FAQ-132: Motion Control - Using I-8094F/8092F/8094

NOTE: XP-8xx7-CE6 supports motion functions and provides Soft-GRAF HMI demos (Refer to Section 1.7.1) since Ver.1.09. Download the latest driver at http://www.icpdas.com/products/PAC/i-8000/isagraf-link.htm

This chapter is about ISaGRAF Motion Control using I-8094F / I-8092F / I-8094 modules. The design method is introduced step-by-step by showing how to create a demo example. All the ISaGRAF demo examples are shown with HMI demos developed by Soft-GRAF.

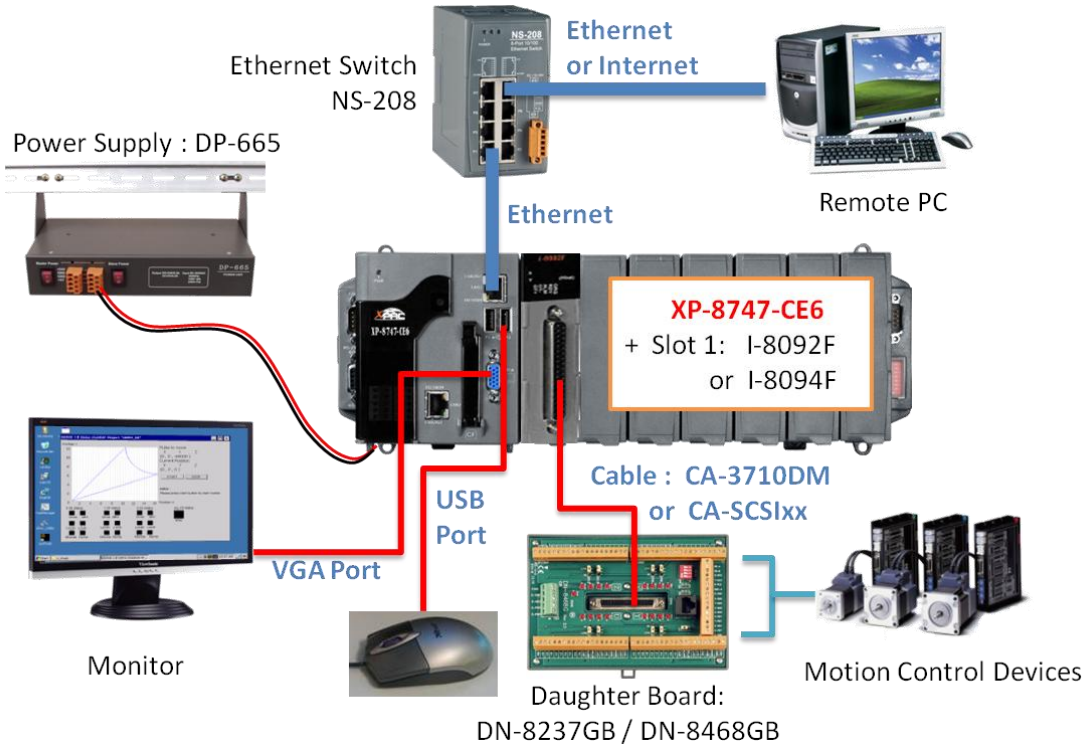
The hardware/software listed below is the basic requirement for the demos in this chapter: one XP-8xx7-CE6 PAC plus one I-8094F or I-8092F motion module. For different motion control applications, please refer to the following website for more devices:
ICP DAS products: http://www.icpdas.com/products/Products-list.htm
Motion control modules: http://www.icpdas.com/products/motion/motion_I8K_Guide.htm

1.1 Hardware / Software Requirement

Hardware Requirement for the demo examples：

Type	Module	Description	Remark
Controller	XP-8xx7-CE6	ISaGRAF XPAC-CE6 PAC	The leftmost I/O slot number of XP-8xx7-CE6 is slot 1.
Motion Modules	I-8092F	2-axis High Speed Motion Control Module card	With one FRnet master port
	DN-8237G	Daughter board for I-8092F	
	CA-3710DM	Cable for I-8092F: 37 Pin Dsub	Connect card with daughter board
	I-8094(F)	4-axis High Speed Motion Control Module card	I-8094F: With FRnet master I-8094: Without FRnet master
	DN-8468G	Daughter board for I-8094(F)	
	CA-SCSIxx	Cable for I-8094F: 68-pin SCSI-II	Connect card with daughter board: CA-SCSI15: length 1.5M CA-SCSI30: length 3 M CA-SCSI50: length 5 M
Power	DP-665	Industrial power supply	
Other Devices	Monitor	VGA port	
	USB mouse	USB port	
	NS-208/NS-205	Industrial Ethernet switch	

Hardware Wiring :



ISaGRAF IO Library :

Item	Type	Project
1	I/O connection file	"i_8092f.xia" : for I-8092F "i_8094f.xia" : for I-8094F/8094
2	Motion C function	"z8094.uia" : for I-8094F/8094/8092F

ISaGRAF Demo Programs :

Please refer to Section 1.7 for detail demo descriptions.

Item	Type	Project
1	I-8094F/8094 demo files	"M94_01.pia","M94_01a.pia","M94_01b.pia", "M94_01c.pia","M94_01d.pia","M94_02.pia", "M94_02a.pia","M94_02b.pia","M94_03.pia", "M94_04.pia","M94_05.pia","M94_06.pia"
2	I-8092F demo files	"M92_01.pia","M92_01a.pia","M92_01b.pia", "M92_01c.pia","M92_01d.pia","M92_02.pia", "M92_02a.pia","M92_02b.pia","M92_03.pia"
3	Motion function file	"samp809.pia"

Before continuing this chapter, please copy all the files listed above to your PC and restore the demo program files to ISaGRAF Workbench (refer to XP-8xx7-CE6 Getting Started Ch.3.2).

NOTE:
If you have never installed ISaGRAF, please install the ISaGRAF software and "ICPDAS Utility for ISaGRAF". If you are not familiar with the ISaGRAF programming, please refer to the Chapter 2.1~2.2 of "Getting Started: The XP-8xx7-CE6 PAC". The Getting Started can be got from the following list.
XP-8xx7-CE6 CD : /napdos/isagraf/setup.exe
FTP : ftp://ftp.icpdas.com/pub/cd/xp-8xx7-ce6/napdos/isagraf/
Web : http://www.icpdas.com/products/PAC/i-8000/getting_started_manual.htm

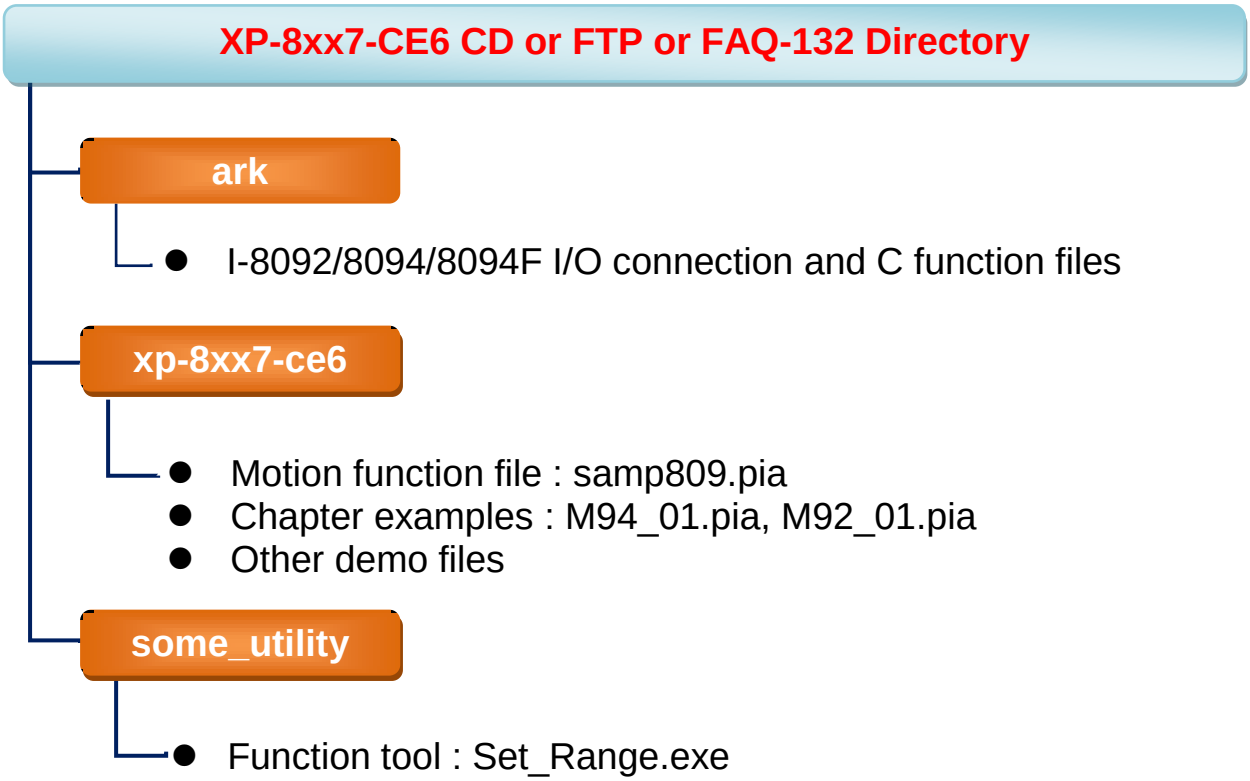
These files can be found in the XP-8xx7-CE6 CD (since version 1.09), FTP and FAQ-132 :

Three directories to get the files :

XP-8xx7-CE6 CD : /napdos/isagraf/

FTP : ftp://ftp.icpdas.com/pub/cd/xp-8xx7-ce6/napdos/isagraf/

FAQ-132 : http://www.icpdas.com/faq/isagraf.htm



1.2 Introduction and installation for I-8094F/8092F/8094

1.2.1 Introduction

The motion control modules, I-8094F/8092F/8094, support 4/2-axis stepping / servo motor controls with a maximum of 4M PPS pulse output rate for each axis. They provide several motion functions, such as 2/3-axis linear interpolation, 2-axis circular interpolation, T/S-curve acceleration/deceleration and auto-home-search… functions. Furthermore, based on its outstanding low CPU loading feature, several motion modules can be used on one XPAC controller at the same time and other I/O statuses can be monitored simultaneously.

