the machine is running. Such abruptly action might cause unpredictable hazards.
- To avoid any accident, please ensure the software's parameter, monitoring and debugging functions are set correctly before conducting the initial trial operation.
- When using the software's triggering function to adjust and test the servo motor and drive, please ensure the operator, who is responsible for adjusting and setting, stays near the machine. Stop all triggering settings in the software when leaving the machine unattended. Otherwise, unnecessary hazards might occur.

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DRAS Introduction

1

This chapter provides relevant information of DRAS software, including general introduction to the software and its usage.

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1.1 DRAS Introduction

Delta Robot Automation Studio (DRAS) is a controller operating software suite, which has integrated multiple functions including status monitoring, parameter editing, scope, tuning, motion controlling, and motion simulation. DRAS enables the user to quickly master the usage of the controller and to create comprehensive motion control procedures. Below is the splash image of DRAS.

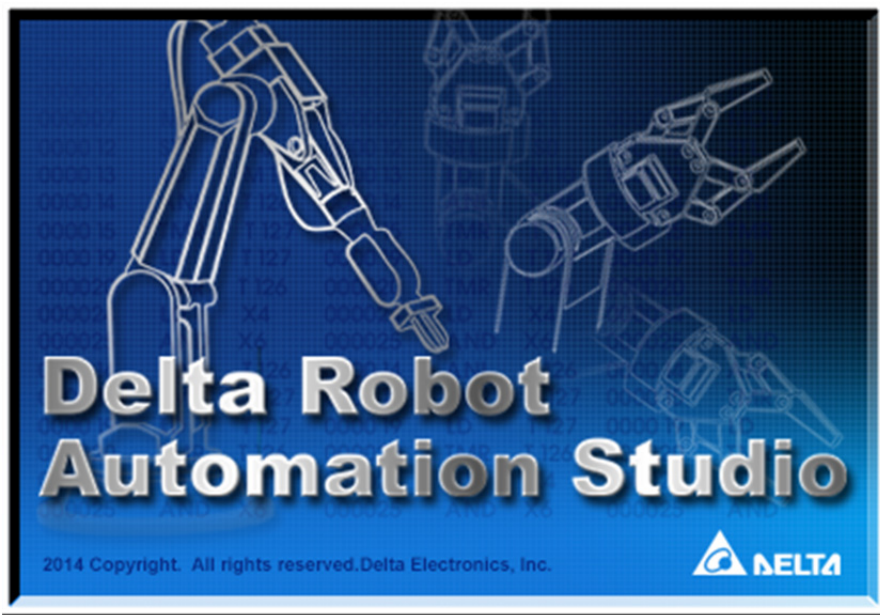


Figure 1.1.1 Splash image of DRAS

1.2 System Requirements

■ Hardware requirements

1. Pentium 1 GHz or higher.
2. 1 GB RAM or more.
3. At least 150 MB available hard disk space.
4. Ethernet card supporting windows operating system.

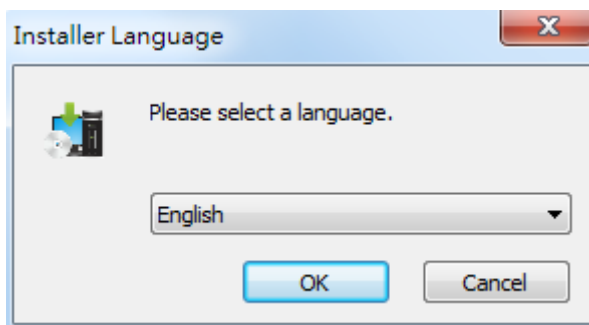
■ Software requirements

1. Windows XP (32 / 64 bit), Windows 7 or Windows 8 operating system.
2. Microsoft .NET Framework 4.0 or later version.

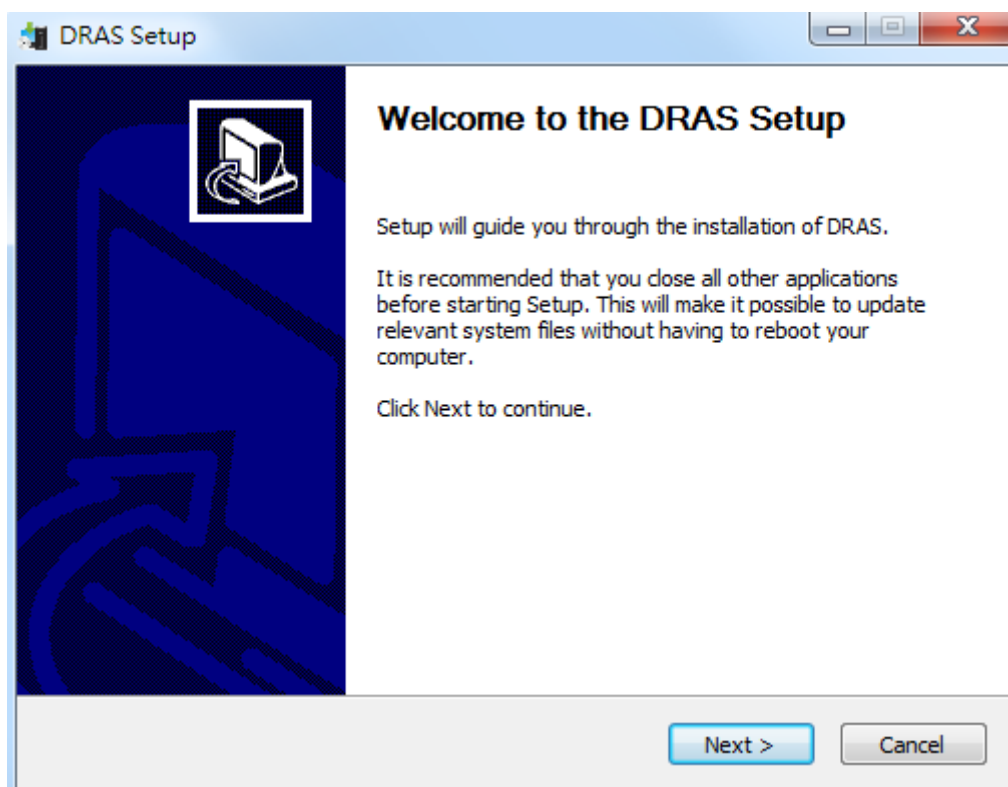
1.3 Installing and Uninstalling DRAS

- **Installing DRAS**

Step 1: Select language for the installation program.



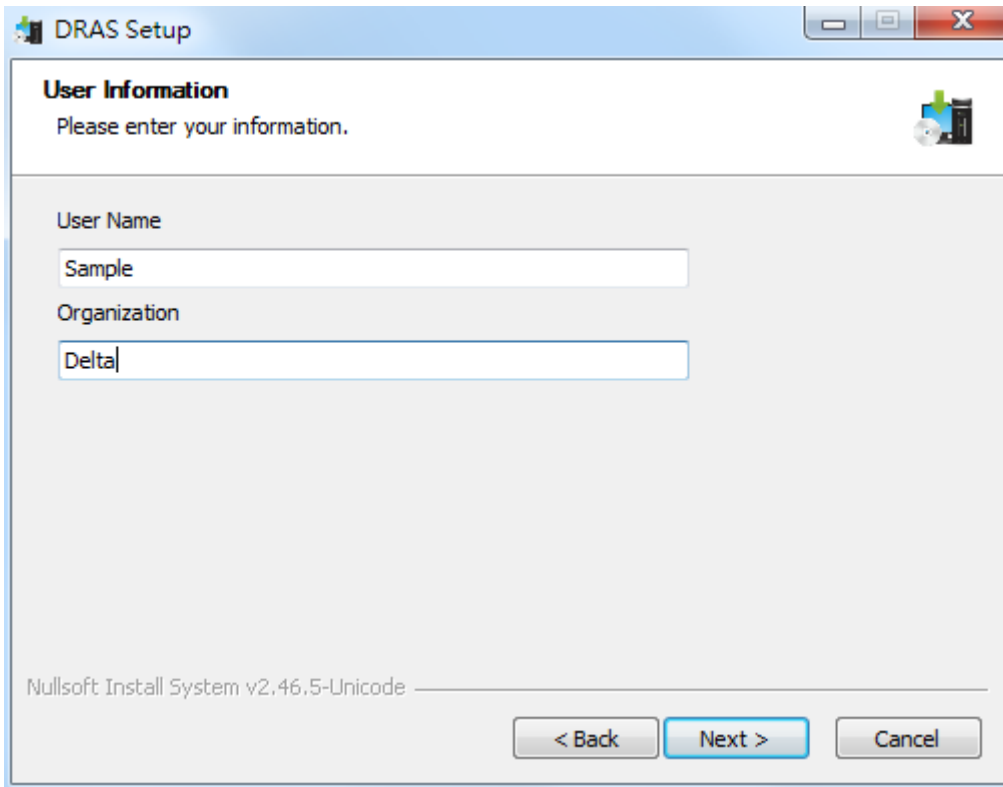
Step 2: Install DRAS in accordance with the instructions of DRAS Setup wizard.



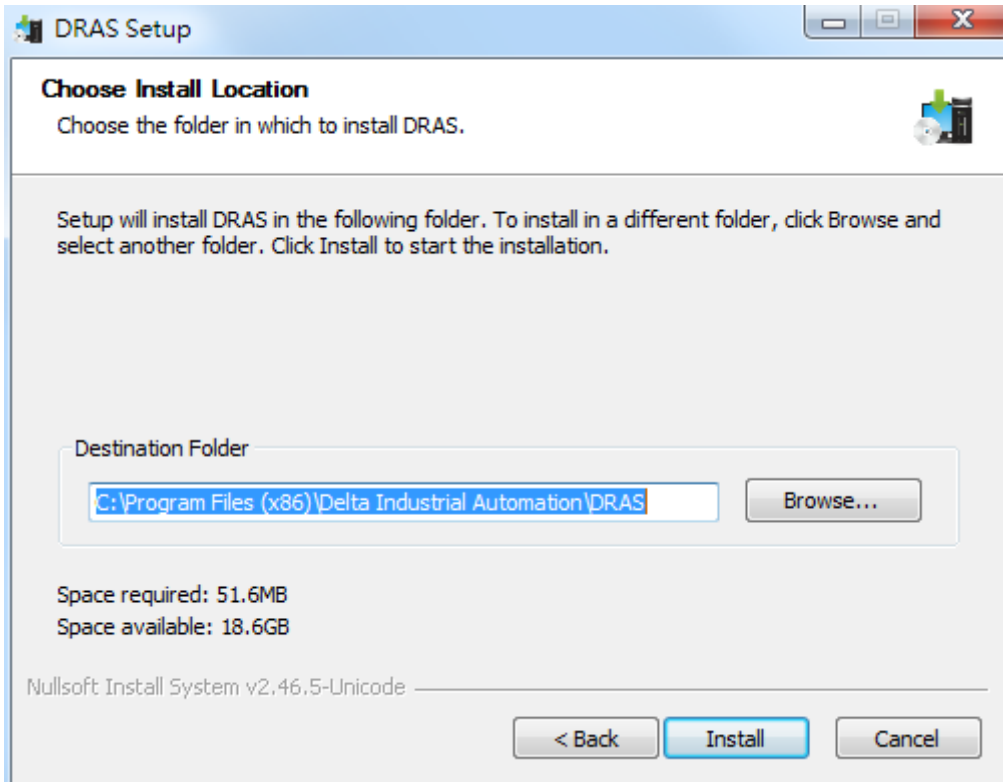
1

Step 3: Enter user information.

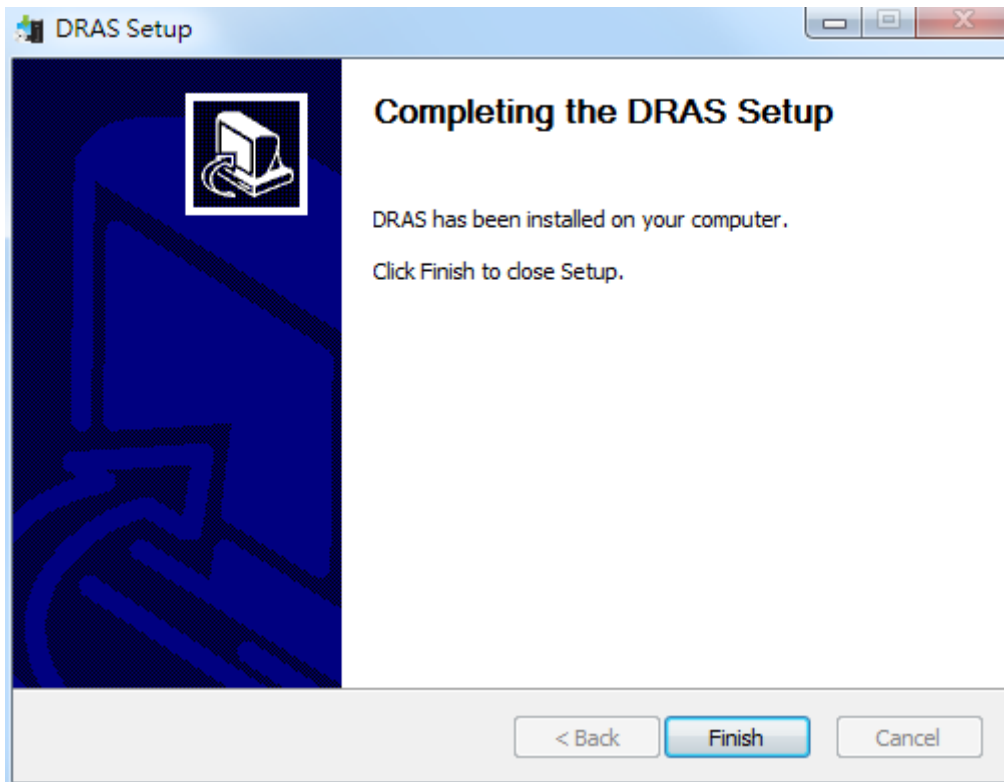
1



Step 4: Select the destination folder for DRAS installation.



Step 5: Click **Finish** to close DRAS Setup wizard.

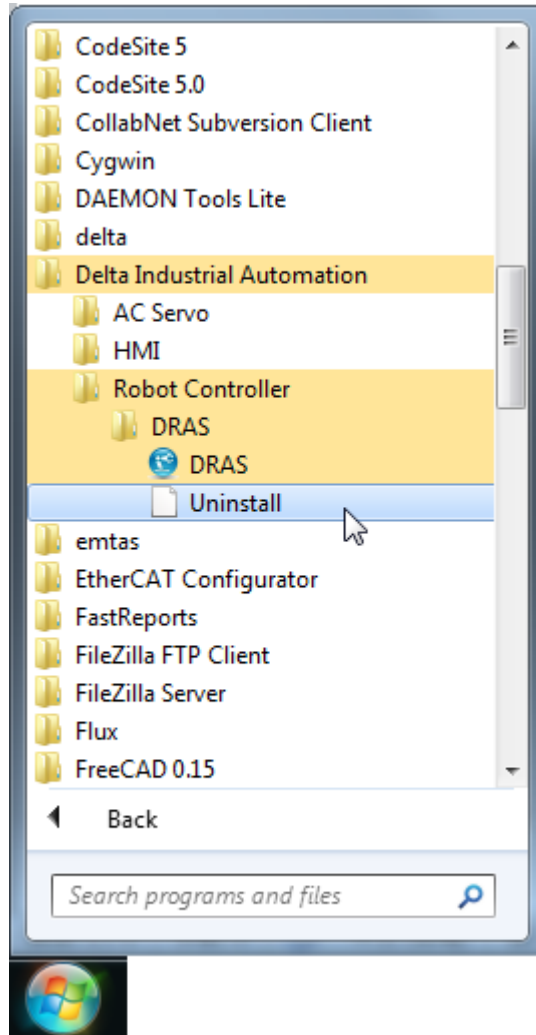


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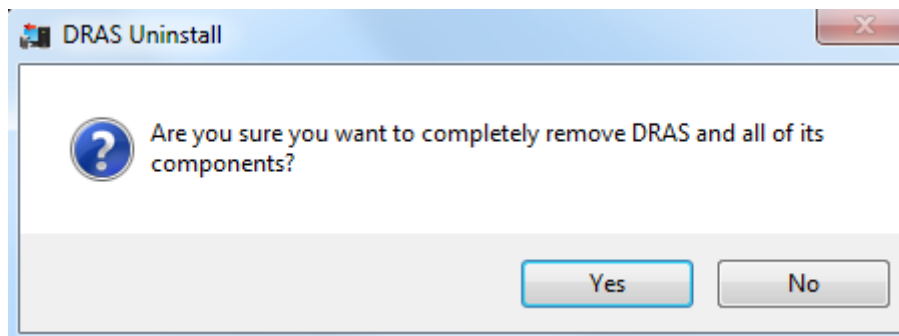
■ **Uninstalling DRAS**

Step 1: Select DRAS folder from windows Start Menu, and then click **Uninstall**.

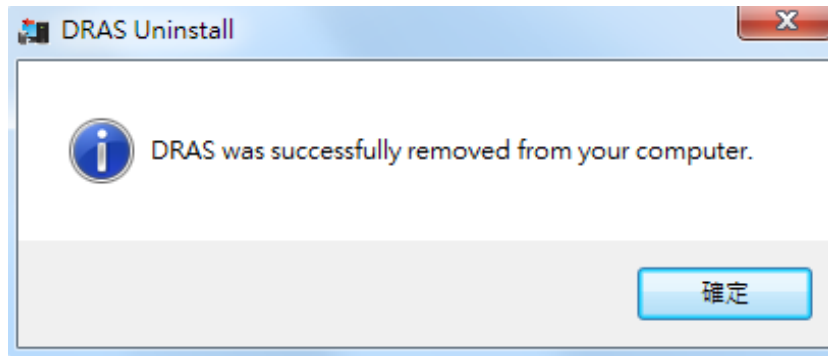
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Step 2: Confirm to uninstall DRAS.



Step 3: Complete uninstalling DRAS



1

1.4 Updating DRAS

Please download the software and updates at Delta website <http://www.deltaww.com/>.

Step 1: Select **Products** on the home page of the website and click **Industrial Automation** from the drop-down menu.



Step 2: Click **Download Center** in the bottom-right corner of the page.

1



Step 3: Select **Industrial Automation** and **Robot Controller with Servo Drive Integrated** and then tick **Software** from **Select Data Types**. Press **Submit**, and the website will start to search for the software and updates.



1.5 Connection Settings

Before operating, DRAS has to be correctly connected to the controller. It is recommended to adopt the connecting method described in section 1.5.1 (connect via Ethernet), which will enable all functions provided by the software.

1.5.1 Connecting via Ethernet

We advise connecting DRAS to the controller via Ethernet, which will allow the user to access all functions of the software. Please refer to the following steps for connection settings.

■ Setting Method

Step 1: Use Ethernet cable to connect PC and controller.

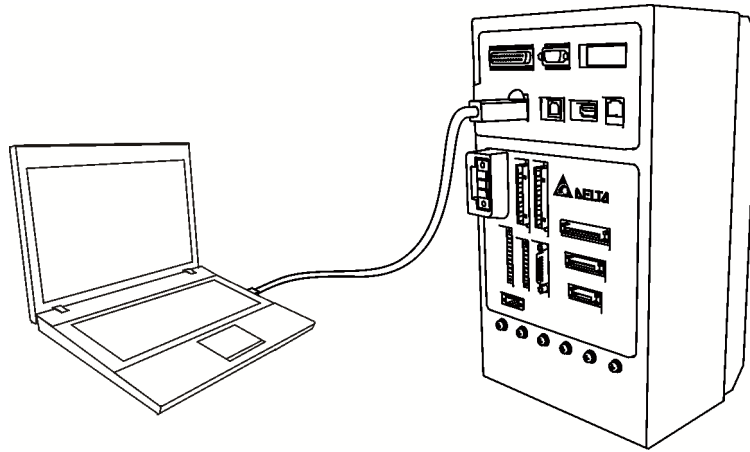
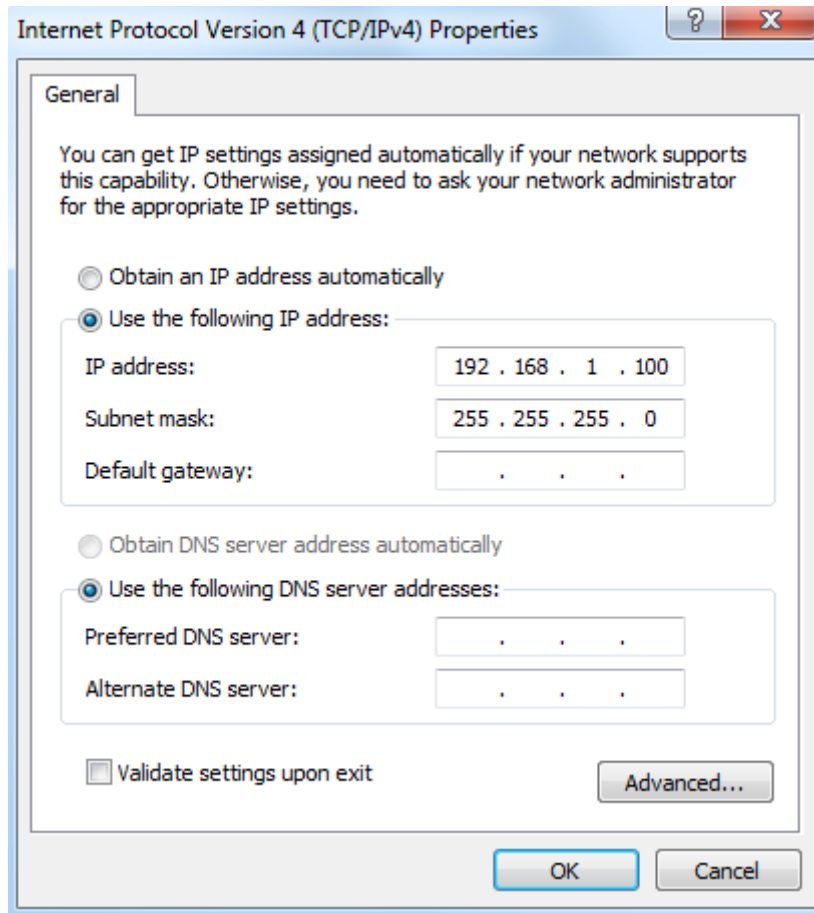


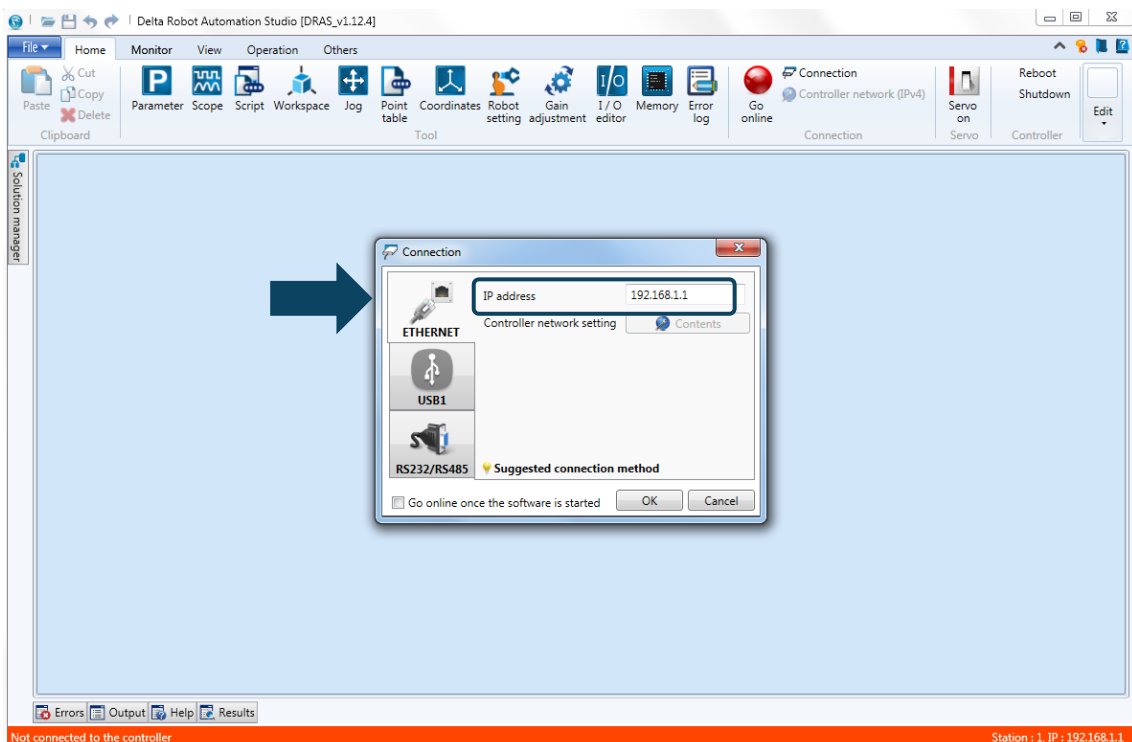
Figure 1.5.1.1 Using Ethernet to connect PC and Robot controller

Step 2: Modify the IP settings of the Ethernet card. The default IP address is 192.168.1.1, which should be changed to the same network of the controller.

1



Step 3: Start DRAS and connect it to the controller. Select **ETHERNET** as the connection method. Then, enter the controller's IP address and press **OK** to connect.

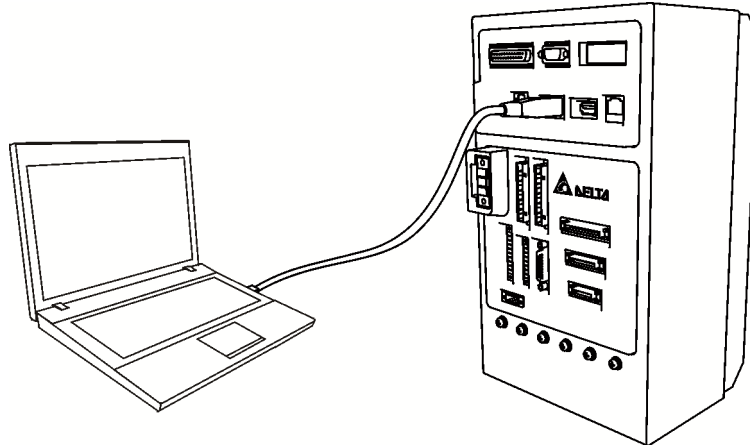


1.5.2 Connecting via USB

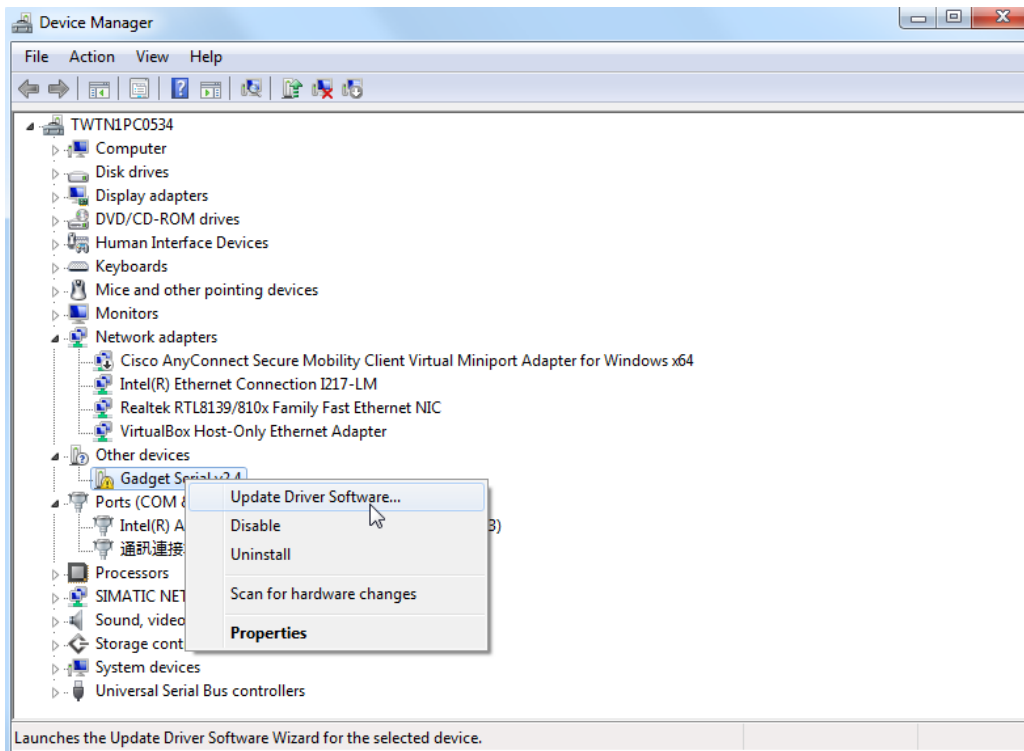
USB connection only supports part of the software functions. If the user wants to access all functions, please use Ethernet as the connecting method.

■ Setting Method

Step 1: Use USB cable to connect PC and controller.

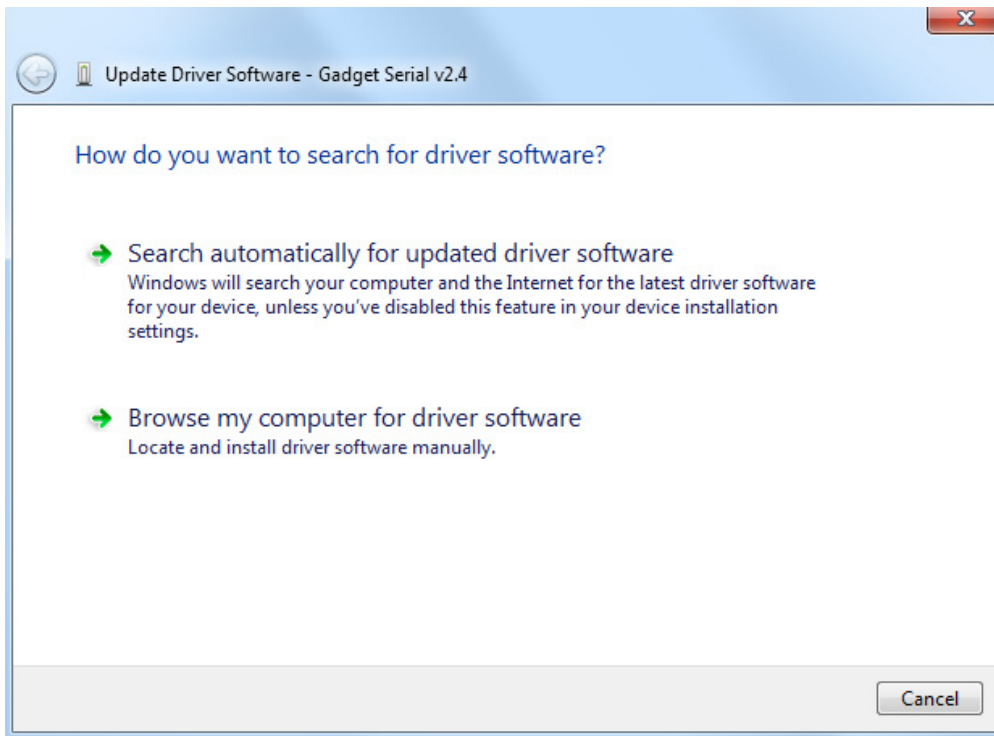


Step 2: Install USB driver software (skip to next step if the driver already installed). Open **Device Manager**, and click **Other Devices**. Then right click **Gadget Serial v2.4**, and select **Update Driver Software** from the drop-down menu.

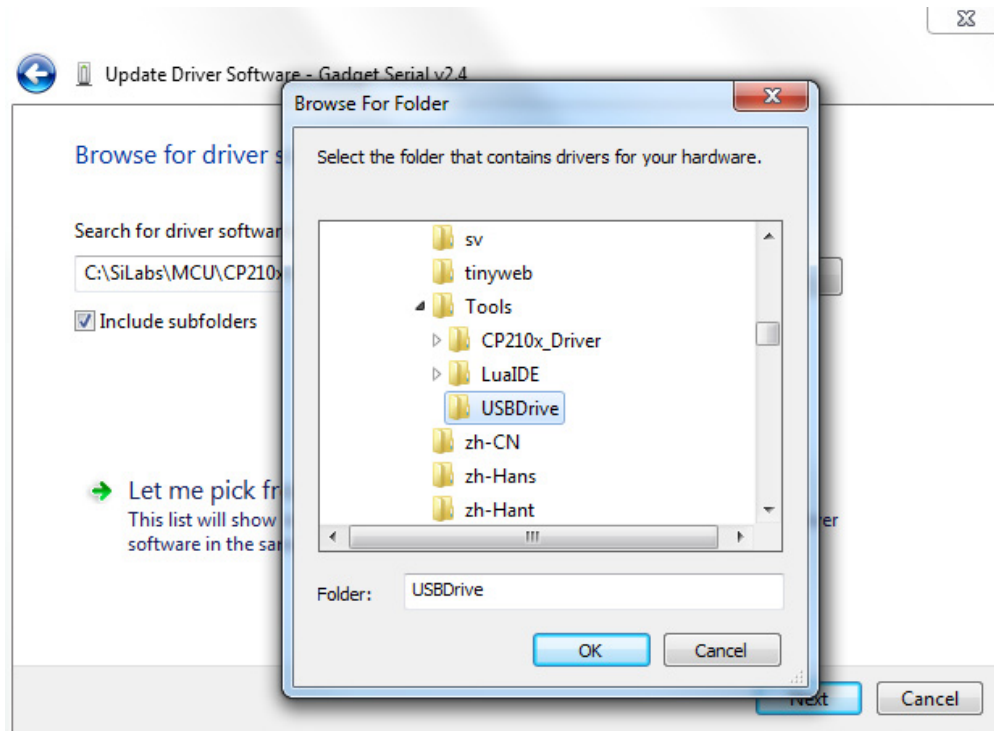


Select **Browse my computer for driver software**.

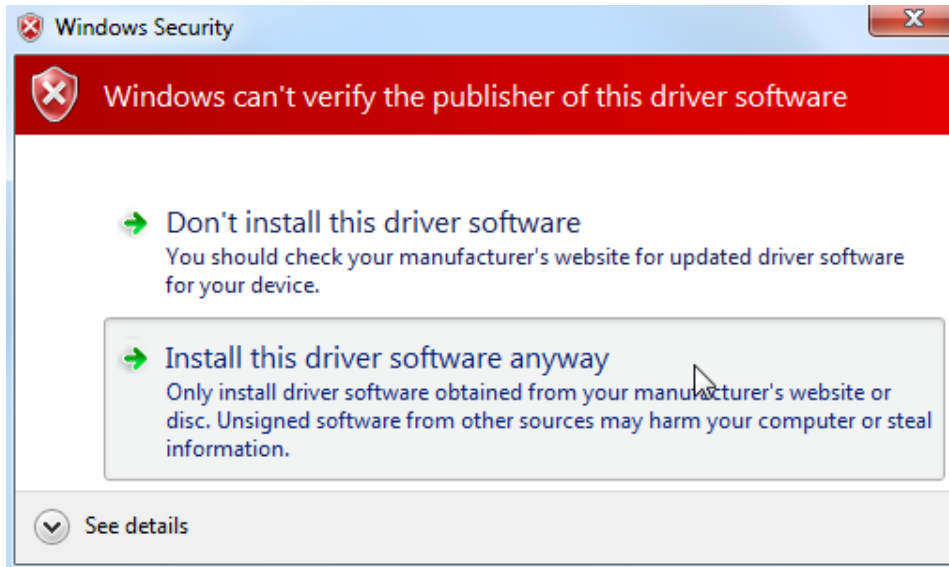
1



Press the **Browse** button to open the folders of DRAS. Then, select **USBDrive** under the **Tools** folder.

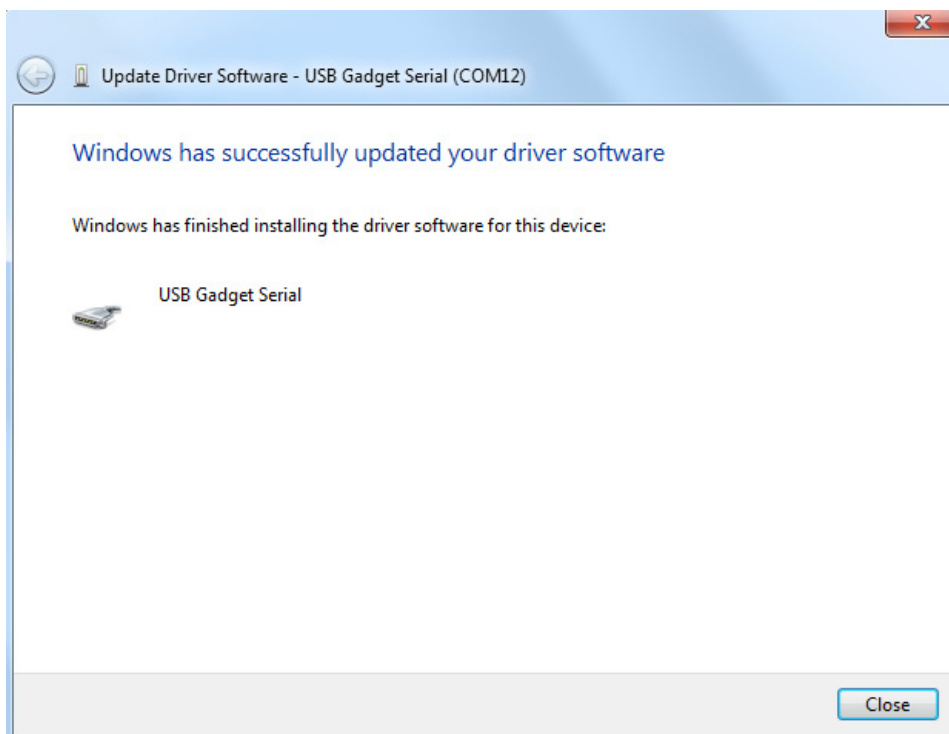


A **Windows Security** window will pop up during the installation process. Please select **Install this driver software anyway**.



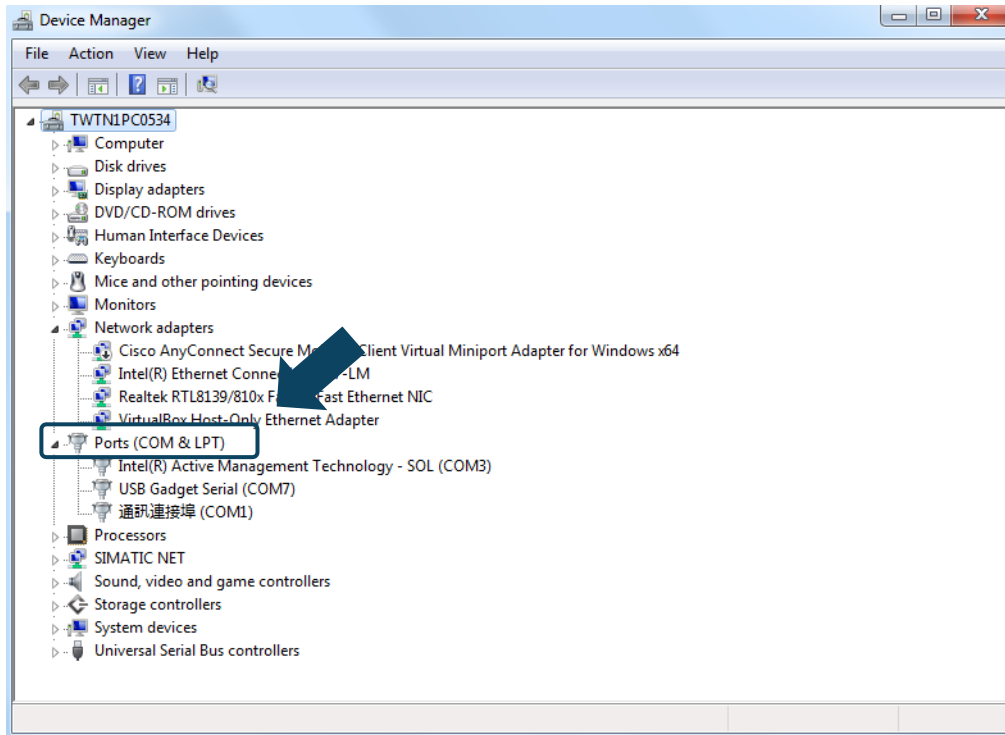
1

When completing the driver installation, a device named **USB Gadget Serial(COM?)** will appear under **Ports (COM & LPT)** in the device manager.

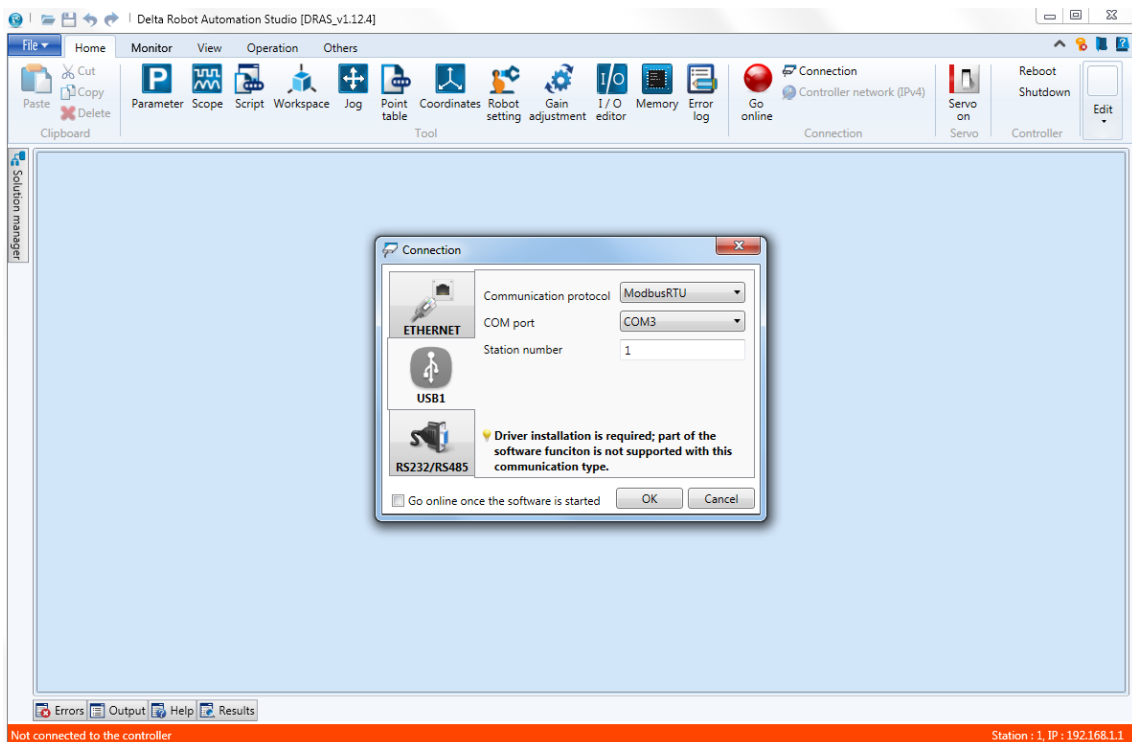


Note: The question mark (?) in **USB Gadget Serial(COM?)** is a variable, which will be automatically specified by PC.

1



Step 3: Start DRAS and connect it to the controller. Select **USB1** as the connection method. Then, specify COM port and Station number (default value is 1) and press **OK** to connect.



User Interface

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You can find detailed descriptions of user interface in this chapter.

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2.1 Start DRAS

Users can double click the DRAS.exe file in Windows File Explorer to start DRAS. If you have already created a DRAS project file (.dras), you can just double click the file to start the software.