1.2.2 Hardware Specification

I-8094F / I-8094 main specifications：

ASIC Chip： MCX314As
Number of axes：4 axes, pulse-type output (Stepping or servo motor)
Maximum pulse output： 4M PPS

I-8092F main specifications：

ASIC Chip：MCX312
Number of axes：2-axis, pulse-type output (Stepping or servo motor)
Maximum pulse output：4M PPS

I-8092F / I-8094F / I-8094 interpolation functions：

2-axis / 3-axis Linear Interpolation：
Interpolation range：−2,147,483,646 ~ +2,147,483,646
Vectors speed of interpolation： 1 PPS ~ 4M PPS
Precision of interpolation： ± 0.5 LSB
Circular interpolation：
Interpolation range： −2,147,483,646 ~ +2,147,483,646
Vectors Speed of interpolation： 1 PPS ~ 4M PPS
Relative interpolation function：
Any 2-axis or 3-axis interpolation; Fixed vectors speed

1.2.3 Hardware Connection

I-8092F Module Connection Example：

www.icpdas.com > Products > PAC > 8K & 87K I/O Modules > I-8092F-G > Manual > Getting Started > I-8092 Getting Started manual for PAC

http://www.icpdas.com/products/motion/download%20data/Motion_download_I-8092F.htm

- Getting Started manual for PAC

I-8094F/8094 Module Connection Example：

www.icpdas.com > Products > PAC > 8K & 87K I/O Modules > I-8094F-G > Manual > Getting Started > I-8094 Getting Started manual for PAC

http://www.icpdas.com/products/motion/download%20data/Motion_download_I8094_i8094F.htm

- Getting Started manual for PAC

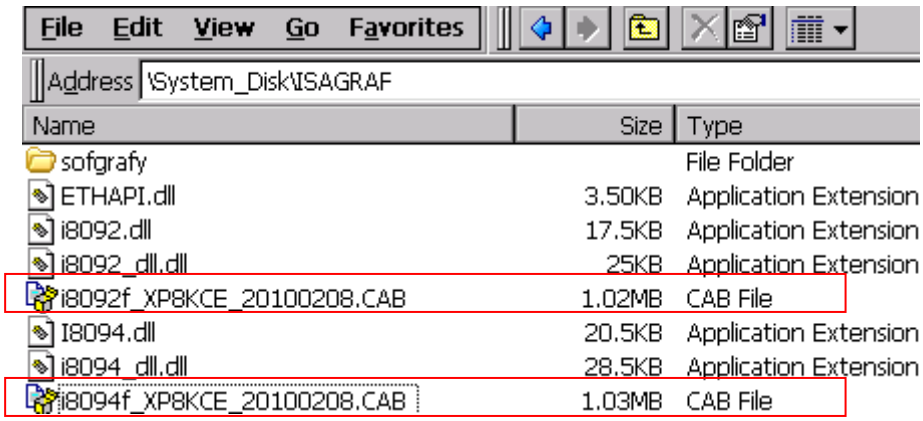
1.2.4 Installation for the Motion Module

Before the first time using the I-8094F / I-8092F / I-8094 modules, user has to update ISaGRAF Driver to V.1.09 or latter version and then install the Drivers, Libraries and the Utilities for the modules.

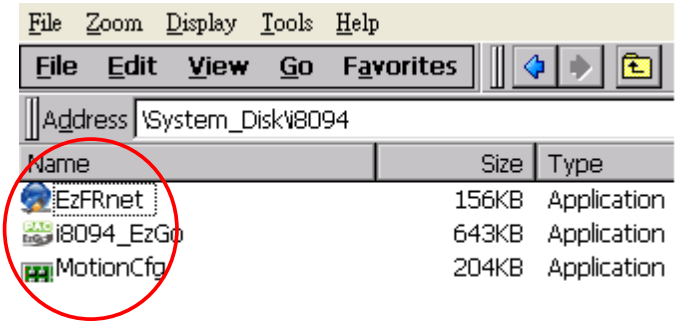
Step 1: Install the PAC CAB file

Run the “My Device” on the XPAC, switch to “ **\System_Disk\ISaGRAF** ”, and then double click the PAC file to install it.

I-8094(F) CAB file: i8094f_XP8KCE_20100208.CAB
I-8092F CAB file: i8092f_XP8KCE_20100208.CAB



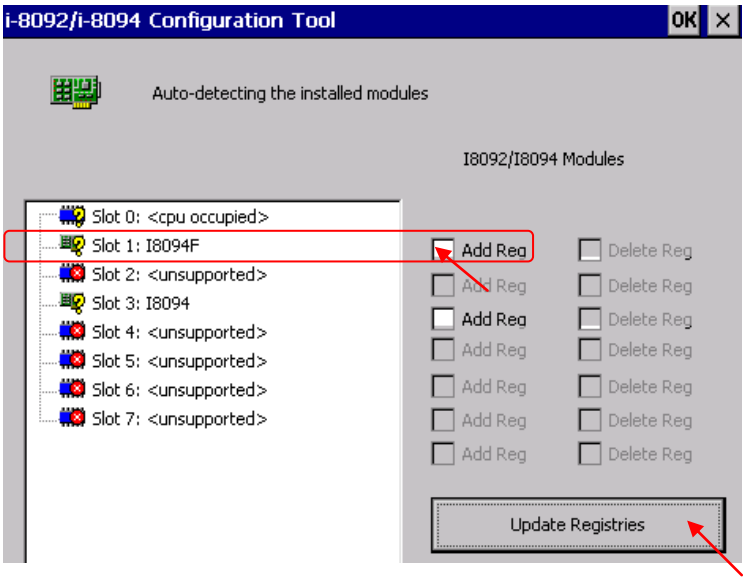
Now, the Drivers and Libraries are installed into the XP-8xx7-CE6；The Utilities are installed to the XP-8xx7-CE6, in the folder of “\System_Disk\i8094” .



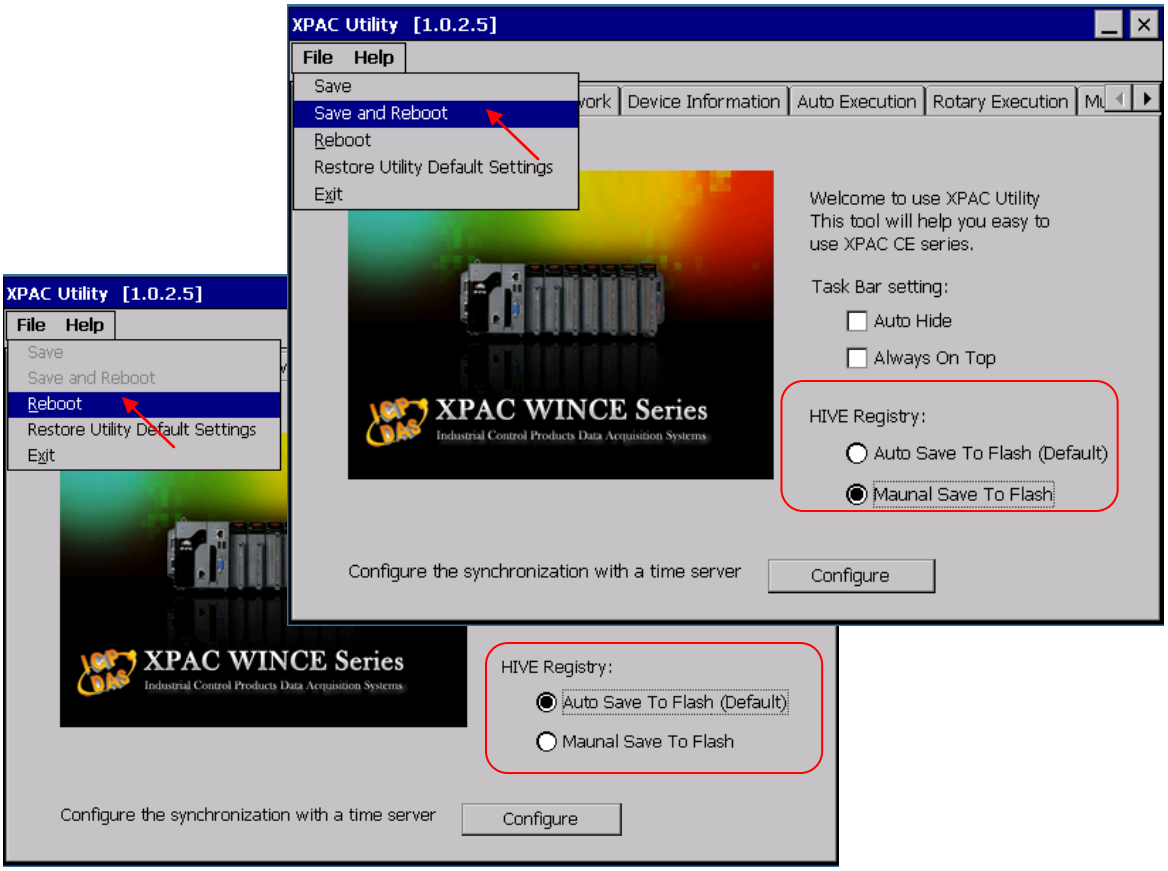
The Utilities files：

Item	Utility Name	Descriptions
1.	MotionCfg	A configuration utility to enable/disable the I-8094F/ 8094/8092F modules on the XP-8xx7-CE6 series.
2.	i8094_EzGo	A tool, similar to the PISO-PS400 PCEzGo, helps to indicate the status of each axis, configure the polarity of external sensors and demonstrate the basic/simple motion-controlling models.
3.	EzFRnet	Demonstrate the FRnet features.

Step 2 : Add system registries of I-8094F/I-8092F card: double click “\System_Disk\i8094\MotionCfg.exe” to open the “I-8012/I-8094 Configuration Tool” window, check the box “AddReg” that mapping to the module slot number, then click “Update Registries” and “OK”. If the module on the slot is changed, please execute "MotionCfg" again and then the module can be used well and correctly.



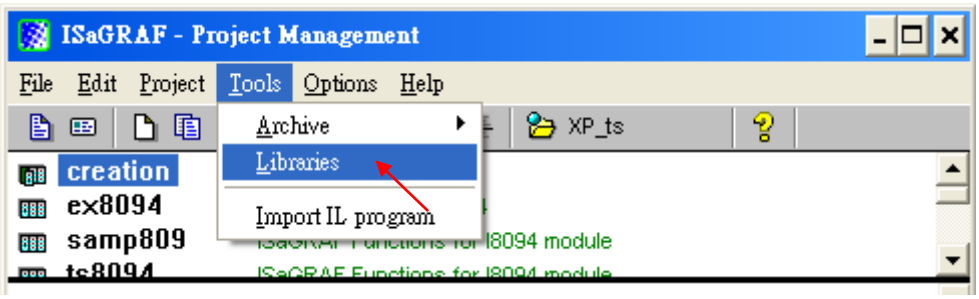
Step 3 : Run XPAC Utility(V.1.0.2.5 or latter Ver.), and click on [File] > [Save & Reboot] to reboot XPAC. (If users do not “Save & Reboot” the XPAC, the card may not work well. If the XPAC is in the Auto Save mode, it’s ok to “Reboot”.)



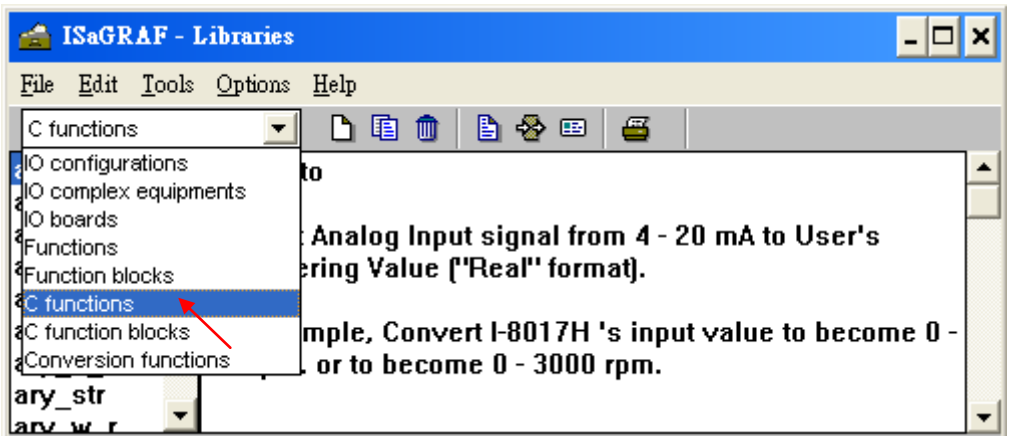
1.2.5 Install the C function “Z_8094” into the ISaGRAF

In this section, we will introduce how to install the C function “Z_8094” into the ISaGRAF Workbench for writing the ISaGRAF Motion programs.

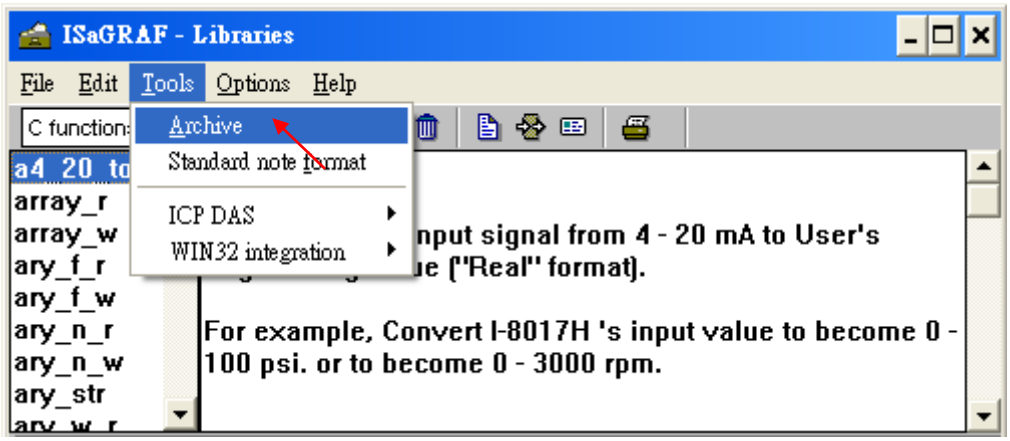
Step 1: Run the ISaGRAF Workbench in the PC. Click [Tools] > [Libraries].



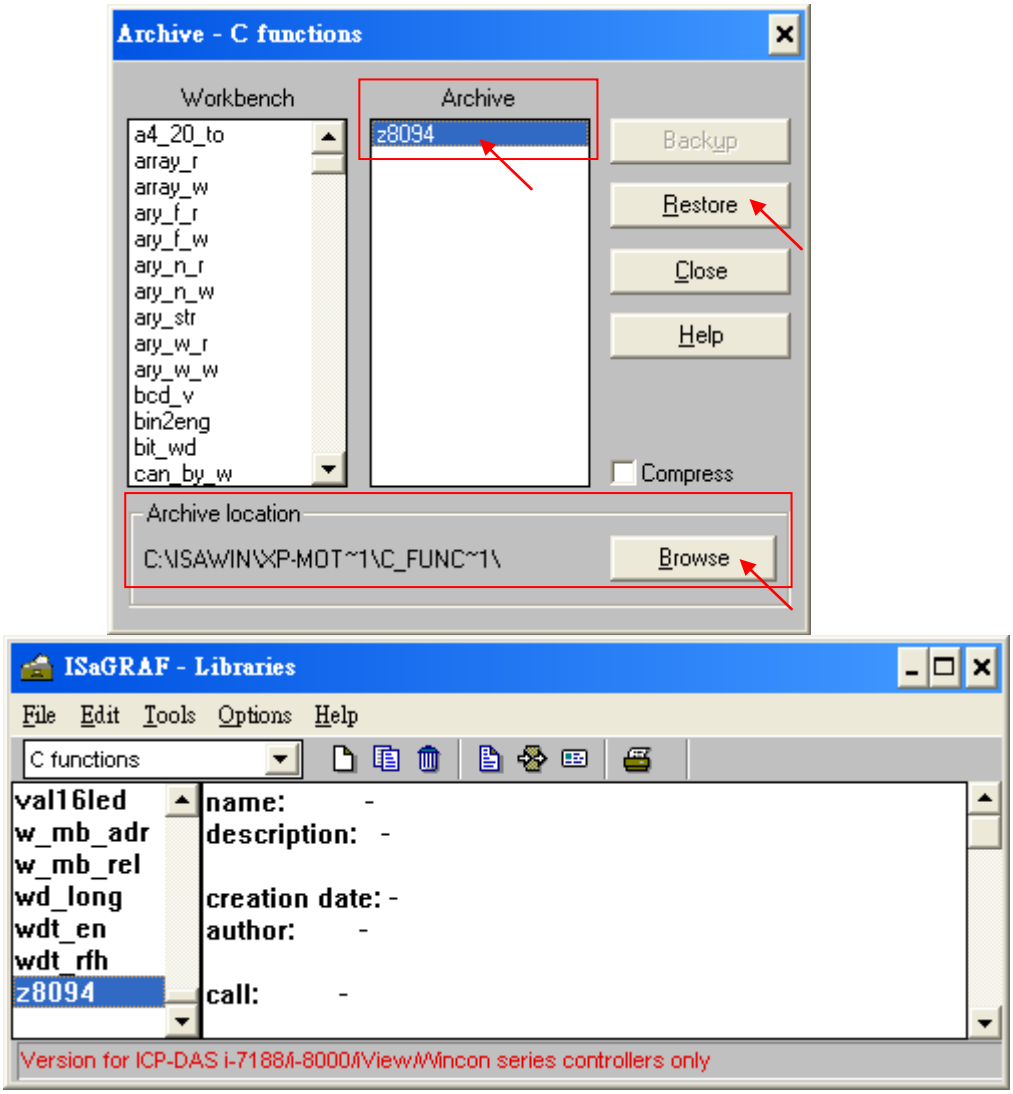
Step 2: Select [C functions]



Step 3: Click [Tools] > [Archive]



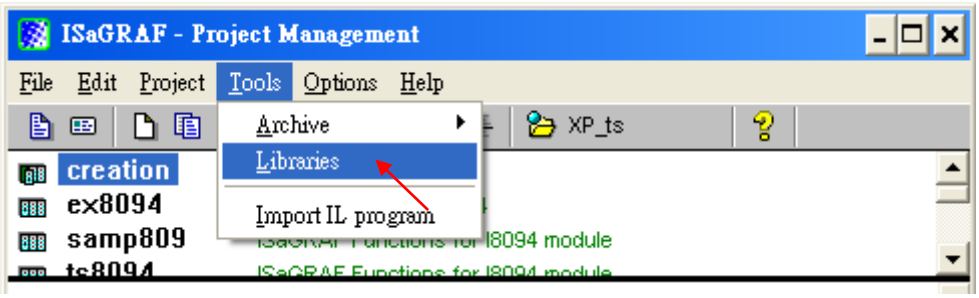
Step 4: Click [Browse] and switch to the folder that the Motion function file are downloaded. Click the motion function “z8094” in the [Archive] box, and click on [Restore] to install the C function “Z_8094” into the ISaGRAF.



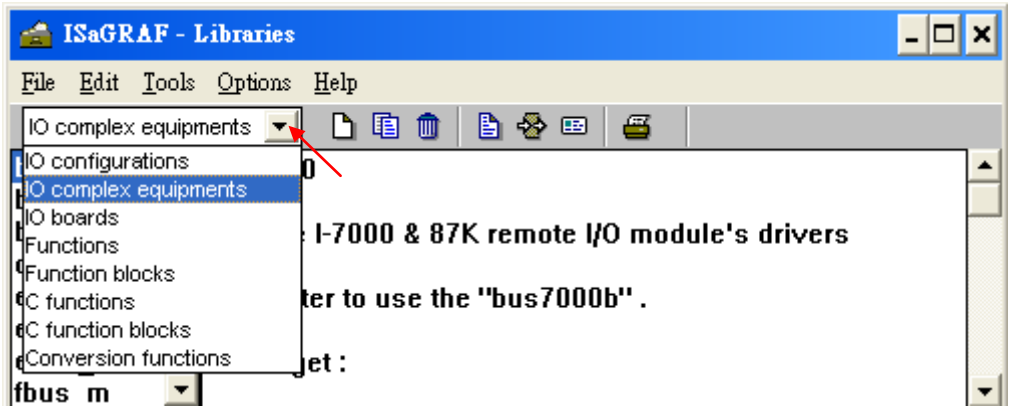
1.2.6 Install the I/O connection: i_8094f & i_8092f into the ISaGRAF

In this section, we will introduce how to install the I/O connection: i_8094f & i_8092f into the ISaGRAF Workbench for writing ISaGRAF Motion programs.

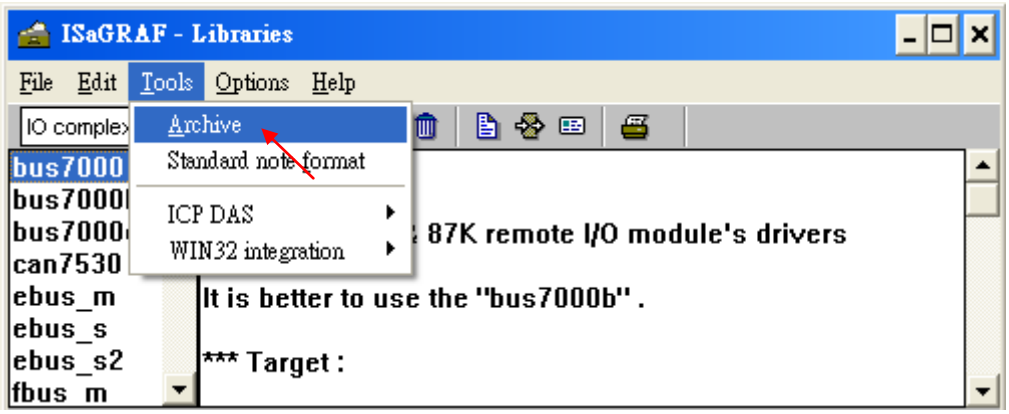
Step 1: In the ISaGRAF Workbench, click [Tools] > [Libraries]



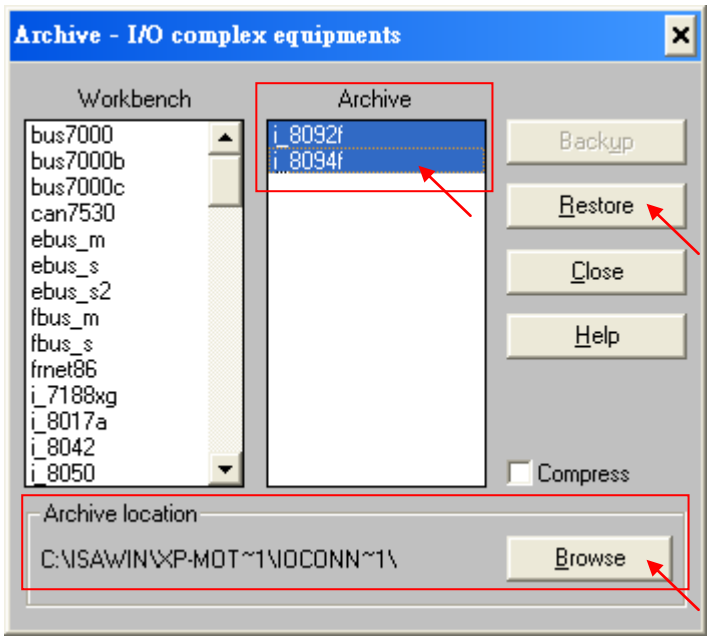
Step 2: Select [I/O complex equipments]



Step 3: Select [Tools] > [Archive]



Step 4: Click [Browse] and switch to the folder that the I/O connection files are downloaded, then select the files in the [Archive] box (press and hold the “Shift” key to select continuous multiple files; press and hold the “Ctrl” key to select non-continuous multiple files.), then click [Restore] to install them into the ISaGRAF Workbench.