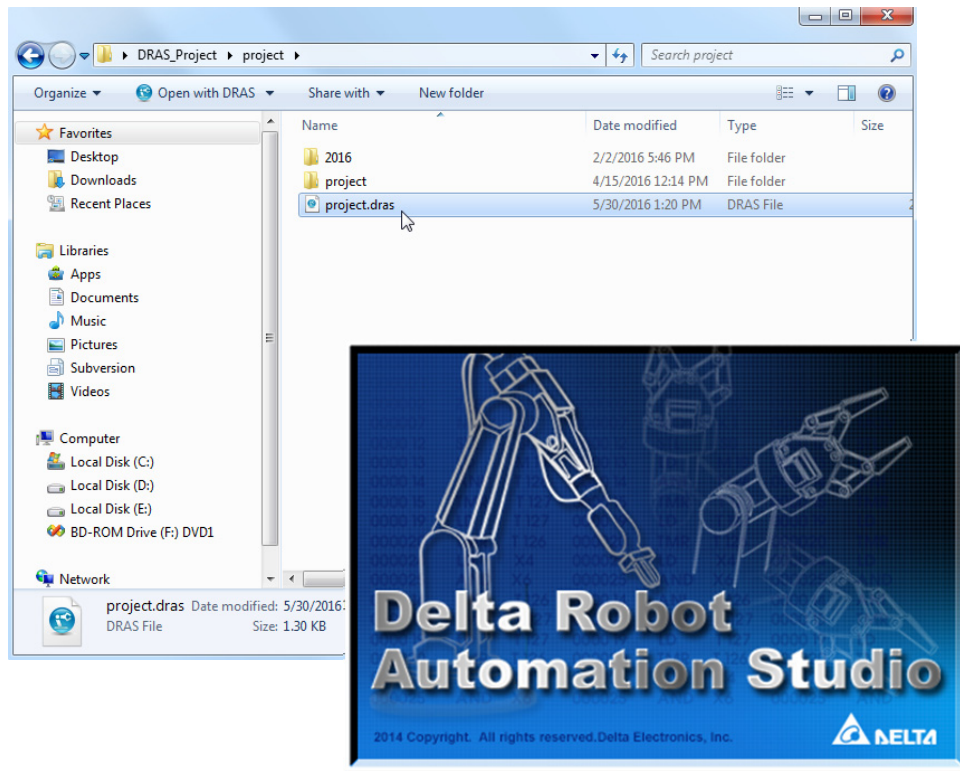


Figure 2.1.1 Double click on project file to start DRAS

2.2 Main Screen

See the main screen is as figure 2.2.1 below. It is divided into 5 sections, Ribbon, Solution explorer, Work area, Auxiliary panel and Status bar. Apart from Ribbon and Status bar, which located on top and bottom of the screen respectively, users can change the size and position for the other three sections. Users can also set Solution manager and Auxiliary panel to auto hide as the screen configuration. See figure 2.2.2.

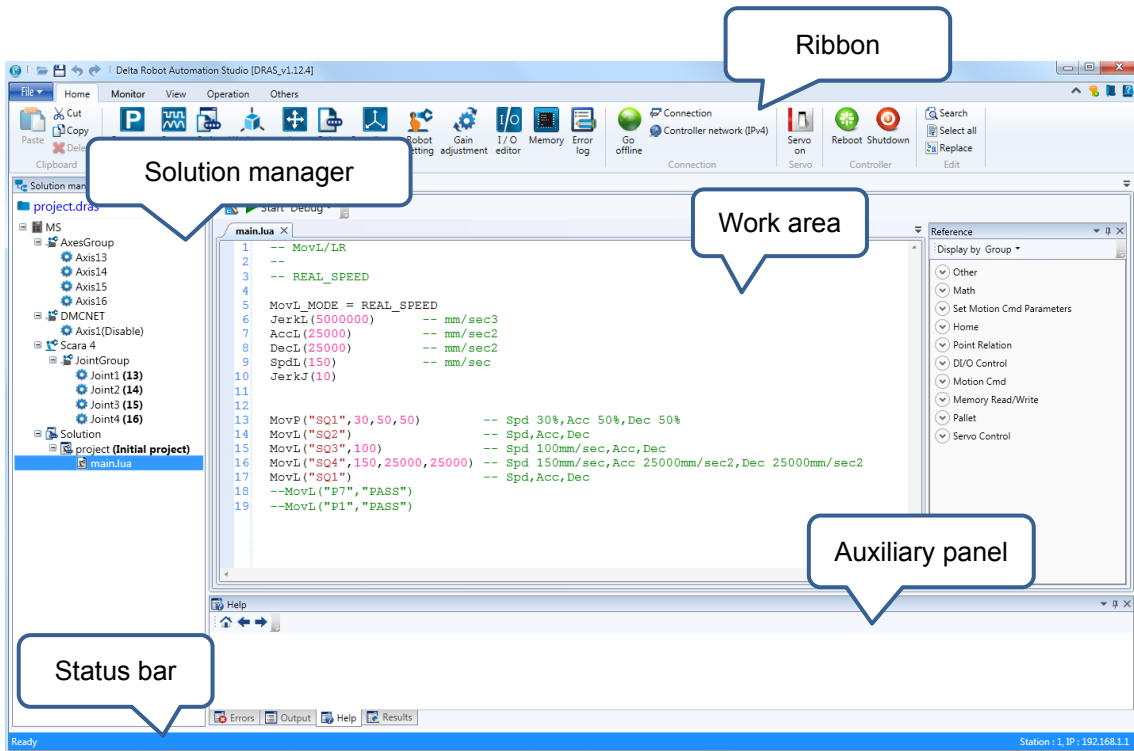


Figure 2.2.1 Main screen

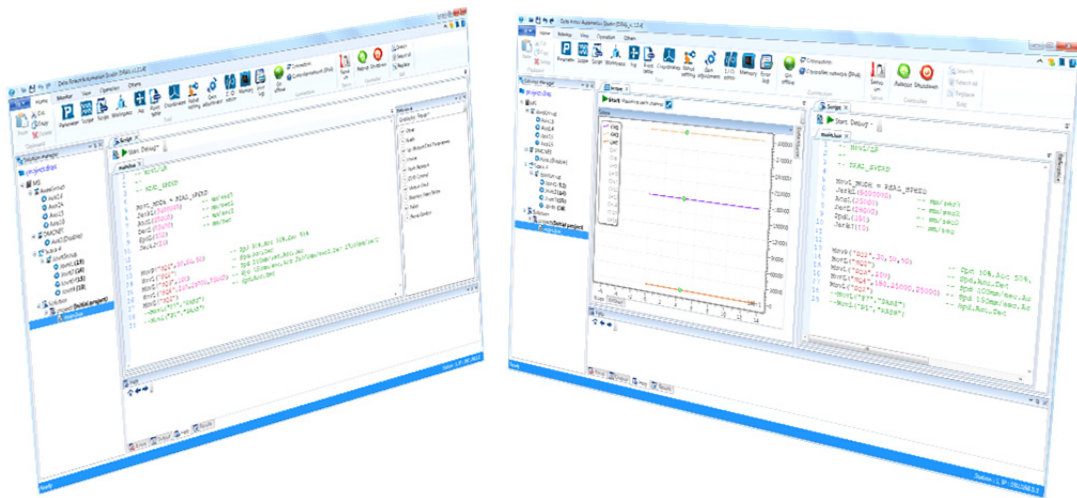


Figure 2.2.2 Users can change the screen configuration

2.3 Ribbon

Functions in Ribbon of DRAS software include Quick access toolbar, Auxiliary area, File list, Home, View, Operation and Others. See further description of each function in next section.

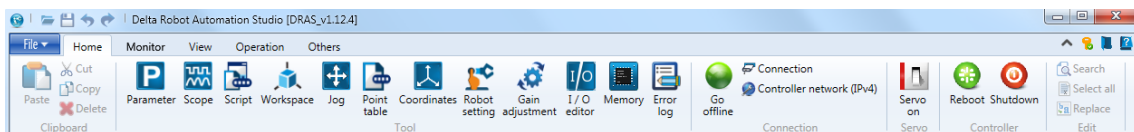
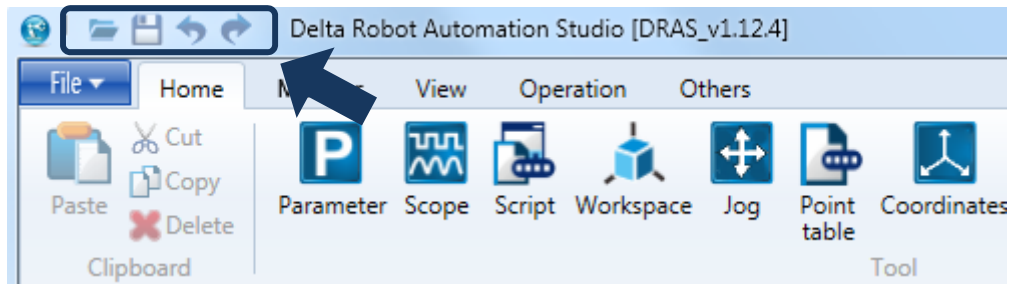


Figure 2.3.1 Menu section

■ Quick access toolbar

Quick access toolbar is in upper-left corner. See the figure below. It includes Open, Save, Undo and Redo function. They all locate on top of the function page you currently used. Please refer to the following table for further information.

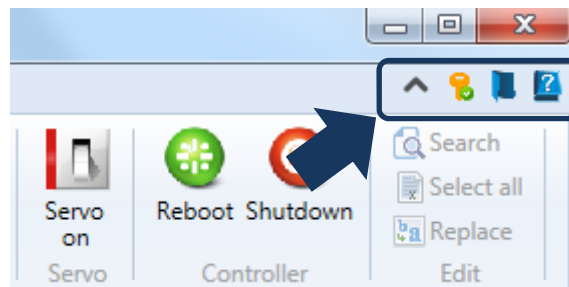


Descriptions of each function on toolbar:

Icon	Name	Keyboard shortcuts	Function
	Open	Ctrl+O	Open a file
	Save	Ctrl+S	Save a file
	Undo	Ctrl+Z	Undo the last action or actions that you made
	Redo	Ctrl+Y	Redo the last action

■ Auxiliary area

Auxiliary area is in upper-right corner. Please refer to the following table for further information.

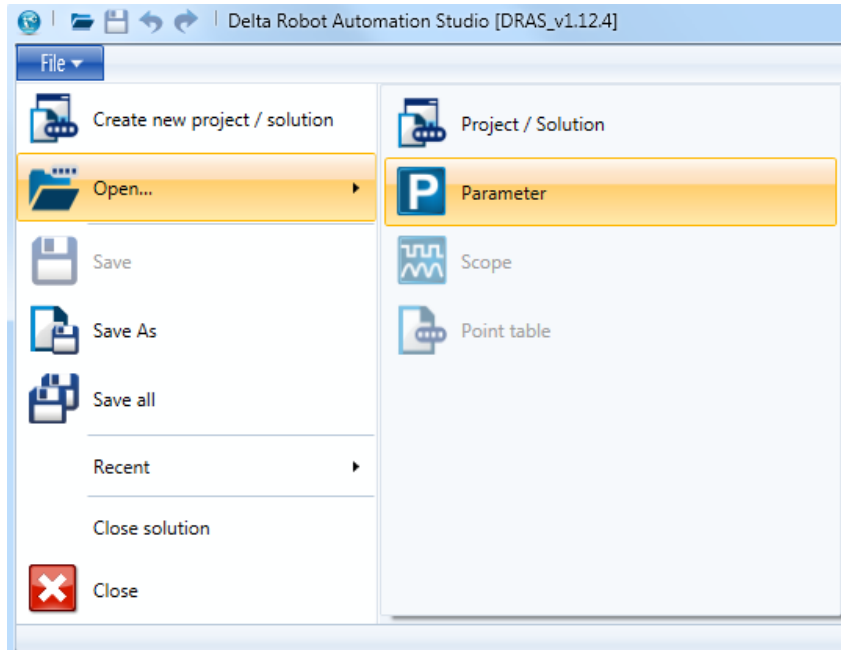


Descriptions of each function:

Icon	Name	Keyboard shortcuts	Function
	Minimized / Display full	-	Minimized / Display the full Ribbon
	Open	-	Open the installation location of DRAS
	Help	-	To open the document for DARS software
	Key verification/unverified	-	Key verification (if it is unverified, some functions are unavailable.)

■ File list

File list manages all files accessing and saving, such as Project/Solution, Parameter, Scope and Point table. See the figure below. Please refer to the following table for further information.

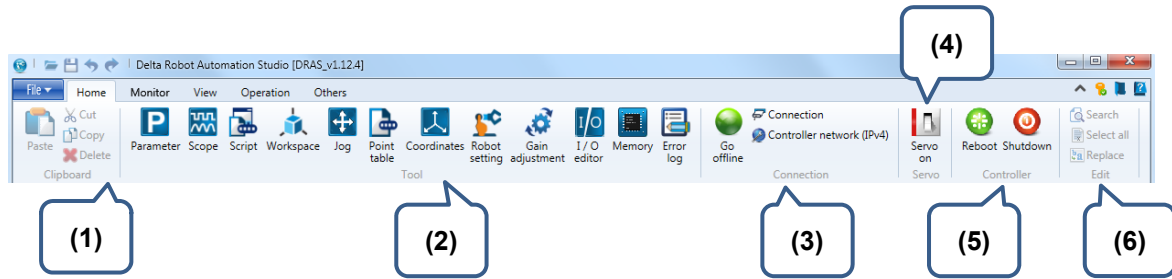


Descriptions of each item in file list:

Icon	Name	Keyboard shortcuts	Function
	Create new project/solution	-	Create new project / solution file.
	Open...	-	Open the existing file, such as project or parameter file.
	Save	Ctrl+S	Save the action that you made.
	Save As	-	Save as the new file.
	Save all	-	Save all files, including current solutions and individual files.
-	Recent	-	Show the project(s) that you recently opened.
-	Close solution	-	Close the current solution.
	Close	-	Close DRAS

■ Home tab

Commonly used functions are in Home tab, which are clipboard, Tool, Connection, Controller and Edit (from the left to the right)



(1) Clipboard

Functions in clipboard include Paste, Cut, Copy and Delete. Please refer to the following table for further information.

Icon	Name	Keyboard shortcuts	Function
	Paste	Ctrl+V	Paste
	Cut	Ctrl+X	Cut
	Copy	Ctrl+C	Copy
	Delete	Delete	Delete




(2) Tool

Parameters, Scope and Script are the functions provided in Tool. Please refer to the following table for further information.

Icon	Name	Keyboard shortcuts	Function
	Parameter	-	Edit parameters of the servo drive and the controller. Please refer to section 2.4 Parameter for further information.
	Scope	-	Monitor the variation of digital signal via Scope. Please refer to section 2.4 Scope for further information.
	Script	-	Develop and run the script. Please refer to Script for further information.
	Workspace	-	Set the workspace for the robot (arm)
	Jog	-	Jog and Teach function for each axis
	Point table	-	Edit System and User point table
	Coordinates	-	Edit Product and Tool coordinate system
	Robot setting	-	Robot parameters setting. Please refer to section 2.4 Robot setting for further information.
	Gain adjustment	-	Adjust the gain for stabling the servo system and optimizing the system performance. Please refer to section 2.4 Gain adjustment for further information.
	I / O editor	-	Monitor and set I/O status. Please refer to section 2.4 I/O editor for further information.
	Memory	-	Monitor PLC memory. Please refer to section 2.4 Memory for further information.
	Error log	-	Error log of the controller

(3) Connection

This section is for quick connection and the related setting. Please refer to the following table for further information.

Icon	Name	Keyboard shortcuts	Function
	Go online / Go offline	-	For quick connection (online / offline)
	Connection	-	Select the connection interface and set related parameters. °
	Controller network(IPv4)	-	Set controller network (IPv4). To use this function, DRAS has to connect to the controller.

Connection

Users can select Ethernet, USB or RS232 / RS485 for controller's connection. Each connection interface requires different parameter settings. Once the setting is done, click on **OK** and the software will connect to the controller.

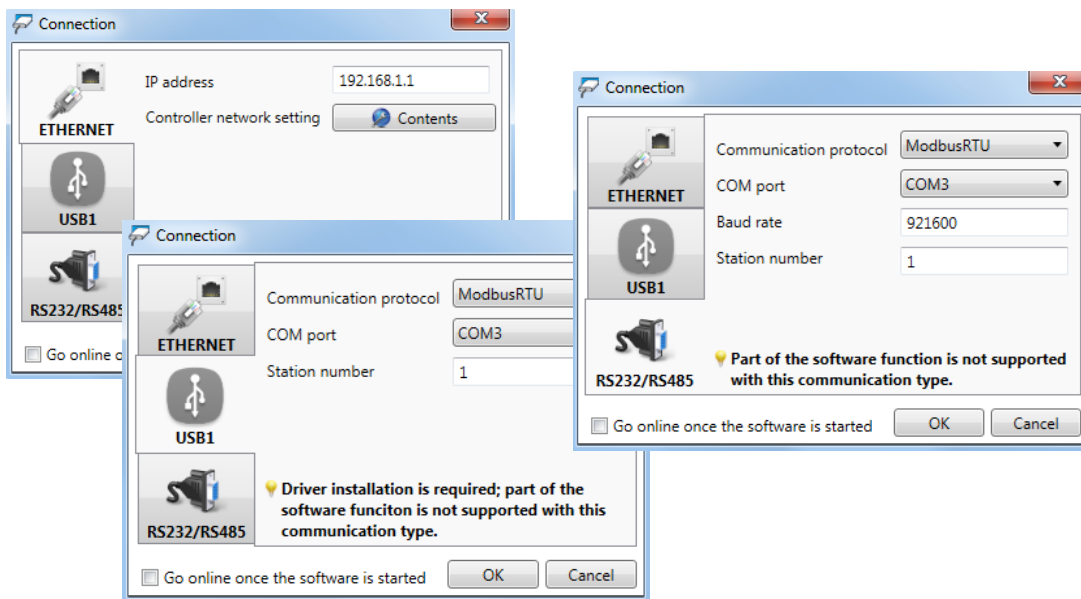


Figure 2.3.2 Connection setting screen

Controller network (IPv4)

This function is used to set network parameters of the controller. Users can choose to automatically obtain the IP address or specify the desired IP. Please be ensured that software has already connected to the controller before applying this function.

2

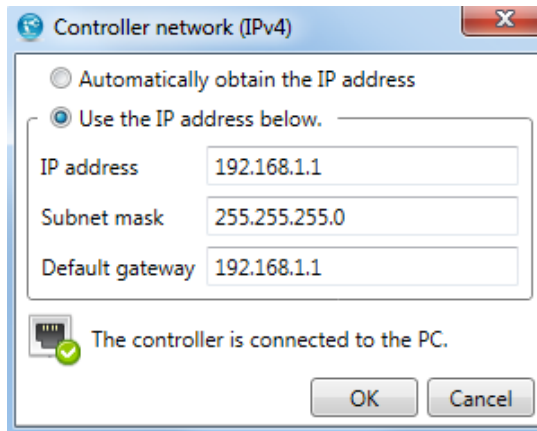


Figure 2.3.3 Controller network (IP v4) setting screen

An icon shows “Loading...” will appear on the main screen when the software is connecting to the controller for the first time. Once the connection is successful, the background color of status bar will be blue; otherwise, the background color will be red. Please refer to section 2.5 for further information of Status bar.

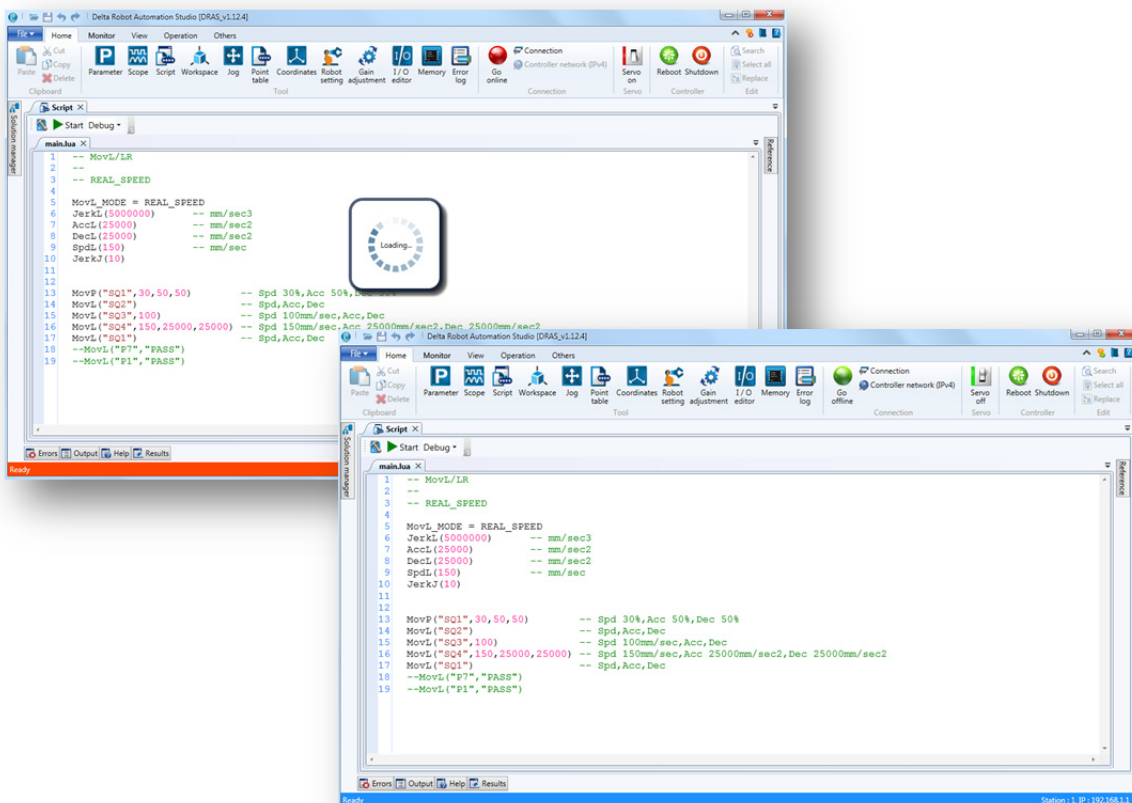



Figure 2.3.4 Fail to connect to the controller and Success to build the connection



(4) Servo

Press this button to change servo status (on or off).

Icon	Name	Keyboard shortcuts	Function
	Servo on / off	-	Show servo status. Users can change servo status via this button.




(5) Controller

Users can reboot or shutdown the controller via this function.

Icon	Name	Keyboard shortcuts	Function
	Reboot	-	Reboot the controller without cutting off the power. This can ensure the file will be saved before restarting the controller.
	Shutdown	-	Shutdown the controller system. The file will be saved before the system is shut down.

(6) Edit

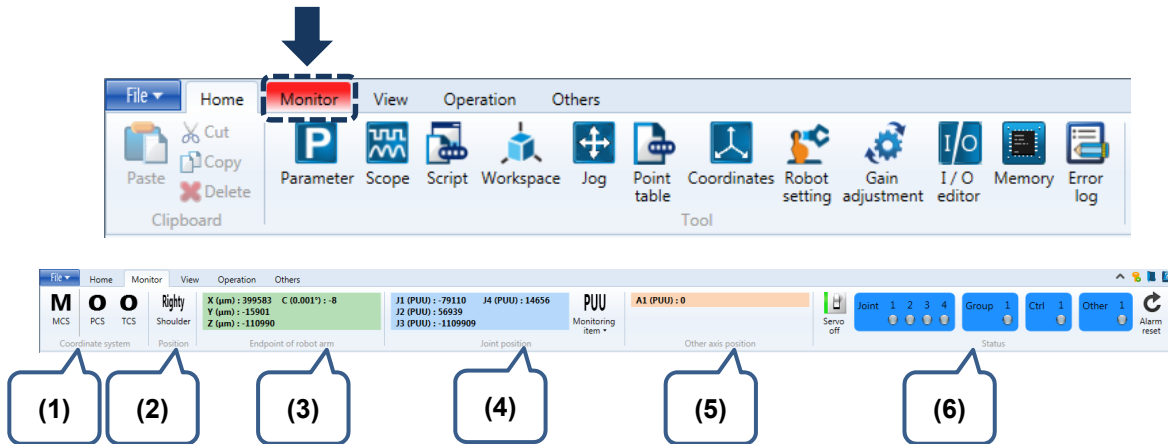
Find and replace functions are provided in editing section. Please refer to the following table.

Icon	Name	Keyboard shortcuts	Function
	Search	Ctrl+F	In the Find what box, type the text that you want to search for.
	Select all	Ctrl+A	Select all text in the text box.
	Replace	-	Type the replacement text in Replace with box.

2

Monitor tab

This function is available only when the software is connected to the controller. It is mainly used to monitor the controller related information. If any error occurs, color of the monitor tab and status bar will be red as warning. You can move the cursor to each alarm indicator to check the alarm causes. See the figure below.



(1) Coordinate system

It is used to display the coordinate type that currently applied. Please refer to the following table for detailed information.

Icon	Name	Keyboard shortcuts	Function
M, P, T, A	Current coordinate	-	It shows the coordinate system that you currently applied. M: Machine Coordinate System (MCS) P: Product Coordinate System (PCS) T: Tool Coordinate System (TCS) A: Axes Coordinate System (ACS)
0 PCS	The number of product coordinate system (PCS)	-	It shows the number of PCS that you currently applied.
0 TCS	The number of tool coordinate system (TCS)	-	It shows the number of TCS that you currently applied.

(2) Position

It shows the arm’s position. The displaying information differs from different robot type.

(3) End point of robot arm

It shows the Cartesian coordinate of robot arm’s end point.

(4) Joint position

It is the feedback position of each joint. You can switch the unit in **Monitoring item**.


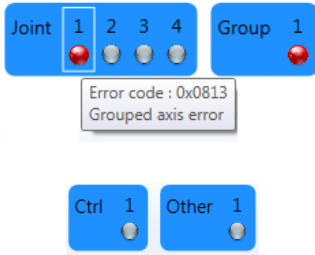

Unit	Keyboard shortcuts	Function
PUU	-	Unit of joint position.
0.001°	-	Unit of joint position.

(5) Other axis position

It displays the motor's feedback position that is not assigned in arm's group.

(6) Status

Functions included in this section are for displaying and setting servo status, showing alarm tip and alarm reset. And the alarm tip is divided into four parts, Joint, Group, Ctrl (controller) and Other (other axes). Please refer to the following descriptions.

Icon	Name	Keyboard shortcuts	Function
	Servo status (on/off)	-	It shows the servo status. Users can change the status (on or off) by directly clicking on this button.
	Alarm tip	-	If any Joint alarm, Group alarm, Ctrl alarm or Other alarm occurs, the alarm indicator will be in red color. To acquire detailed information of each alarm, please move your cursor to the indicator that shows red. The related error code and alarm description will pop up.
	Alarm reset	-	Clear all alarms

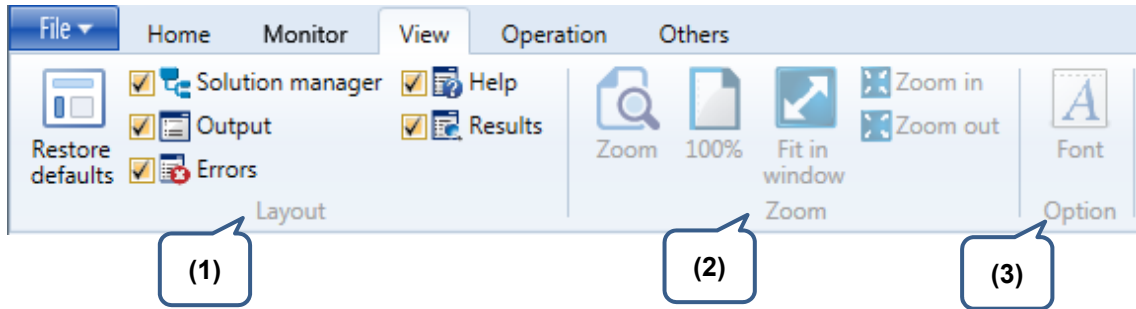
Alarm Tip

The following briefly introduces the definition and function of the four parts.

1. Joint: The motor of each joint on robot arm is defined as a joint axis. It will display the alarm information of each joint when you move the cursor to the alarm indicator.
2. Group: The motor (joint axis) on robot arm is assigned to one group.
3. Ctrl (controller): It will display the alarm information of controller system.
4. Other (other axes): Apart from the joint axis, other axes will be categorized as Other. It will display the alarm information of other axes. If there is no other axis, then this section will not be shown on the screen.

■ View tab

The View tab includes three sections, Layout, Zoom and Option. Please note that only the Layout function is available now. See the figure below.



(1) Layout

Users can define the screen layout of DARS software via this function. To restore the screen to the default layout, please press the **Restore defaults** button. Moreover, users can determine to display or hide the panels.

Icon	Name	Keyboard shortcuts	Function
	Restore defaults	-	Restore to the default layout
	Solution manager	-	Display / hide solution manager
	Output	-	Display / hide the output panel
	Errors	-	Display / hide the error list
	Help	-	Display / hide the help panel
	Results	-	Display / hide the search result

(2) Zoom

This function is not available now.

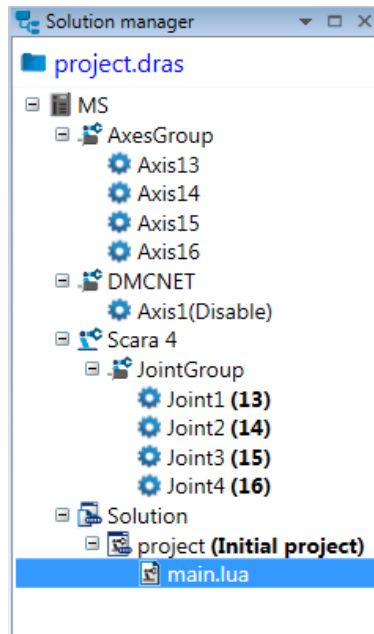
(3) Option

This function is not available now.

Solution manager

Tree view in solution manager displays the structural relation among controller, Scara (arm) and script. See the figure below.

2



It will display the path when moving your cursor to the project name. See Figure 2.3.5. Click on it to open the folder that stores the resolution. Please refer to the following table for further information of the node.

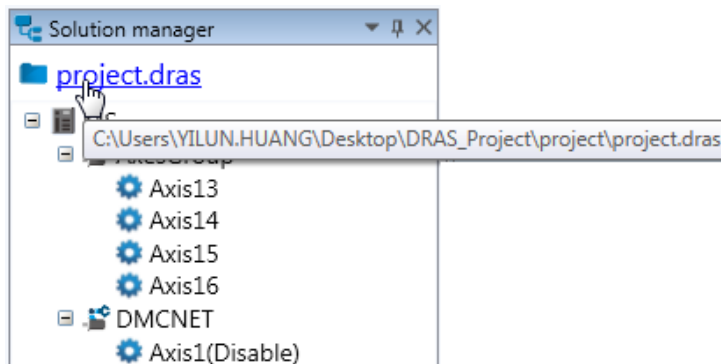






Figure 2.3.5 Path of the current solution

Each node of tree view in solution manager:

Icon	Name	Function
	Project / Solution	Move the cursor to its name to display the path
	Controller	Controller
	Axes Group	Axis number of the controller
	Expanded Fieldbus	Expanded fieldbus (DMCNET) ◦
	Axis / Joint	Axis / Joint
	Robot (Arm)	The current displayed name will be the selected robot (arm) type

Icon	Name	Function
	Solution	Solution can contain several projects, but only one initial project.
	Project	One main.lua script for one project only. Users can add new or other existing scripts / folders.
	Script	Its filename extension is “.lua”
	Folder	For classifying the script

You can right click on the specified item to open the context menu of each node. See further information in the following table.

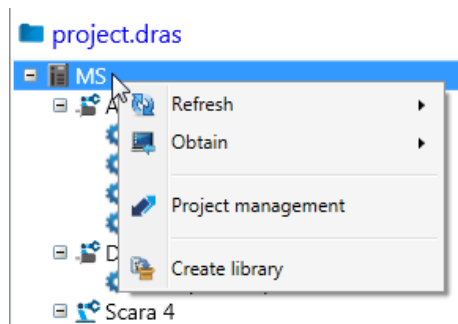




























Figure 2.3.6 Open context menu

Detailed description of the context menu:

Icon	Name	Function
	 Refresh	Update items (system library, PLC or firmware) to the controller.
	 Obtain	Acquire the library of the controller.
	 Project management	Upload or download the project (password is required).
	 Create library	Create the system library for the script.
	Scan the slave	Obtain the extended module and controller.
	 Change robot type	Change the robot type
	 Edit the grouped axes	Assign the axis for each joint. See figure 2.3.7.
	Activate the robot type setting	If the set robot type does not match to robot type connected to the controller. This function can be applied to change the setting.
	 Add	Add new or existing project
	 Add	Add new or existing script or folder
	Set as the initial project	Set the project as the initial project. Only the initial project can be run and used to debug. One initial project for one solution.
	 Paste	Paste the folder or file
	 Delete	Delete the project
	 Rename	Rename the project

2

Icon	Name	Function
	Remove from the solution	Remove project from the solution, but still store the original project folder and file.
 Folder	 Add	Add new or existing script or folder
	 Copy	Copy the folder, including all folders and files under the copied one
	 Paste	Paste the folder or file
	 Delete	Delete the folder, including all folders and files under the deleted one
	 Rename	Rename the folder
 Script (main.lua)	Open the script	Open the script for editing.
	 Copy	Copy the script
	 Delete	Delete the script, including the original file
	 Rename	Rename the script
	Save as lux file	Save the script as .lux file that is the format of special encoding. This is for protecting the code.
	Remove from the project	Remove the script from the project but keep the original file.

Users can edit the grouped axis of each joint via the editing window below. In the following figure, the left hand side shows the robot joint and the right hand side displays the current axes, including the controller-built-in axis and controller-expansion axis. Each robot joint has to be assigned to one grouped axis. Users can directly drag the axis from the right hand side to the specified joint on the left.

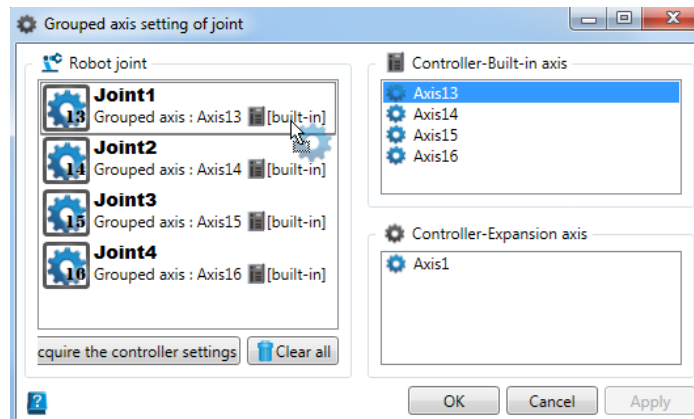
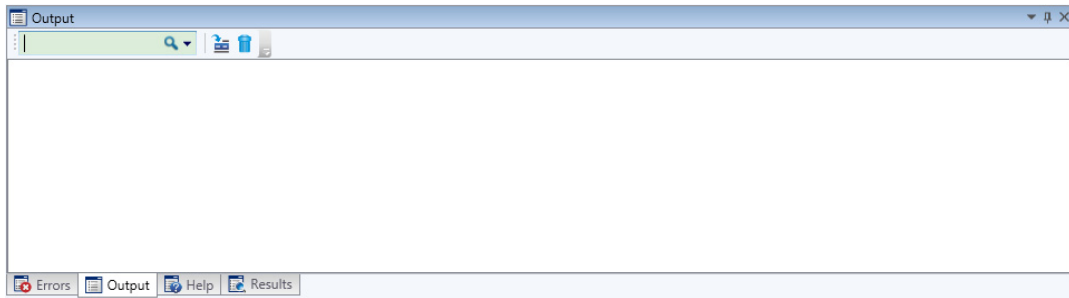


Figure 2.3.7 Edit grouped axis

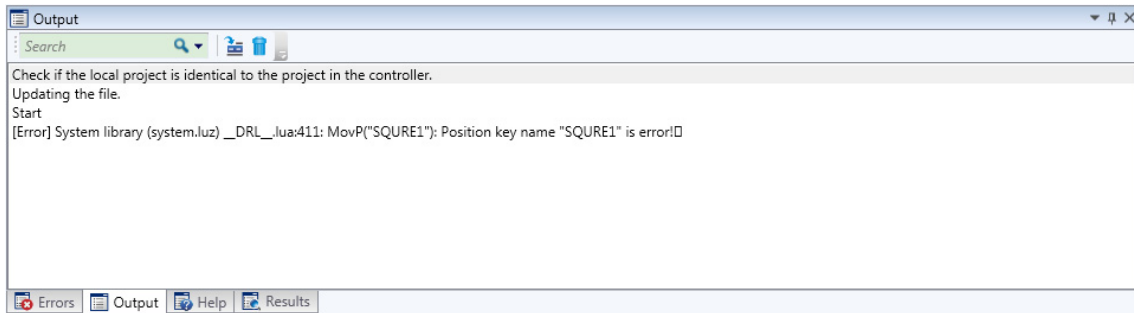
Auxiliary Panel

Functions on auxiliary panel include Error (error list), Output, Help and Result (search result). Thus, its display is changed according to the selected function.



Output

The output panel mainly displays the execution status and error message. See the description of each function below.

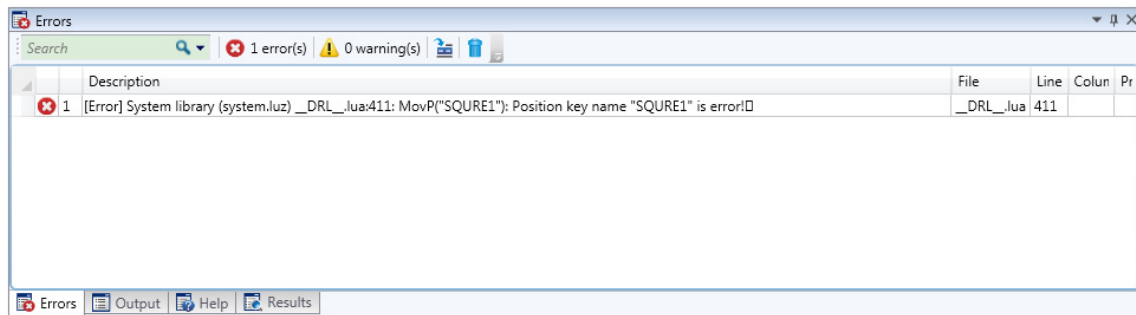


Detailed description of the output panel:

Icon	Name	Keyboard shortcuts	Function
	Search	-	Search the specified keyword in output panel
	Move to target	-	Direct the cursor to the code which causes an error.
	Clear all	-	Clear all content on the panel

Errors (Error list)

This panel displays warnings or errors that occurred during operation, including the script syntax check, parameters reading/writing warning and error message. Users also can double click on the item to move to the error where it occurred.

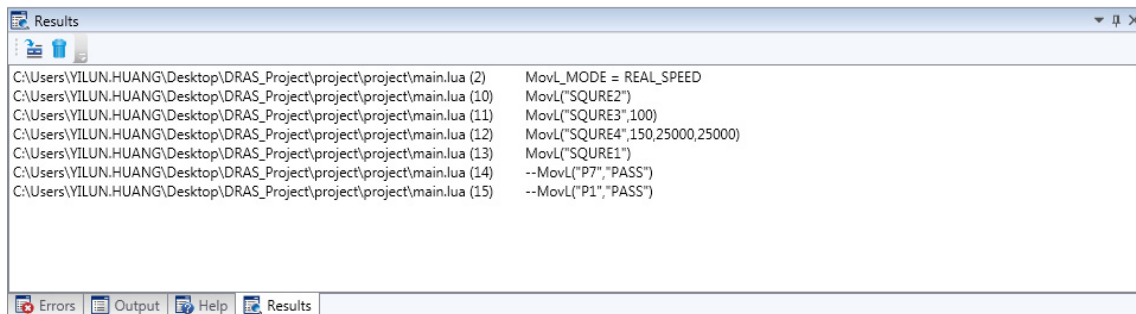


Detailed description of the error list:



Icon	Name	Keyboard shortcuts	Function
	Search	-	Search the specified keyword in error list
	Error(s)	-	Display / hide all errors
	Warning(s)	-	Display / hide all warnings
	Move to target	-	This function directs the cursor to the code which causes an error or alarm. (Users can also double click on the items in the error panel.)

Results (Search result)

This function can be applied in some functional pages, such as script. The search result will display on the panel. See the description of each function below.



Detailed description:




Icon	Name	Keyboard shortcuts	Function
	Move to target	-	This function directs the cursor to the code which causes an error or alarm. (Users can also double click on the items in the error panel.)
	Clear all	-	Clear all contents on the panel.

Help

This panel displays the code description and helps users to be familiar with the application method of each code. See the description of each function below.

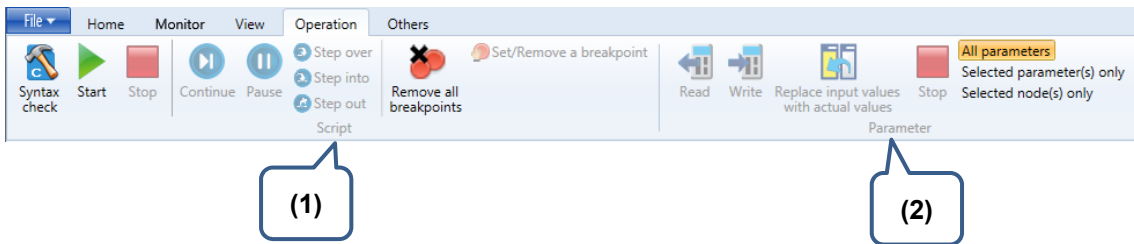


Detailed description:

Icon	Name	Keyboard shortcuts	Function
	Home	-	Return to Home page.
	Previous	-	Return to the previous page
	Next	-	Go to the next page.

■ **Operation tab**

The operation tab consists of two sections, Script and Parameter. See the figure below. Script is used to write the code. The included functions are syntax check, start (start operation), step into and set/remove a breakpoint. In Parameter section, users can read / write parameters. And the accessible and writable parameters are determined by the function page that you currently use.







(1) Script

This section is mainly used to create the script. See the detailed description of each function below.

Icon	Name	Keyboard shortcuts	Function
	Syntax check	F6	Check the syntax of the initial project
	Start	F5	Activate the initial project
	Stop	-	Stop running the current program
	Continue	F5	Debug mode- Continue
	Pause	-	Debug mode - Pause
	Step over	F10	Debug mode - Step over
	Step into	F11	Debug mode - Step into
	Step out	Shift+F11	Debug mode - Step out
	Remove all breakpoints	Ctrl+Shift+F9	Debug mode - Remove all breakpoints
	Set/Remove a breakpoint	F9	Debug mode – Set a breakpoint in this line

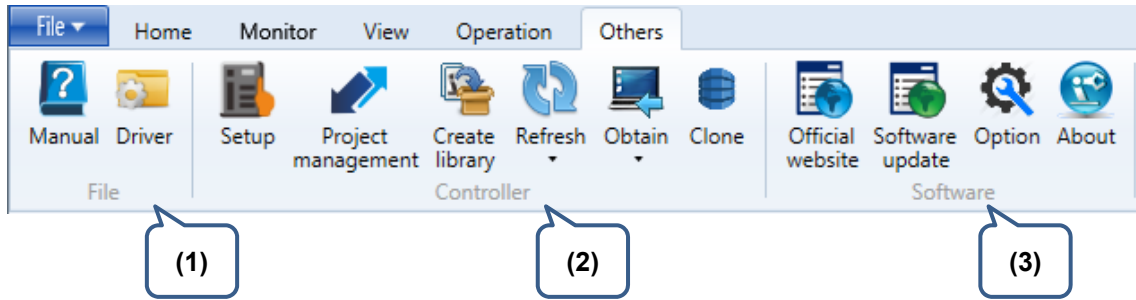
(2) Parameter

Parameter section includes read / write the selected or all parameters and replace input values with actual values. And the accessible and writable parameters are determined by the function page that you currently use. Refer to the following table for further description.