1.3 A simple Motion Example - Using I-8094F Module

In this section, we introduce how to program the motion control project, using I-8094F motion module, by creating a simple ISaGRAF example “M94_01”. All the motion functions are collected in the “samp809” file. We need to copy “samp809” into the new project and the method will be introduced in the following steps.

NOTE：

1. All about speed and pulse output setting must be set according to your actual motion machines to avoid any danger.

2. If you are not familiar with the ISaGRAF programming, please refer to the Chapter 2.1 of "Getting Started : The XP-8xx7-CE6 PAC".

XP-8xx7-CE6 CD： /napdos/isagraf/xp-8xx7-ce6/chinese-manu/

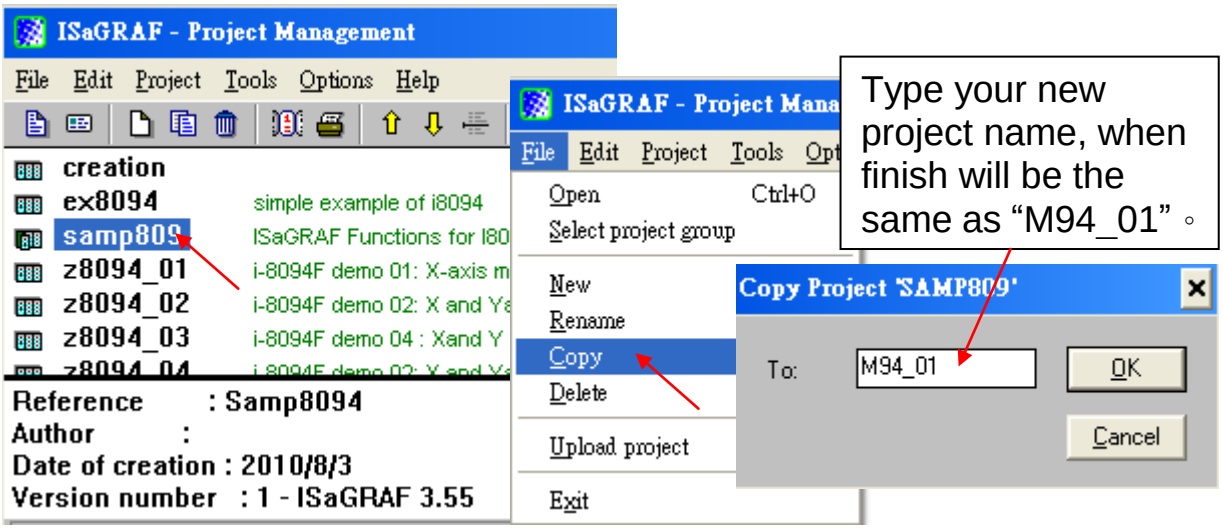
Web: http://www.icpdas.com/products/PAC/i-8000/getting_started_manual.htm

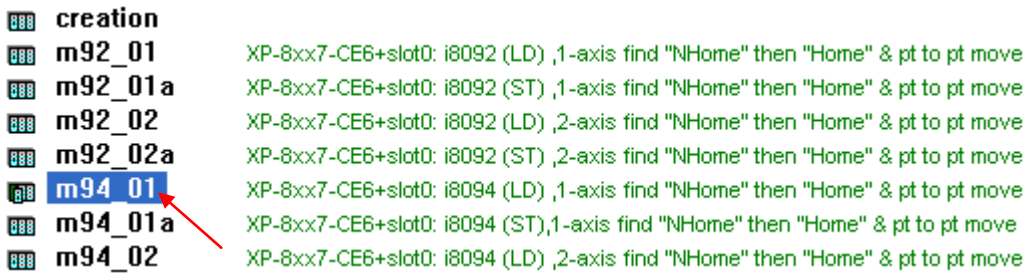
1.3.1 Create an ISaGRAF Motion Project

Please make sure the Motion demo files are restored already. If not yet, please refer to Ch.1.1 for the files. And refer to the Chapter 3.2. of XP-8xx7-CE6 Getting Started for the restoring steps.

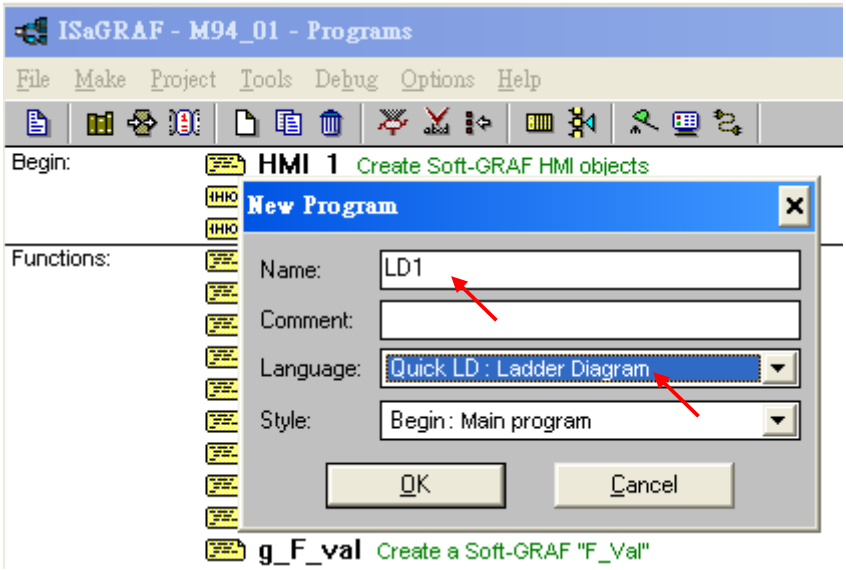
In this section, user will create a simple ISaGRAF project (the same as the example “M94_01” when finish.) in the ISaGRAF Workbench and download to the XP-8xx7-CE6 PAC (slot1: I-8094F), then execute this project. This project includes 2 LD (LD1 & LD2) and one ST (HMI_1) programs which code can be copied from the “M94_01”. About the HMI_1, please refer to www.icpdas.com > FAQ > Software > ISaGRAF > FAQ-131 .

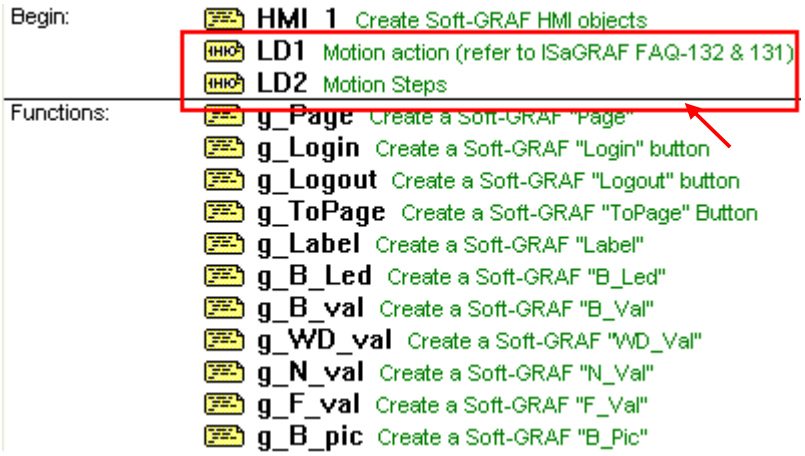
Step 1. Copy the Motion function file “samp809” to the new project. Double click the file to open it.





Step 2. Click [File] > [New] or “Create new program” tool icon to create the LD program “LD1” & “LD2”.





Step 3. Declare variables and write the ST code.

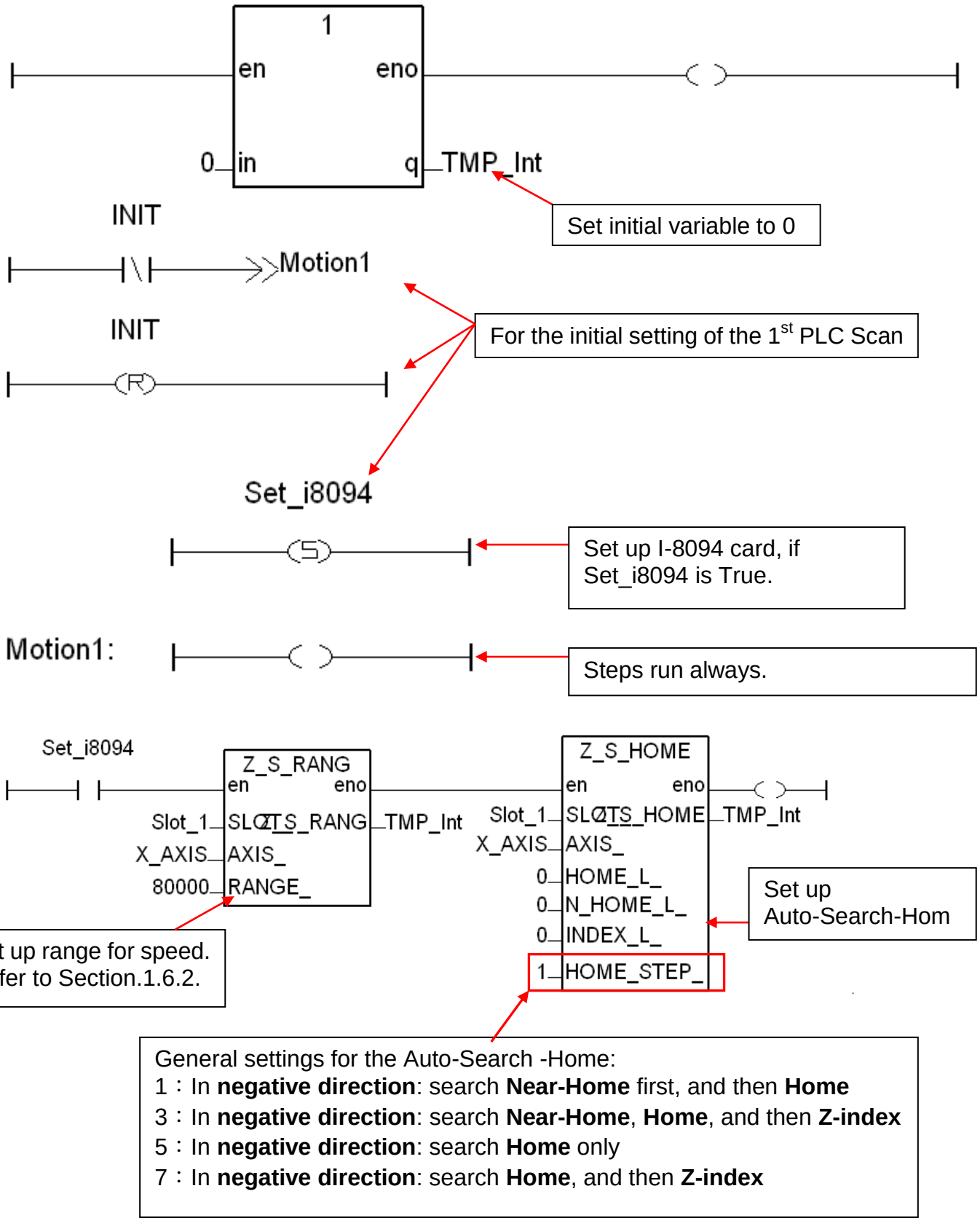
Variables Declaration：

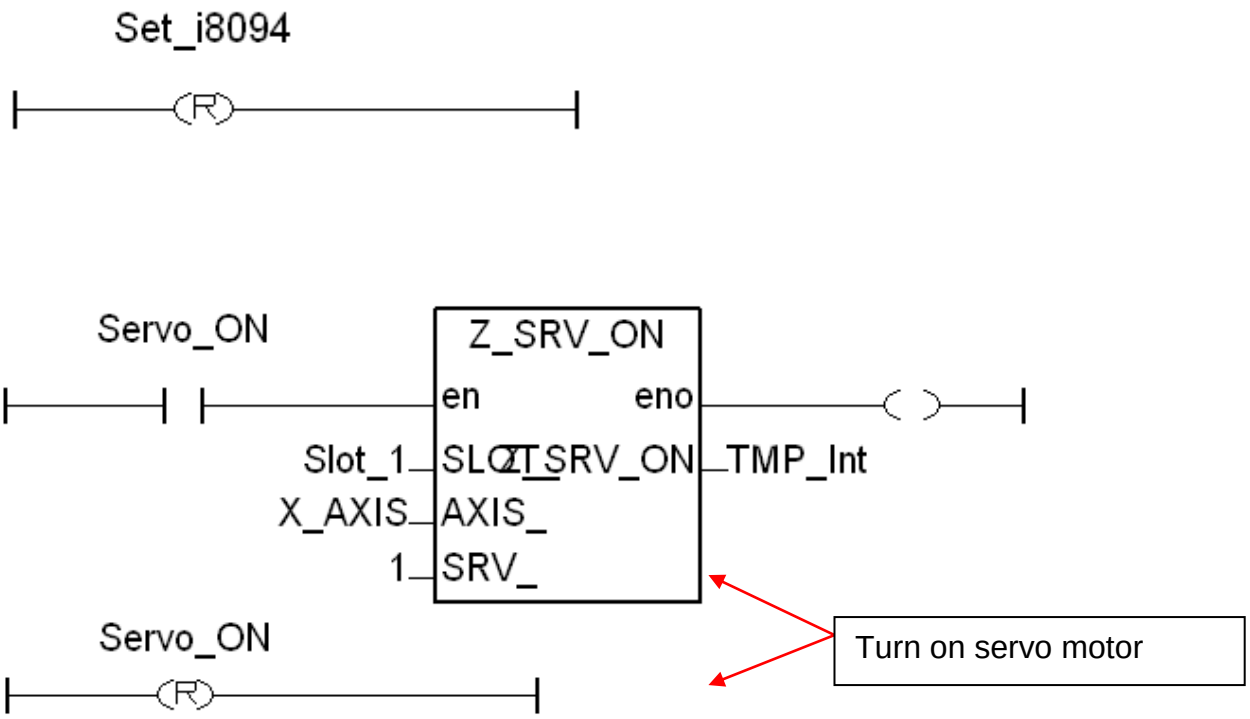
Variable Name	Type	Attribute	Network addr.	Description
TMP	Boolean	internal		Temp variable for creating the Soft-GRAF HMI.
Soft_GRAF_init	Boolean	internal		Initial for Soft-GRAF HMI, default True
INIT	Boolean	internal		Initial for motion, default True
Start	Boolean	internal	1	Start the motion
Move_it	Boolean	internal	2	Move to the next point
Clear_Trace	Boolean	internal	3	Clear the HMI trace region
Set_i8094	Boolean	internal		Set the I-8094 parameters
Server_ON	Boolean	internal		Turn on the servo motor
Find_Home	Boolean	internal		Auto-search-home
Reset_ENCO	Boolean	internal		Reset the encoder value
Mov_PT	Boolean	internal		The needed pulses for the single-axis moving
Stop_Motion	Boolean	internal		Stop motion
Server_OFF	Boolean	internal		Turn off the servo motor
Limit_P_X	Boolean	input	11	Hardware limit+ signal
Limit_N_X	Boolean	input	12	Hardware limit- signal
EMG_X	Boolean	input	13	Emergency stop signal
NHome_X	Boolean	input	14	Hardware Near-Home signal
Home_X	Boolean	input	15	Hardware Home signal
DRV_X	Boolean	input	16	Check if the motor is running
Ack_Error	Boolean	internal	4	Check if the error code is set to 0
Slot_1	Integer	internal		The slot number of the card, default 1
X_AXIS	Integer	internal		X-axis of the card, default 1
Y_AXIS	Integer	internal		Y-axis of the card, default 2

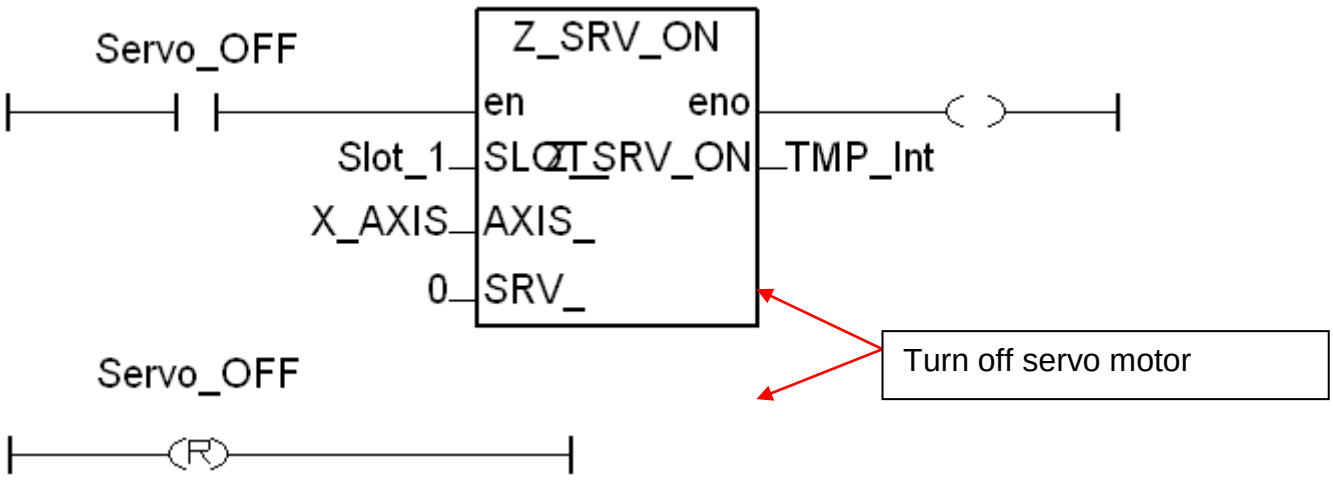
Variable Name	Type	Attribute	Network addr.	Description
Z_AXIS	Integer	internal		Z-axis of the card, default 4
U_AXIS	Integer	internal		U-axis of the card, default 8
ACC_T_X	Integer	internal		Set the acceleration of X-axis
DEC_T_X	Integer	internal		Set the deceleration of X-axis
Mov_Pulse_cnt_X	Integer	internal		Calculate how many pulses need to move. Can be negative.
Mov_Speed_X	Integer	internal		The average speed of moving
Step	Integer	internal		Check the current moving step
TMP_Int	Integer	internal		The temp variable for moving function
Current_point_X	Integer	input		Current point of the X-axis
Next_Point_X	Integer	internal		Move to the next point
Z_Done_X	Integer	internal		Check if the moving done
Trace_type_x	Integer	internal		For the Soft-GRAF trace function, default 1
Error_code	Integer	internal		The error code for the moving

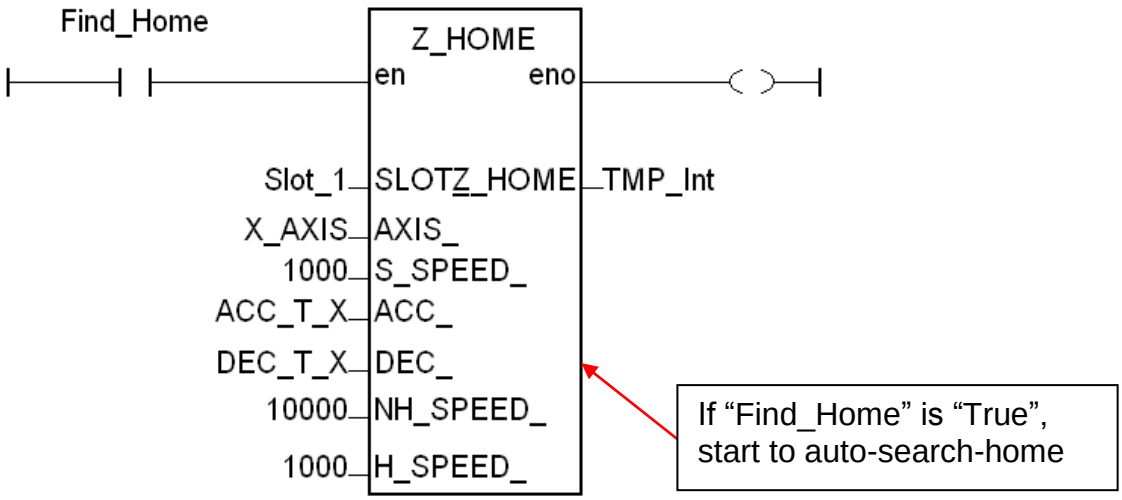
Laddar Program (LD1)：

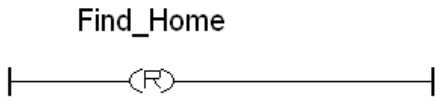
(Type the code or copy from the “LD1” in the project “M94_01”)