Icon	Name	Keyboard shortcuts	Function
	Read	F6	Read parameters from the controller
	Write	F5	Write parameters to the controller
	Replace input values with actual values	-	Replace input values with actual values
All parameters	All parameters	-	Read/write all parameters
Selected parameters(s) only	Selected parameters(s) only	F10	Read/write the selected parameter(s) only
Selected node(s) only	Selected node(s) only	F11	Read/write the selected node(s) only
	Stop	F5	Stop reading / writing parameters

■ Others tab

You can find information of files, controller and software in this tab. See the figure and detailed description below.



(1) File

Icon	Name	Keyboard shortcuts	Function
	Manual	-	Open the documentation about DRAS software.
	Driver	-	Open the folder that stores USB driver

(2) Controller

Icon	Name	Keyboard shortcuts	Function
	Setup	-	Function setting and controller version.
	Project management	-	Upload/download the project (password is required). Please refer to Download the project to the controller section of Chapter 3 for further information.
	Create library	-	Create system library for the script. Please refer to Create system library section of Chapter 3 for further information.
	Refresh	-	Update items, such as system library, PLC or firmware to the controller
	Obtain	-	Obtain controller related information, such as system library, and system log.
	Clone	-	Clone or update the controller system. See further information in Clone section of Chapter 3

(3) Software

Icon	Name	Keyboard shortcuts	Function
	Official website	-	Direct to Delta's website via web browser
	Software update	-	Update the software
	Option	-	Setup the software
	About	-	See information about DRAS software

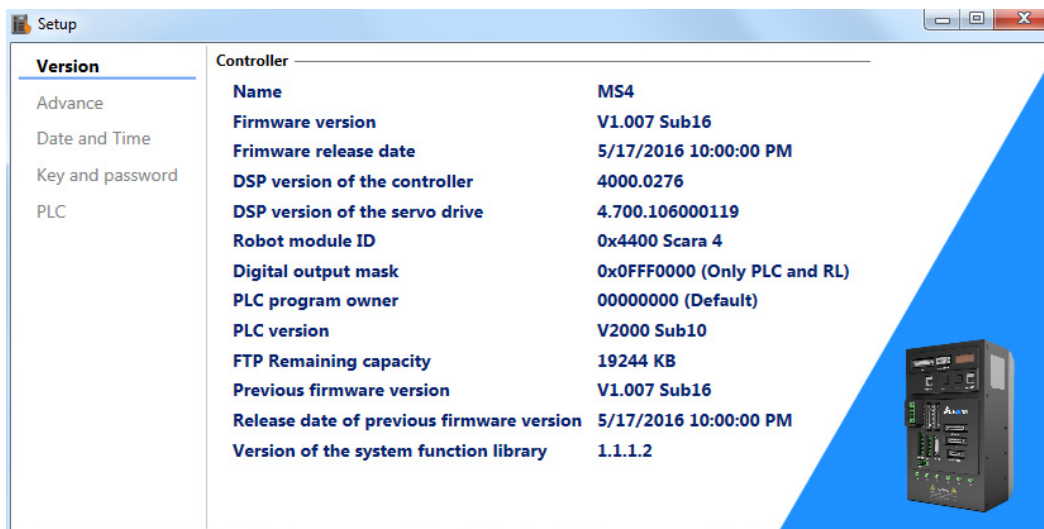
 Setup

In this page, users can check the controller version and function settings. It includes Version, Advance, Date and Time, Key and password and PLC pages. See the detailed information below.

2

Version

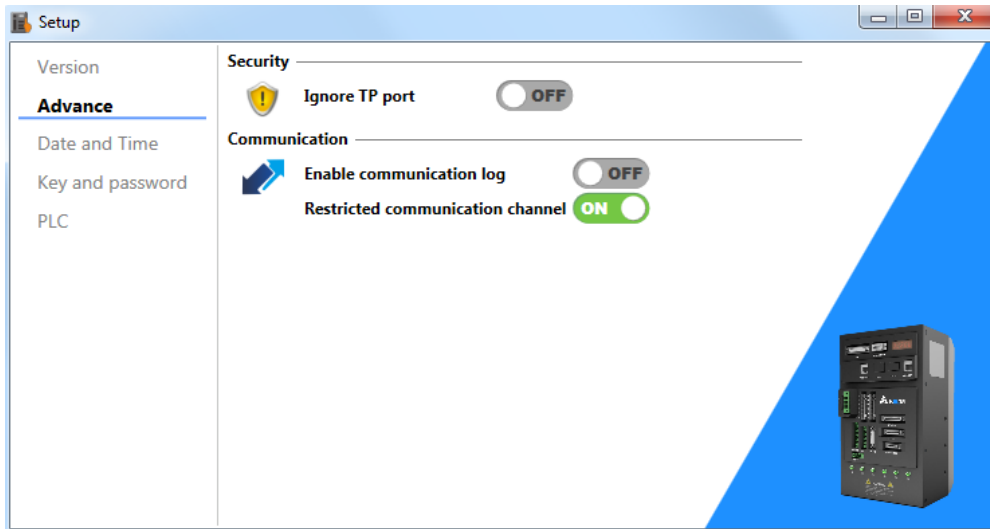
It displays the controller's version and update information.



Advance

Users can enable or disable the communication function of controller TC port.

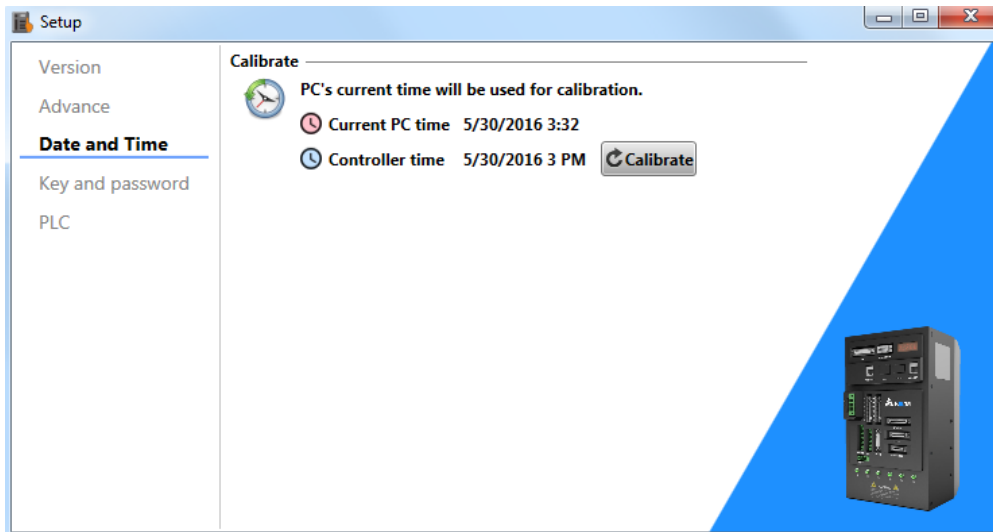
2



Icon	Name	Function
	Ignore TP port	When the controller is not connected to TP port, an alarm will occur. If the TP port is not required, you can turn off the Ignore TP port option to clear the alarm. Note: This function setting will be reset when controller is restarted.
	Enable communication log	When this function is enabled, the controller starts to record the packet sent by Modbus. When this function is disabled, the packet recording file (debug.log) will be stored in controller's FTP. Note: When this function is enabled, if the file size exceeds 1 MB, this function will be disabled automatically.
	Restricted communication channel (one channel only)	When this function is enabled, it can only connect to one IP address via Modbus TCP/IP. The controller can connect to more than one IP addresses (max. six) when this function is disabled.

Date and Time

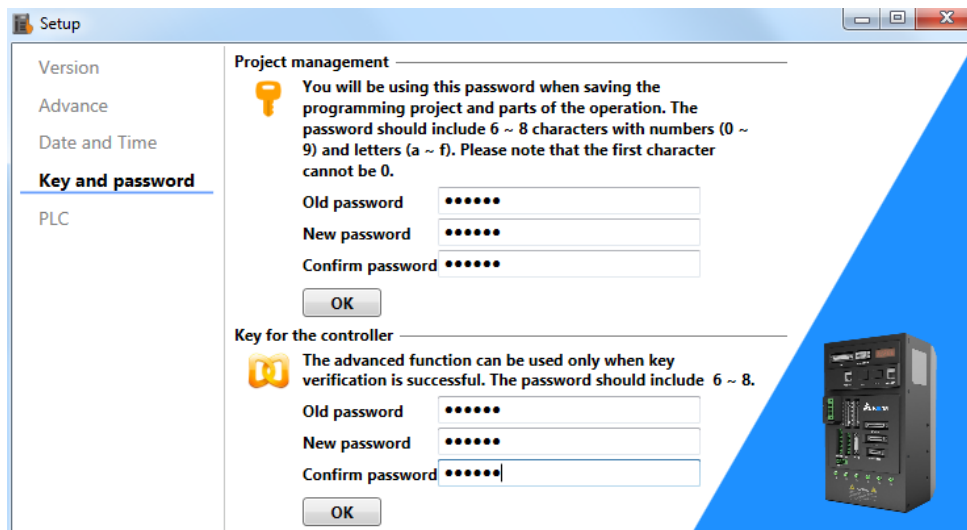
If the controller's time is different from the PC's current time, this function can be used for calibration.



2

Key and password

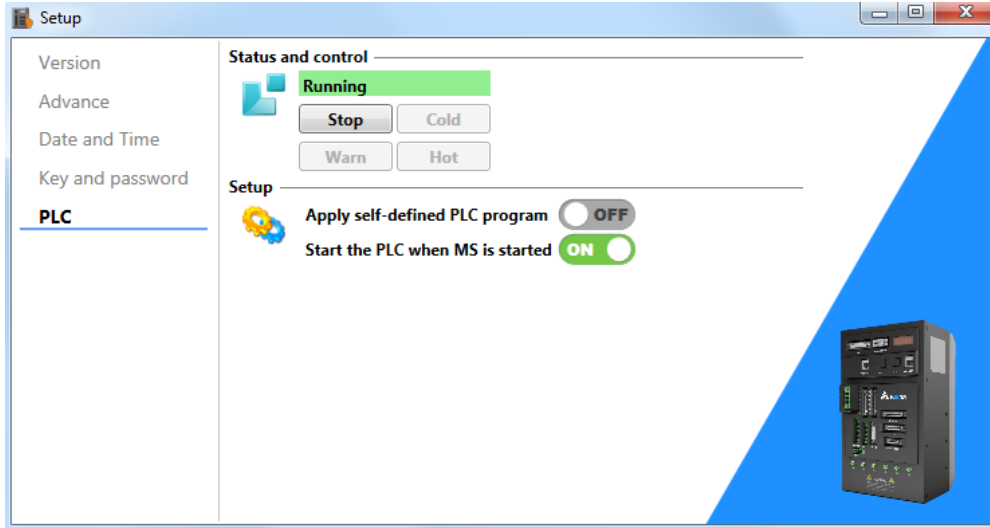
The controller has two passwords, one is for project management and the other one is the key for the controller. Password for project management is used when saving programming project in FTP. This is for protecting the user's project. Key for the controller is used to restrict some DRAS functions. With this function, the controller's setting cannot be changed if users do not enter the correct password. Following is the page for changing the password.



2

PLC

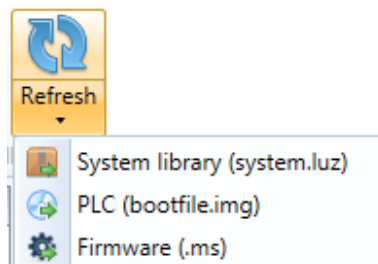
There is one PLC program running in the controller. The following page displays PLC’s current status, either running or stop. User also can control the PLC via this page. If the PLC program is written by the users, users can choose to apply self-defined PLC program or the default PLC program.



Icon	Name	Function
	Stop	Stop PLC program
	Warm	Initialize all non-volatile variables and start running PLC program
	Cold	Initialize all variables and start running PLC program
	Hot	Do not initialize variables and start running PLC program
	Apply self-defined PLC program	This function can be applied when user’s self-defined PLC program has been uploaded to the controller.
	Start the PLC when MS is started	When the controller is turned on, the PLC program will be started automatically. Disable this function if you do not want to start the PLC when the controller is on.

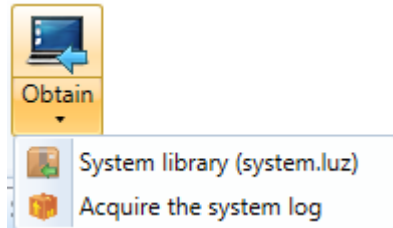
Refresh

Users can update system library, PLC and firmware here.



 **Obtain**

The system log stores the current status and information when alarm occurs or the system is updated. If an error occurs, the controller's system library and system log can be acquired for analyzing alarm occurrences.



 **Option**

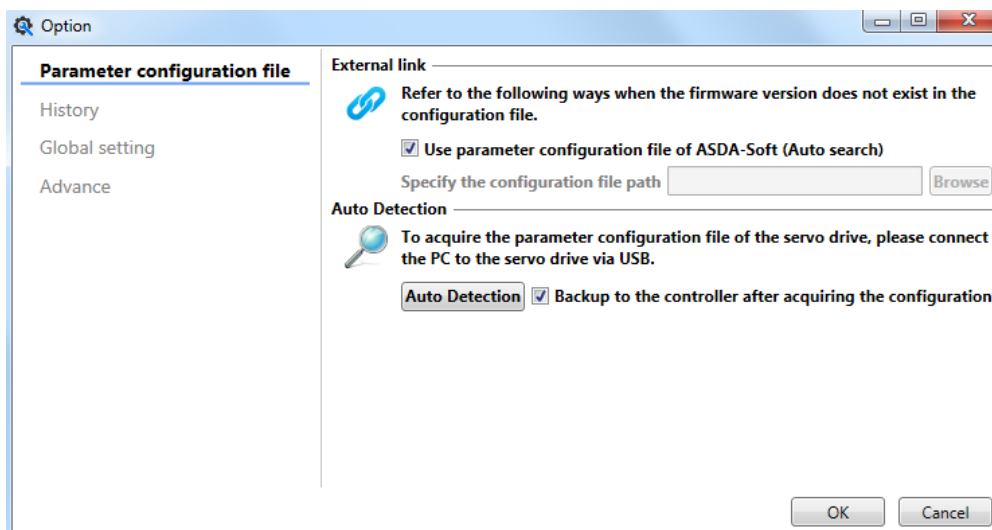
Settings in this page includes parameter configuration file, history, global setting and advance functions.

Parameter configuration file

When the controller connects to the expanded servo drives via Fieldbus, parameter configuration is required to access parameters from the expanded servo drive. See the following three methods:

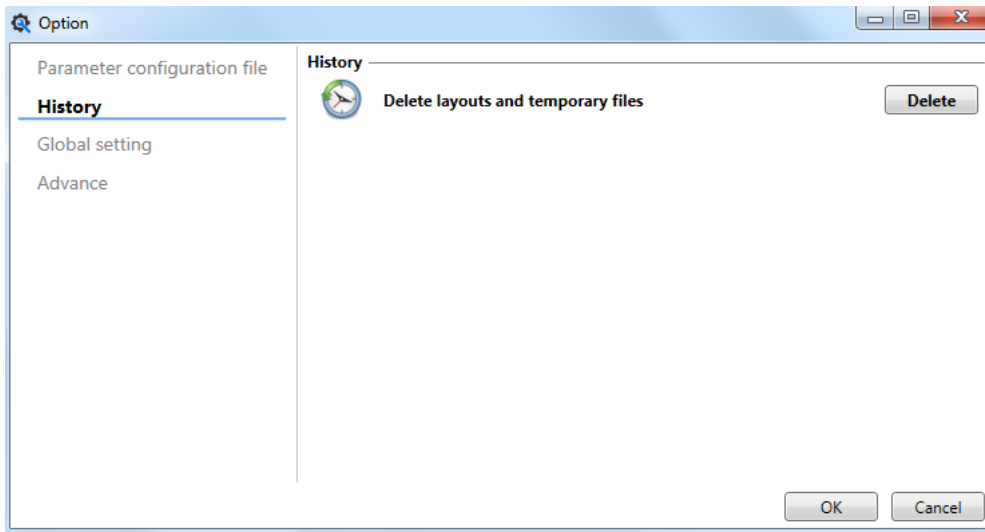
1. If you have installed ASDA-Soft, the software will automatically find the parameter configuration file.
2. If you have already had the parameter configuration file, you can specify the configuration path for the connection.
3. If your PC connects to the servo drive via USB, the software will acquire the parameter configuration file of the servo drive when clicking on **Auto Detection**.

If the parameter configuration file is successfully acquired, the software will record it. No need to set it up again next time.



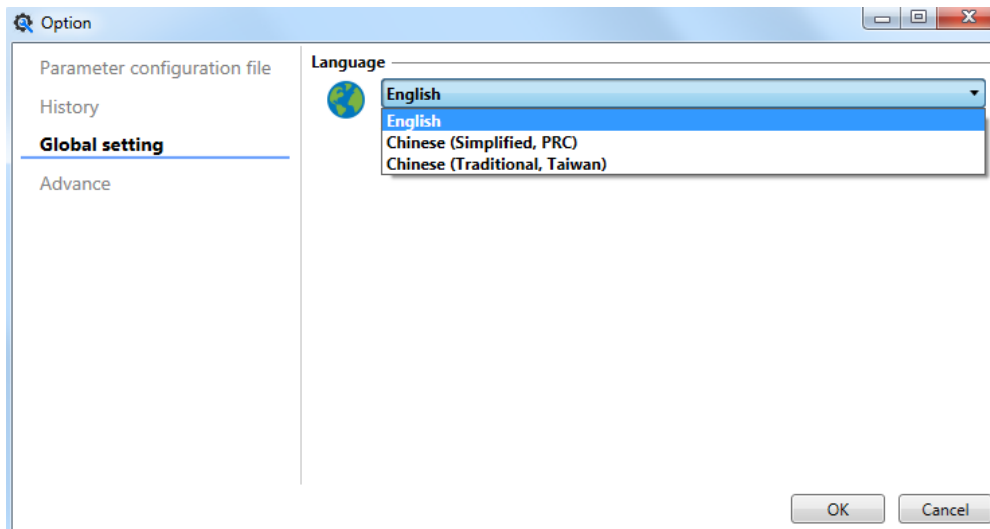
History

The software records the operation and setting during operation, such as interface configuration, point table, scope setting and parameters tree. Users can delete the information by clicking on **Delete**.



Global setting

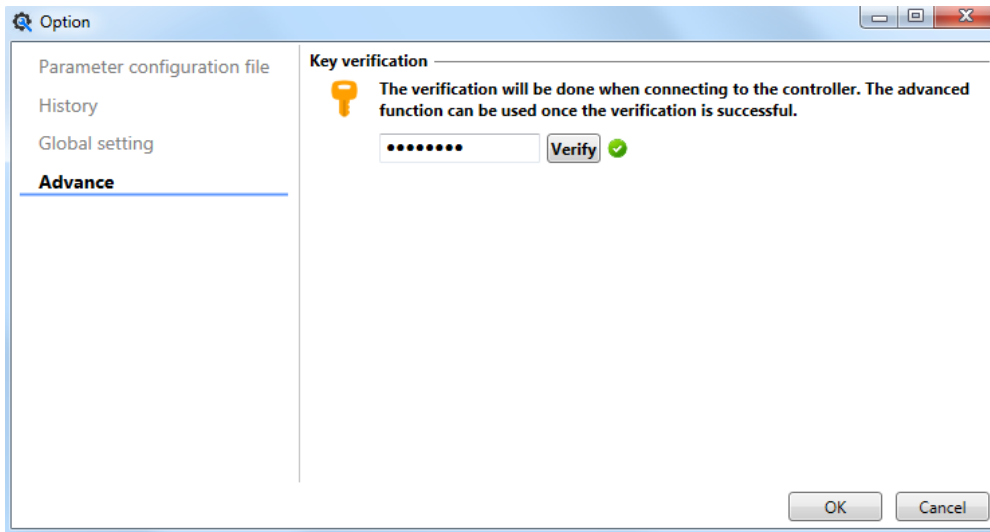
In global setting, Traditional Chinese, Simplified Chinese and English are available now. Users can change the interface language here.



Advance

Parts of the advanced functions can be activated via key verification. The verification password is the password of the controller. When entering the correct password, a green check icon will show on the screen. Then, you can use the advanced functions.

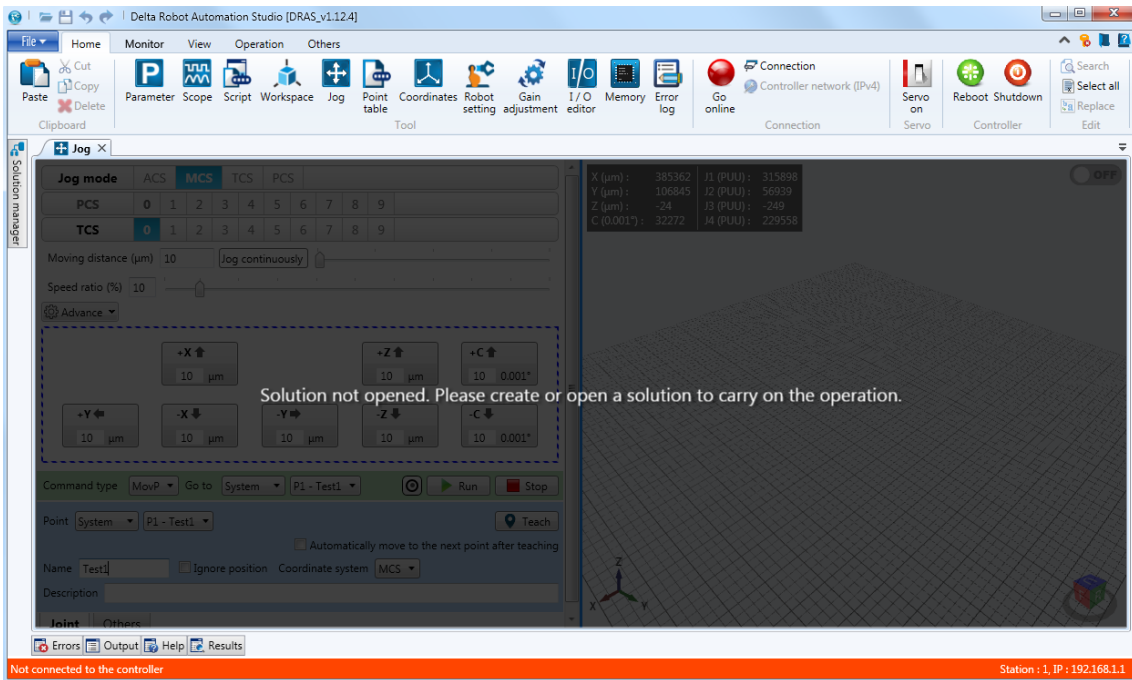
2



2.4 Work Area

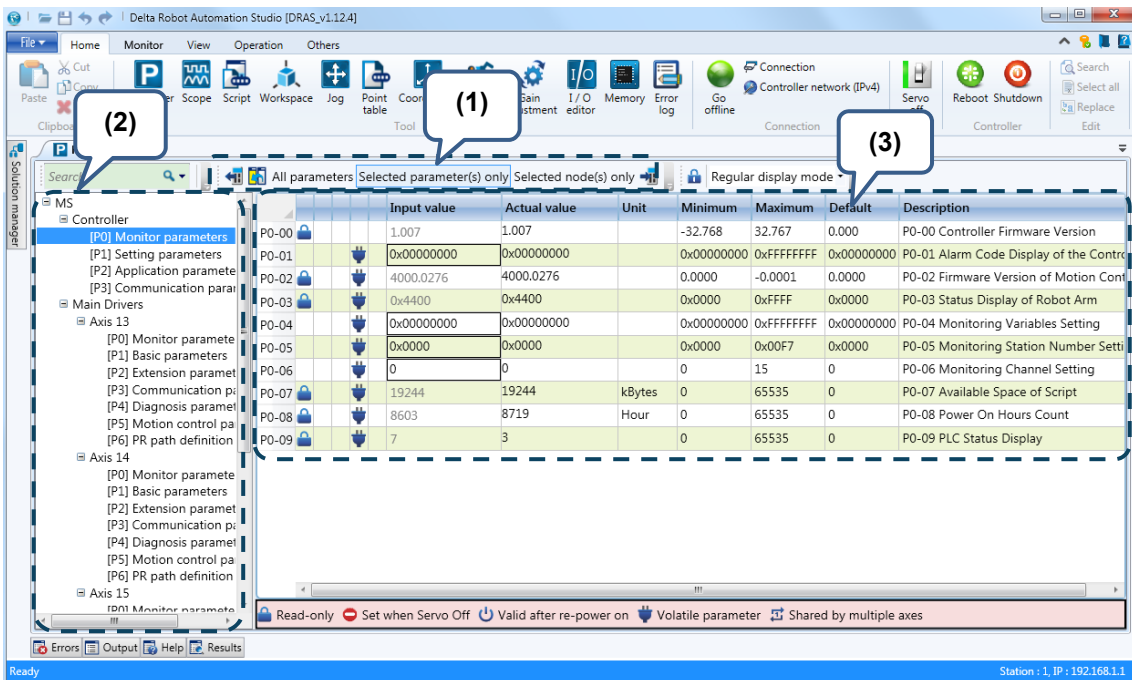
All operations are conducted in work area and the individual tool function is displayed as tab. Users can adjust the layout according to the application. Please refer to section 2.2 for further information. Error(s) or alarm(s) will be displayed on **Errors** panel. Users can see the alarm occurrence and its corrective actions through the detailed description shown on the panel.

The following will introduce each function in Work Area. Part of the functions in Work Area is related to the robot type you selected. If your screen shows the following message (see the figure below), it means you have not selected any solution. Please create or open a solution to carry on the operation.



Parameter

Parameter editing section manages all parameters of the controller. Users can read, write or browse parameters here. See the figure below. It is divided into three sections, toolbar, parameter tree and parameter list.



(1) Toolbar

Please refer to the following table of each function in tool bar.

Purpose	Icon	Function
Parameters editing		Read parameters from the controller
		Write parameters to the controller
		Replace input values with actual values
	All parameters	Edit all parameters
	Selected parameter(s) only	Edit the selected parameter(s) only
	Selected node(s) only	Edit the selected node(s) only
		Stop current operation
Other		Lock or unlock the hidden parameter
	Regular display mode	Switch the display mode. Three display modes are available. 1. Regular display mode 2. Only display items which actual value is different from the default value 3. Only display items which actual value is different from the input value
	Search	Input the keyword to find the related parameters

(2) Parameter tree

Parameter tree is used to present parameter groups in a tree structure. There are more than 3000 parameters in the controller. With the parameter tree, it is easier to edit and search the needed parameters. By clicking on any node on the parameter tree, you can view all parameters of the node in the parameter list on the right hand side. See the figure below.

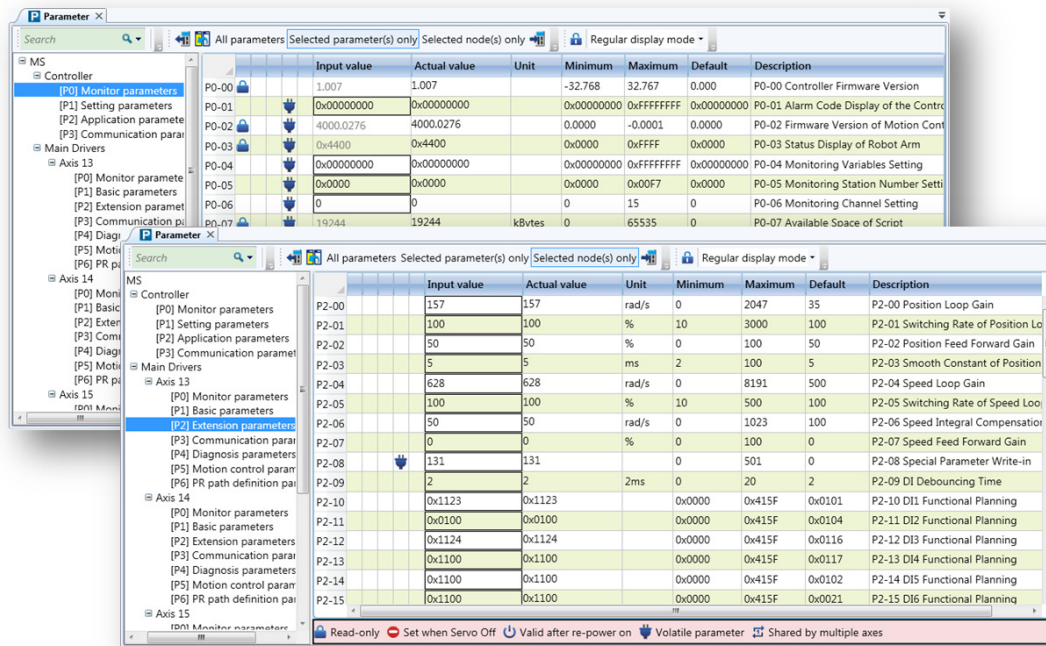


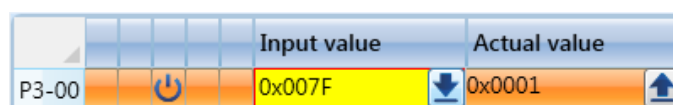
Figure 2.4.1 Selected items of parameter tree and parameter list

(3) Parameter list

Parameter list includes parameter’s actual value, minimum and maximum value, default value, description and input value. The symbol showed next to the input value represents the parameter’s property. Please refer to the detailed description of each property below.

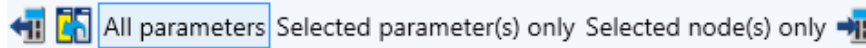
Icon of parameter property	Description
	This parameter is read-only.
	When it is in Servo On status, parameters cannot be set.
	The parameter setting is valid after re-power on.
	When the power is off, the parameter value will be the default value.

User can edit and write the value in Input value column. However, parameter value is read-only in Actual value column. If you wish to change one parameter value, please write the value in Input value column first. Then, download it to the controller by either clicking on the **Download** button or directly pressing the **Enter** key. See the figure below. The **Write** button also can be used to download the parameter value.



When the value in Input value column is different from the value in Actual value, its background color will be yellow. It is for reminding the users to check if the value is correct. In addition, the value in Input value column can be updated to the same value in Actual value by clicking the button of **Replace input values with actual values**.

Three modes are provided to set parameters, which are All parameters, Selected parameter(s) only and Selected node(s) only.



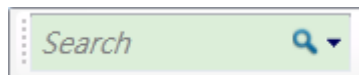
User can select one mode to set parameters. **All parameters** means all parameters of the controller. And the **selected parameter(s)** will be shown in orange as the figure below.

		Input value	Actual value	Unit	Minimum	Maximum	Default	Description
P3-00		0x007F	0x0001		0x0001	0x007F	0x007F	P3-00 Address Setting
P3-01		0x0203	0x0203	bps	0x0000	0xF405	0x0203	P3-01 Transmission Speed
P3-02		0x0006	0x0006		0x0000	0x0008	0x0006	P3-02 Communication Protocol
P3-03		0x0000	0x0000		0x0000	0x0001	0x0000	P3-03 Communication Error Disposal
P3-04		0	0	sec	0	20	0	P3-04 Communication Timeout
P3-05		0x0000	0x0000		0x0000	0x0001	0x0000	P3-05 Communication Mechanism
P3-06		0x0000	0x0000		0x0000	0x3FFF	0x0000	P3-06 Control Switch of Digital Input

Selected node(s) only means all parameters of the selected node will be displayed in parameter list.

		Input value	Actual value	Unit	Minimum	Maximum	Default	Description
P0-00		1.007	1.007		-32.768	32.767	0.000	P0-00 Controller Firmware Version
P0-01		0x00000000	0x00000000		0x00000000	0xFFFFFFFF	0x00000000	P0-01 Alarm Code Display of the Cont
P0-02		4000.0276	4000.0276		0.0000	-0.0001	0.0000	P0-02 Firmware Version of Motion Co
P0-03		0x4400	0x4400		0x0000	0xFFFF	0x0000	P0-03 Status Display of Robot Arm
P0-04		0x00000000	0x00000000		0x00000000	0xFFFFFFFF	0x00000000	P0-04 Monitoring Variables Setting
P0-05		0x0000	0x0000		0x0000	0x00F7	0x0000	P0-05 Monitoring Station Number Set
P0-06		0	0		0	15	0	P0-06 Monitoring Channel Setting
P0-07		19244	19244	kBytes	0	65535	0	P0-07 Available Space of Script
P0-08		8603	8719	Hour	0	65535	0	P0-08 Power On Hours Count
P0-09		7	3		0	65535	0	P0-09 PLC Status Display

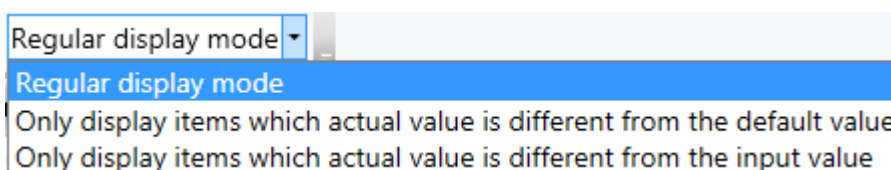
To enter the keyword in search tool box and press the **Enter** key, the search result will be displayed in parameter list.



Parameter editor supports the function of import or export .dpar parameter file. Please note that exporting the file is for recording the actual value of all parameters; importing is for updating all data in Input value column. To update the parameter file to the controller, you need to import the parameter file to the controller first.

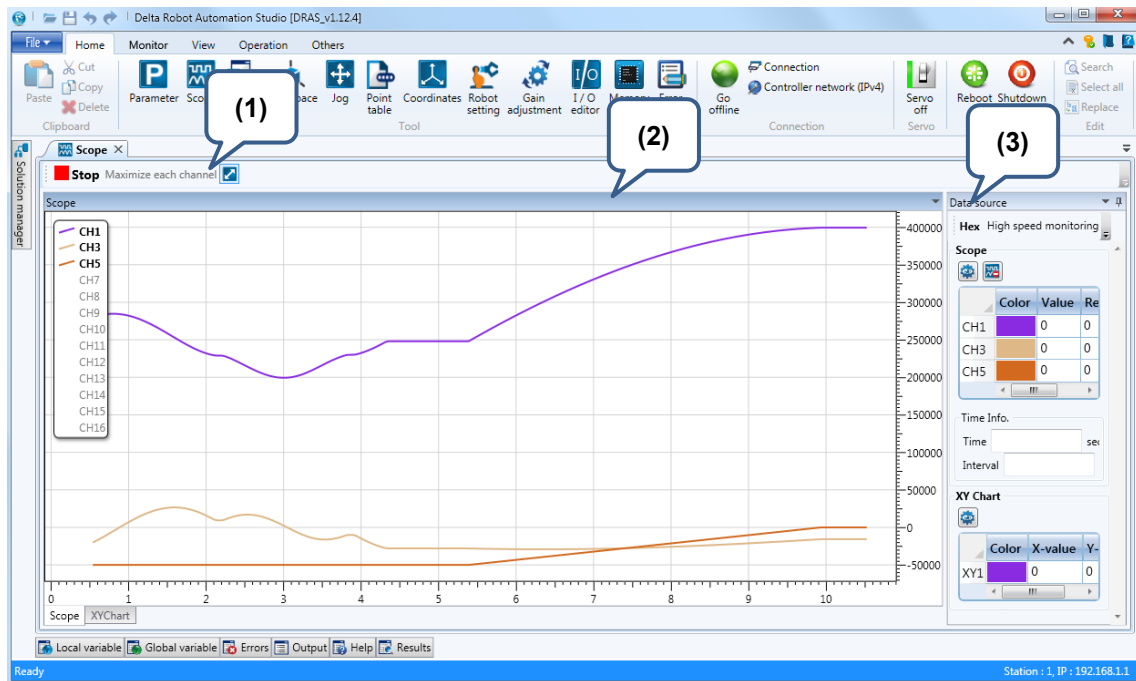
Three display modes are available: Regular display mode, Only display items which actual value is different from the default value and Only display items which actual value is different from the input value. Users can select the item from parameter list after selecting the display mode.

1. Regular display mode: No parameter is selected.
2. Only display items which actual value is different from the default value: Filter those items that actual value is different from the default value and display in parameter list.
3. Only display items which actual value is different from the input value: Filter those items that actual value is different from the input value and display in parameter list.



■ Scope

Scope is used to display the variation of digital signal in waveform and monitor the controller and mechanism status. The scope screen can be divided into three sections, tool bar, waveform and data source.



(1) Tool bar

You can find basic functions on tool bar. See the information in the following table.

Purpose	Icon	Function
Waveform operation		Start running
		Stop running
Other	Maximize each channel	All channels apply individual coordinate system

(2) Waveform

All digital data in monitoring channel will be displayed in waveform. Each channel is presented by different colors, which is shown in upper-left corner. You can click on the channel's icon to display or hide the data. See figure 2.4.2. Once the text shown in grey, it means the channel is not displayed in Waveform.

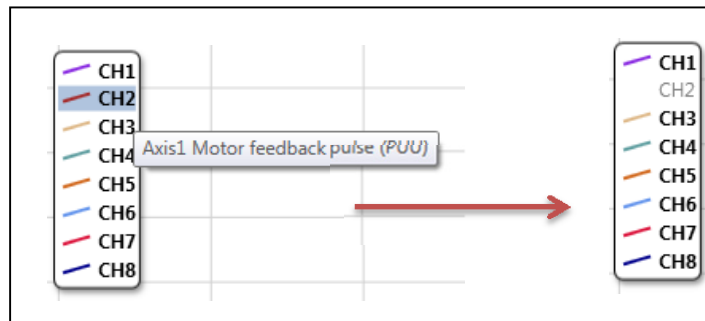


Figure 2.4.2 Display/hide channel data

Click on Waveform to call the context menu. See figure 2.4.3. The function of context menu is different from the toolbar. It includes the auxiliary function that can be quickly launched. See further information of each function below.

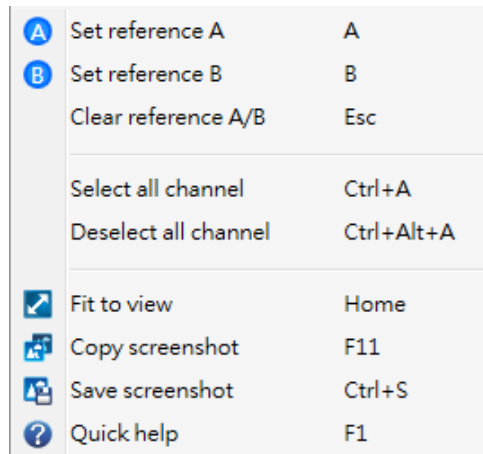


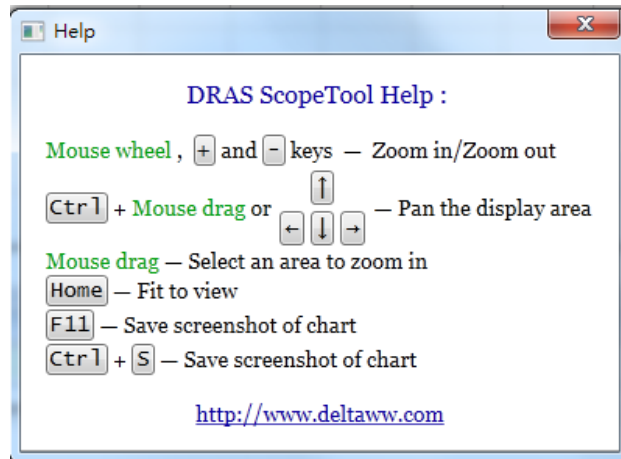
Figure 2.4.3 Context menu of the scope

Detailed description of context menu:

Icon	Name	Keyboard shortcuts	Function
	Set reference A	A	Set reference A
	Set reference B	B	Set reference B
-	Clear reference A / B	Esc	Clear reference A / B
-	Select all channel	Ctrl + A	Monitor the wave of all channels
-	Deselect all channel	Ctrl + Alt + A	Disable the wave from all channels
	Fit to view	Home	Maximize the current wave
	Copy screenshot	F11	Copy the current wave
	Save screenshot	Ctrl + S	Save the current wave as .bmp file.
	Quick help	F1	Enable Quick help screen




Click on **Quick help** icon, the Help screen will pop up and you can find the information of the basic operation. See the figure below.

2



(3) Data source

Data source panel is used to adjust the monitoring items of each channel. Wave related data and time is displayed in the panel as well. See further description below.

Icon	Function
	Setup monitoring item.
	Set up the condition for monitoring stop.
Hex	Data displaying format. Click on the Hex button, the format will be changed from decimal to hexadecimal.
High speed monitoring 	Switch the sampling frequency

Monitoring item

Once the function of monitoring item is enabled, a window will pop up for users to set the corresponding items, including the information of axis and group. See figure 2.4.4.

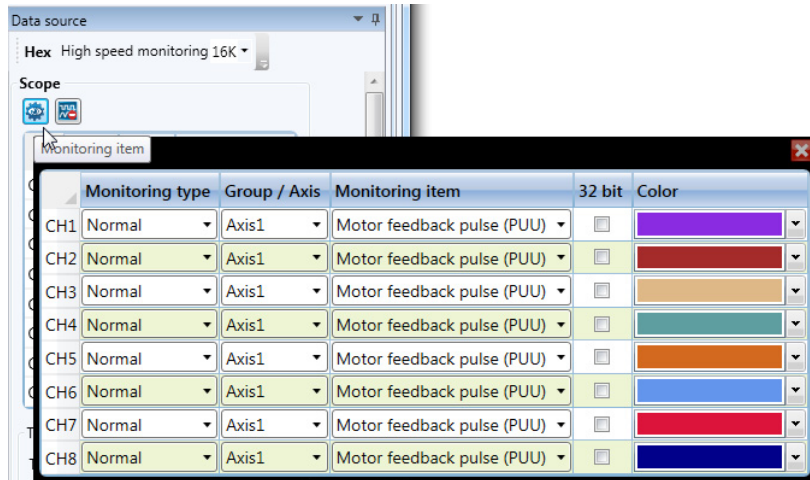


Figure 2.4.4 Setup monitoring item

Setting for stopping monitoring items

Click the button of **The setting for stopping monitoring items**, the Condition window will pop up. See figure 2.4.5, **Value** is the value of the monitoring item. When the value is within the setting range, scope will stop monitoring. You can set the **Delay time** to control the time for stopping monitoring.