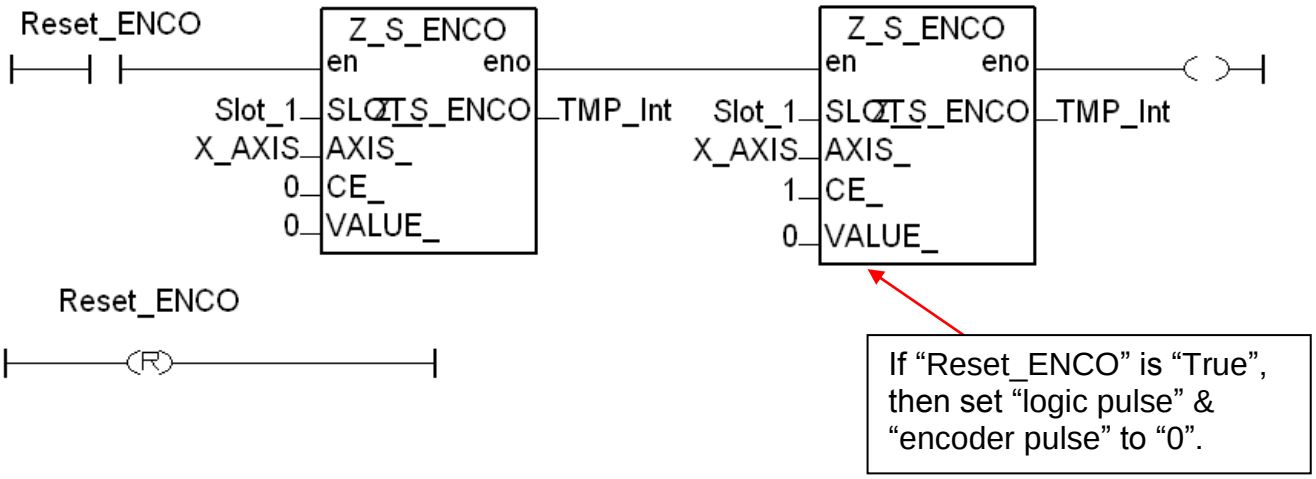



Set_i8094
Servo_ON
Z_SRV_ON
en
eno
Slot_1
SLOT
SRV_ON
TMP_Int
X_AXIS
AXIS_
1
SRV_
Servo_ON
Turn on servo motor

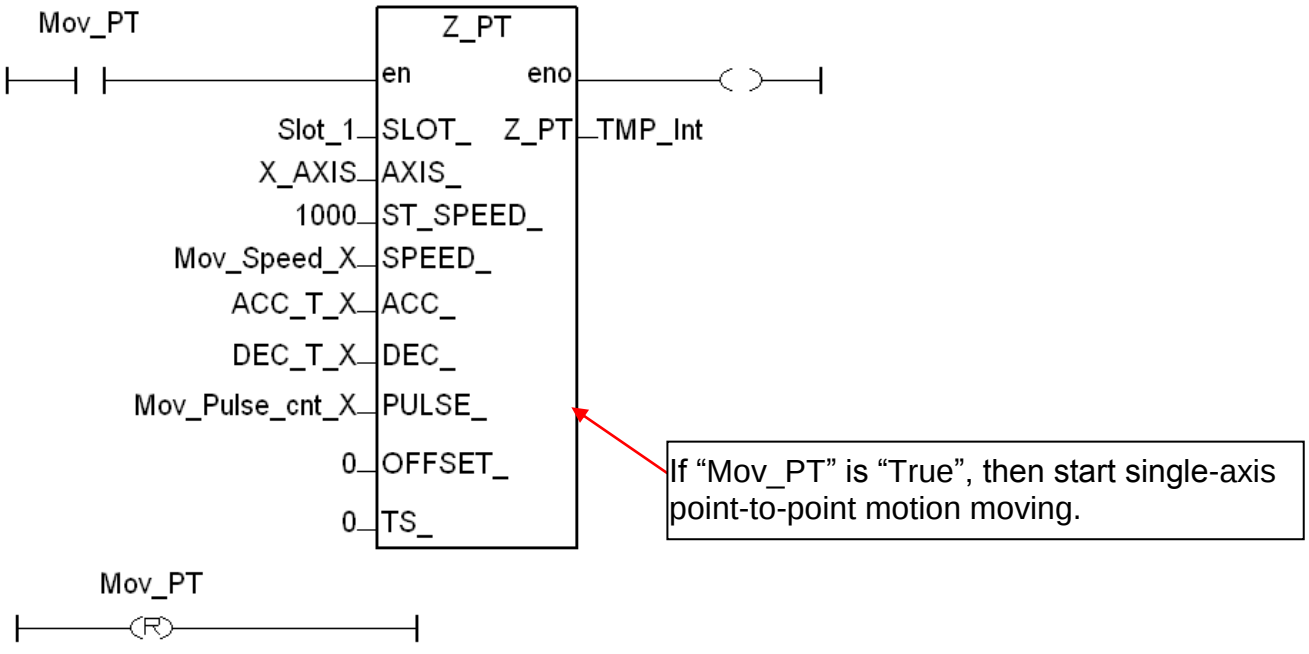

Servo_OFF
Z_SRV_ON
en
eno
Slot_1
SLOT
SRV_ON
TMP_Int
X_AXIS
AXIS_
0
SRV_
Servo_OFF
Turn off servo motor


Find_Home
Z_HOME
en
eno
Slot_1
SLOTZ_HOME
TMP_Int
X_AXIS
AXIS_
1000
S_SPEED_
ACC_T_X
ACC_
DEC_T_X
DEC_
10000
NH_SPEED_
1000
H_SPEED_
If “Find_Home” is “True”, start to auto-search-home

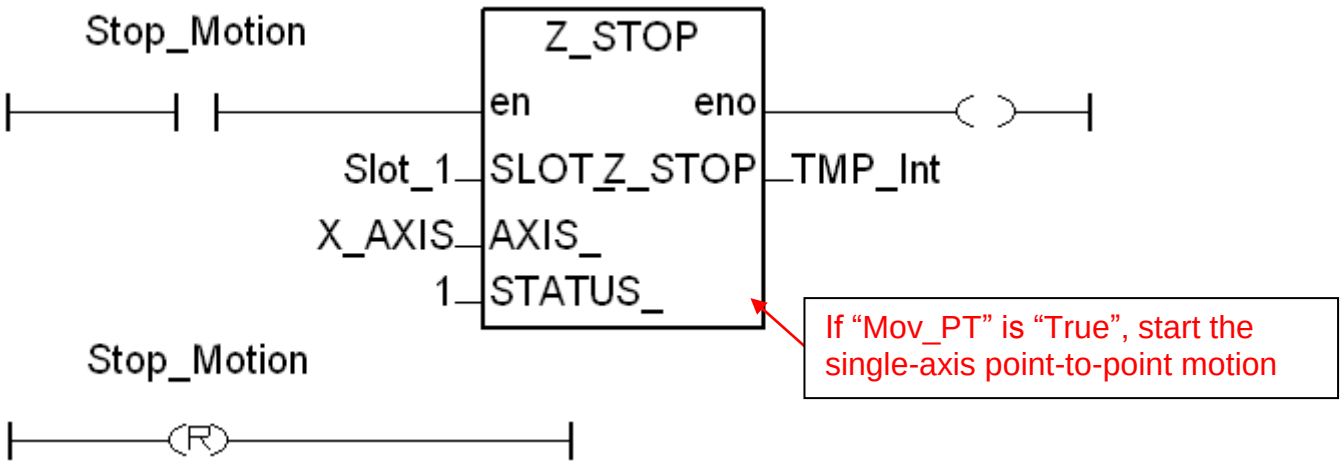

Find_Home
R

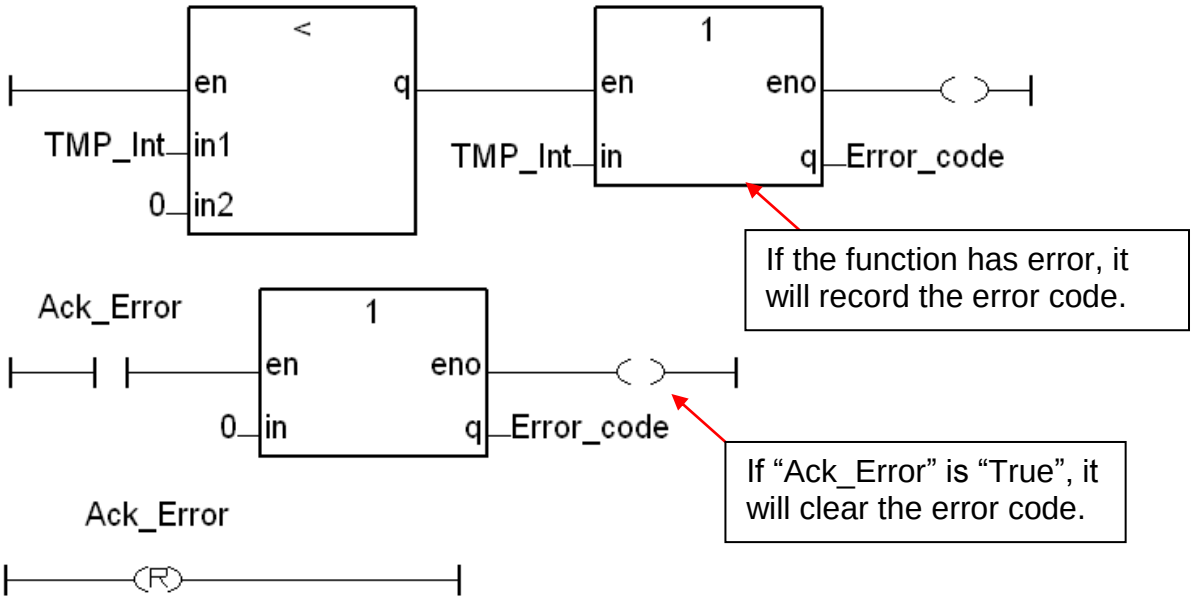

Reset_ENCO
Z_S_ENCO
en
eno
Slot_1
SLOTS_ENCO
TMP_Int
X_AXIS
AXIS_
0
CE_
0
VALUE_
Z_S_ENCO
en
eno
Slot_1
SLOTS_ENCO
TMP_Int
X_AXIS
AXIS_
1
CE_
0
VALUE_
If “Reset_ENCO” is “True”, then set “logic pulse” & “encoder pulse” to “0”.