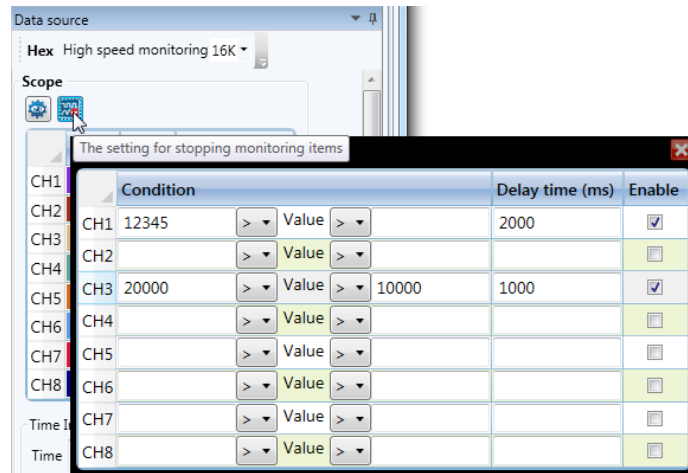


Figure 2.4.5 Setting for stopping monitoring item

High speed monitoring

High speed monitoring is used to select the sampling frequency of the scope. Its drop-down list is determined by the controller’s specification. The sampling frequency might change the channel number to be monitored.

XY chart

See figure 2.4.6, when you select (1), the scope screen is switched to XY chart. The XY chart turns the values from two monitoring items to a planar graph. (2) indicates monitoring setting items.

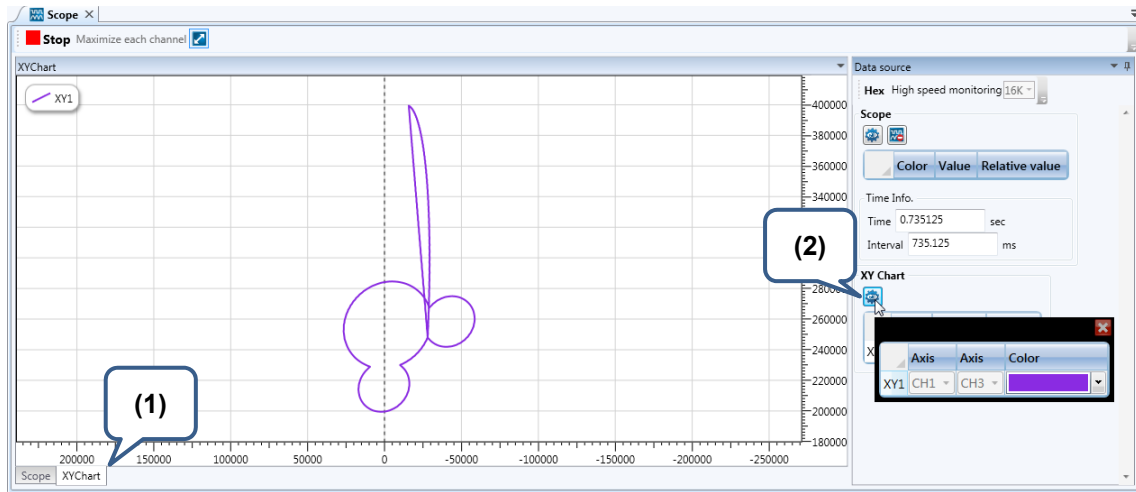
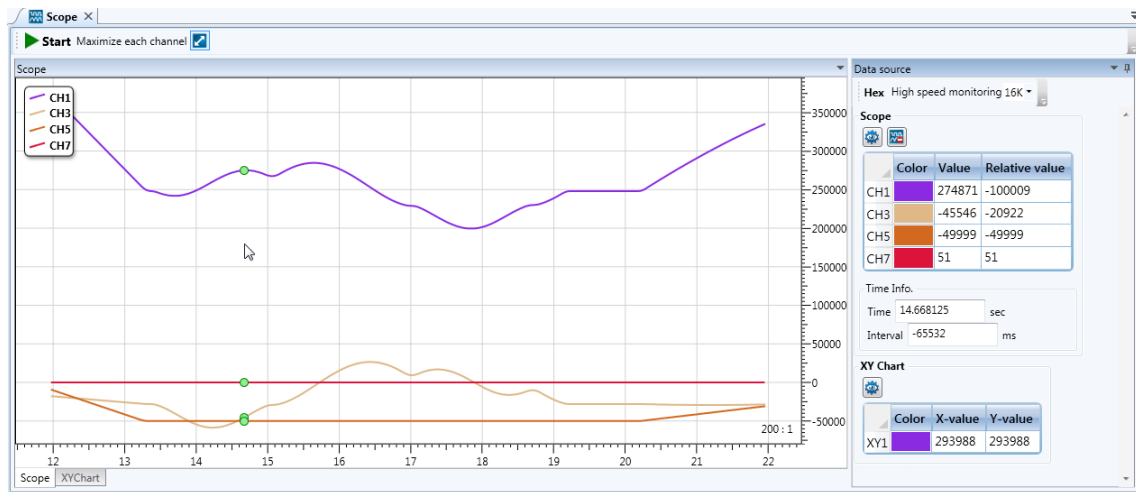


Figure 2.4.6 XY Chart

Auxiliary functions on Scope panel

See the figure below. When moving your mouse (green dot), the time shown in the panel is changed in accordance with the variation of the cursor's position. You can check the monitoring information simply by moving the cursor in Wave zone.



Users also can press the **Tab** key or the A/B reference line to display the information where the cursor stops. See figure 2.4.7 and figure 2.4.8.

2

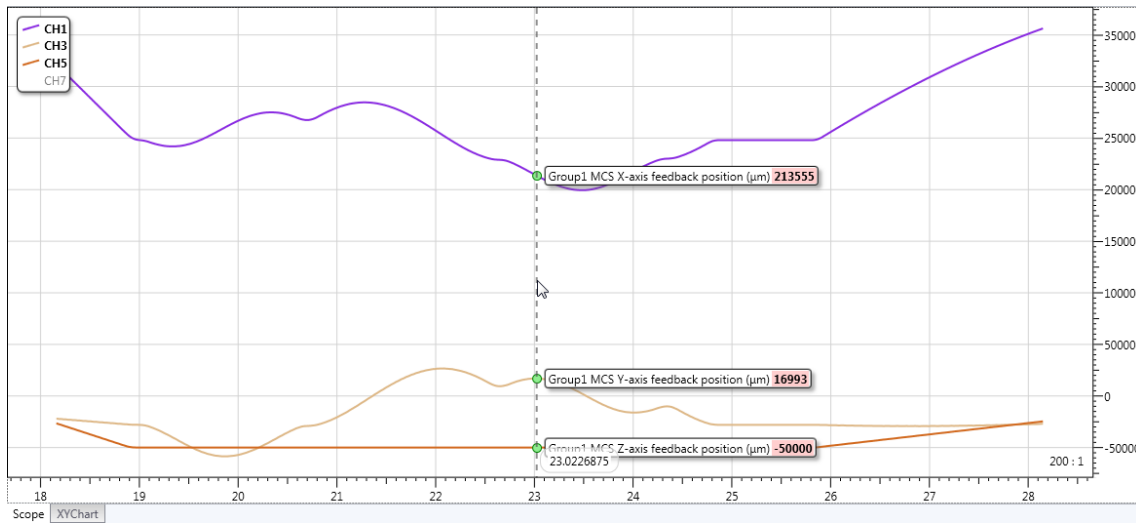


Figure 2.4.7 Display the detailed information where the cursor stops

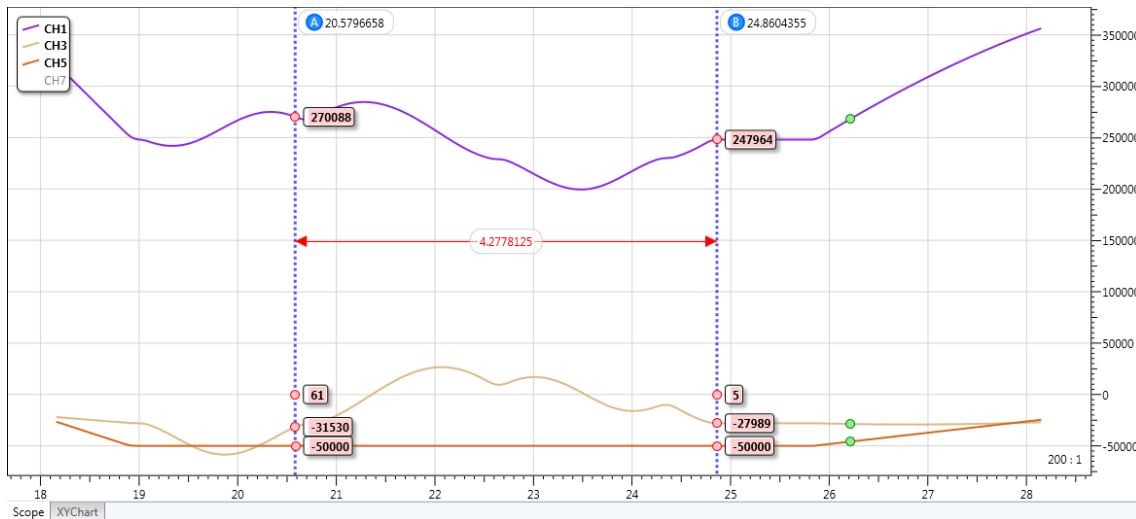
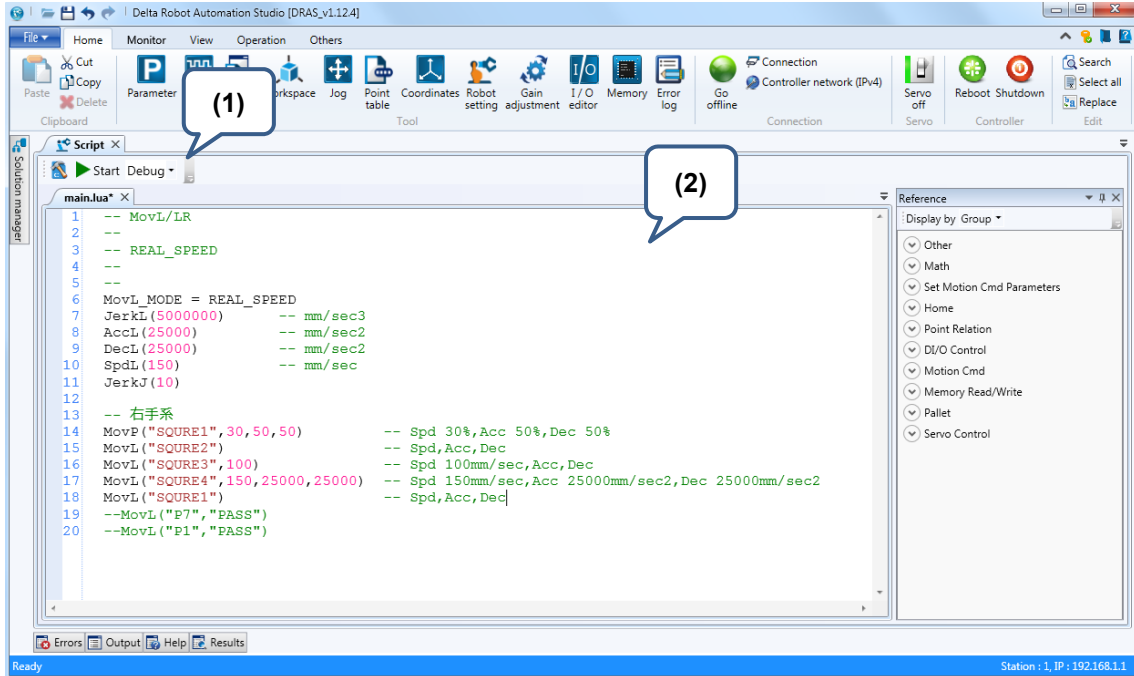


Figure 2.4.8 Display the detailed information of A/B reference line

■ Script

Script can be used to create a complete motion program. Apart from the basic functions such as script writing, download and operation, functions like debug, syntax check, keywords tool and function tip are also provided. These are for helping users to be familiar with and develop programs easily. See the following figure. Script can be divided into two sections, toolbar and script editing area.



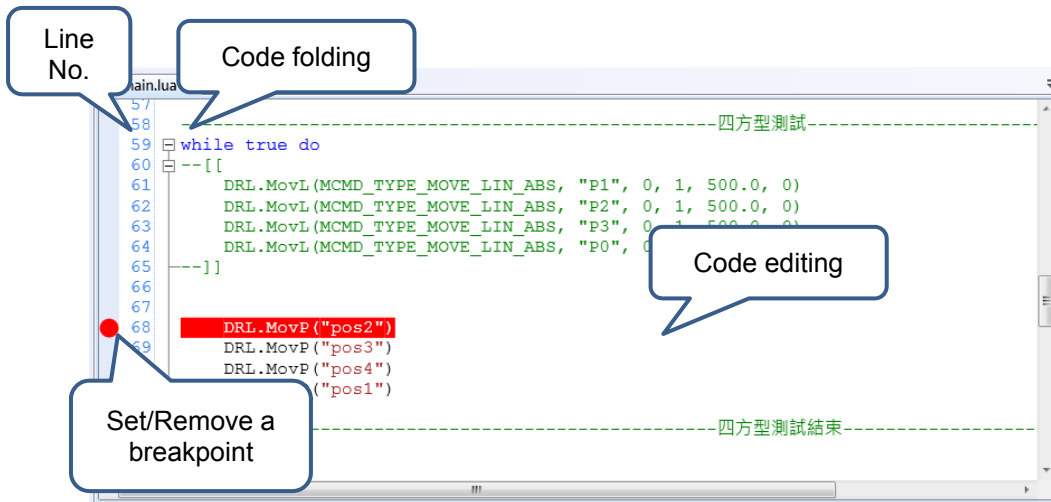
(1) Toolbar

See the description of each function below.

Icon	Name	Keyboard shortcuts	Function
	Syntax check	F6	Check the syntax of the initial project
	Start	F5	Activate the initial project
	Stop	-	Stop the current running code
	Continue	F5	Debug mode - Continue
	Pause	-	Debug mode - Pause
	Step over	F10	Debug mode - Step over
	Step into	F11	Debug mode - Step into
	Step out	Shift+F11	Debug mode - Step out

(2) Script editing area

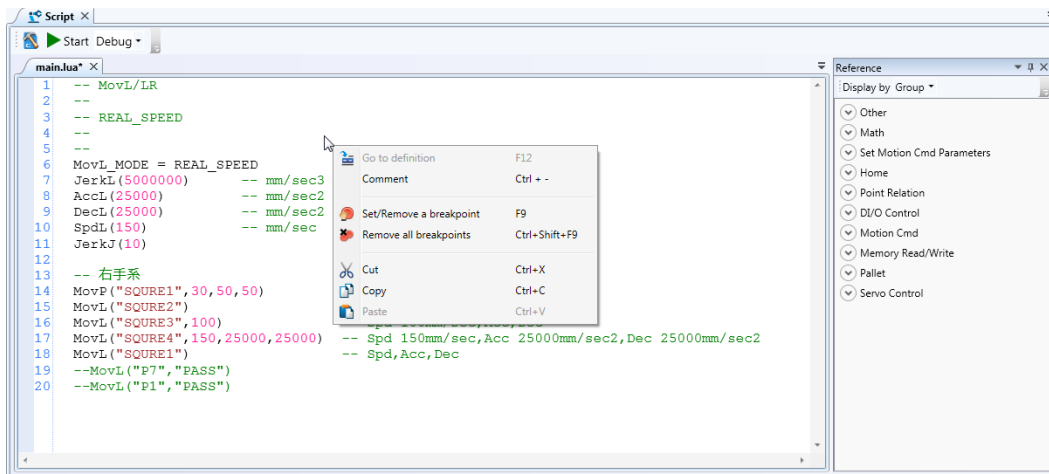
It has four sections, which are set/remove a breakpoint, line number, code folding and code editing.



Please edit the code in code editing area. DRL(Delta Robot Language) is a machine language based on Lua programming language. Thus, most of the programming language is identical to Lua. Please refer to Chapter 6, Programming Language for Robots of ASDA-MS user manual for further information.

Context menu

Right click the mouse on code editing area and a context menu will pop up. Please see the description of each function in the following table.

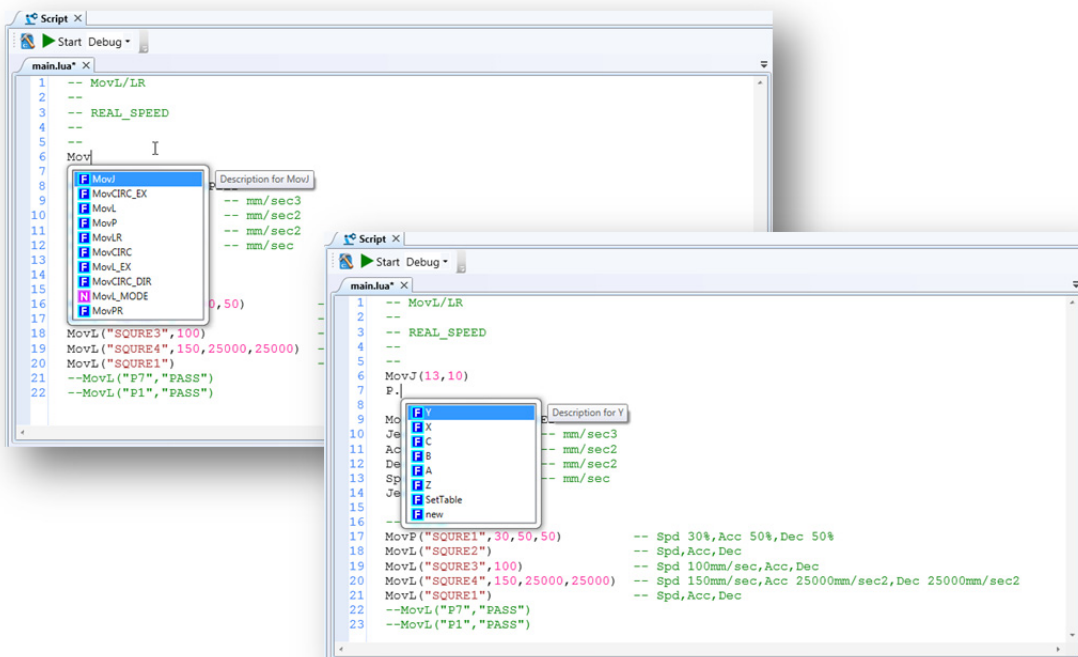


Descriptions of each function:








Icon	Name	Keyboard shortcuts	Function
	Go to definition	F12	Move to the function definition.
	Comment	Ctrl + / Ctrl -	To add or delete comments
	Set/Remove a breakpoint	F9	Set a breakpoint in this line
	Remove all breakpoints	Ctrl+Shift+F9	Remove all breakpoints
	Cut	Ctrl+X	Cut the code
	Copy	Ctrl+C	Copy the code
	Paste	Ctrl+V	Paste the code

Keyword tip

When editing the script, the keyword tool enables users to quickly search and to enter the code. Refer to the following table for the definition of each symbol.

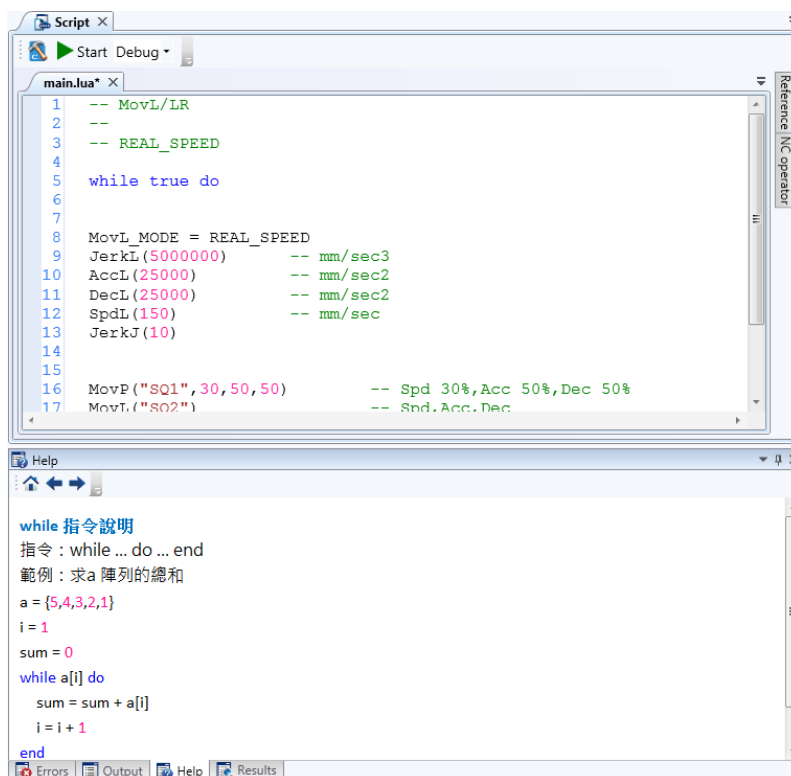


Lua types description:

Icon	Name	Function
	Control	Flow control
	Table	Lua table. If the table includes HashTable and Array types, it will be displayed with this icon.
	Array	Lua arrays
	Function	Lua functions
	String	Lua strings
	Number	Lua numbers, including integer and floating point number
	Bool	Lua Boolean type

Basic syntax and function tip

If you are not familiar with the basic syntax and function when editing the code, you can find the related information in Help panel. Its content is determined by the position where the cursor stops.



When entering the function, a box that showing tips will pop out.

2

```
1  
2 require "MyLib/globalVars" --comment  
3 MaxSpdJ(6000)  
4 MaxAccJ(10000000)  
5  
6 MArchL(  
7   JerkJ(2  
8   AccJ(10 *多軸Line拱形運動(距離插斷)  
9   DecJ(10 以多軸Line運動且距離插斷的方式做拱形移動至該目標位置  
10  SpdJ(10 Point: 點位編號或點位名稱  
11  
12
```

Go to definition

Right clicking the mouse and select **Go to definition**, users are able to find the definition with this function.

```
1 require "sub"  
2  
3 while true do  
4   On_Off_Test  
5 end
```

```
1 function On_Off_Test()  
2   mem.mb3.Write16(0x2000, 1)  
3   DELAY(0.1)  
4   pause()  
5   mem.mb3.Write16(0x2000, 0)  
6   DELAY(0.1)  
7 end
```

Syntax check

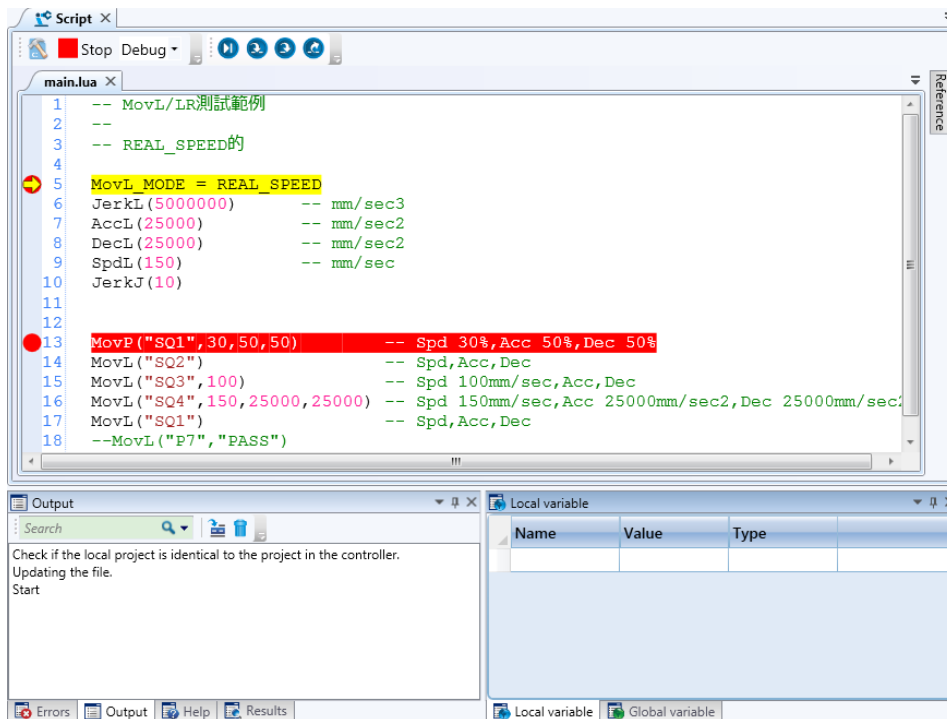
It is suggested to use syntax check to make sure the accuracy of the script. Error(s) will be displayed in output panel or error list. If no error is found, keyword tip and function tip will be automatically updated to the system.

Mode









Script has two modes, Debug and Release. Both can be switched anytime during operation. The Debug mode is for debugging the program; the Release mode has no debug function, but the program runs smoothly in this mode. It is suggested to apply Debug mode when developing the program. Then, apply Release mode to improve system effectiveness.

Debug

This is a vital step for developing the program. Debug mode helps to provide a more stable and reliable program. Set a breakpoint in an appropriate position. Then, debug the program with Global / Local variable panel in Debug mode. See detailed descriptions below.

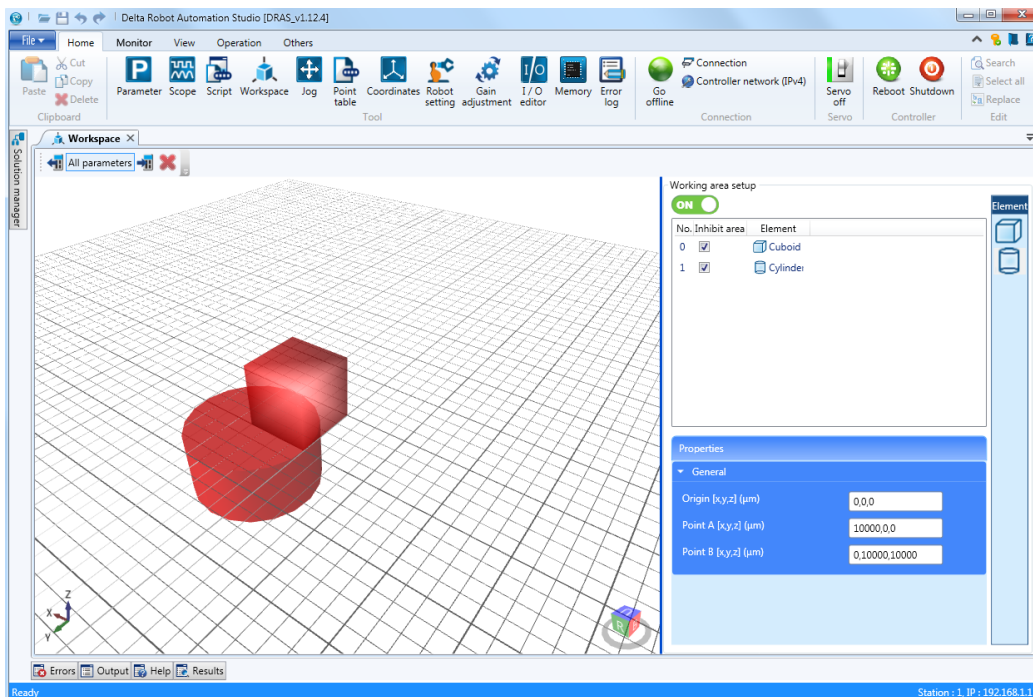


Descriptions of commonly used debug function:

Purpose	Icon	Name	Keyboard shortcuts	Function
Move		Breakpoint	F9	The program will stop at a breakpoint. You can choose to stop at that line, continue, step over, step into or step out the program.
		Continue	F5	When the program pauses or stops at a breakpoint, press this button to continue.
		Pause	-	Pause the current function
		Step over	F10	Move to the next line without stepping into the function
		Step into	F11	Move one line per time
		Step out	Shift+F11	Exit the current function
Panel		Global variable	-	It is the panel to monitor global variables
		Local variable	-	It is the panel to monitor local variables

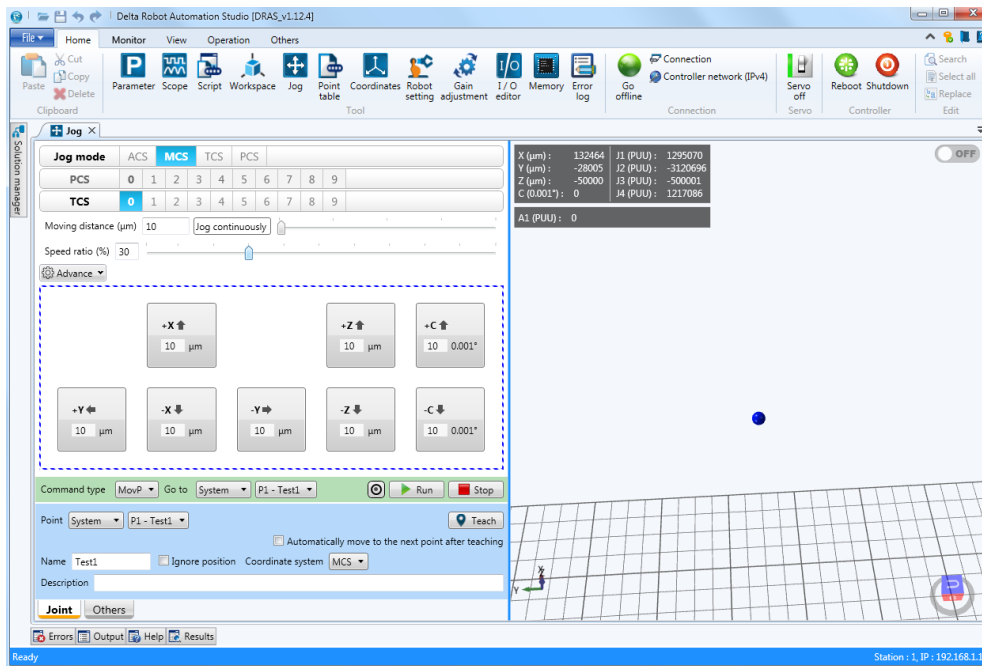
Workspace

The robot arm will be limited by user-defined workspace. Once the arm reaches the restricted area or reaches out the workspace, the system will immediately stops the operation and alarm(s) will occur. See the figure below. Users can directly drag the specify element to the workspace for setting the restricted area or creating geometric blocks. In the mimic diagram, the restricted area is shown in translucent red and the workspace is shown in translucent grey. You can edit the position and parameters of each geometry element in blue section.



■ Jog

Jog function allows users to verify the arm’s moving direction and to do point-teaching to generate a motion path. In the Jog page, you can find Jog and Teach function in the left part. The 3D simulation of the arm and workspace is on the right hand side.



Jog and Teach

Operation of **Joint** and **Others** is in different table. The **Joint** tab is for controlling robot arm’s operation, which also includes the coordinates setting. In **Others** tab, other axes can only be controlled to jog in forward or backward direction.

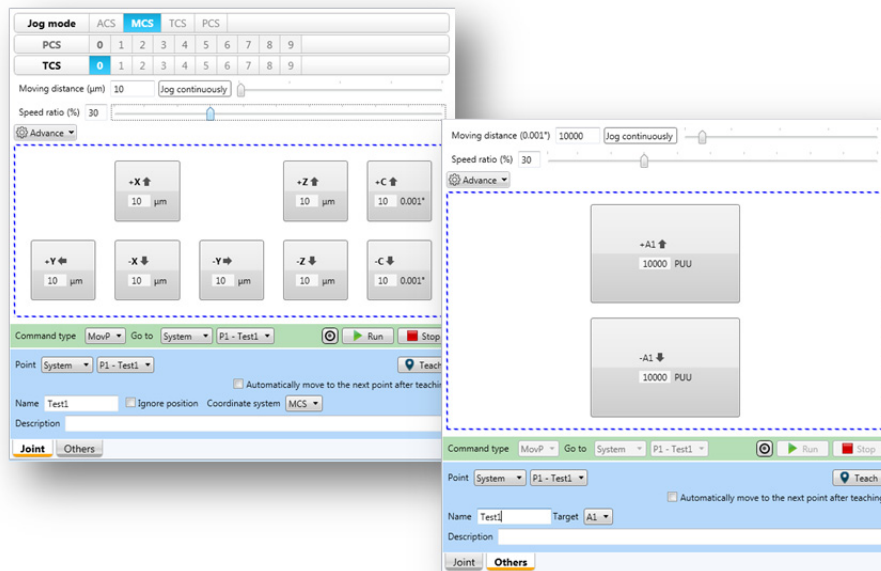


Figure 2.4.9 Joint and Others tabs

2

Joint


Joint has four modes, which are ACS, MCS, TCS and PCS. When applying jog function, users can adjust the moving distance and speed ratio for different applications. When the moving distance is less than 1, it will be set as jog continuously. Then, click on the mouse to jog the motor. The motor now starts running and stops when you release the mouse. Please adjust parameters of acceleration and deceleration by clicking on the **Advance** key.

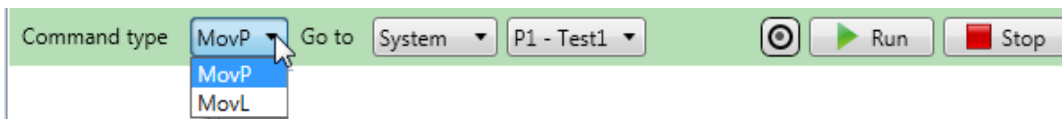
Others

Non-joint axes will be regarded as Others. Most settings are the same except that no coordinate-related parameters can be set here.

Command type

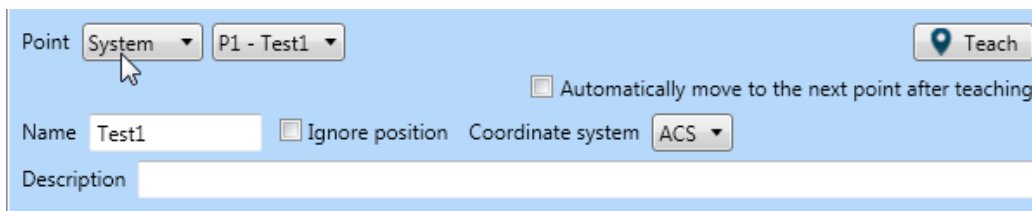
In light green block, you can select different function in **Command type** and command the motor to jog to the specify position. Press the **Run** key to start and the **Stop** key to stop the operation.

In addition, users can use this button  (Move to the specify position) to jog with the selected command type. Click your mouse and the motor will run to the target position. Or the motor will keep running until you release the mouse.



Point teaching

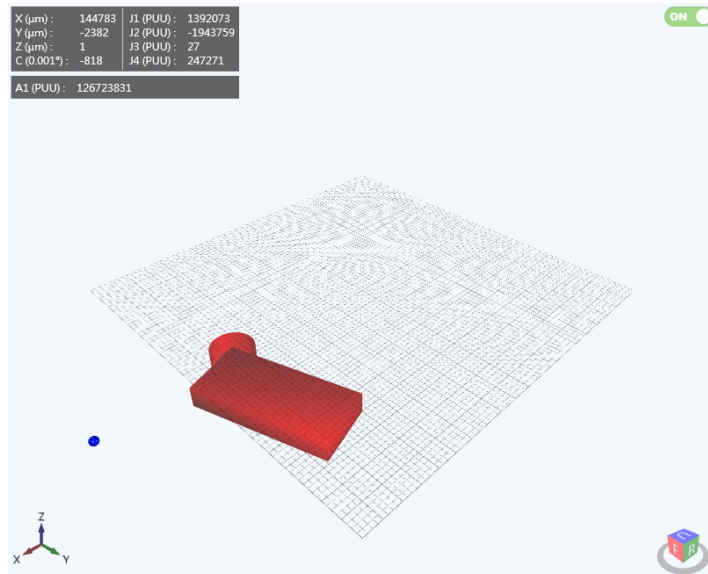
Point teaching function is located in light blue block. It is mainly used for recording the arm and motor's current position. Users can set the point's name, description and related parameters. When it needs to teach more than one points, it is suggested to check **Automatically move to the next point after teaching** for a more effective operation.



Position information and simulation

Right hand side of the jog function page shows position information and simulation. The arm's end point is simulated as a blue ball. Users can hold the right key of the mouse to move or scroll the mousewheel to change the viewing angle. Or use the ←, ↑, →, ↓, **A**, **W**, **S** and **D** key to adjust the angle. The grey block in upper-left corner records the position of the arm's end point and the position of non-joint motor. The coordinate system in lower-left corner and the cubic in lower right corner represent the relation of the coordinates system and view angle. The switch in upper-right corner is for enabling / disabling the function of user-defined workspace. Once this function is enabled, the mimic screen will indicate the restricted area of the robot arm. Please refer to Chapter 3 for the advanced setting of workspace.

2



Point table

The recorded points are applied by the robot arm to do point-to-point movement. And this point table is for viewing and maintaining all points.

Name	X (μm)	Y (μm)	Z (μm)	A (0.001°)	B (0.001°)	C (0.001°)	PCS	TCS	Shoulder	Ignore position	Coordinat
13 Arch3	300000	-150000	0	0	0	0	[0]	[0]	Right	No	MCS
14 Arch4	300000	-150000	-25000	0	0	0	[0]	[0]	Right	No	MCS
15 Arch5	250000	150000	-15000	0	0	0	[0]	[0]	Right	No	MCS
16 Arch6	300000	-150000	-15000	0	0	0	[0]	[0]	Right	No	MCS
17 P0	300000	100000	-25000	0	0	0	[0]	[0]	Right	No	MCS
18 P1	300000	200000	0	0	0	0	[0]	[0]	Right	No	MCS
19 P2	300000	0	0	0	0	0	[0]	[0]	Right	No	MCS
20 P3	300000	80000	-15000	0	0	0	[0]	[0]	Right	No	MCS
21 ZERO	0	0	0	0	0	0	[0]	[0]	Right	No	MCS
22 TEMP	0	200000	0	0	0	0	[0]	[0]	Right	No	MCS
23 TEMP2	0	0	0	0	0	0	[0]	[0]	Right	No	MCS
24 P5	50000	0	0	0	0	0	[0]	[0]	Right	No	MCS
25 P6	350000	10000	-25000	0	0	0	[0]	[0]	Right	No	MCS
26 P7	300000	0	0	0	0	0	[0]	[0]	Right	No	MCS
27 SQ1	300000	10000	0	0	0	0	[0]	[0]	Right	No	MCS
28 SQ2	350000	10000	0	0	0	0	[0]	[0]	Right	No	MCS
29 SQ3	350000	-10000	0	0	0	0	[0]	[0]	Right	No	MCS
30 SQ4	300000	-10000	0	0	0	0	[0]	[0]	Right	No	MCS

System point table and User point table

The controller-has two types of point table, System and Users. System point table is stored in controller memory (The storage is determined by the controller specification). User point table is stored in project folder as a file. You can switch these two tabs in lower-left corner. Please note that data in red in System tab means the data is not consistent with data in the controller. In this case, you should read or write the data first. However, there is no need to worry if the User point data is not consistent since it is not recorded in the controller.

Name	X (μm)	Y (μm)	Z (μm)	A (0.001°)	B (0.001°)	C (0.001°)
1 Test1	600000	0	0	0	0	0
2 Test2	300000	-200000	-100000	0	0	0
3 Test3	200000	-200000	0	0	0	0
4 Test4	200000	200000	0	0	0	0
5 Test5	230000	-34650	-1000	0	0	0
6 Test6	350000	-34650	-1000	0	0	0
7 Test7	300000	-250000	-10000	0	0	0
8 Test8	300000	250000	-10000	0	0	0
9 Test9	229400	-166000	-37900	0	0	0
10 Test10	229400	84000	-37900	0	0	0
11 Arch1	250000	150000	-25000	0	0	0

Point format

Apart from Teach function, the point can be generated by editing the point table. The recording data of ACS is different from other coordinate systems. You can see from figure 2.4.10, ACS records the point by motor's feedback position (PUU). And for the other coordinate system, it records the position. If the table shows in grey color, it means it is not supported by the robot type.

Name	J1 (PUU)	J2 (PUU)	J3 (PUU)	J4 (PUU)	J5 (PUU)	J6 (PUU)	PCS	TCS	Shoulder	Ignore position	Coordinate system
1 Test1	600000	0	0	0	0	0	[0]	[0]	Right	No	MCS
2 Test2	300000	-200000	-100000	0	0	0	[0]	[0]	Left	No	MCS
3 Test3	200000	-200000	0	0	0	0	[0]	[0]	Right	No	MCS
4 Test4	200000	200000	0	0	0	0	[0]	[0]	Right	No	MCS
5 Test5	230000	-34650	-1000	0	0	0	[0]	[0]	Right	No	ACS
6 Test6	350000	-34650	-1000	0	0	0	[0]	[0]	Right	No	ACS
7 Test7	300000	-250000	-10000	0	0	0	[0]	[0]	Right	No	ACS
8 Test8	300000	250000	-10000	0	0	0	[0]	[0]	Left	No	PCS
9 Test9	229400	-166000	-37900	0	0	0	[0]	[0]	Right	No	TCS
10 Test10	229400	84000	-37900	0	0	0	[0]	[0]	Right	No	MCS
11 Arch1	250000	150000	-25000	0	0	0	[0]	[0]	Right	No	MCS
12 Arch2	250000	150000	0	0	0	0	[0]	[0]	Right	No	MCS

Figure 2.4.10 Point data in ACS format

Name	X (µm)	Y (µm)	Z (µm)	A (0.001°)	B (0.001°)	C (0.001°)	PCS	TCS	Shoulder	Ignore position	Coordinate system
1 Test1	600000	0	0	0	0	0	[0]	[0]	Right	No	MCS
2 Test2	300000	-200000	-100000	0	0	0	[0]	[0]	Left	No	MCS
3 Test3	200000	-200000	0	0	0	0	[0]	[0]	Right	No	MCS
4 Test4	200000	200000	0	0	0	0	[0]	[0]	Right	No	MCS
5 Test5	230000	-34650	-1000	0	0	0	[0]	[0]	Right	No	ACS
6 Test6	350000	-34650	-1000	0	0	0	[0]	[0]	Right	No	ACS
7 Test7	300000	-250000	-10000	0	0	0	[0]	[0]	Right	No	ACS
8 Test8	300000	250000	-10000	0	0	0	[0]	[0]	Left	No	PCS
9 Test9	229400	-166000	-37900	0	0	0	[0]	[0]	Right	No	TCS
10 Test10	229400	84000	-37900	0	0	0	[0]	[0]	Right	No	MCS
11 Arch1	250000	150000	-25000	0	0	0	[0]	[0]	Right	No	MCS
12 Arch2	250000	150000	0	0	0	0	[0]	[0]	Right	No	MCS

Figure 2.4.11 Point data in non-ACS format

Read / Write function and context menu

Users can read or write the point in System tab through this function on toolbar. It allows users to read and write the data in batch. Users also can hold the mouse to select one or more points. Then, a context menu box will pop up. The Read / Write function is exactly the same as the function on toolbar. Command type selection is included in context menu as well.

Name	J1 (PUU)	J2 (PUU)	J3 (PUU)	J4 (PUU)	J5 (PUU)	J6 (PUU)
1 Test1	600000	0	0	0	0	0
2 Test2	300000	-200000	-100000	0	0	0
3 Test3	200000	-200000	0	0	0	0
4 Test4	200000	200000	0	0	0	0
5 Test5	230000	-34650	-1000	0	0	0
6 Test6	350000	-34650	-1000	0	0	0
7 Test7	300000	-250000	-10000	0	0	0
8 Test8	300000	250000	-10000	0	0	0
9 Test9	229400	-166000	-37900	0	0	0
10 Test10	229400	84000	-37900	0	0	0
11 Arch1	250000	150000	-25000	0	0	0
12 Arch2	250000	150000	0	0	0	0

Figure 2.4.12 Context menu for point table

Export / Import

See the following table for the file format supported by export/import function. Now, .bin, .xml, .xls and .xlsx are supported. When importing .xls and .xlsx file, you can complete the advanced setting in **Xls to Point** table.

File format supported by point table:

	Export	Import
.bin	<input type="radio"/>	<input type="radio"/>
.xml	<input type="radio"/>	<input type="radio"/>
.xls	<input type="radio"/>	<input type="radio"/>
.xlsx	<input type="radio"/>	<input type="radio"/>

Xls file preview is on the right side of **Xls to Point**. Point property setup on the left side can be used to select the binding field.

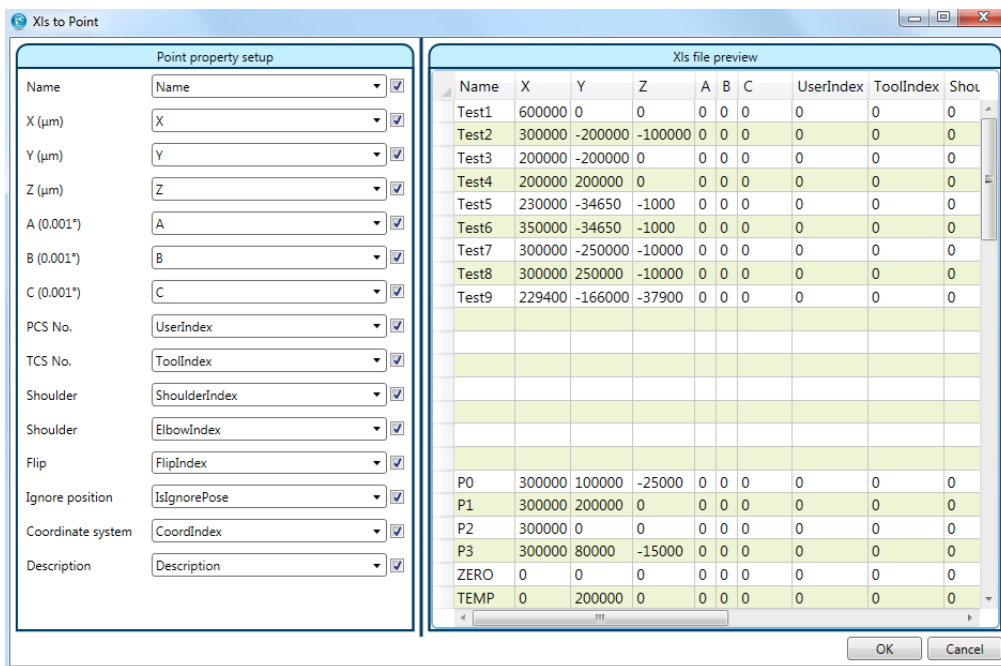
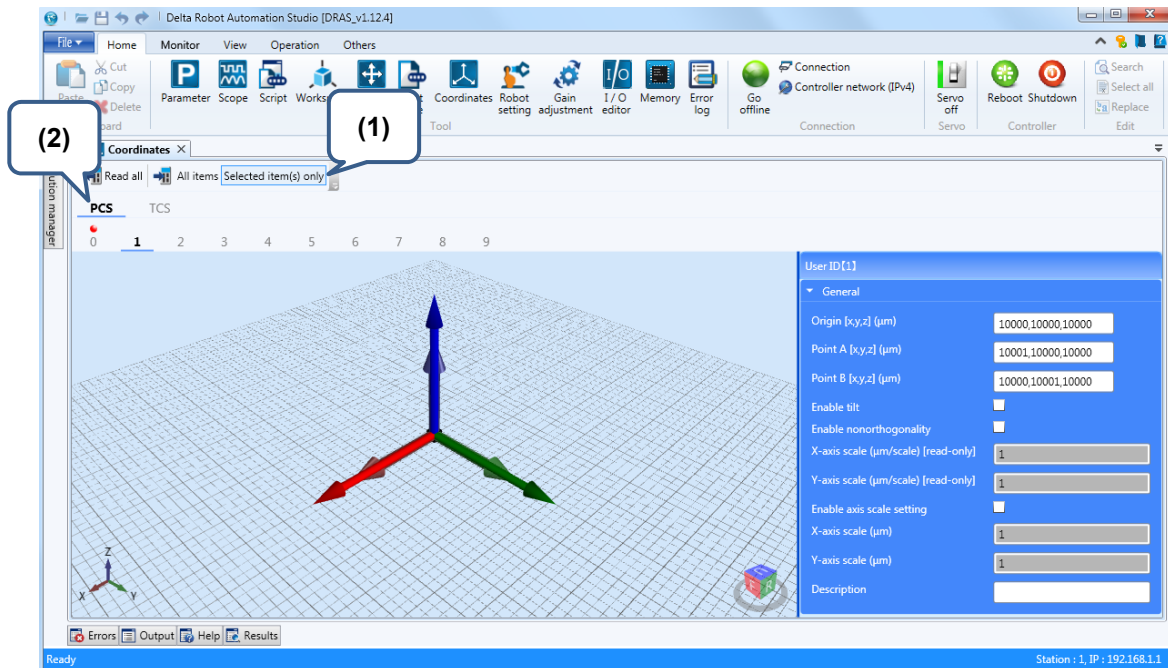


Figure 2.4.13 Xls to Point

Coordinates

Coordinates setting screen includes product coordinates (PCS) and tool coordinates (TCS). Each coordinate has N User ID (determine by controller specification). User ID 0 is default and not available for teach function.



(1) Toolbar

See each function of the toolbar below.

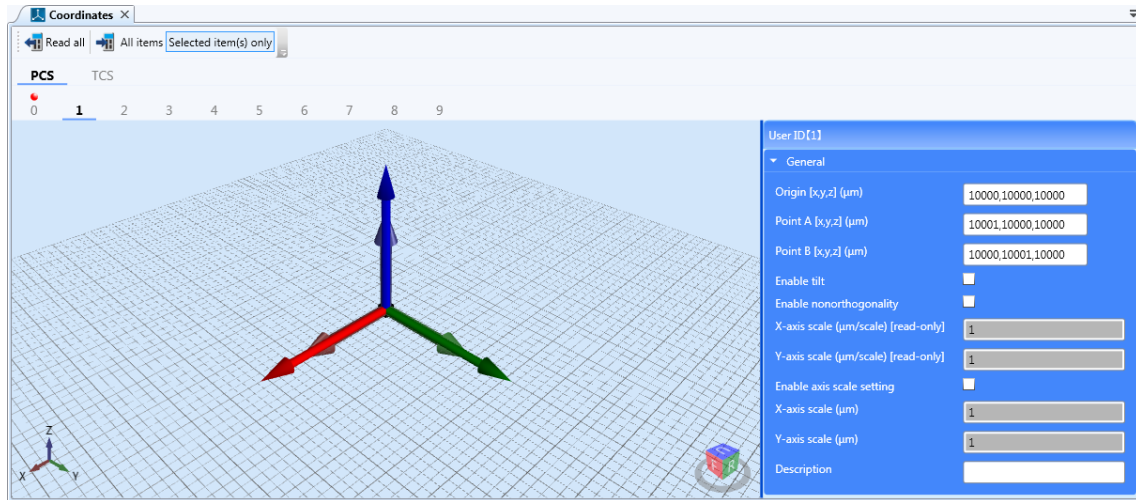
Icon	Name	Keyboard shortcuts	Function
	Read all	-	Read all parameters
	Write	-	Write parameters
-	All items	-	Edit all parameters
-	Selected item(s) only	-	Edit the selected item(s) only

(2) Tab

It has two tabs for selection, PCS and TCS.

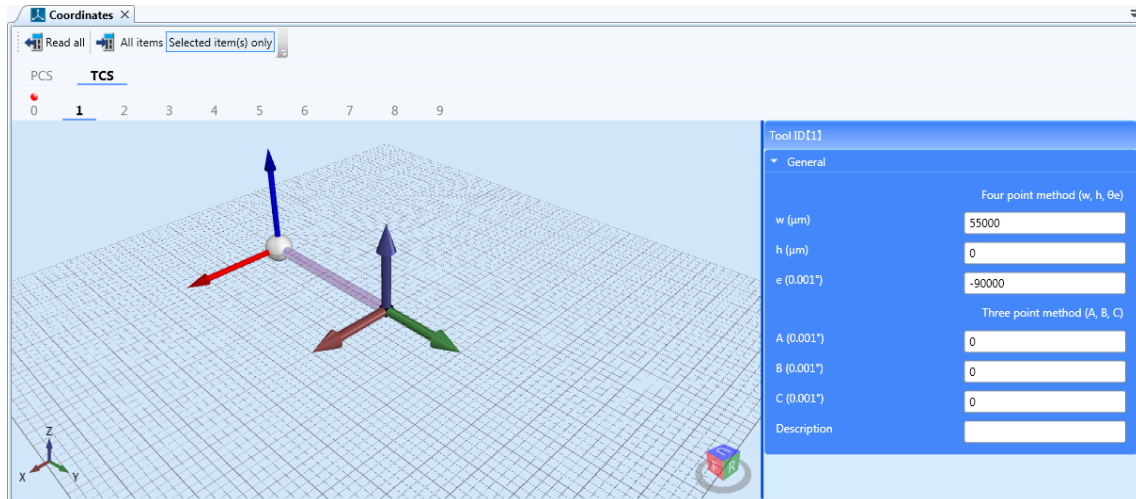
PCS

Select the User ID first. Then edit it on the right hand side. The 3D simulation is on the left which provides a more intuitive viewing for teaching. Its operation method is the same as that mentioned in Jog section. The XYZ coordinate (with dark color) in 3D simulation is the center of MCS (machine coordinates). Another XYZ coordinate (with lighter color) shows the point-teaching position. Value change will influence the relation between XYZ coordinate and MCS.



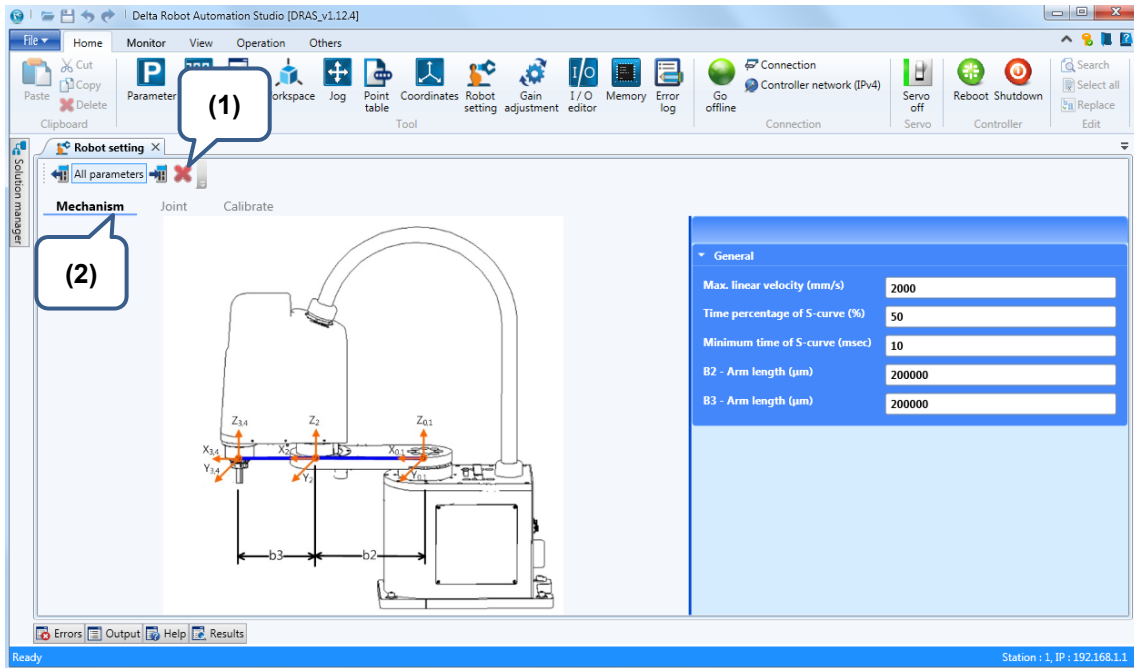
TCS

TCS teach steps are identical to PCS. The purple cylinder extended from the coordinate center is the result of TCS teach.



■ Robot setting

This page is for setting parameters of the robot arm and each joint. Please input correct values so that the motion can be more accurate.



(1) Toolbar

Please refer to the table below for the description of each item in robot setting.

Icon	Name	Keyboard shortcuts	Function
	Start / Stop monitoring	-	Start / Stop monitoring the end point of the mechanism
	Read	-	Read parameters
	Write	-	Write parameters
All parameters	All parameters	-	Edit all parameters
	Stop	-	Stop current operation

(2) Tab

You can see three tabs in Robot setting, which are Mechanism, Joint and Calibrate.

2

Mechanism

Different type of mechanism requires different setting. Users need to fill in the correct to complete the setting. If the parameter shows in red color, it means the value does not match to the value in the controller. It is suggested to write or read parameters first.

Joint

Joint-related parameters are shown in table. If the parameter shows in red color, it means the value does not match to the value in the controller. It is suggested to write or read parameters first.

	J1	J2	J3	J4
Gear ratio (PUU/rev)	100000	100000	100000	100000
Speed reduction ratio (numerator)	80	80	1	160
Speed reduction ratio (denominator)	1	1	1	3
Lead (µm)	0	0	10000	0
Positive limit (PUU)	2888889	3222223	200000	5333334
Negative limit (PUU)	-2888889	-3222223	-3000001	-5333334
Saturation velocity of Special Filter (PUU/ms)	10000	10000	10000	10000
Saturated acceleration of Special Filter (PUU/ms ²)	0	0	0	0
Motor deviation angle (PUU)	0	0	0	0
Max. rotation speed limit (PUU/ms)	10000	10000	10000	10000
Max. acceleration limit (PUU/ms ²)	500	500	500	500
Max. deceleration limit (PUU/ms ²)	500	500	500	500
Max. jerk limit (PUU/ms ³)	500	500	500	500
Encoder type	Incremental	Incremental	Incremental	Incremental
Motor rotating direction	 +: CW -: CCW	 +: CW -: CCW	 +: CCW -: CW	 +: CW -: CCW
Homing				

Calibrate

Robot arm is composed of fine structures. However, during the assembly process, the assembly deviation might cause low precision of robot arm's positioning. The system provides an algorithm that enables users to calculate motor's offset angle and length of the robot arm through a higher precision fixture and simple positioning method. Please see the figure below and refer to Chapter 3 for its setting steps. Calibrate function is only supported by part of the robot types for now.

Robot setting

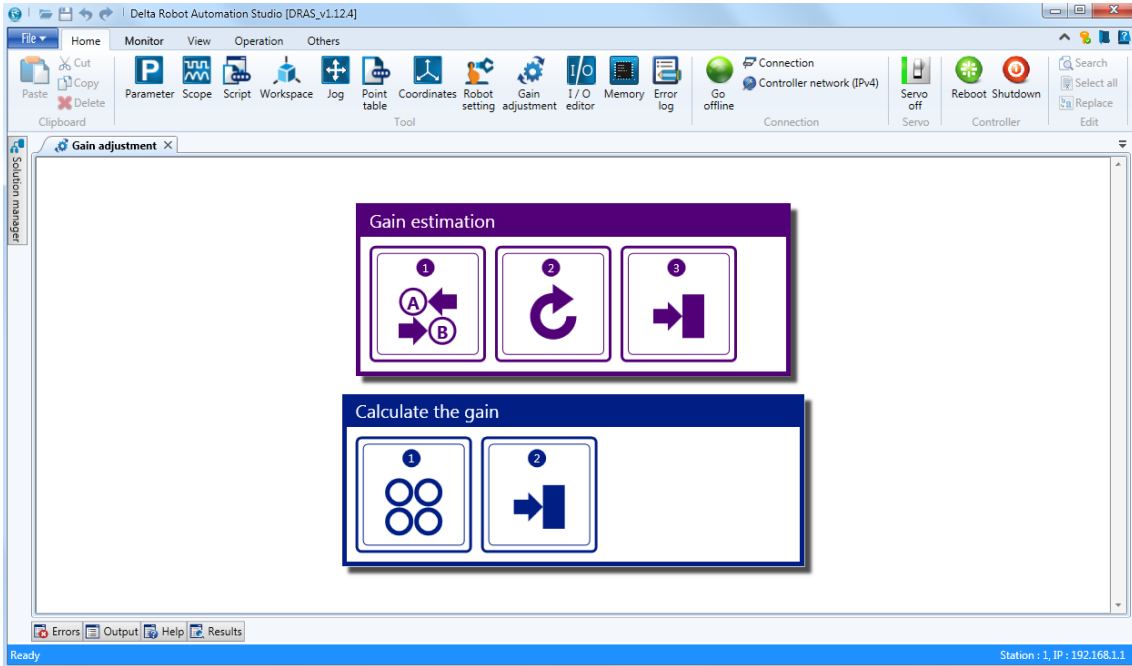
Mechanism Joint **Calibrate**

Offset amount relative to point A (µm): Calculate and Calibrate
 (a, b) = (210000 , 0) (c, d) = (210000 , 297000) (e, f) = (0 , 297000)

Name	J1 Feedback angle (0.001°)	J2 Feedback angle (0.001°)
A	-39464	82747
B	-27275	57825
C	-30549	57825
D	0	0

Gain adjustment

Users need to adjust gain-related parameters for a better and stable system performance. This setting page provides two modes for selection, which are Gain estimation and Gain calculation.



Gain estimation

Gain estimation can be applied when the inertia ratio is unknown. Follow the instructions to complete gain estimation. Please select the axis number to be adjusted first.

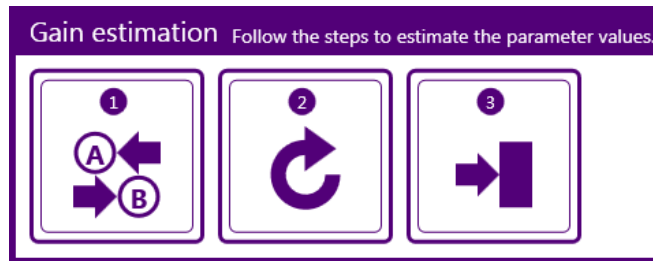


Figure 2.4.14 Gain estimation

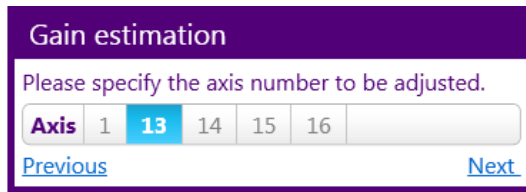


Figure 2.4.15 Axis selection for gain estimation

The first step is to position two points (A and B) of the motor. The motor will run back and forth between these two points until the value of inertia ratio is stable (small variation) and acquires the suggested parameters. Click on **Write the result to the controller** to complete gain estimation. During estimation, users can set the advanced motion parameters if needed. See the following table for motion parameters.

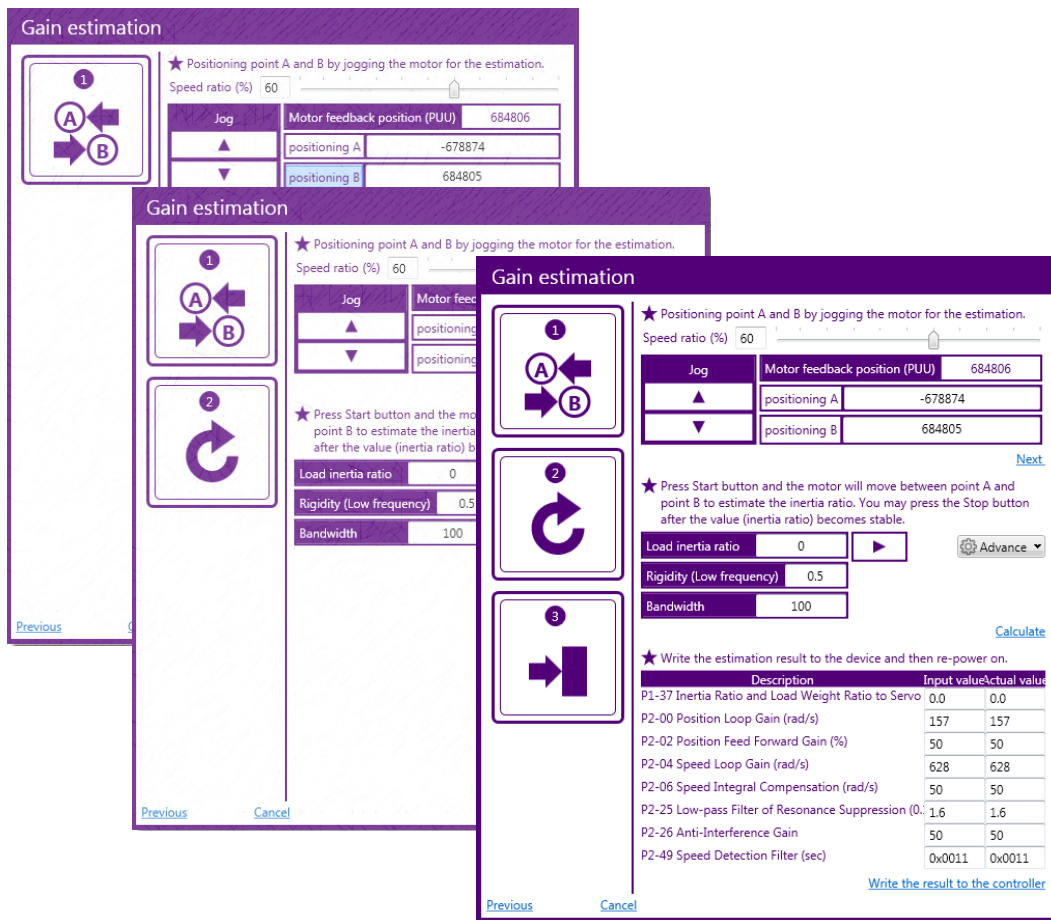


Figure 2.4.16 Three steps for gain estimation

Descriptions of the advanced motion parameters:

Item	Description
Speed (PUU/ms)	Motor speed when runs between A and B point.
Acceleration	Motor speed when accelerates between A and B point.
Deceleration	Motor speed when decelerates between A and B point.
Time interval (ms)	The waiting time between two actions.

Gain calculation

Gina calculation is applied when you have already known the inertia ratio and frequency. Please select the axis number to be adjusted first. See figure 2.4.18.

2

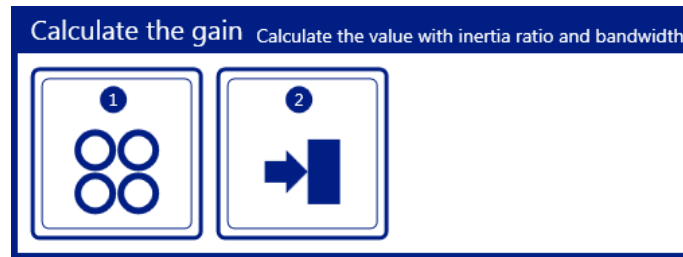


Figure 2.4.17 Gain calculation

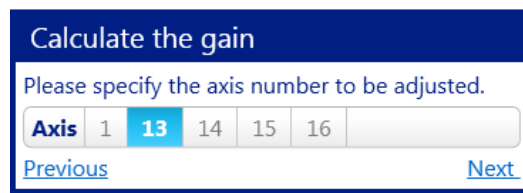
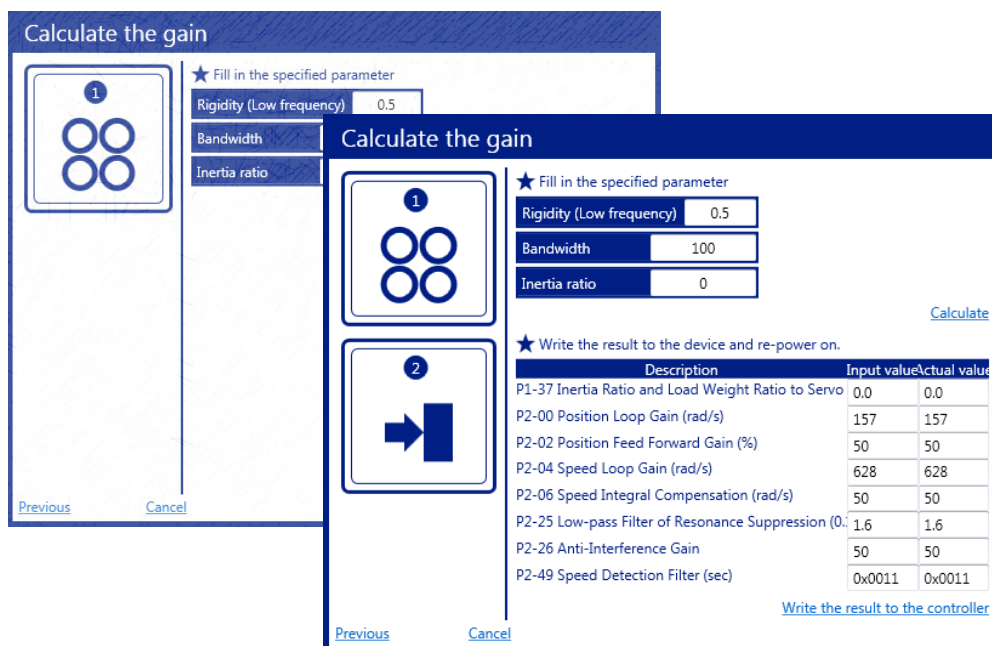


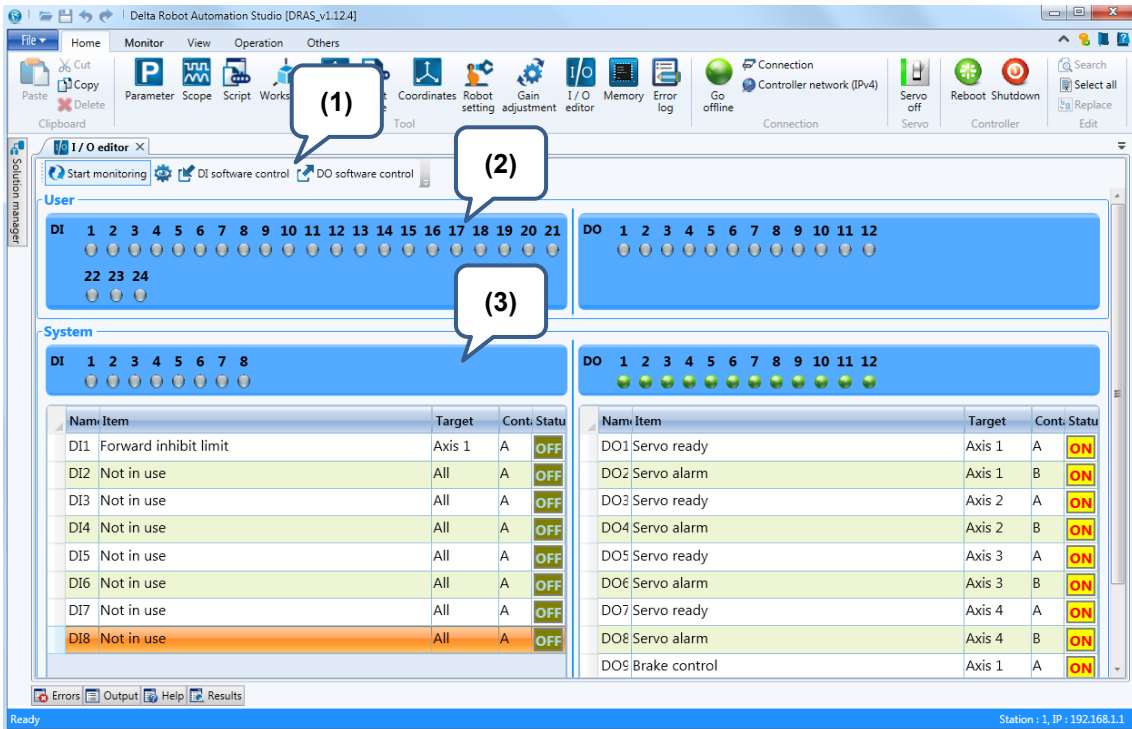
Figure 2.4.18 Axis selection for gain calculation

It only has two steps in Gain calculation. Please fill in the specified parameters for calculation. Then, click on **Write the result to the controller** to complete gain calculation.



■ I/O editor

I/O control page allows users to monitor I/O point of the controller, setup functions or use software to trigger I/O. This helps the communication between the controller and its peripheral devices. See the setting screen below. It is divided into three sections, toolbar, User I/O and System I/O.



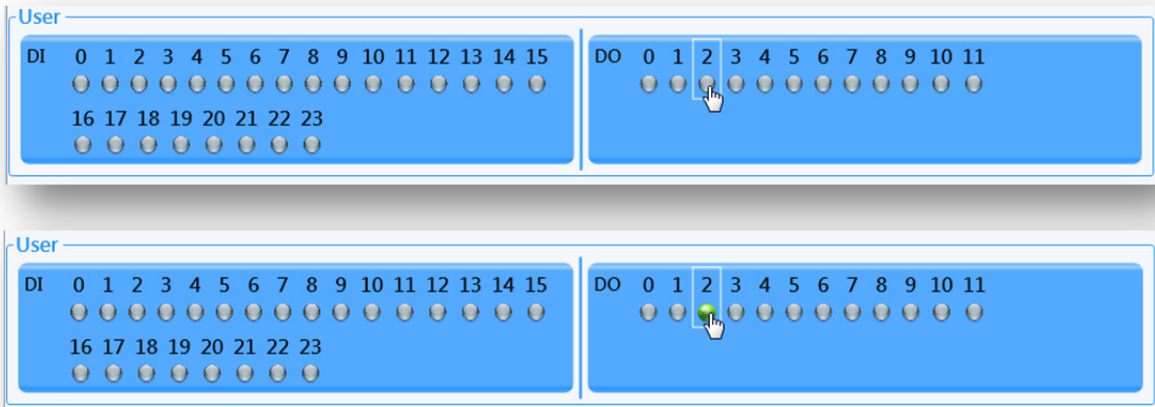
(1) Tool bar

Refer to the following table for the description of each item on toolbar. Apart from **Start/Stop monitoring**, all functions are available only when monitoring function is activated.

Icon	Name	Keyboard shortcuts	Function
	Start / Stop monitoring	-	When start monitoring, the icon will keep rotating in clockwise direction. When it stops monitoring, the icon stops rotating.
	Edit system DIO	-	Edit system DIO after activating monitoring function
	DI software control	-	DI software control can be activated after starting monitoring.
	DO software control	-	DO software control can be activated after starting monitoring.

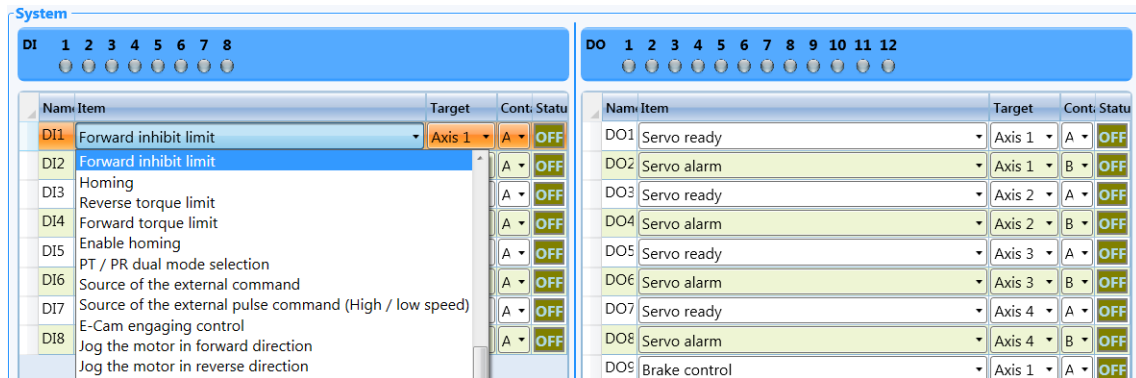
(2) Users I / O

Apart from monitoring function, users can activate DO software control to trigger the output point. See the figure below. The signal status can be changed by clicking the mouse on the light number. When it shows green, the signal is On. Otherwise, the signal is Off.



(3) System I / O

The difference between System I/O and User I/O is that System I/O has already defined the commonly used control function. Thus, System I/O provides one more table for users to set each signal. Before you start to set the I/O, please activate monitoring function first.



System I/O supports DI software control. Please click on **DO software control** to set digital output via the software.

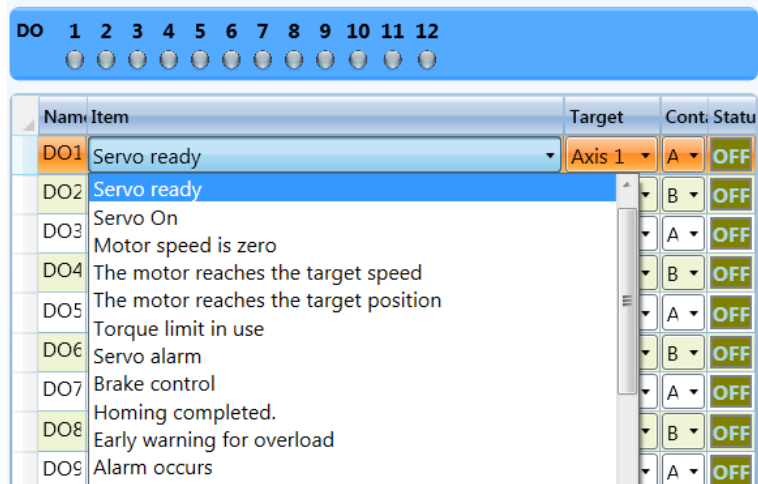
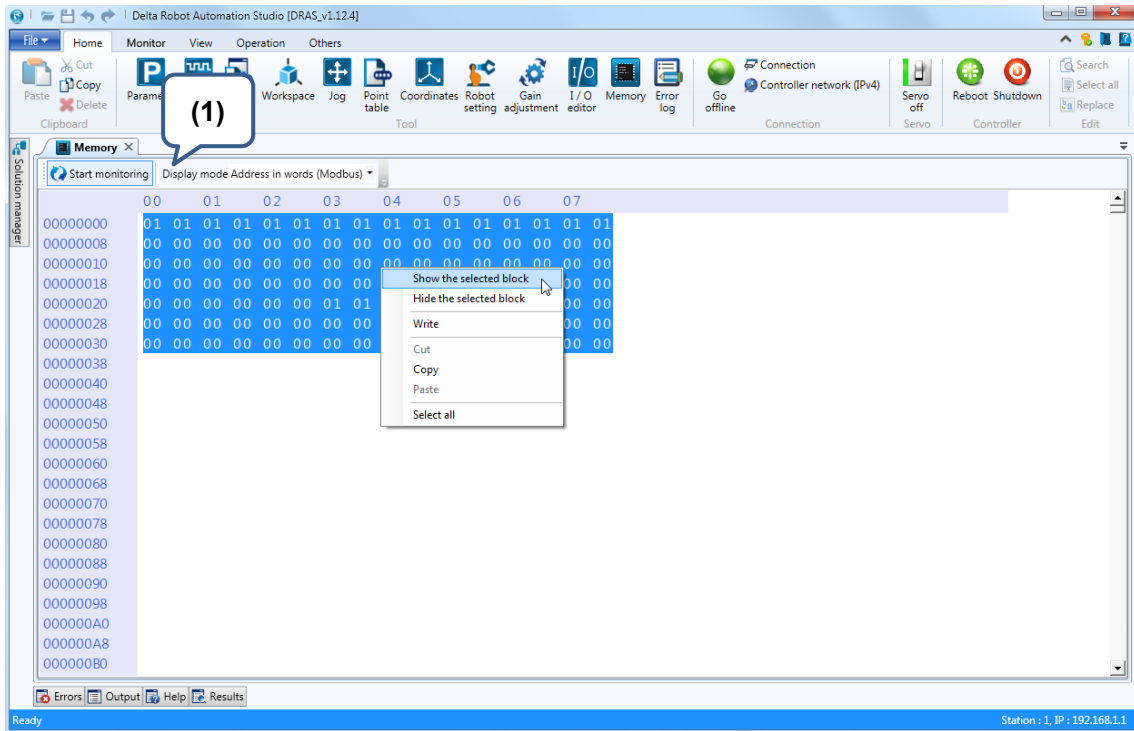


Figure 2.4.19 DO software control

2

Memory

Memory of the controller provides one block for users to read and write through communication. With this block, the controller can communicate with the peripheral devices (e.g. vision system) according to the demand. DRAS also provides memory monitoring tool for communication and test.



(1) Toolbar

See the description of each item below.

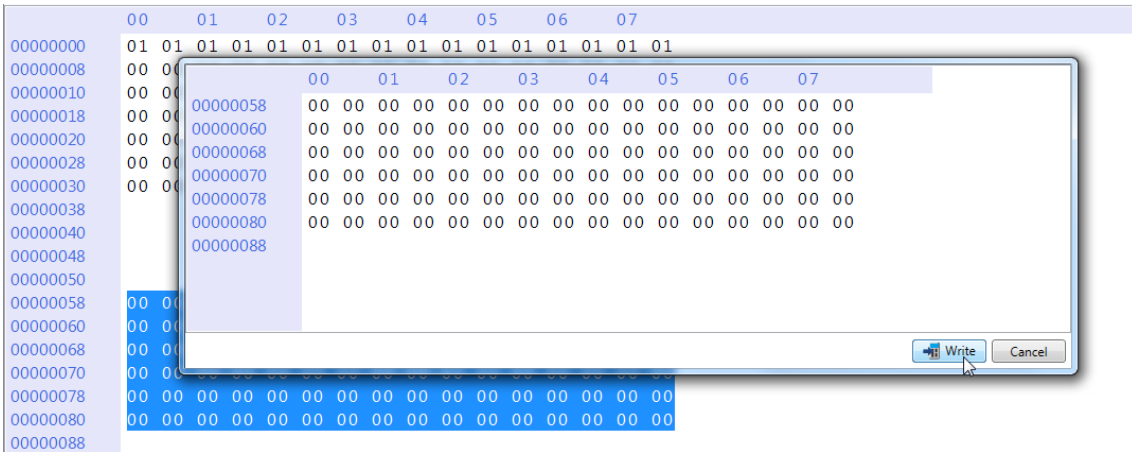
Icon	Name	Keyboard shortcuts	Function
	Start / Stop monitoring	-	When start monitoring, the icon will keep rotating in clockwise direction. When it stops monitoring, the icon stops rotating.
-	Display mode	-	(1) Address in words (2) Address in bytes

Read memory

As the figure shown above, you need to select the block to be monitored first. Then, click the mouse and select **Show the selected block** or **Hide the selected block** to display / hide the data of the selected memory. Please activate monitoring function first before monitoring memory status.

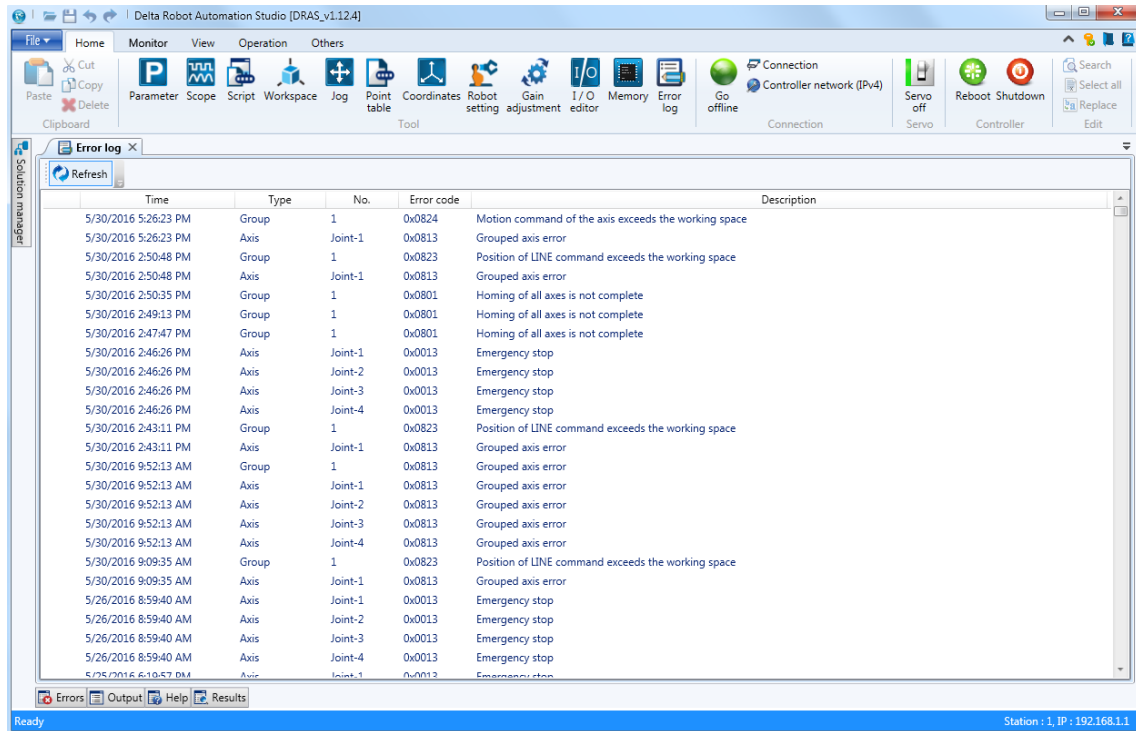
Write memory

You may select **Write** in context menu to write and edit the selected block into the memory.



■ Error log

When an error occurs, the controller will record the error. Users can view the error record in error log. Click on **Refresh**, the system will update and list all error records.



2.5 Status bar

The information of current status, warning and error will show on the left hand side of status bar. It also uses different background colors (orange, blue and red) to represent different status. You can find further description of each background color below. **Working progress** shows the loading processing of the system. And **Connection** shows the information including station number and IP address. When connecting to the controller through Ethernet, it will display IP address; when connecting to the controller via RS-232/RS-485, it will display the port number and baud rate.

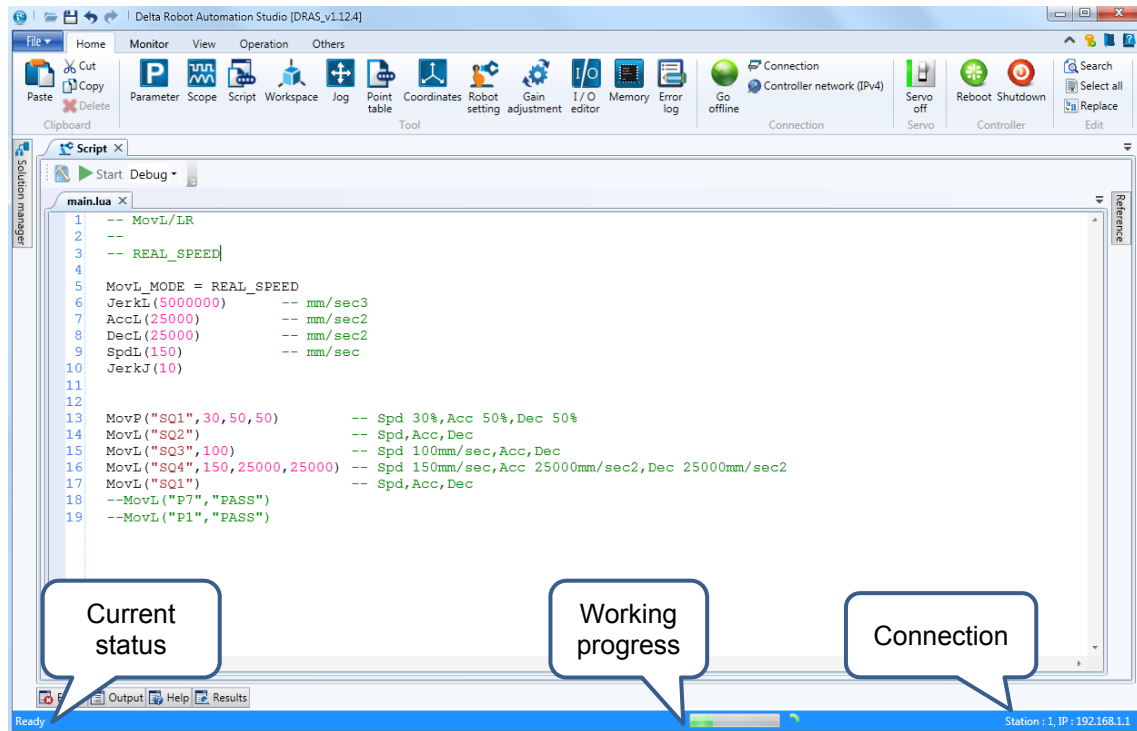


Figure 2.5.1 Status bar

Background color of status bar:

Color	Meaning
Orange	It means warning. When the system does not connect to the controller, the background color of status bar will be orange. Please refer to the description shown on the left hand side of status bar.
Blue	It means normal connection.
Red	It means error occurrence (abnormal connection). Please refer to the description shown on the left hand side of status bar.