Reset_ENCO
R


Mov_PT
Z_PT
en
eno
Slot_1
SLOT_
Z_PT
TMP_Int
X_AXIS
AXIS_
1000
ST_SPEED_
Mov_Speed_X
SPEED_
ACC_T_X
ACC_
DEC_T_X
DEC_
Mov_Pulse_cnt_X
PULSE_
0
OFFSET_
0
TS_
If “Mov_PT” is “True”, then start single-axis point-to-point motion moving.

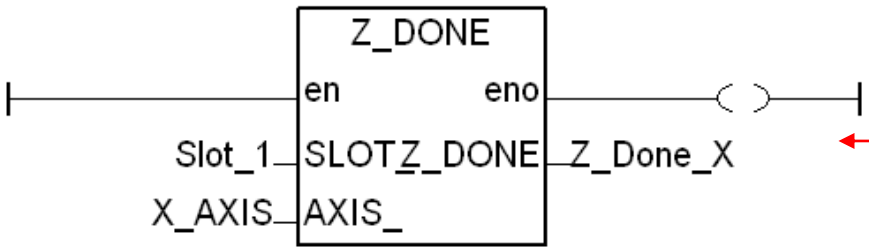
Mov_PT
R


Stop_Motion
Z_STOP
en
eno
Slot_1
SLOT_Z_STOP
TMP_Int
X_AXIS
AXIS_
1
STATUS_
If “Mov_PT” is “True”, start the single-axis point-to-point motion
Stop_Motion
R

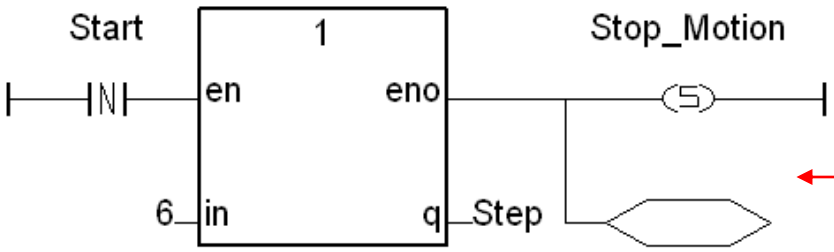

<
en
q
TMP_Int
in1
0
in2
1
en
eno
TMP_Int
in
q
Error_code
If the function has error, it will record the error code.
Ack_Error
1
en
eno
0
in
q
Error_code
If “Ack_Error” is “True”, it will clear the error code.
Ack_Error
R

Laddar Program (LD2)：

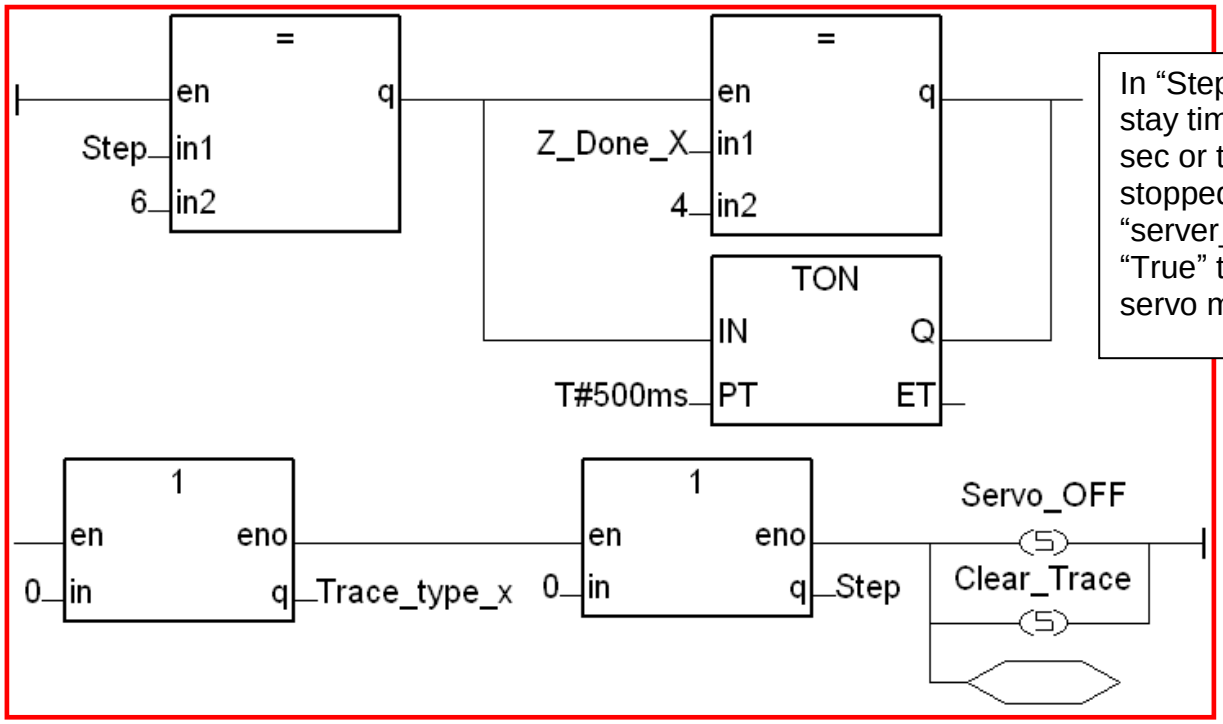
(Type the code or copy from the “LD2” in the project “M94_01”)



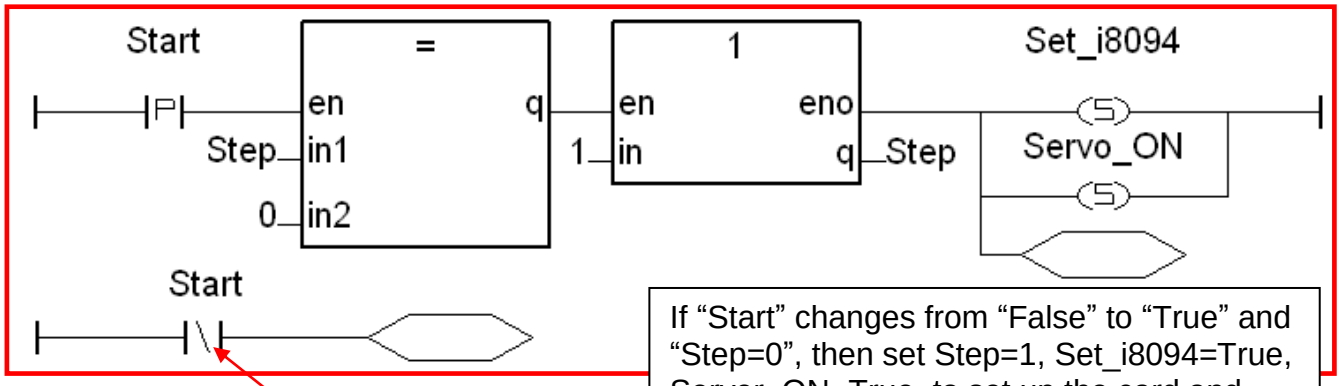
Check the state of the X-axis



If “Start” changes from “True” to “False”, it will set “Stop_Motion” to “True” to stop the Motion.

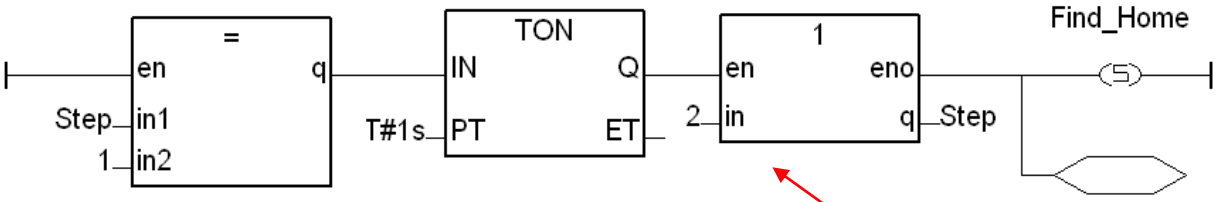


In “Step=6”, if the stay time is over 0.5 sec or the motor is stopped, it will set “server_OFF” to “True” to stop the servo motor.

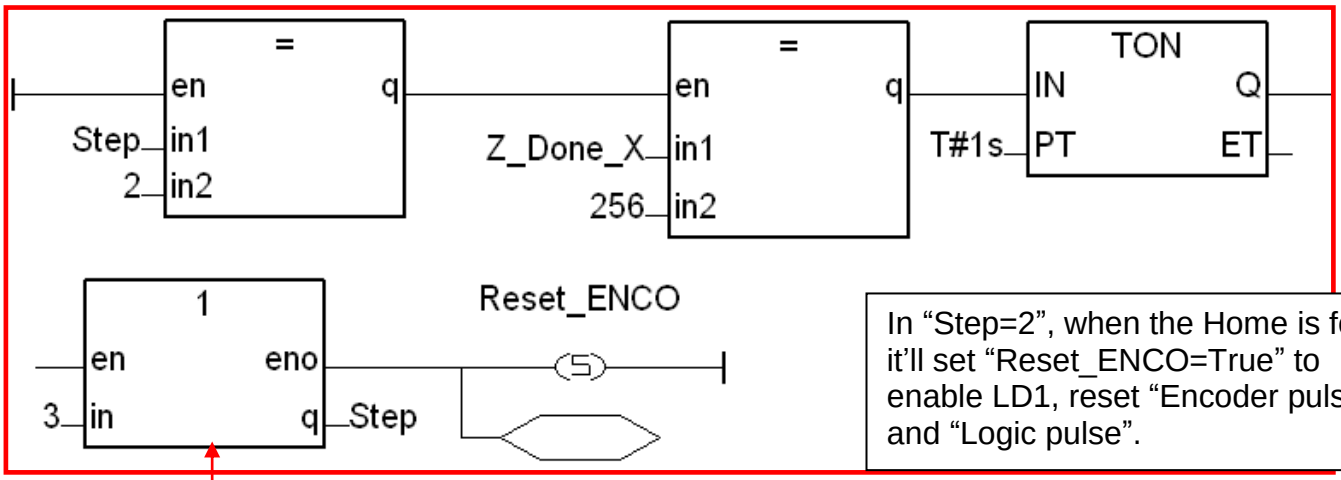


If “Start” changes from “False” to “True” and “Step=0”, then set Step=1, Set_i8094=True, Server_ON=True, to set up the card and turn on the servo motor.

The following program is running only if “Start=True”.