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2

Advanced Operation

3

Before starting using DRAS, you can refer to this chapter for basic operation.

3.1	Connect DRAS with your controller	3-3
3.1.1	Connect the controller via Ethernet	3-3
3.1.2	Connect the controller via USB	3-4
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3.3.2	Mechanism calibration	3-9
3.4	Tuning	3-11
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3.4.2	Gain calculation	3-12
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3.6	Define workspace	3-16
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3.8.2	How to set the breakpoint?	3-19
3.8.3	How to debug a program?	3-20
3.9	Upload projects to the controller	3-21
3.10	Create coordinate system	3-22
3.10.1	How to create PCS (Product Coordinate System)?	3-22
3.10.2	How to create TCS (Tool coordinate system)?	3-23
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3.12	Data base update	3-31
3.12.1	Update the firmware	3-31
3.12.2	Update the system function library	3-32
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3.13	Create system function library	3-35
3.14	Clone the controller	3-36

3.14.1 Clone 3-37

3.14.2 Update 3-39

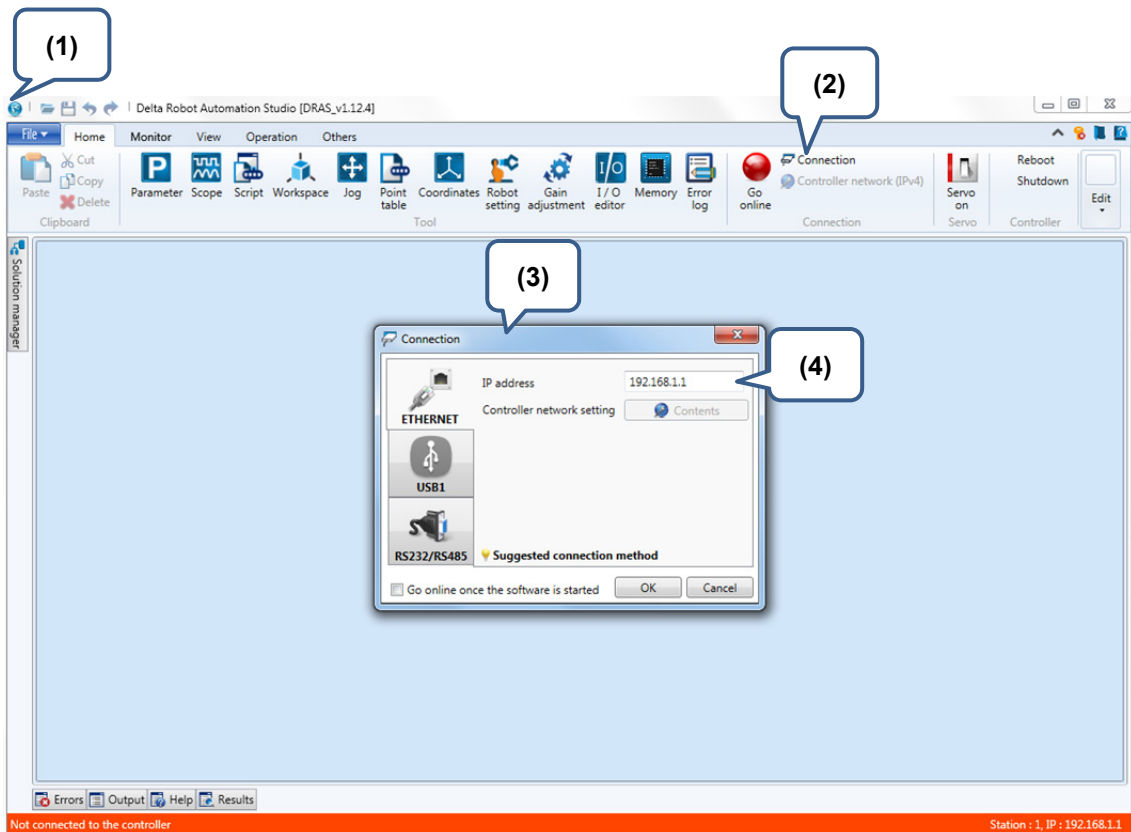
3

3.1 Connect DRAS with your controller

This section tells you how to make your controller work. One of the means is to connect DRAS with the controller and to operate the motor by issuing commands to the controller. The following sections will introduce the three methods to connect the controller.

3.1.1 Connect the controller via Ethernet

Controller can be connected via Ethernet. You can follow the steps below for connection.

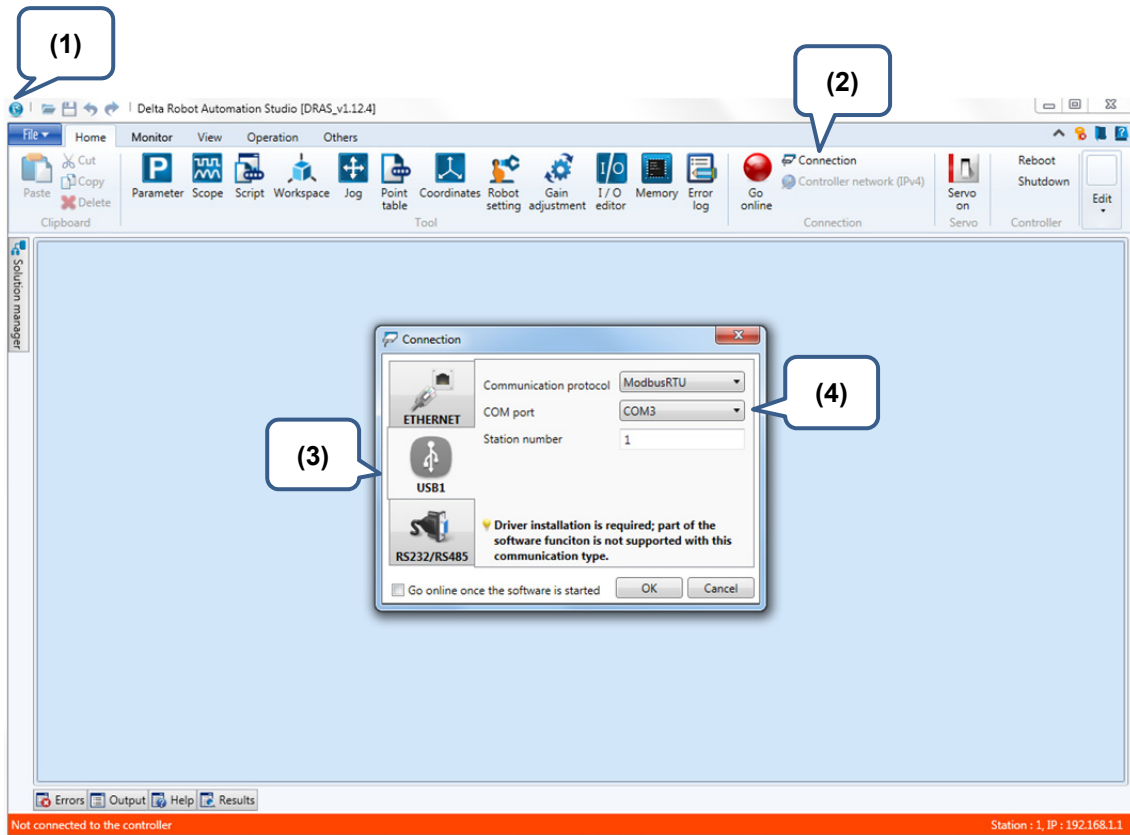


- (1) Start the DRAS software.
- (2) Click the **Connection** button in the Home screen.
- (3) Now, the Connection window will pop up.
- (4) Input the IP address and click on **OK**. (Default IP: 192.168.1.1. If the IP address has been changed, use the changed IP for connection.)

3.1.2 Connect the controller via USB

To use USB to connect the controller, please follow the steps below.

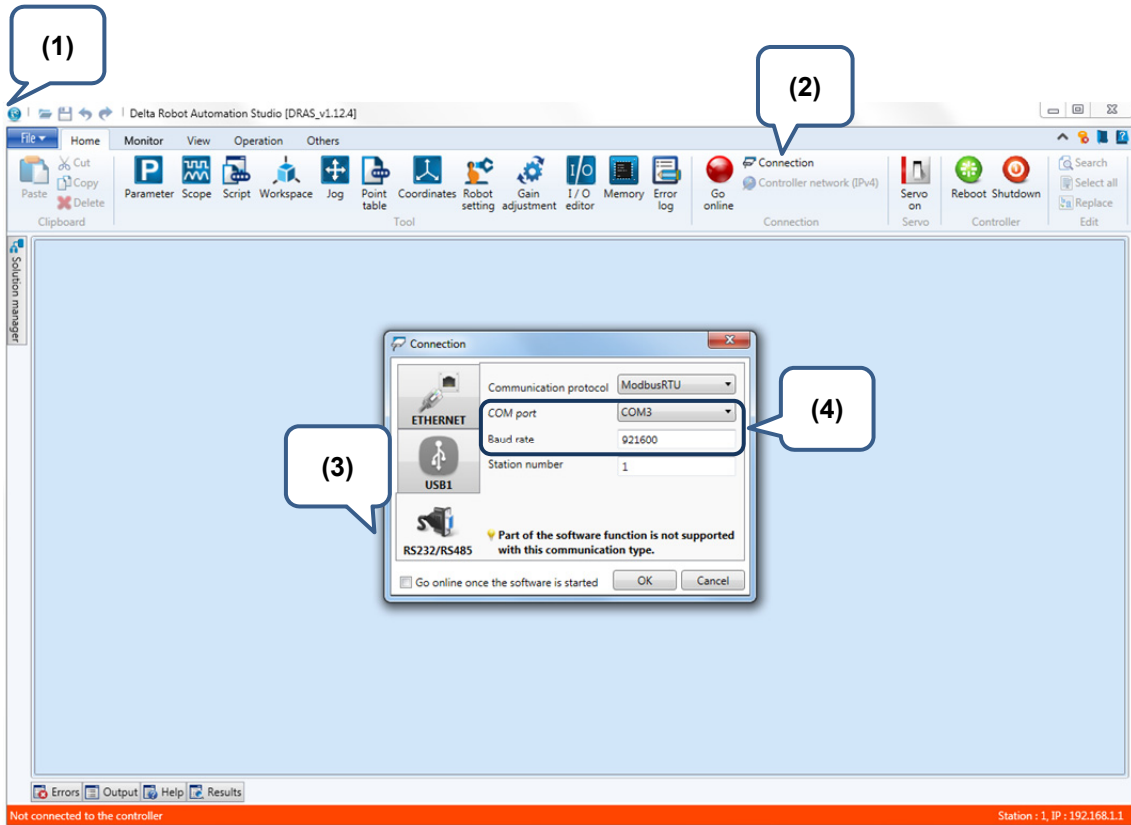
3



- (1) Start the DRAS software.
- (2) Click the **Connection** button in the Home screen.
- (3) Now, the Connection window will pop up. Please click on **USB1** to do the setting.
- (4) Select the COM port and click on **OK** to start connecting.

3.1.3 Connect the controller via RS-232/RS-485

Before connecting your controller via RS-232/ RS-485, you should complete the setting of controller parameter P3-01, P3-02, and P3-05. For more setting detail, please refer to ASDA-MS user manual. The connecting steps are as follows.

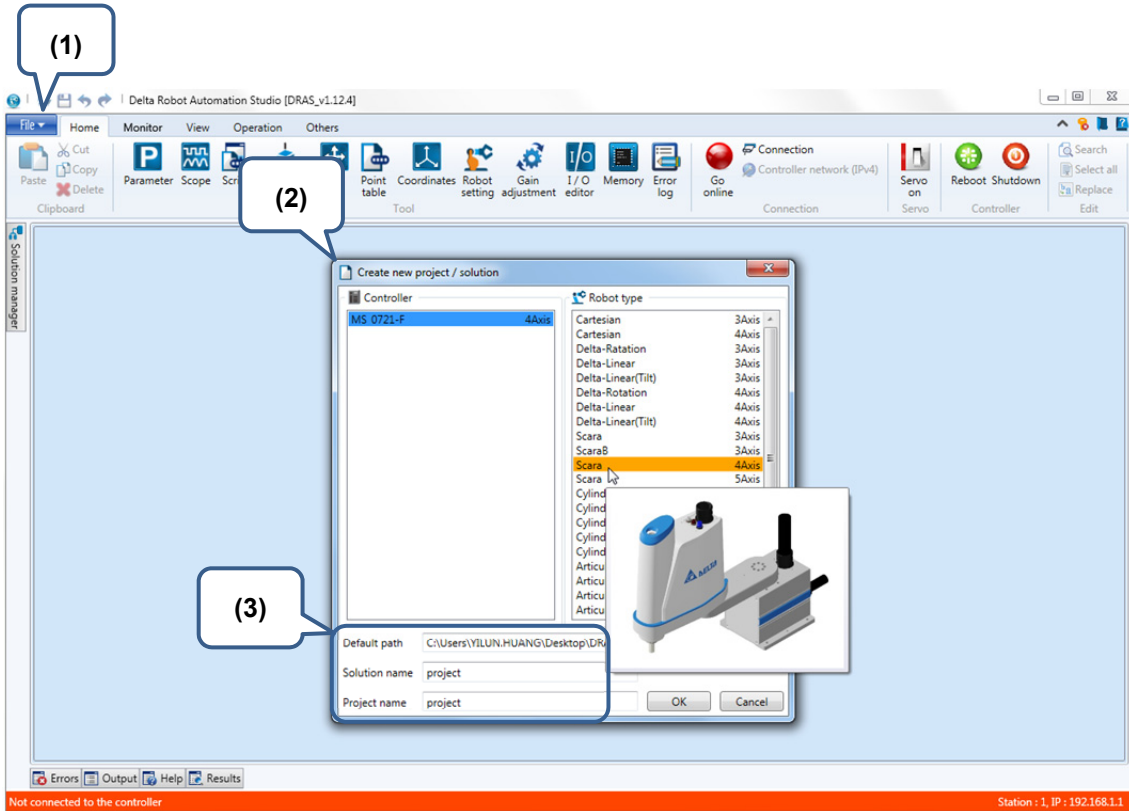


- (1) Start the DRAS software.
- (2) Click the **Connection** button in the Home screen.
- (3) Now, the Connection screen will pop up. Please click on **RS232/RS485** to do the setting.
- (4) Select the COM port and set baud rate. Then, click on **OK** to start connecting.

3.2 Create a new project

You can create a new project and complete its setting in this setting page. Please follow the steps below.

3

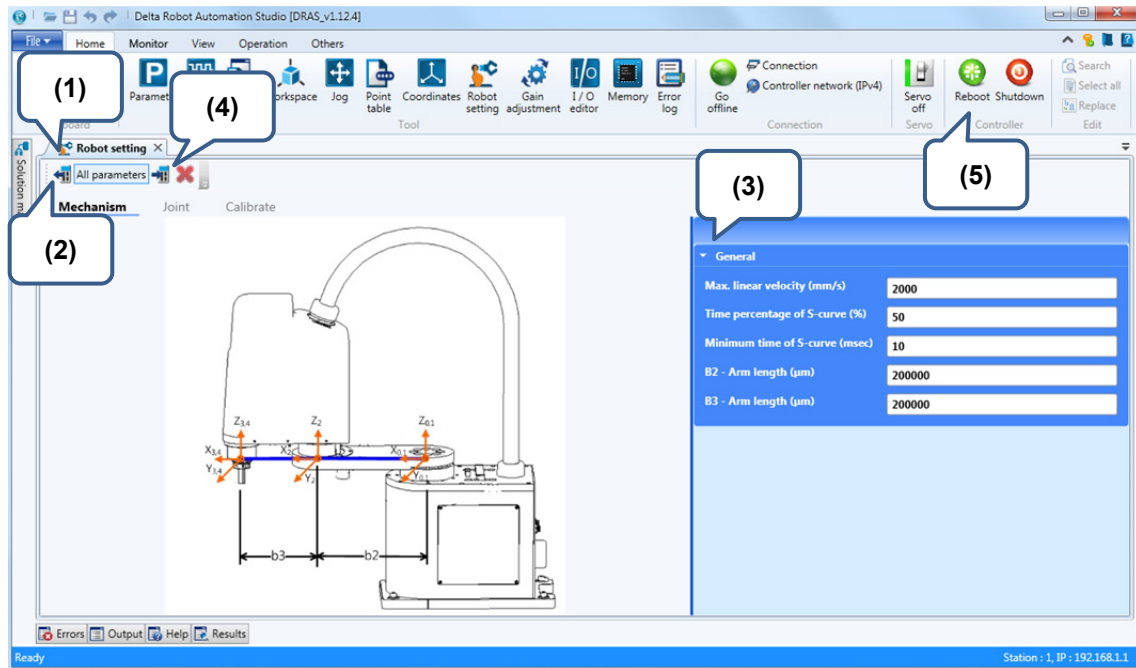


- (1) Go to **File** and click on **Create new project / solution** to select project type.
- (2) Then, the **Create new project / solution** window will pop up.
- (3) Specify the path for saving the project and enter the solution name and project name.

3.3 Robot setting

Before loading the robot arm data to the controller, users will need to set the robot parameters. The controller will load the parameters to the built-in robot arm model. Then, the robot arm will calculate the motion path and range according to the loaded parameters. Please make sure the parameter setting is correct, or the accuracy of robot end point's positioning will be affected.

Robot setting refers to parameters of the real mechanism. Please input the values which are measured based on the real mechanism.

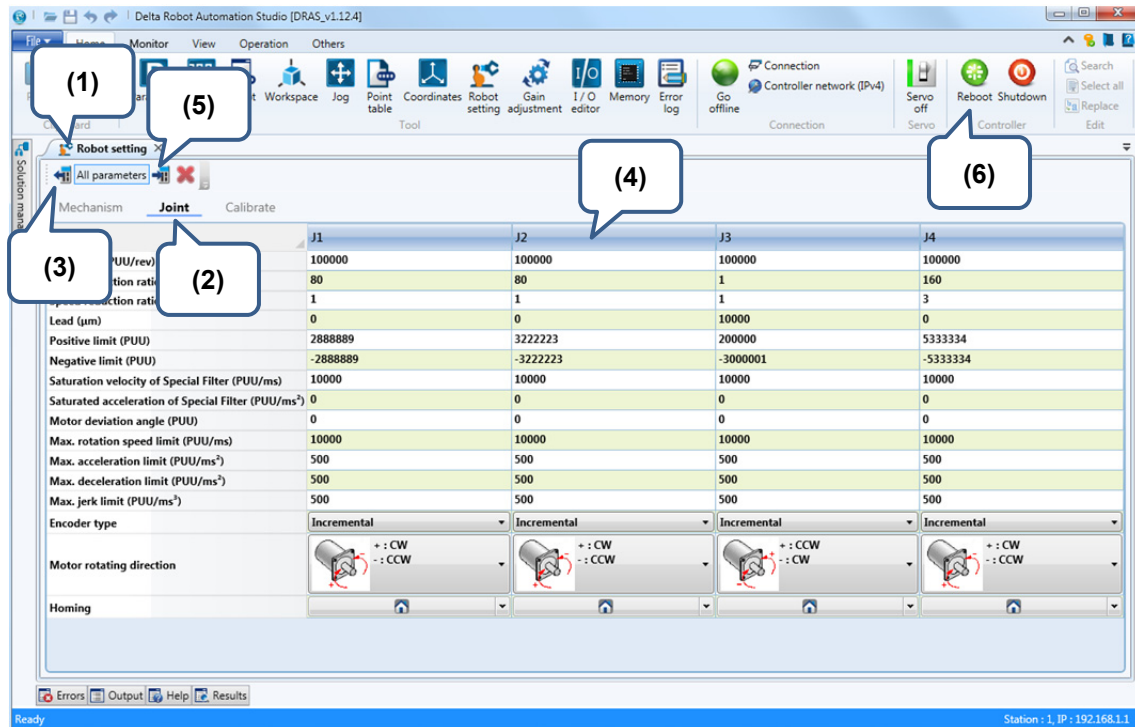


- (1) Click **Robot setting** tab.
- (2) Read the Mechanism parameters and check if the values are correct. Please make sure DRAS is connected with the controller beforehand.
- (3) Input the specifications of the mechanism and motor in the corresponding field.
- (4) Click on the **Write** icon to write parameters. (Make sure DRAS is connected with the controller.)
- (5) Restart the controller.

3

3.3.1 How to set joint parameters


The motor that equipped on the robot arm is regarded as joint. Users need to set the parameters for each joint (motor) according to the motor specifications and the robot type. In this case, the controller is able to operate each motor correctly. Please follow the steps below to set joint parameters.



- (1) Click **Robot setting** tab.
- (2) Click on **Joint** to go to the joint setting page.
- (3) Access and check if the parameter values match the design and specifications of the motor. Make sure the controller is connected with the DRAS.
- (4) Input values according to the mechanism and motor specifications in the corresponding field.
- (5) Click on the **Write** button to write the parameters. Make sure DRAS is connected with the controller.
- (6) Restart the controller.

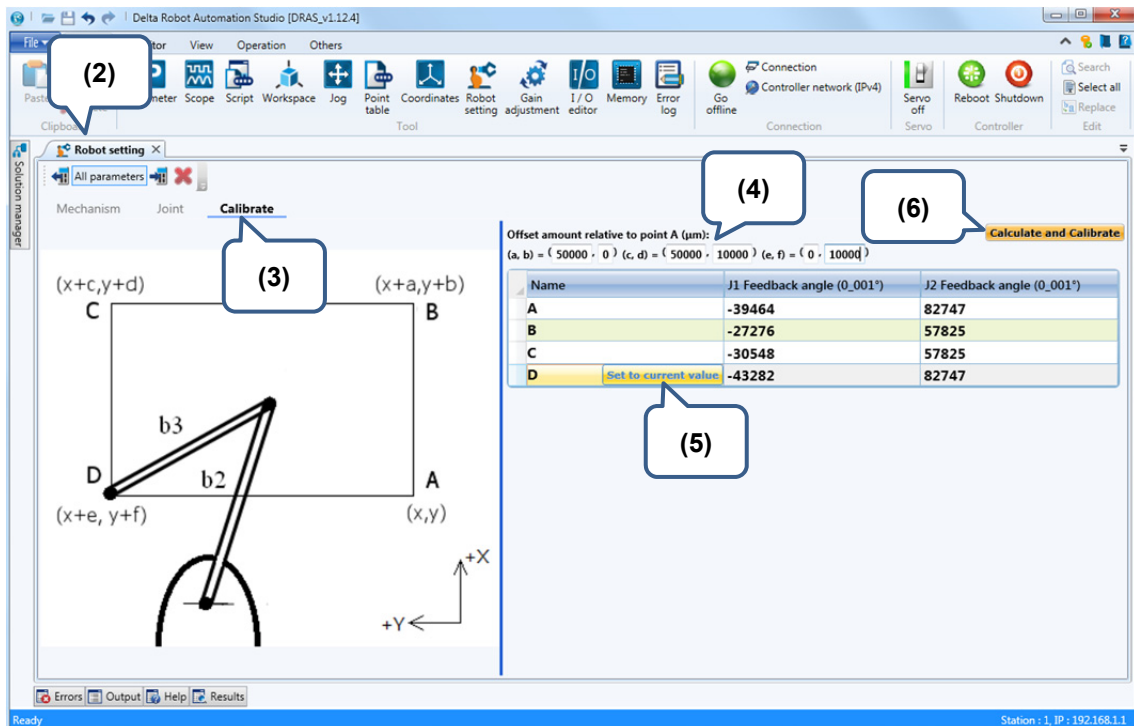
3.3.2 Mechanism calibration

The purpose of mechanism calibration is to eliminate the position error caused by the motor so as to avoid the mechanism error. By using mechanism calibration, the positioning of robot arm can be more accurate. Please follow the steps below to start the calibration.



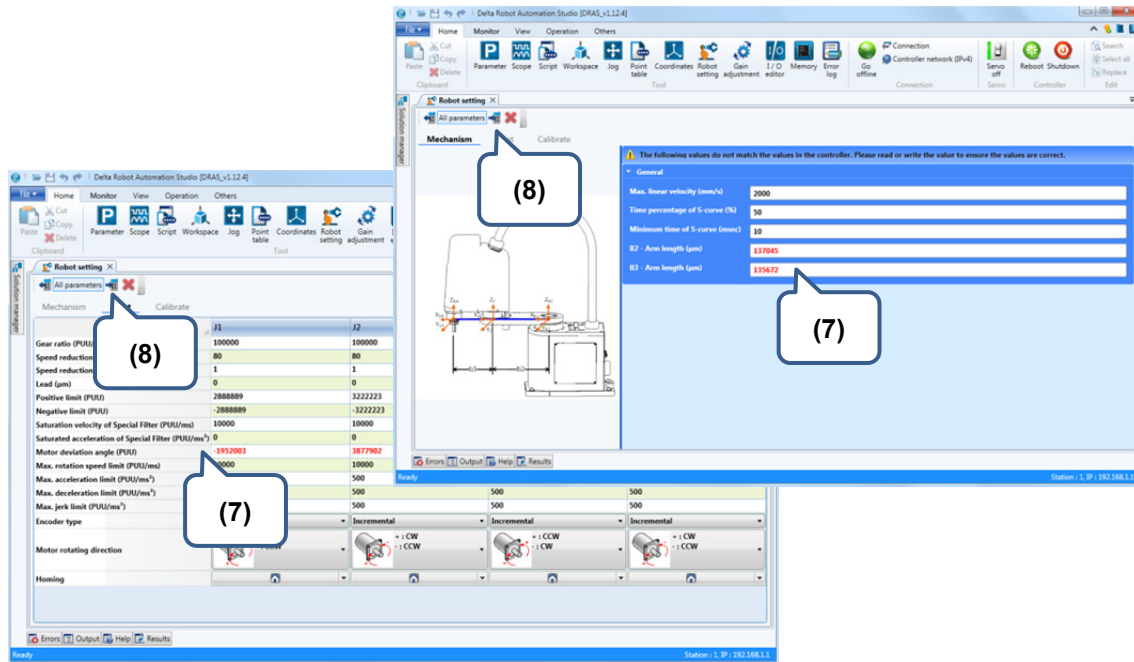
Warning: The mechanism calibration function is only supported by SCARA.

- (1) Prepare a pointed object (such as an iron pin) and fit it at the end of a robot arm. In addition, prepare a rectangle object with the least manufacture error.



- (2) Click **Robot setting** tab.
- (3) Click on the **Calibrate** tab to go to the calibration page.
- (4) Input the distance of each target (a, b), (c, d), and (e, f) respectively.
- (5) Move the robot arm to point A in Jog mode and press **Set to current value**.
- (6) Specify point A, B, C, and D respectively and then press **Calculate and Calibrate** to get the result.

3



- (7) The calibration will modify the value of motor deviation angle and arm length. However, the values have not been written to the controller at the moment.
- (8) Click the **write** button in the **Mechanism** and **Joint** page respectively to write the values to the controller.

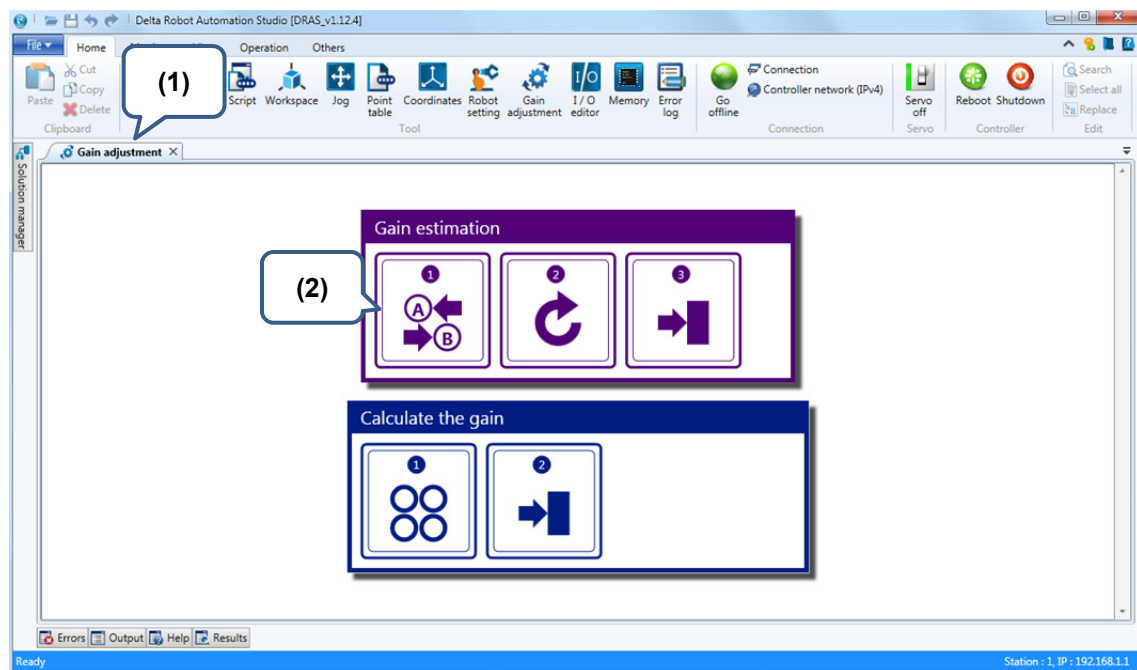
3.4 Tuning

Once the setting of robot arm is completed, tuning is required for optimizing the performance. Therefore, tuning plays a critical role. In the following sections, two tuning methods supported by the controller will be explained, gain estimation and gain calculation.

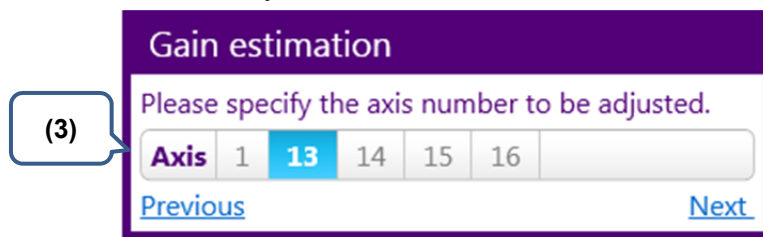
3.4.1 Gain estimation

Gain estimation is to use the built-in algorithm for gain adjustment to calculate the motion parameters. This function allows users to quickly figure out the basic motion parameter value for the robot arm. Please follow the steps below for auto tuning.

- (1) Click **Gain adjustment** tab.
- (2) Click on **Positioning A/B** in the gain estimation window.



- (3) Specify the axis number to be adjusted and click **NEXT**.



- (4) Go the setting page to position point A and B .Then, use the ▲ and ▼ keys to move the arm and press positioning A and B to record the position. Once completed, go to NEXT for further estimation.
- (5) During the estimation, use the ► key to move single arm so as to acquire the load inertia estimation. When the value becomes stable, you can press the ■ key to stop the estimation and press **Calculate** to get the result.

3

(6) Then, press **Write the result to the controller**.

Gain estimation

★ Positioning point A and B by jogging the motor for the estimation.

Speed ratio (%) 60

Jog	Motor feedback position (PUU)	684806
▲	positioning A	-678874
▼	positioning B	684805

Next

★ Press Start button and the motor will move between point A and point B to estimate the inertia ratio. You may press the Stop button after the value (inertia ratio) becomes stable.

Load inertia ratio 0 ▶ ⚙️ Advance

Rigidity (Low frequency) 0.5

Bandwidth 100 ▶ Calculate

★ Write the estimation result to the device and then re-power on.

Description	Input value	Actual value
P1-37 Inertia Ratio and Load Weight Ratio to Servo	0.0	0.0
P2-00 Position Loop Gain (rad/s)	157	157
P2-02 Position Feed Forward Gain (%)	50	50
P2-04 Speed Loop Gain (rad/s)	628	628
P2-06 Speed Integral Compensation (rad/s)	50	50
P2-25 Low-pass Filter of Resonance Suppression (0.	1.6	1.6
P2-26 Anti-Interference Gain	50	50
P2-49 Speed Detection Filter (sec)	0x0011	0x0011

Write the result to the controller

Previous Cancel

3.4.2 Gain calculation

If you are an experienced user, you may complete the tuning manually based on the motor noise and the smoothness of the robot motion. Please directly input the motion control parameters and conduct trial run in jog mode to observe the motion of robot arm. Following is the example of manual tuning.

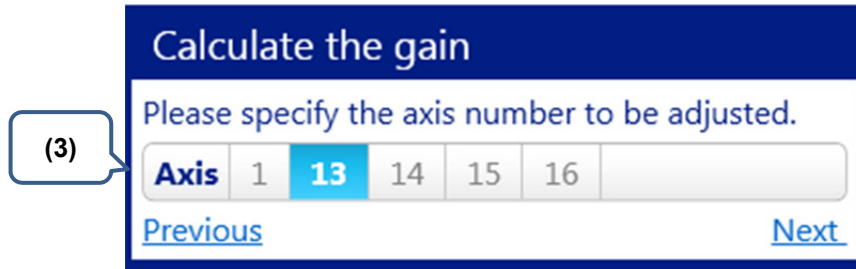
- (1) Click **Gain calculation** tab.
- (2) Click on option 1 in the gain calculation window.

Delta Robot Automation Studio [DRAS_v1.12.4]

(1) Gain calculation

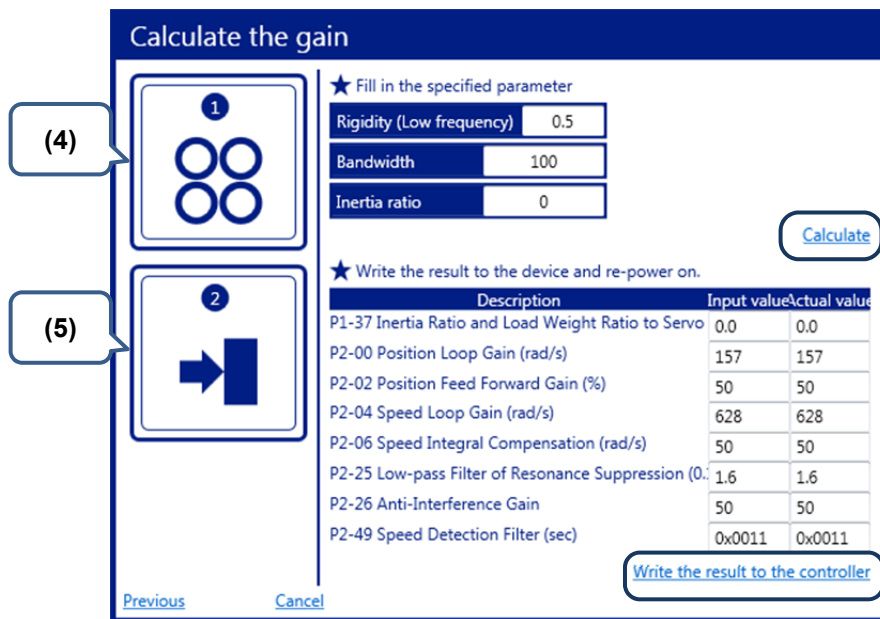
(2) Calculate the gain

(3) Specify the axis number to be adjusted and click **NEXT**.



(4) Input the parameter values of rigidity (low frequency), bandwidth, inertia ratio and click on **Calculate**.

(5) Then, click on **Write the result to the controller**.



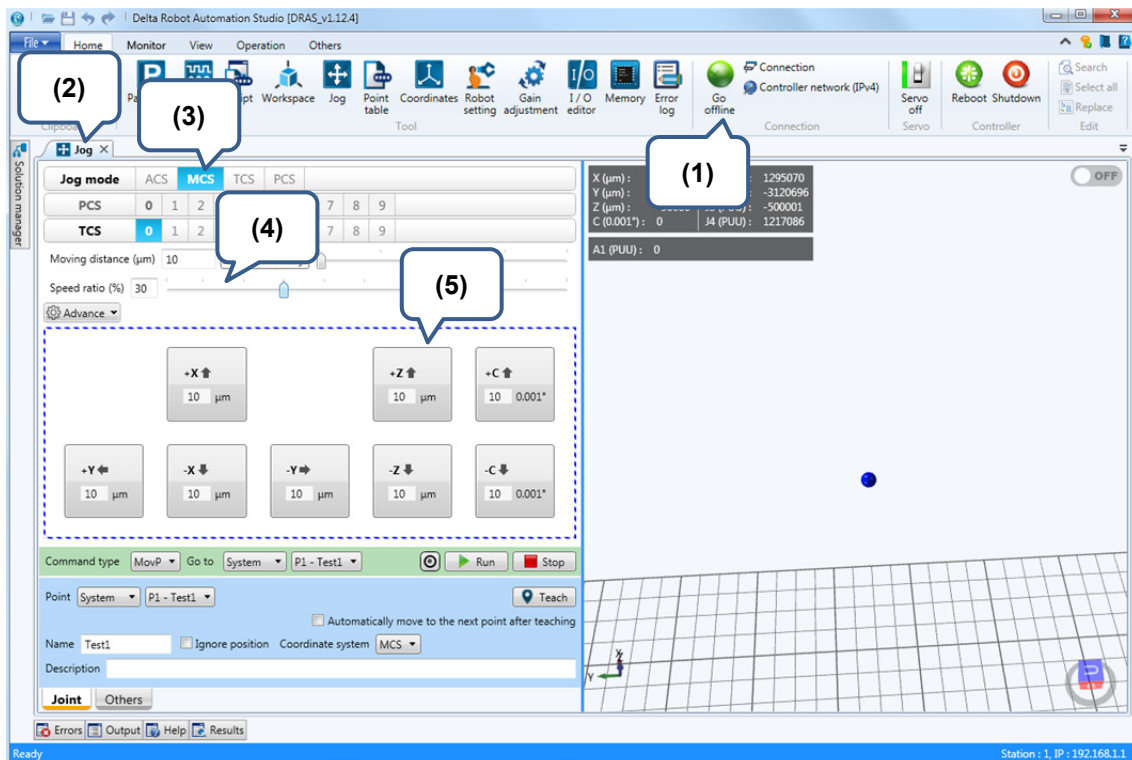
3

3.5 Trial run of robot arm

After completing the configuration of robot arm and controller as well as the gain estimation, you can start the trial run of the robot arm. Before the trial run, be sure to keep minimum clearance for the robot to avoid personnel injury during operation.

3.5.1 Jog in MCS mode

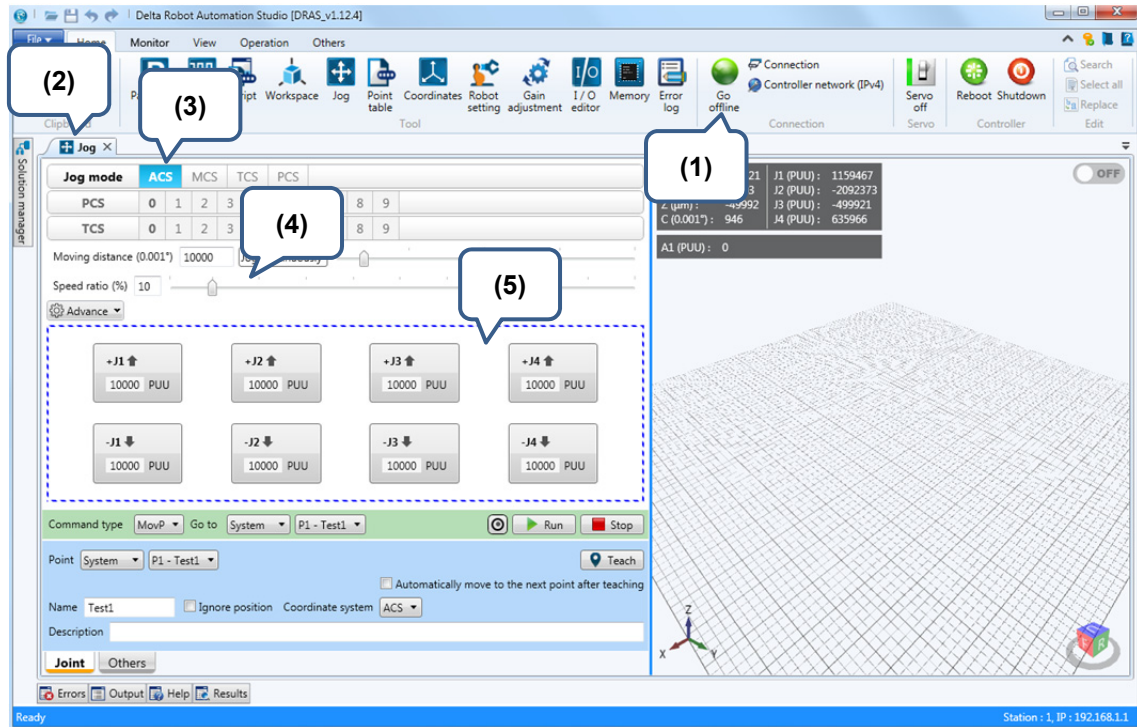
In jog mode, you can choose MCS (Machine Coordinate System) to conduct the trial run. This mode allows the end point of robot arm move in X, Y, Z, A(Row), B(Yaw), and C(Pitch) direction in Cartesian coordinate system. Please follow the steps below to start the trial run.



- (1) Make sure DRAS is connected with the controller.
- (2) Go to the **JOG** page.
- (3) Select **MCS**.
- (4) Adjust the **Speed ratio** and input the **Moving distance**.
- (5) Click to run in X, Y, Z, or C direction.

3.5.2 Jog in ACS mode

To run one motor during the trial run or teaching process, you can do it in ACS (Axial Coordinate System) and allow each motor (axis) to move in forward or reverse direction. Please follow the steps below.



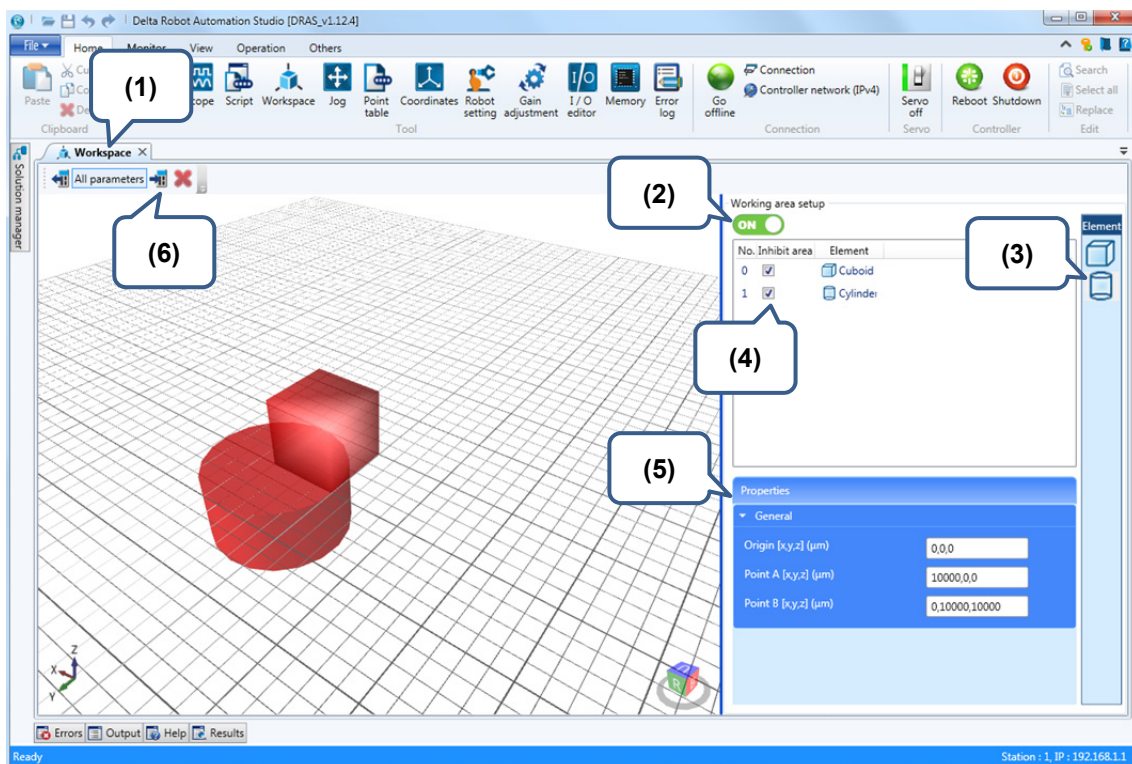
- (1) Make sure DRAS is connected with the controller.
- (2) Go to the **Jog** page.
- (3) Select **ACS**.
- (4) Adjust the **Speed ratio** and input the **Moving distance**.
- (5) Click on **J1+**, **J1-**, **J2+**, **J2-**, **J3+**, **J3-**, **J4+**, and **J4-** to move the motor in different directions for trial run.

3

3.6 Define workspace

Although you can set software limit to limit motor's rotation range, in some circumstances you will need to define a given space as a workspace or a restricted area for robot arm's motion. By setting the robot arm's workspace, the motor's workspace will be limited. If the motor operates beyond the setting range or restricted area, the controller alarm will occur and the system will stop the robot arm operation.

You can define a workspace for the robot arm so it will not exceed the area and cause personnel injury. Or you can set a restricted area the robot arm cannot enter. See the steps below to set the workspace.



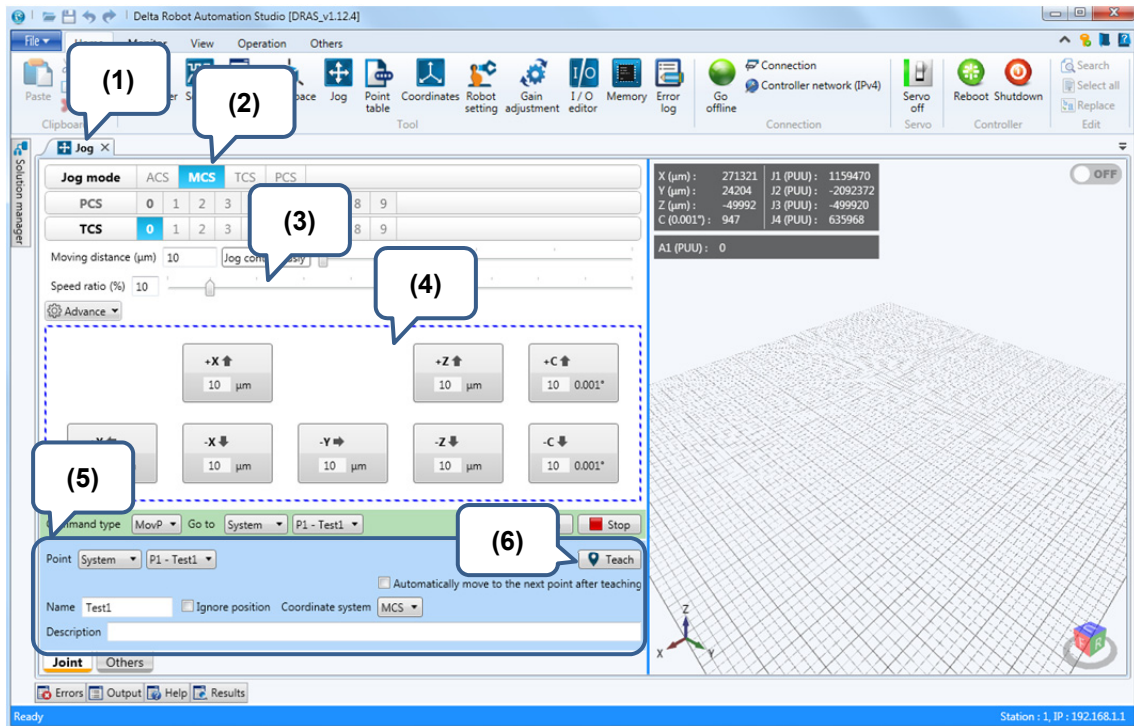
- (1) Click **Workspace** tab.
- (2) Enable **Working area setup**.
- (3) Drag the element on the right section to the working area setup window. Then, you will find the element on the left section.
- (4) Define the element as an inhibited zone or workspace.
- (5) Write the parameters or use teaching method to write the origin, point A, and point B. (If it is a cylinder, the center, radius, and height will be written.)
- (6) Click on **Write** to load the setting to the controller.

3.7 Set up and record points

In each project, users can set up and record points for the robot arm to execute machining or moving commands. This section will tell you how to do point teaching and record points.

3.7.1 How to do point teaching?

In **Jog** page, you can move the robot arm to the target point and complete “point teaching”. Follow the steps to start the teaching.



- (1) Click **Jog** tab.
- (2) Select **MCS**.
- (3) Adjust the **Speed ratio** and enter the **Moving distance**.
- (4) Move the end point of the robot arm to the target point.
- (5) Use point teaching function to record the current point. Set the point number in System or User mode and input the point name and description.
- (6) Click **Teach** to save the point.

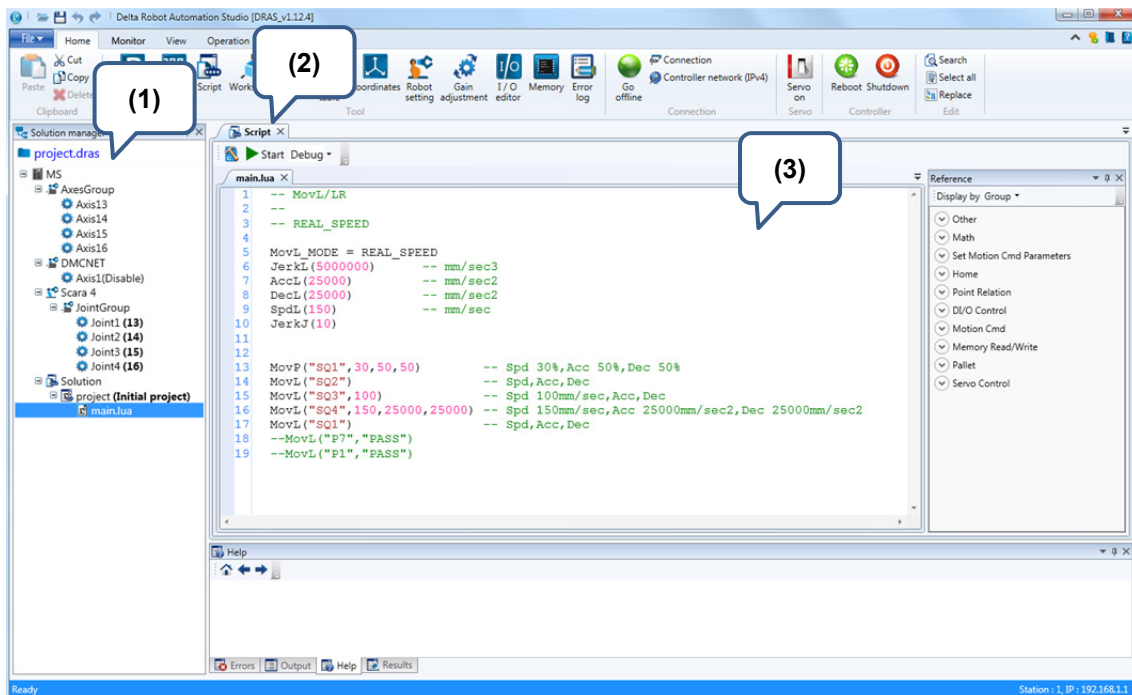
3

3.8 Script

As motion and function of robot arm has to be programmed via the script, you can use DRL (Delta Robot Language) to create your own script. The following sections will introduce how to create a script and how to debug a program on-line.

3.8.1 Create a script

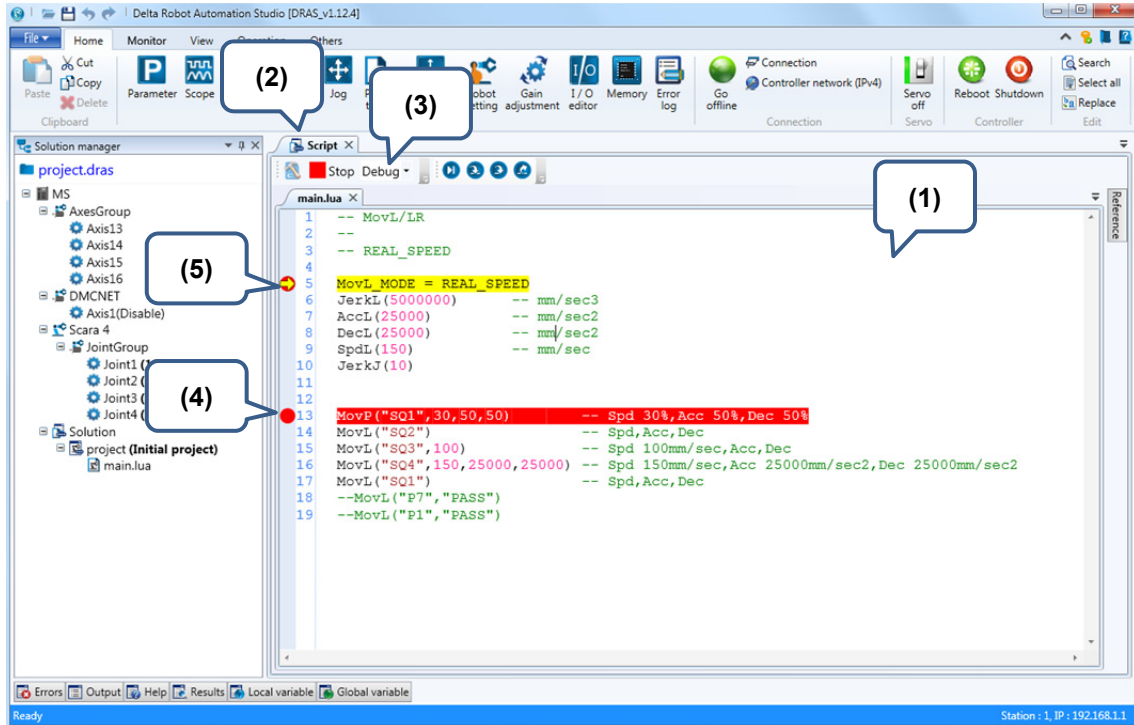
Users can create their own scripts based on the project requirement. For further information about relevant functions and compiling method provided by DRL, please refer to ASDA-MS user manual. Steps to create a script are as follows.



- (1) Create a new project (Refer to section 3.2 for setting example.).
- (2) Go to the **Script** page.
- (3) Start editing the script.

3.8.2 How to set the breakpoint?

After the script is created, you can apply the debug function to start testing the program and use breakpoint function to stop it. In this case, the values and their changes can be monitored. The following paragraph will tell you how to use the function to debug the program.

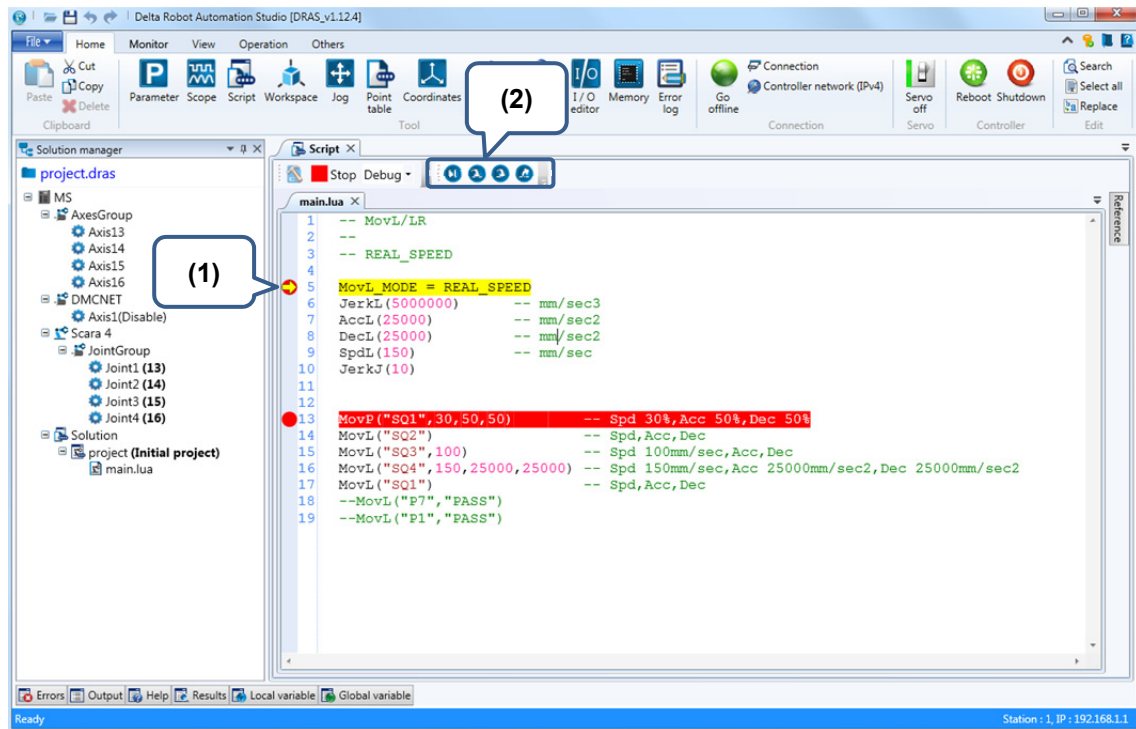


- (1) Edit the script (Refer to section 3.8.1 for setting example).
- (2) Go to the **Script** page.
- (3) Switch to debug mode.
- (4) Move the cursor to the grey column which is on the left side of the line number and click on it. Then, the red dot will appear.
- (5) When running the script, it will stop when execute the line where there is a red dot and this line will be highlighted in yellow.

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3.8.3 How to debug a program?

Debugging function can be used to check whether this script meets the requirement of your application. The following paragraph will tell you how to use this function.



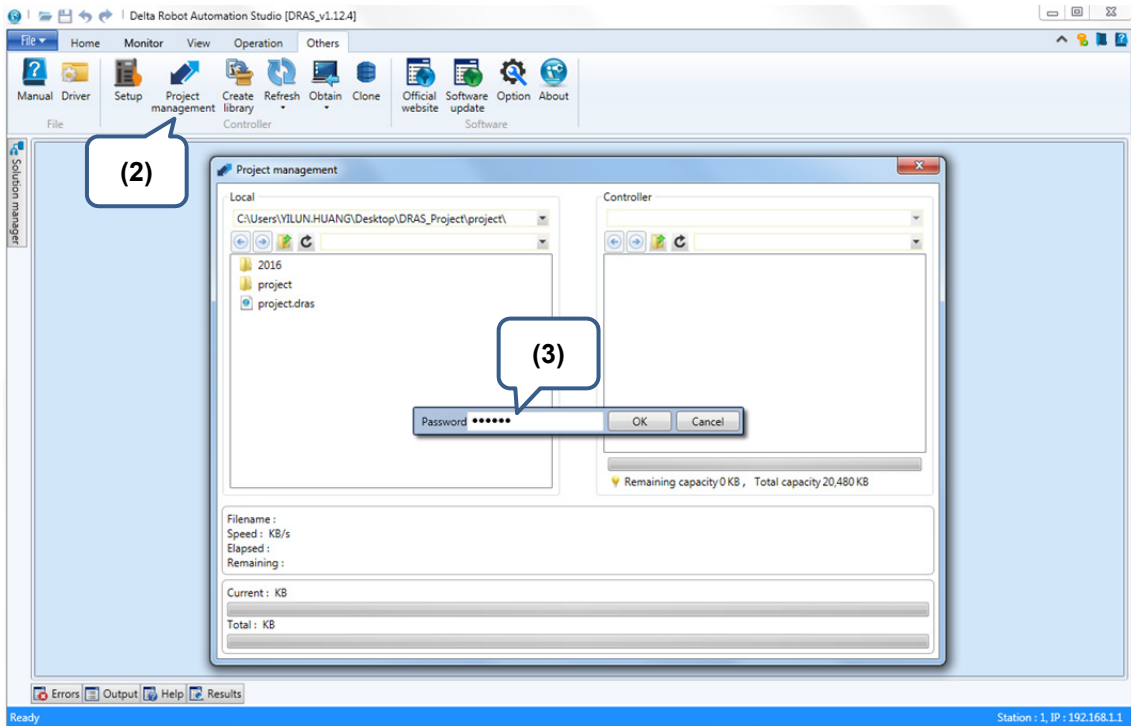
- (1) After editing the script, let the program stop at the breakpoint. (Refer to section 3.8.2 for setting example.)
- (2) Use the debugging function keys to monitor the program operation.

Icon	Function	Keyboard Shortcut	Description
	Continue	F5	The program will continue to run from the current line.
	Step over	F10	Do not execute the function and directly execute the next line and then stop.
	Step into	F11	Execute one line only and then stop.
	Step out	Shift+F11	Exit the function and stop at the next line (the line following the function-calling one).

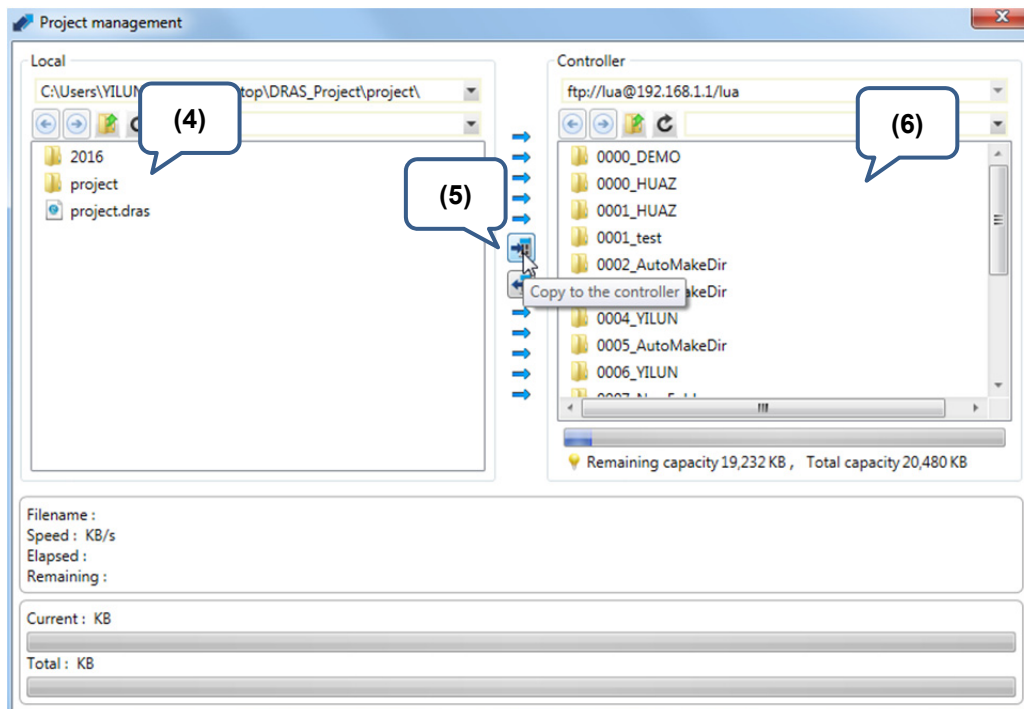
3.9 Upload projects to the controller

The projects you created can be uploaded to the controller. The controller will number the project after they are downloaded and you can call the numbered project by DRAS or hand-held type HMI.

The way to upload / download projects to the controller is illustrated as follows:



- (1) Create a project (Refer to section 3.2 for setting example.).
- (2) Click on **Others > Project management**.
- (3) Go to **Project management** page and enter the password.



- (4) Select the project to be uploaded.

- (5) Click on **Copy to the controller** and you will find the files in the controller section. The filename contains file project number and project name.
- (6) Check the files shown in the controller section to see if upload is successful.

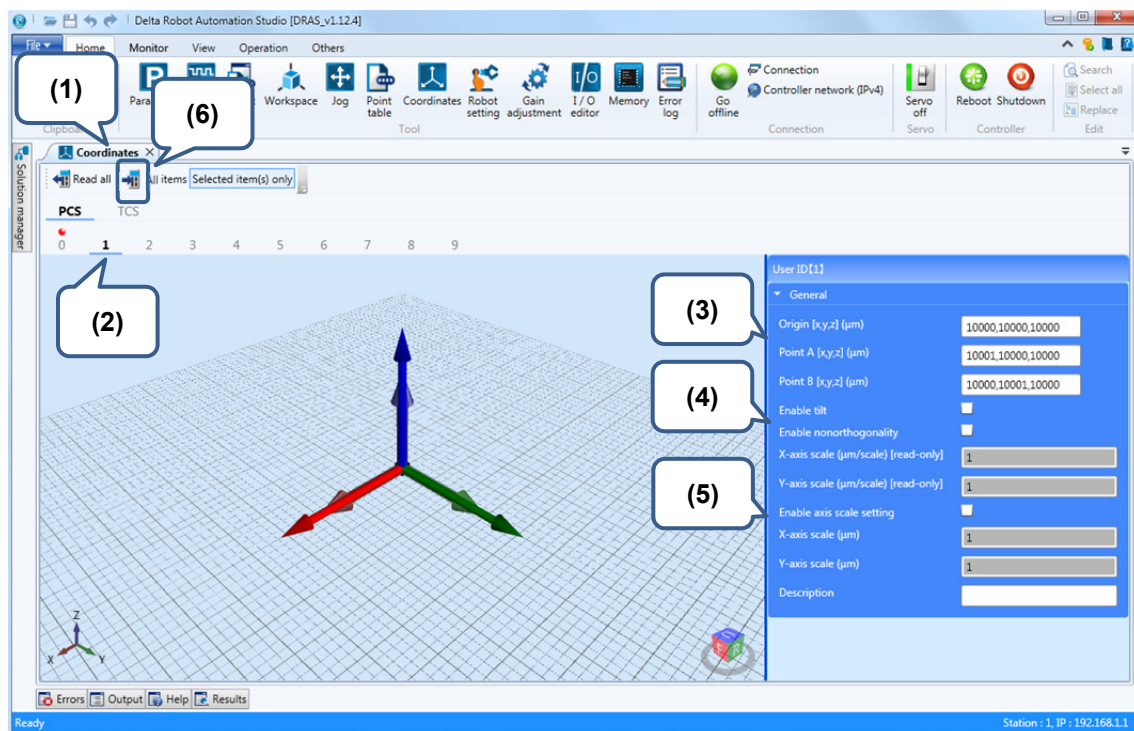
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3.10 Create coordinate system

When the robot arm moves, it requires a coordinate system to define the point position. In DRAS, MCS, PCS, TCS and ACS coordinate systems are provided. Among these systems, PCS and TCS can be defined by users. Therefore, how they can be created will be elaborated in the following sections.

3.10.1 How to create PCS (Product Coordinate System)?

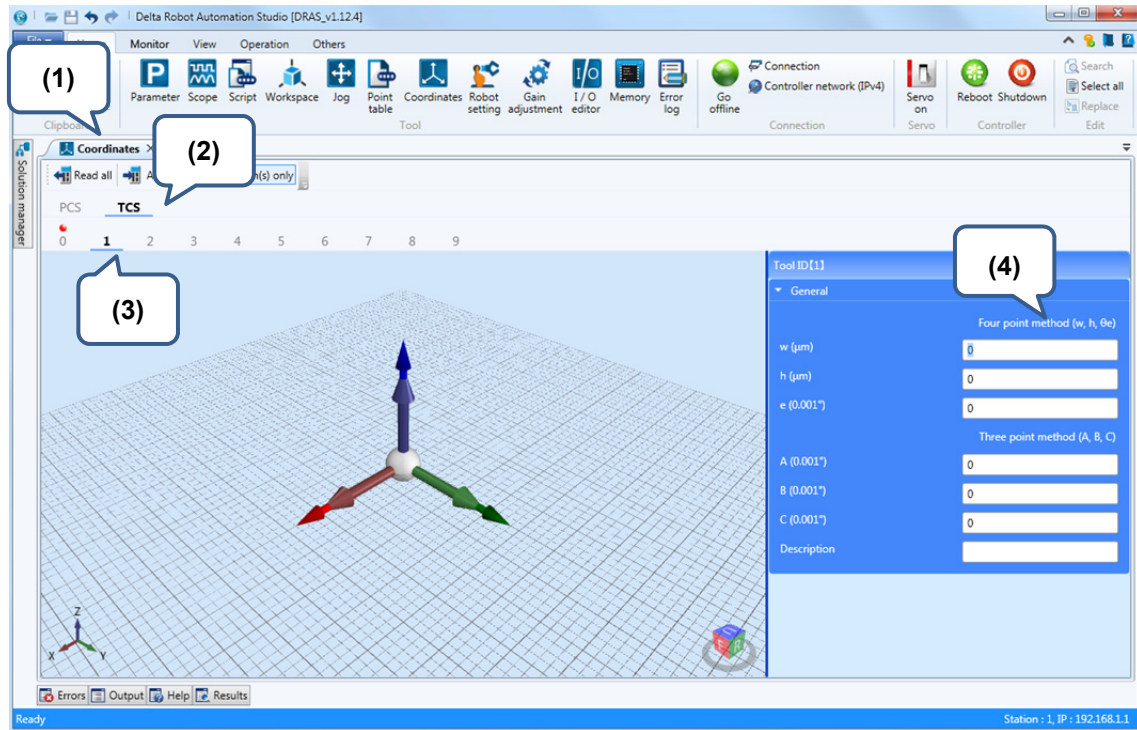
The main purpose of creating PCS is to change the position of the coordinate system for setting the point. This is usually applied in the applications, which relative position is unchanged, such as welding point. The following paragraph will introduce how to create PCS.



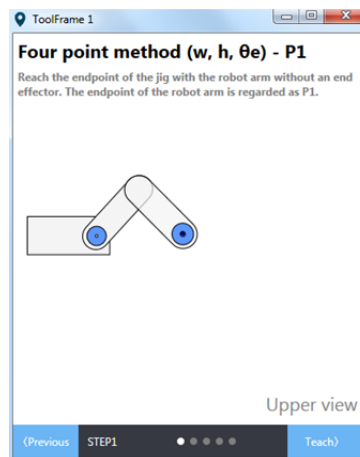
- (1) Click **Coordinate** tab.
- (2) Select the number of PCS (0 is default and cannot be edited.)
- (3) Move the arm to the origin, target point A and B. Then, click on **Teach** to record the current position.
- (4) Enable tilt or non-orthogonal according to the application. (x stands for enable)
- (5) Enable scale setting based on the application (x stands for enable)
- (6) Click on the **Write** icon and the coordinate system will be saved in the controller.

3.10.2 How to create TCS (Tool coordinate system)?

The purpose of applying TCS is to change the position of robot arm's end point. When an end effector is fitted on the robot arm, the robot arm's end point is changed. To make the path and position planning easier, the controller provides TCS setting for different applications.

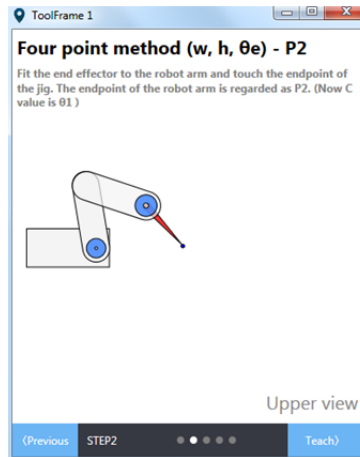


- (1) Click **Coordinates** tab.
- (2) Click on **TCS**.
- (3) Select the number of TCS (0 is default and cannot be edited).
- (4) Click on **Four point method (w, h, θ_e)** to start the wizard.
- (5) Reach the endpoint of the fixture (jig) with the robot arm that is not fitted with an end effector.

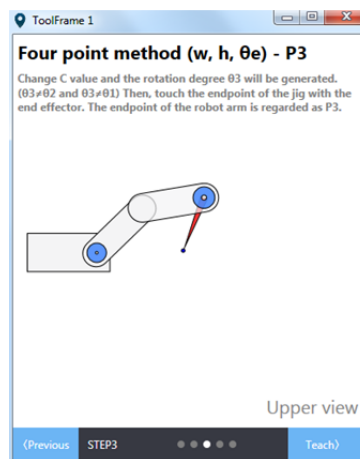


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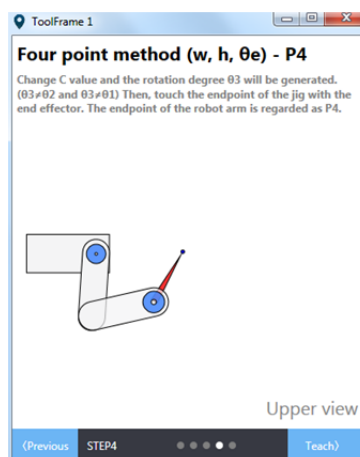
- (6) Fit the end effector on the robot arm and reach the endpoint of the fixture (jig).



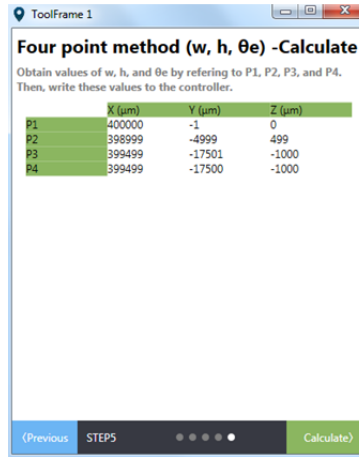
- (7) Rotate the robot arm to change its rotation angle C. Then, reach the fixture endpoint with the end effector.



- (8) Rotate the robot to change the rotation angle C again. Then, reach the fixture endpoint with the end effector.

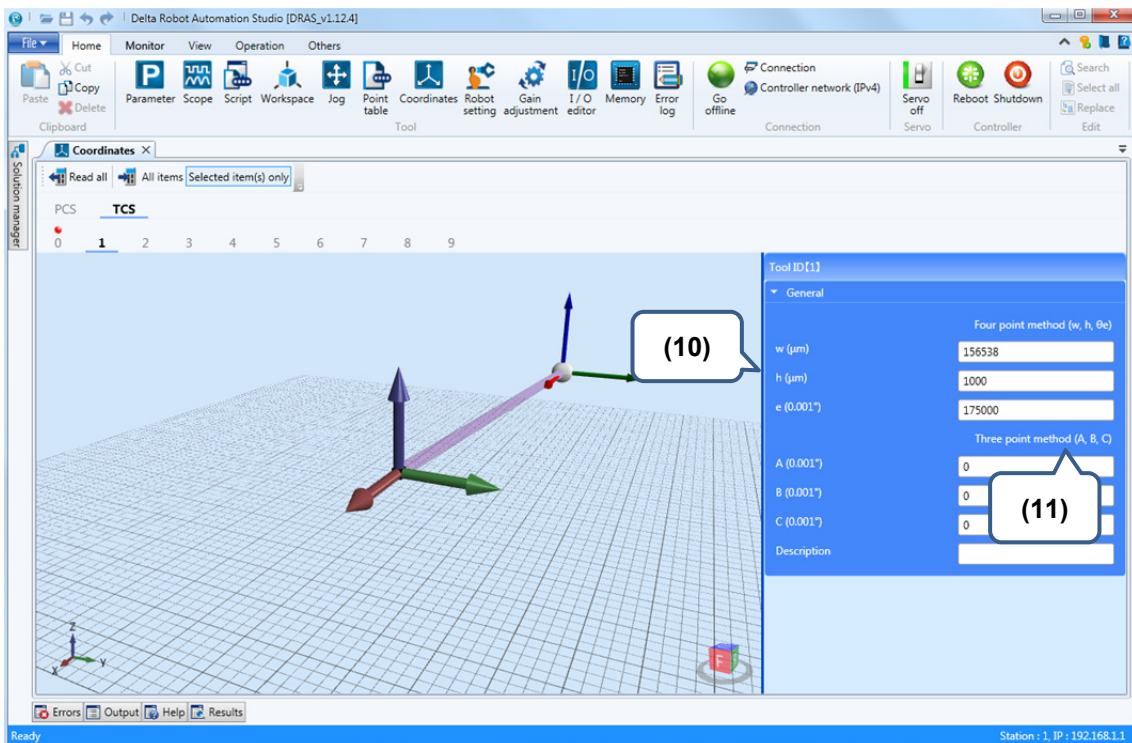


(9) After finishing the teaching, click on **Calculate** to obtain the result.



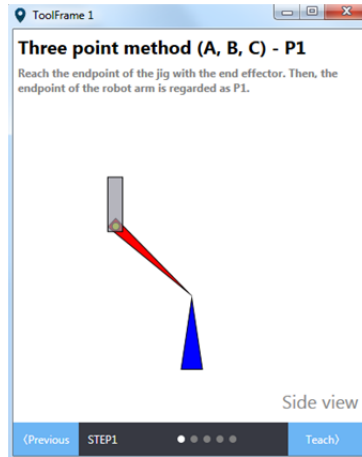
(10) Acquire the result of the four point teaching (w , h , θ_e)

(11) Click on **Three point method (A, B, C)** to start the wizard.

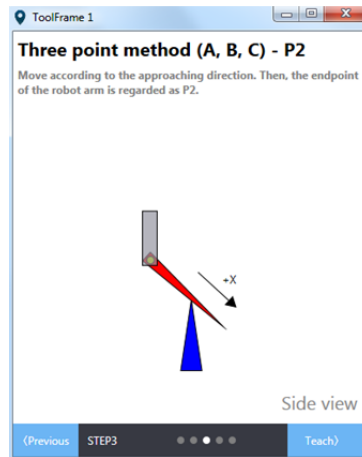


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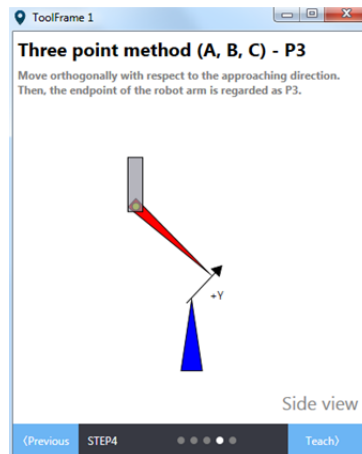
(12) Reach the fixture endpoint with the end effector.



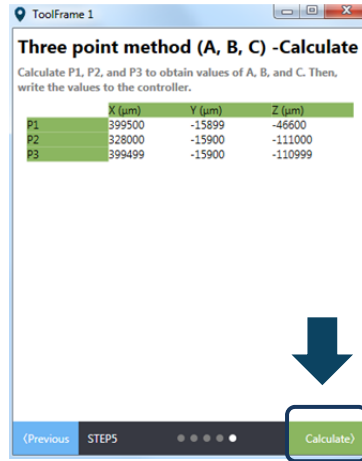
(13) Move toward the approaching direction and the robot arm's moving direction on X-axis will be recorded.



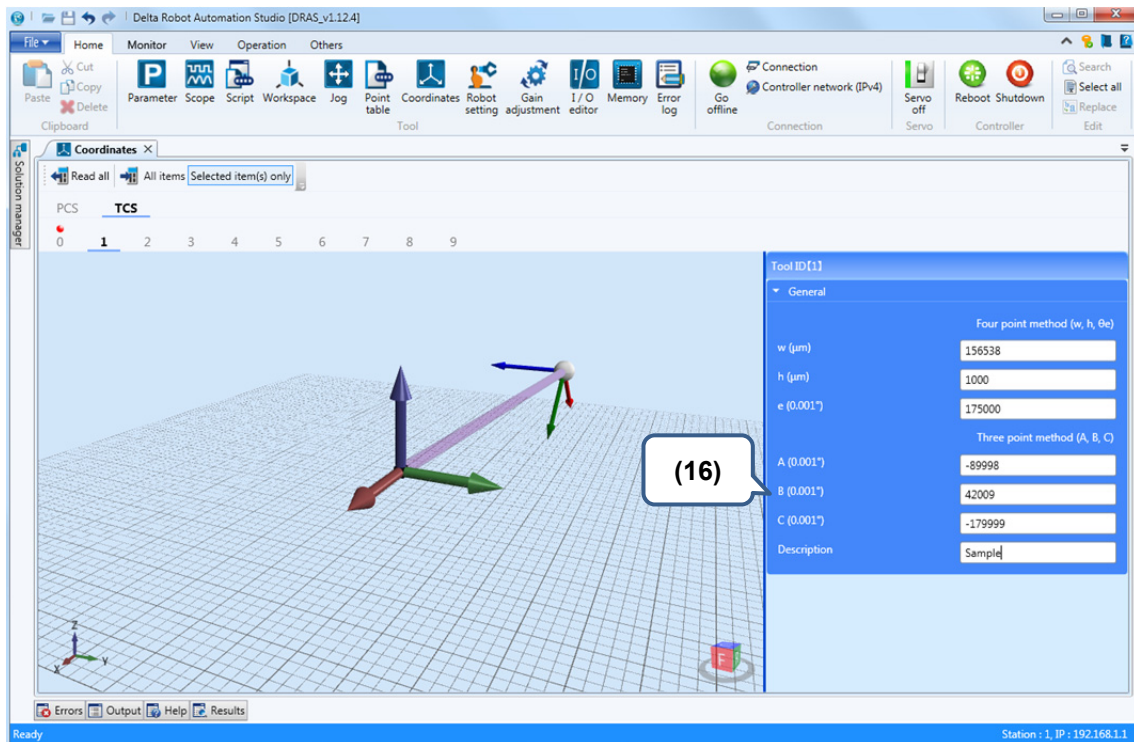
(14) Move orthogonally with respect to the approaching direction (Y-axis direction) and robot arm's moving direction on Y-axis will be recorded.



(15) Finish the three point teaching (A, B, C) and click on **Calculate** to get the result.



(16) Then, the teaching of point A, B, and C and TCS setting is completed.

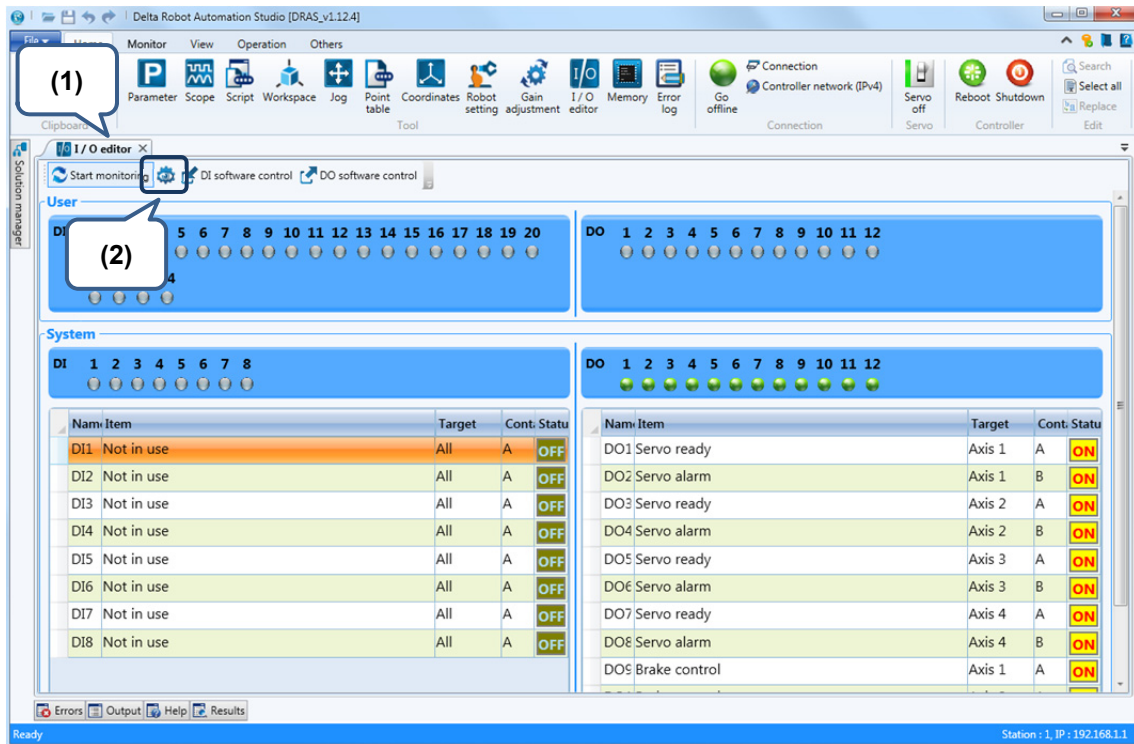


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3.11 I/O function

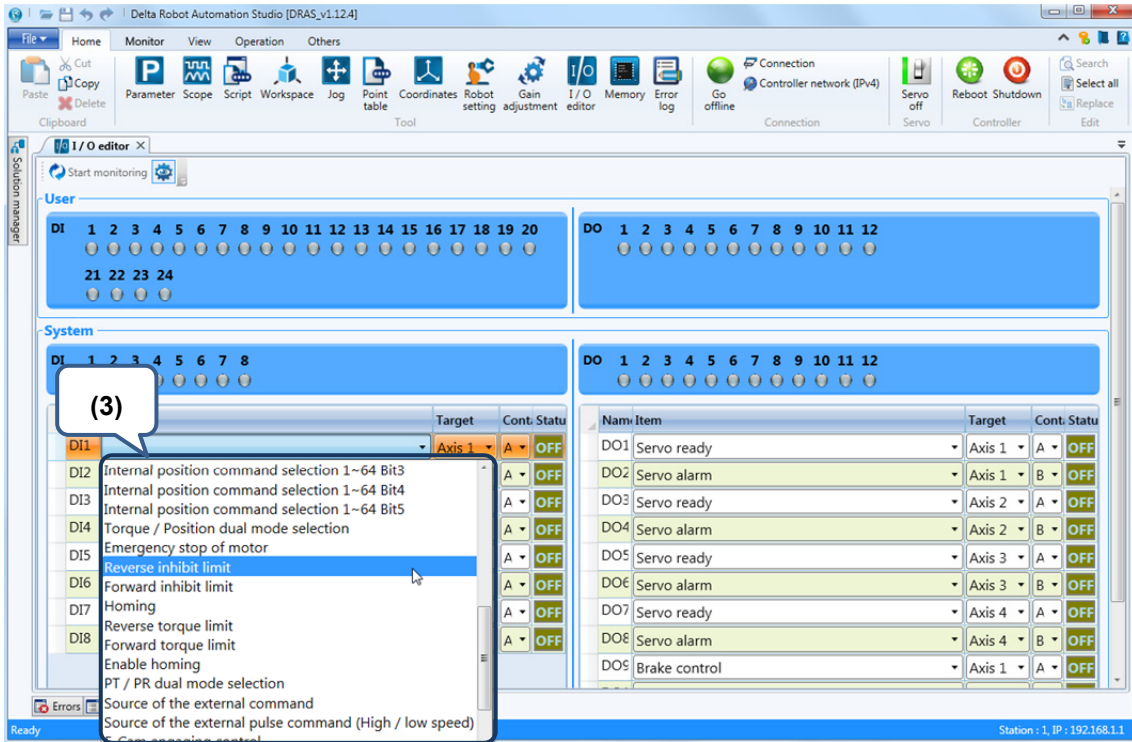
Usually, a project requires communication between controller and other peripheral devices. Thus, digital input and output function can be used to serve the purpose. Two types of digital input/output are provided, User and System. The introduction of the two is as follows.

System I/O points are built-in commands and is user-defined, such as emergency stop. The emergency stop is taken as the example below.

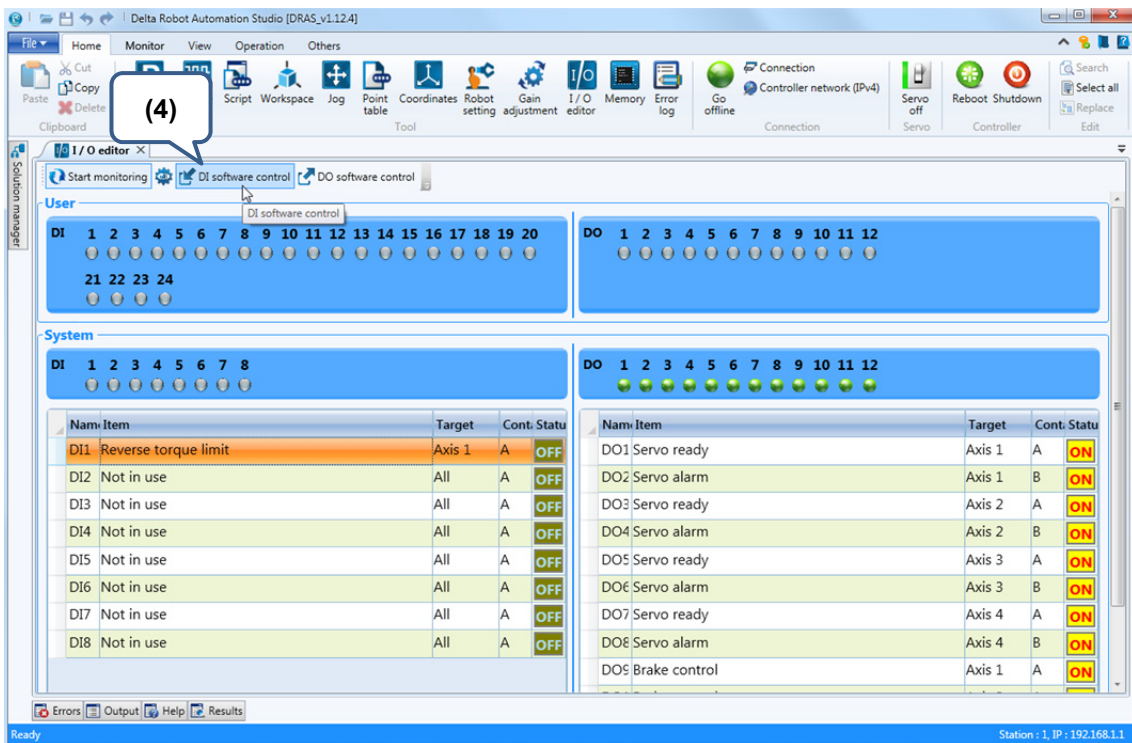


- (1) Click **I/O editor** tab.
- (2) Click on **Edit system DIO** to start editing.

(3) Select the items in the drop down menu and they will be enabled.

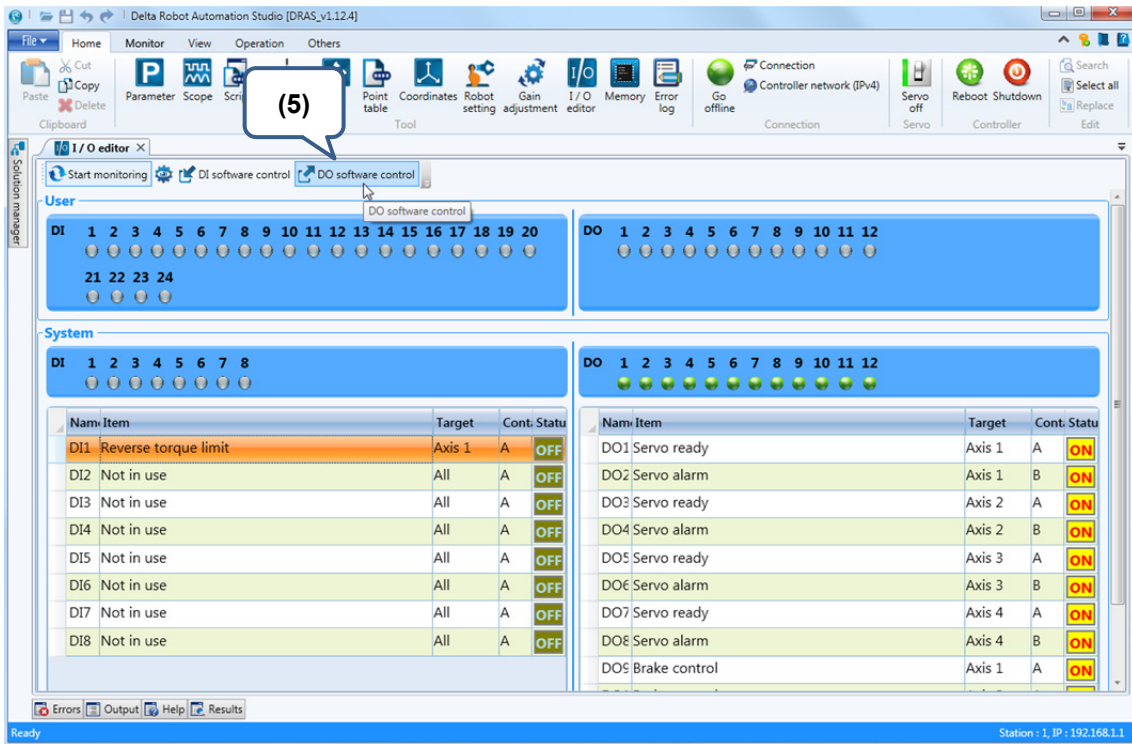


(4) Enable DI software control.

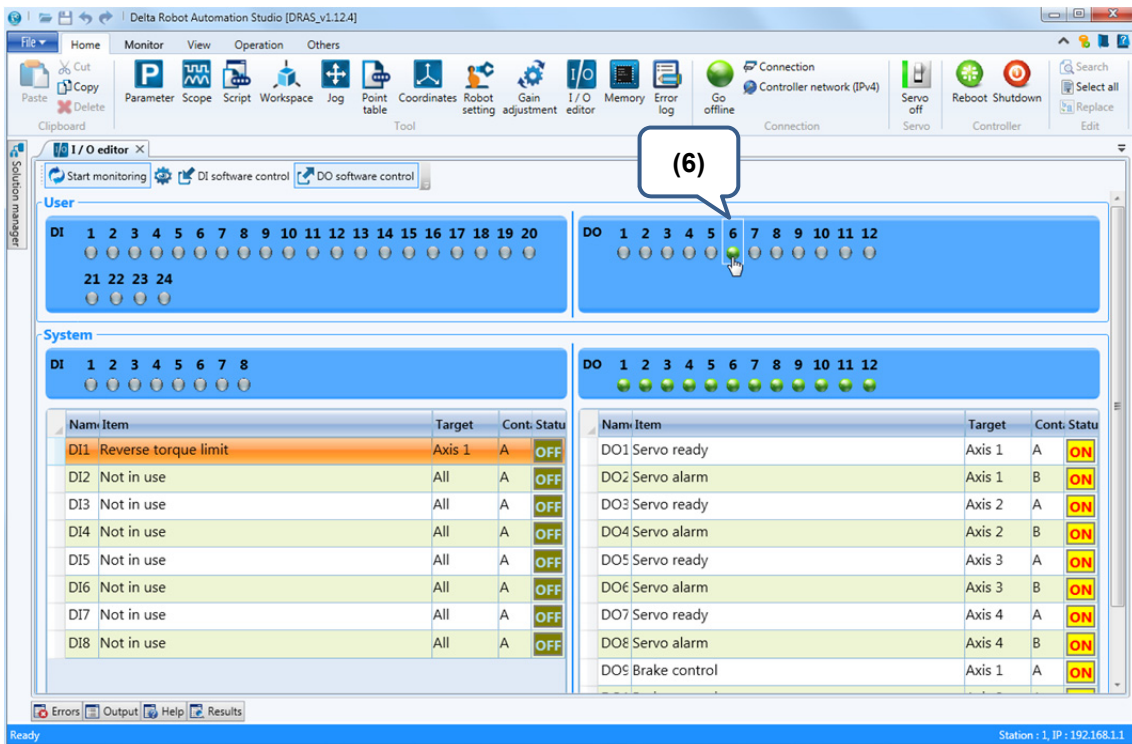


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(5) Enable DO software control.



(6) Click on the indicator.



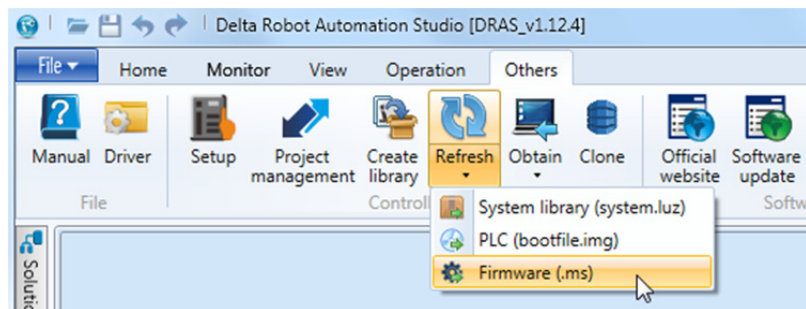
3.12 Data base update

The firmware, system function library, and PLC database can be updated in the controller. Delta will provide new files whenever there is a new function or revision. Users can update the data based on their needs. The following sections will tell you how to update the database.

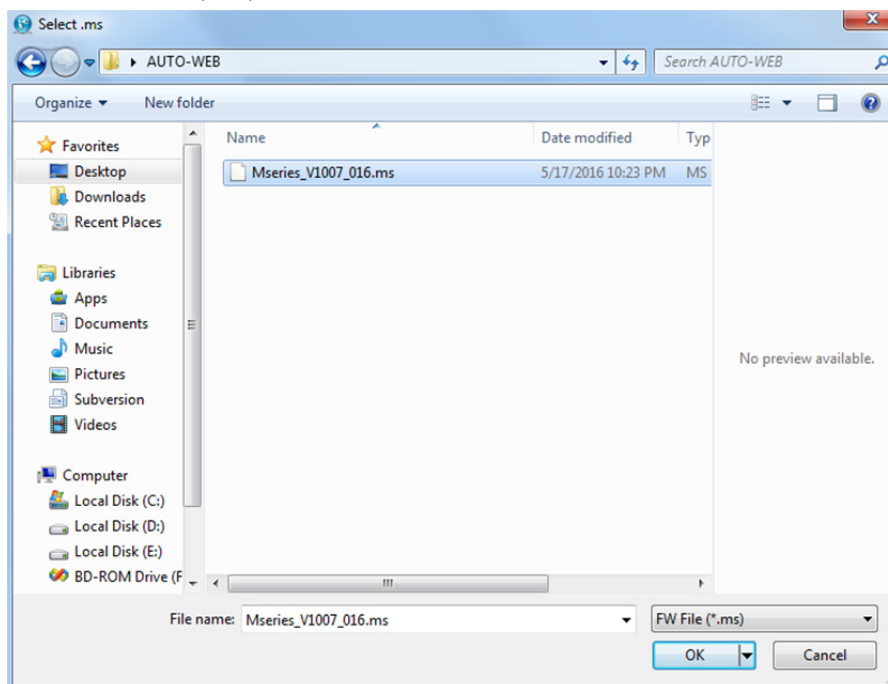
3.12.1 Update the firmware

When new functions are issued or there is a revision, users can update the controller by following the steps below.

- (1) Go to **Other** page and click on **Refresh**, and select **firmware (.ms)**.



- (2) Find the firmware file (.ms) of the controller and click on **OK**.



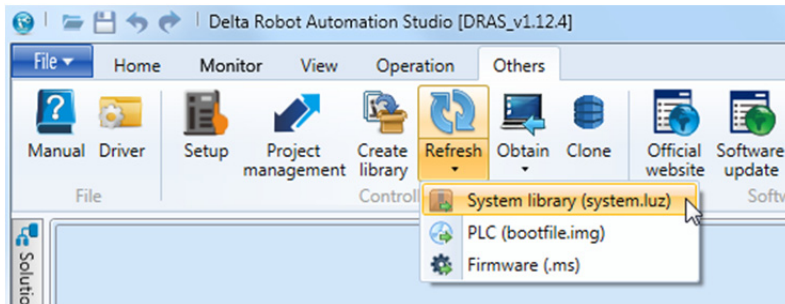
- (3) The DRAS will stop running automatically before **run** is displayed on the controller and meanwhile the update is complete.

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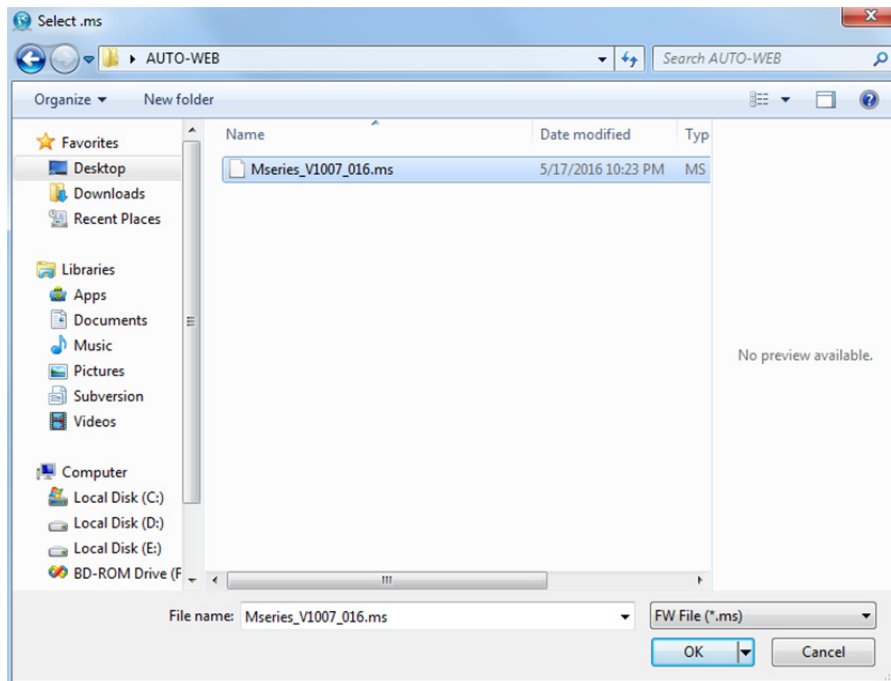
3.12.2 Update the system function library

System function library is written by DRL. When new functions are issued or modified, users can update it with the following steps.

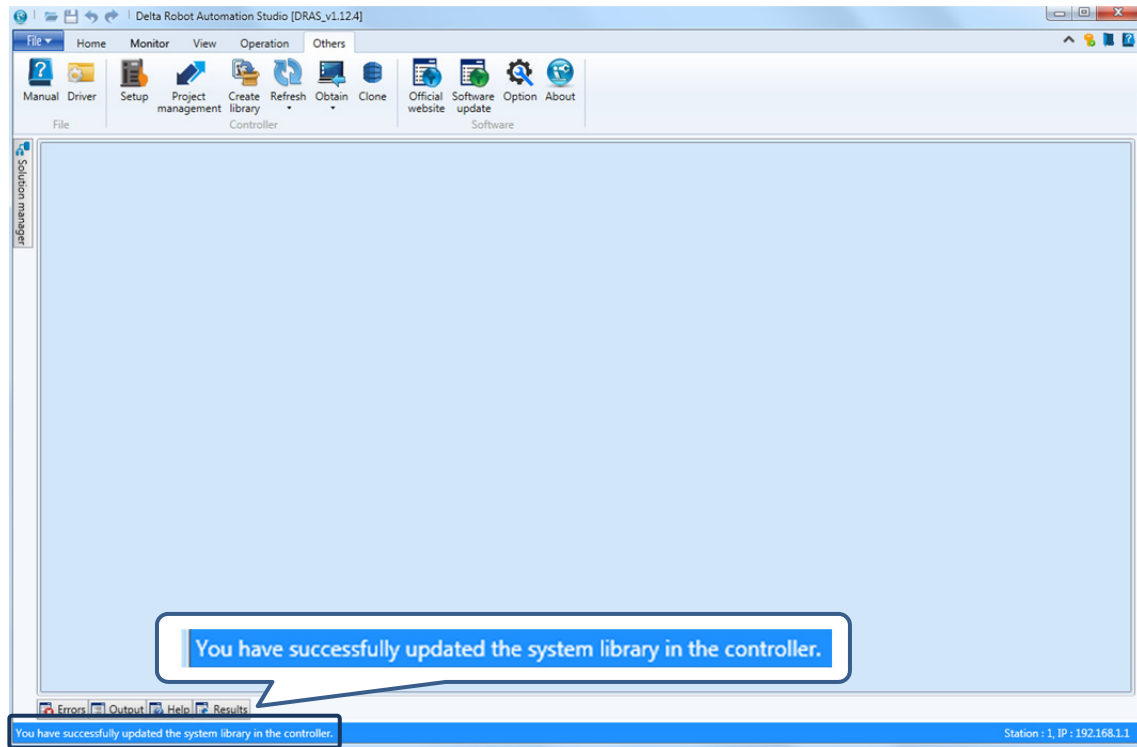
- (1) Go to **Other > Refresh > System function library** and you will be directed to the update page.



- (2) Find the system function library (.luz) of the controller and click on **OK**.



(3) Connection status of DRAS will be displayed on the left-bottom corner.



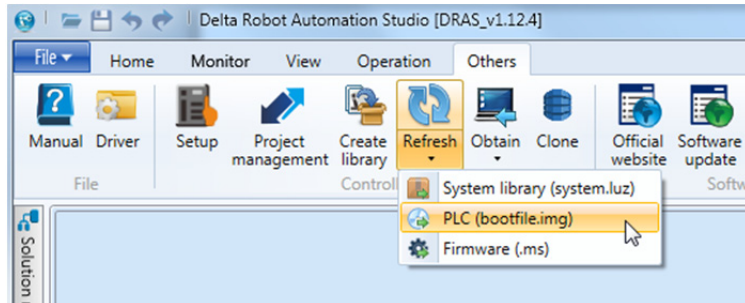
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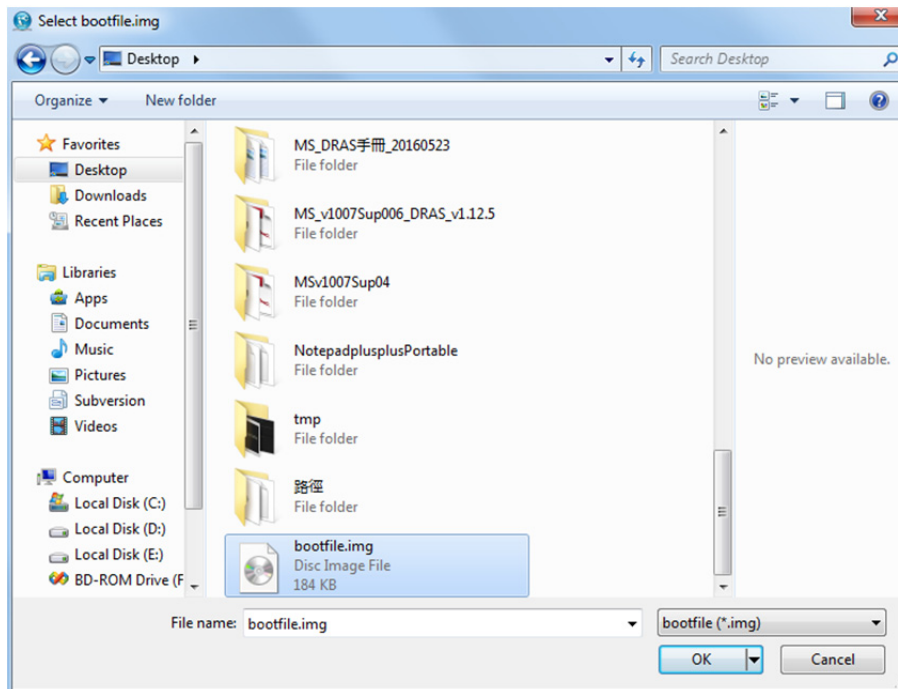
3.12.3 Update PLC database

PLC database provides PLCOpen functions. When firmware is updated, the PLC functions will be updated at the same time. When there is a new function developed with user's own PLC program, follow the steps below to update the database.

- (1) Go to **Other** page > **Refresh** > select **PLC (bootfile.img)**



- (2) Find the PLC file (bootfile.img) of the controller and click **OK**.

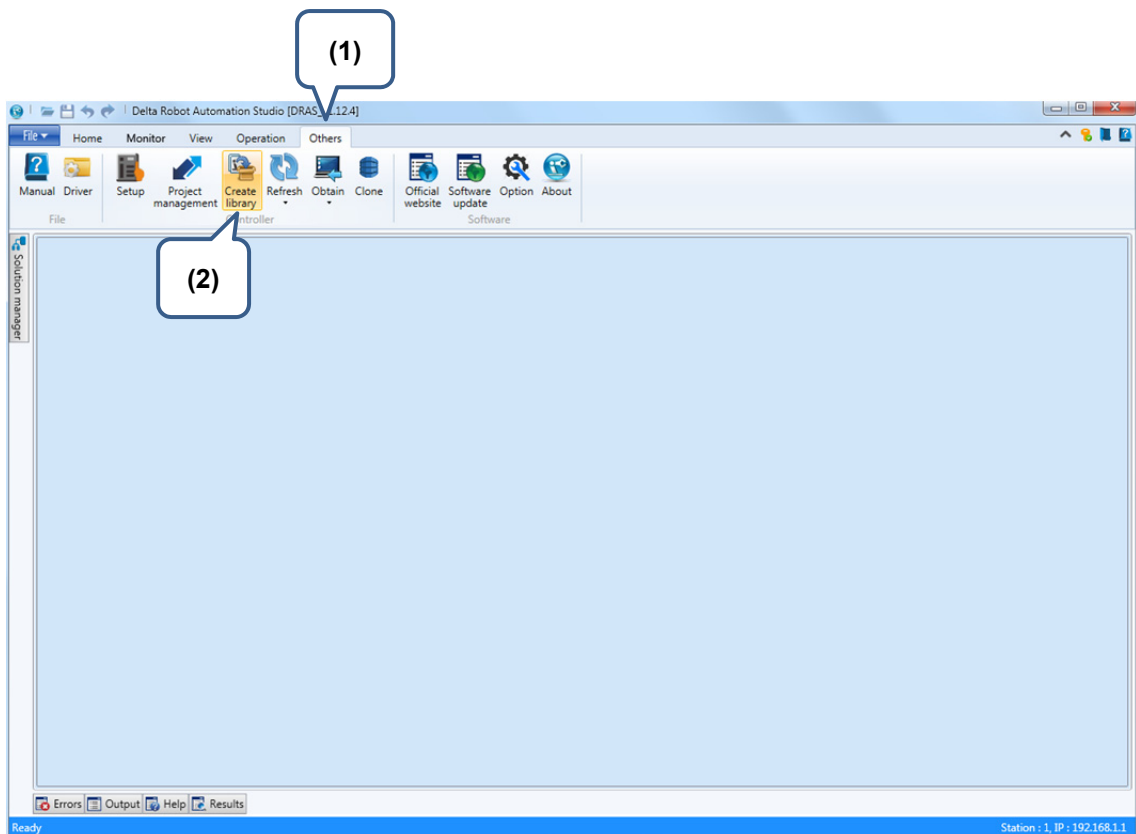


3.13 Create system function library

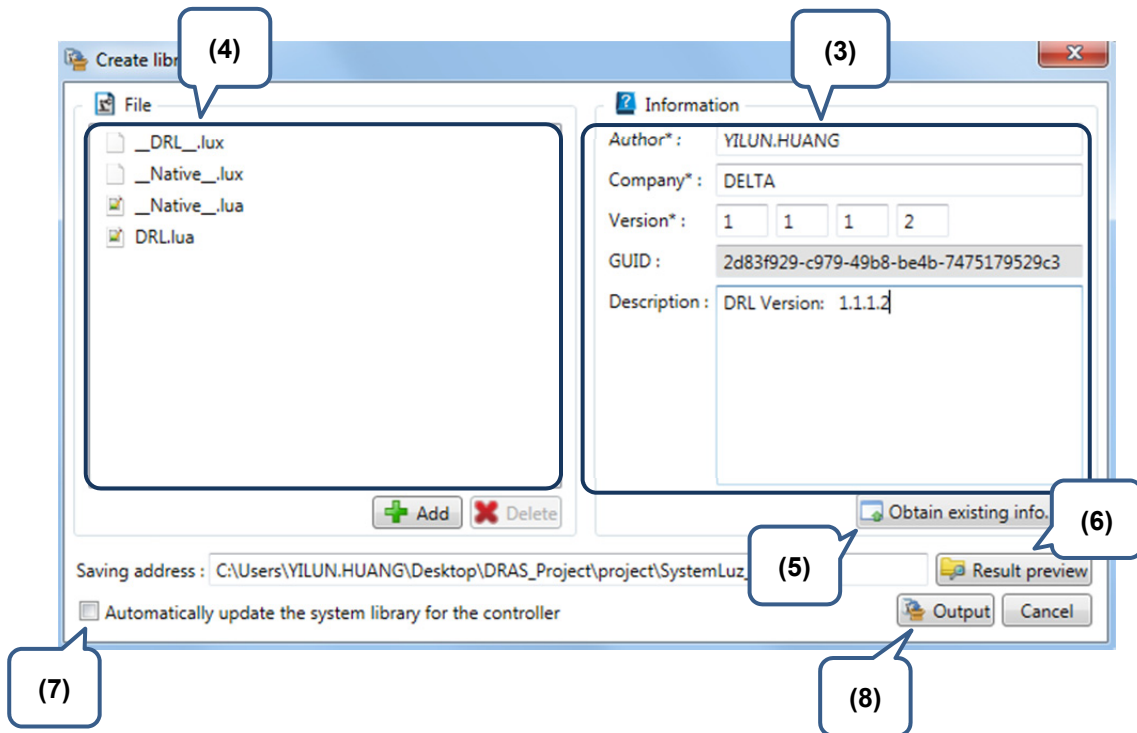
The controller has a default system function library. To save a user-defined system function library in the controller, you can replace the default with the self-defined one by creating a new system function library.

If you already have a self-defined function script, you can create a system function library by following the steps:

- (1) Go to the **Others** page.
- (2) Click on **Create library**.
- (3) Enter the compulsory information, such as author, company, and version.
- (4) Add the user-defined function script.
- (5) Obtain the existing information and the information field will be updated with the information of system function library. Then, you will be asked if you want to add .luz to the file. (this is to add the content of the original system function library to the new one and the file will be presented with the filename extension, .lux, and the content will be protected.
- (6) Specify the path for generating the system function library.
- (7) Check this box. Once the system function library is generated, it will be updated to the controller.
- (8) Start creating the system library.

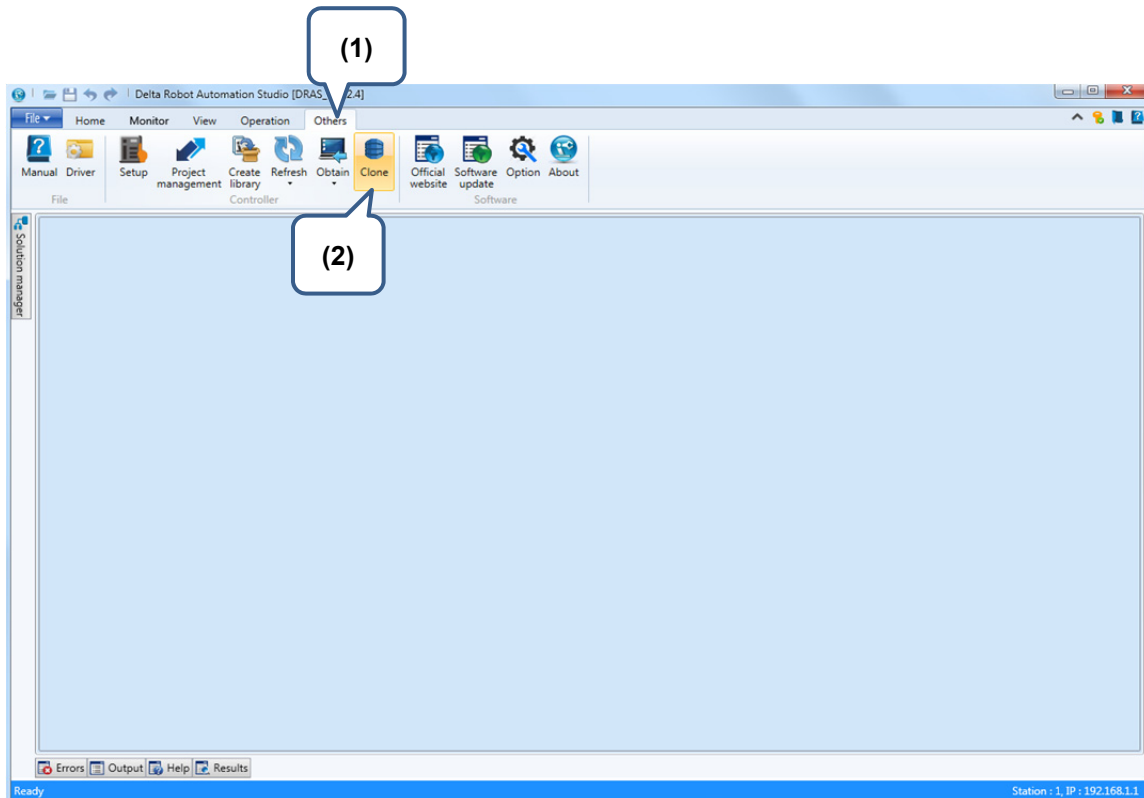


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3.14 Clone the controller

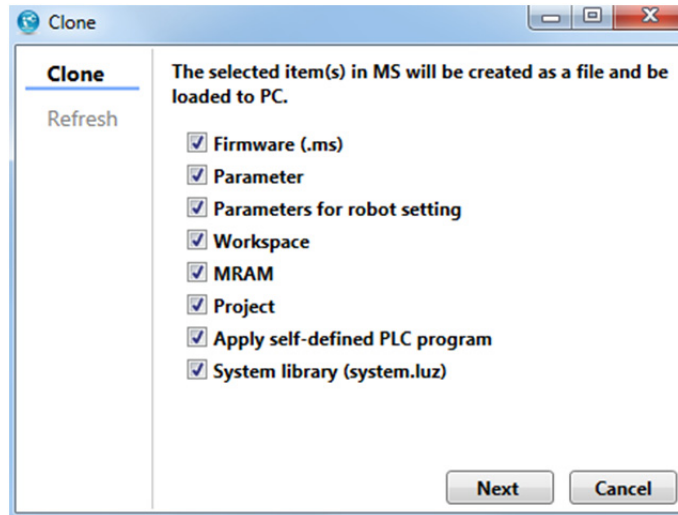
As data in the controller can be loaded and packed as a file, you can use this packed file to update the controller. The file can include firmware, parameters, robot setting, workspace, MRAM, project, user-defined PLC program, and system function library. Please note that this function can be applied only when PLC is off and Script is disabled.



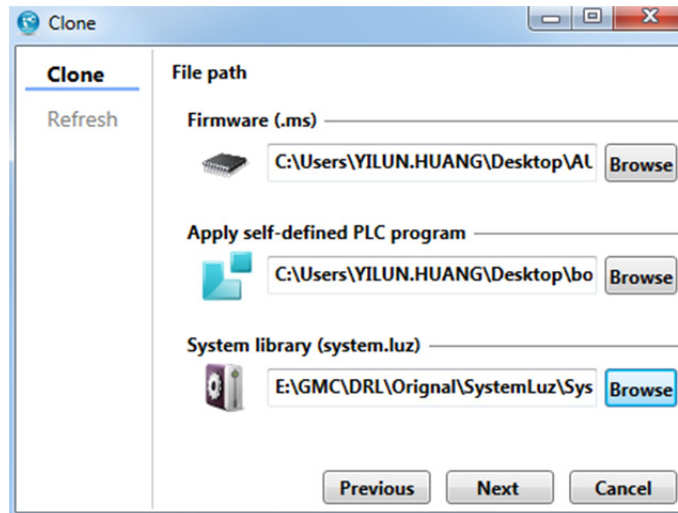
3.14.1 Clone

To pack the relevant data of the controller as a file for future update, please follow the steps below.

- (1) Click **Other** tab.
- (2) Click on **Create library**.
- (3) Select the items to be packed.

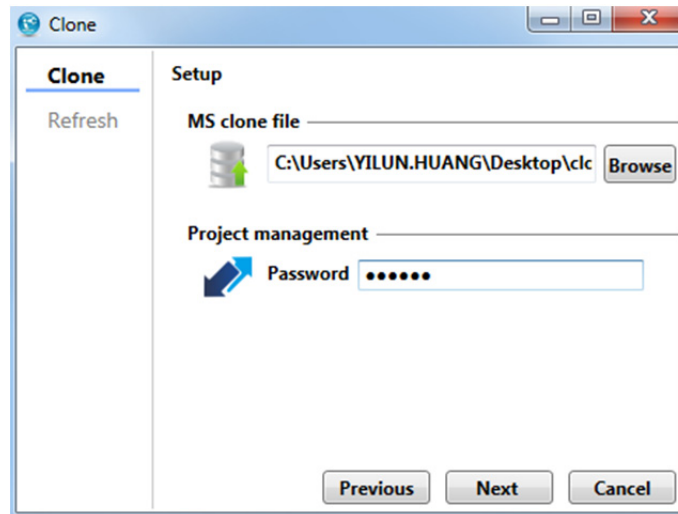


- (4) Specify the file path. The firmware, PLC program, and system function library have to be provided by users.

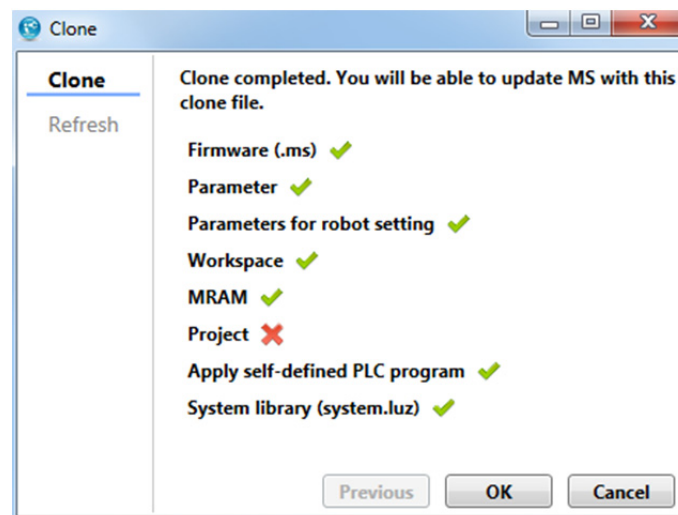
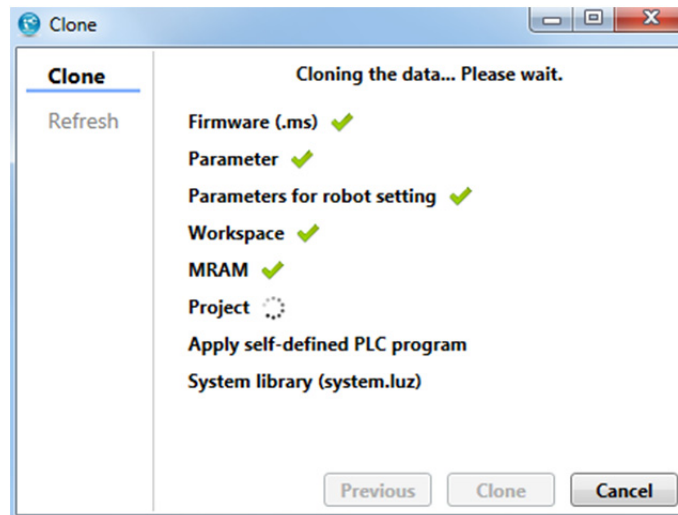


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- (5) Specify the path for generating the clone file. Enter the password if you have selected the project in the controller for cloning.




- (6) Cloning starts. Green check stands for update successful whereas red X for update failure.



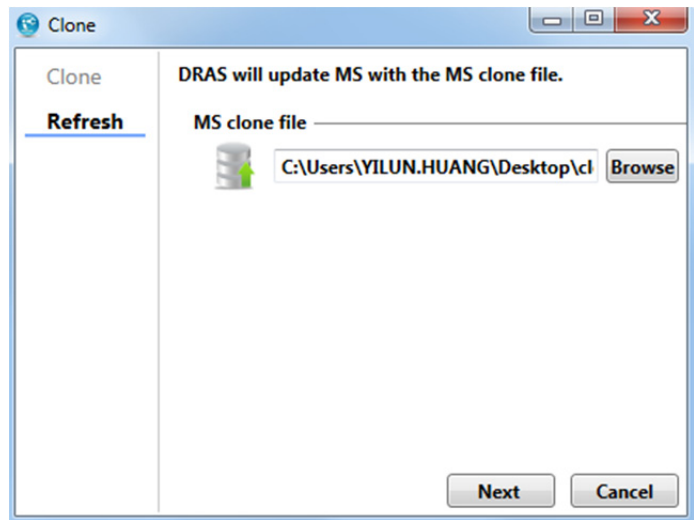
3.14.2 Update

You can follow the steps below to update the controller with a clone file.

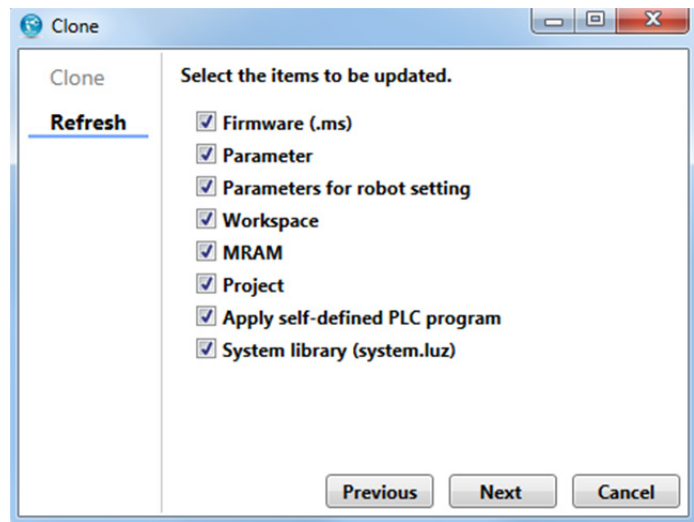
 **Warning:** The supported parameters are subject to change based on the software/firmware version. Please check the firmware version you are using before using this function. Or an error will occur if using the non-corresponding version.

Warning: The mechanical parameters and project selection are subject to change based on the robot type. Please check the corresponding robot type or an error will occur.

- (1) Go to **Other** page.
- (2) Click on **Create library**.
- (3) Specify the path of the clone file.

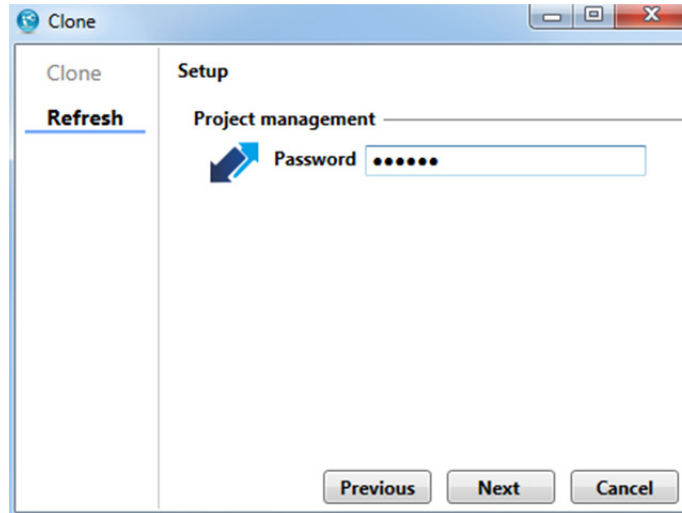


- (4) Select the items to be updated.

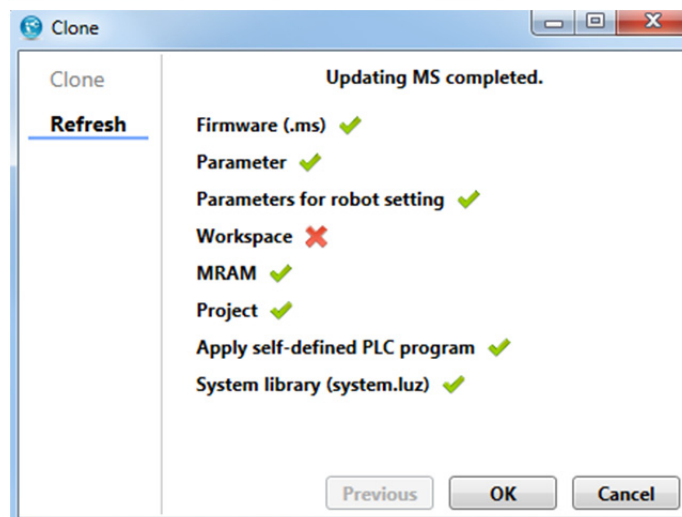
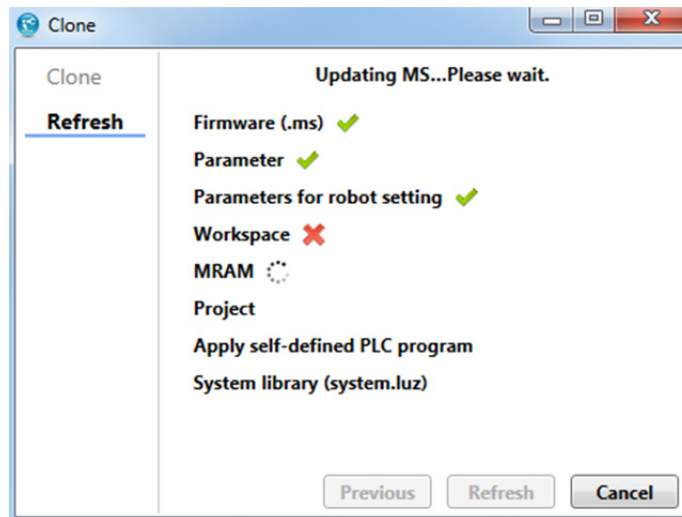


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(5) Enter the password if you are going to update the project.



(6) Update starts. The green check stands for update successful whereas the red X for update failure.



Revision History

Release date	Version	Chapter	Revision Contents
July, 2016	V1.0	N/A	First Edition

For other relevant information about DRAS Software Manual, refer to the manual below:

(1) ASDA-MS User Manual (to be released in December, 2016)

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