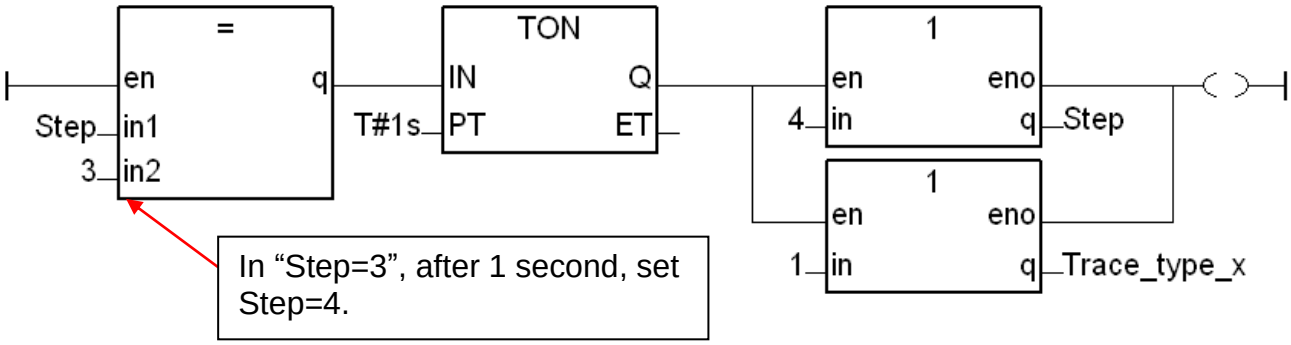


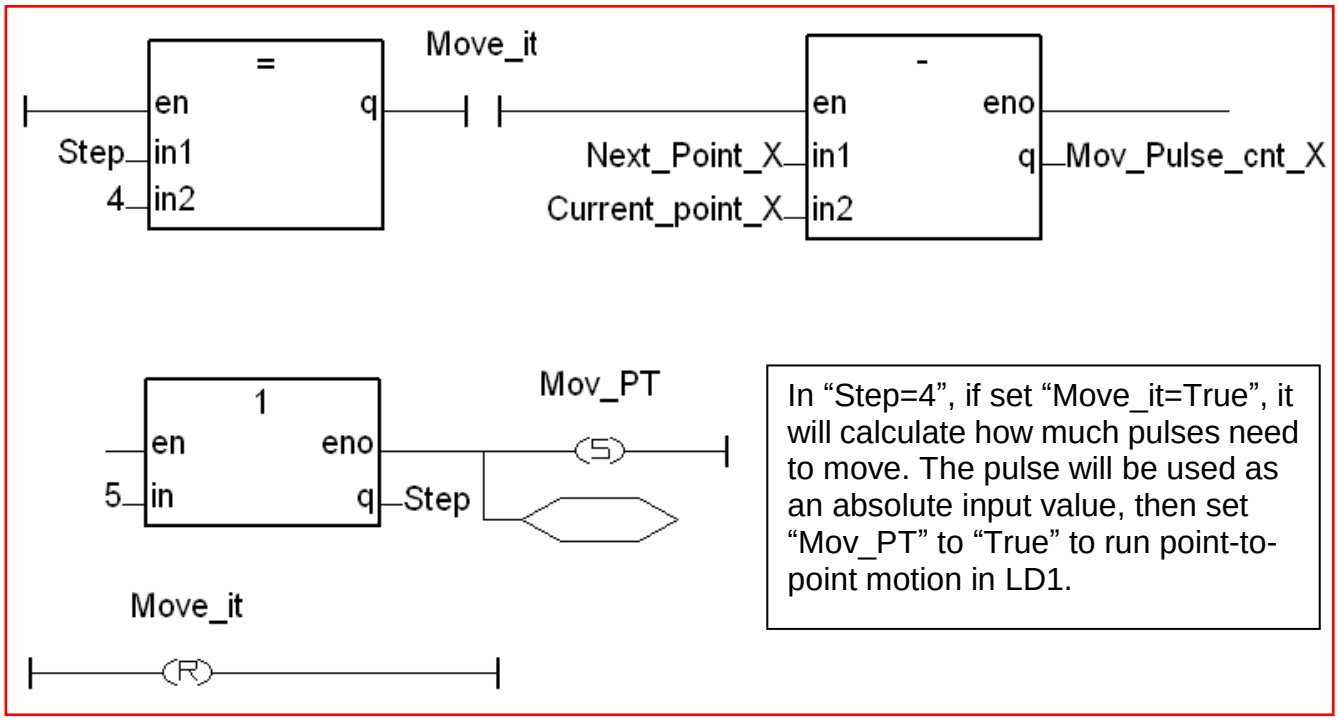
In “Step=1”, if stay over 1 sec, set “Find_Home” to “True” to start the Auto-Search-Home.

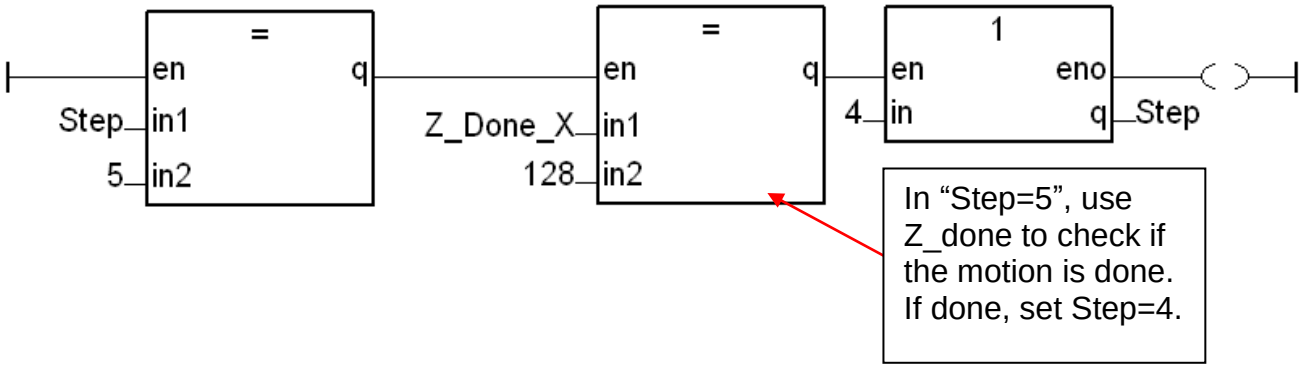


In “Step=2”, when the Home is found, it’ll set “Reset_ENCO=True” to enable LD1, reset “Encoder pulse” and “Logic pulse”.

※ When the Home is found, the program must wait for a little time to start any other motion function to ensure “Encoder” has been reset correctly.

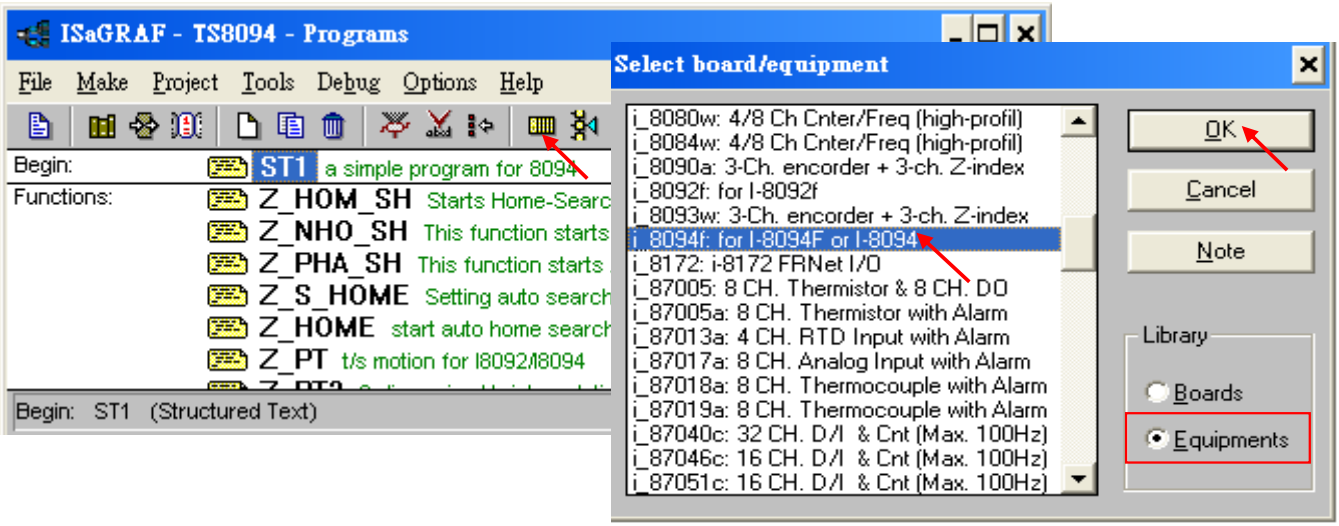

=
en
q
Step
in1
3
in2
TON
IN
Q
T#1s
PT
ET
1
en
eno
4
in
q
Step
1
en
eno
1
in
q
Trace_type_x
In “Step=3”, after 1 second, set Step=4.


=
en
q
Step
in1
4
in2
Move_it
-
en
eno
Next_Point_X
in1
q
Mov_Pulse_cnt_X
Current_point_X
in2
1
en
eno
5
in
q
Step
Mov_PT
S
Move_it
R
In “Step=4”, if set “Move_it=True”, it will calculate how much pulses need to move. The pulse will be used as an absolute input value, then set “Mov_PT” to “True” to run point-to-point motion in LD1.

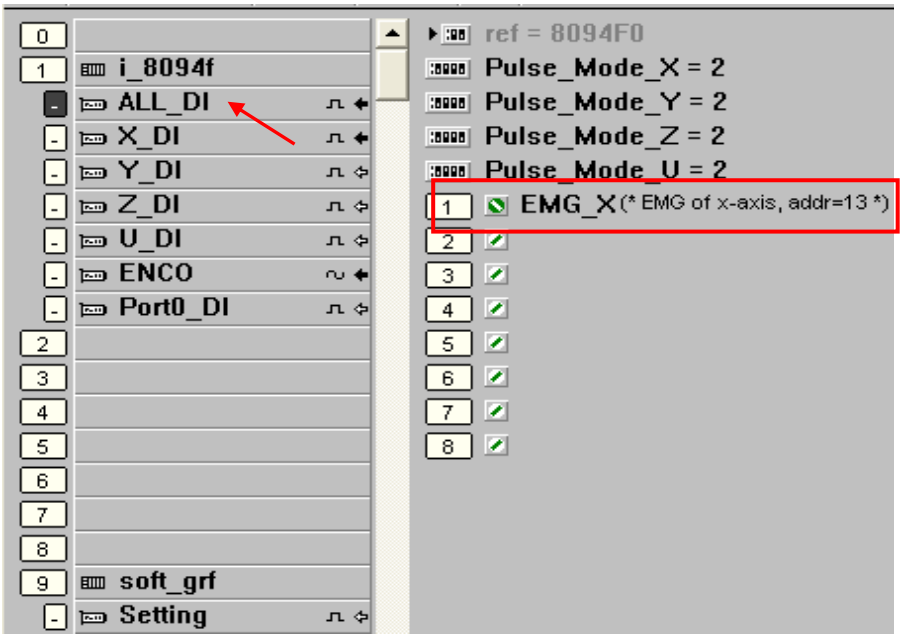

=
en
q
Step
in1
5
in2
=
en
q
Z_Done_X
in1
128
in2
1
en
eno
4
in
q
Step
In “Step=5”, use Z_done to check if the motion is done. If done, set Step=4.

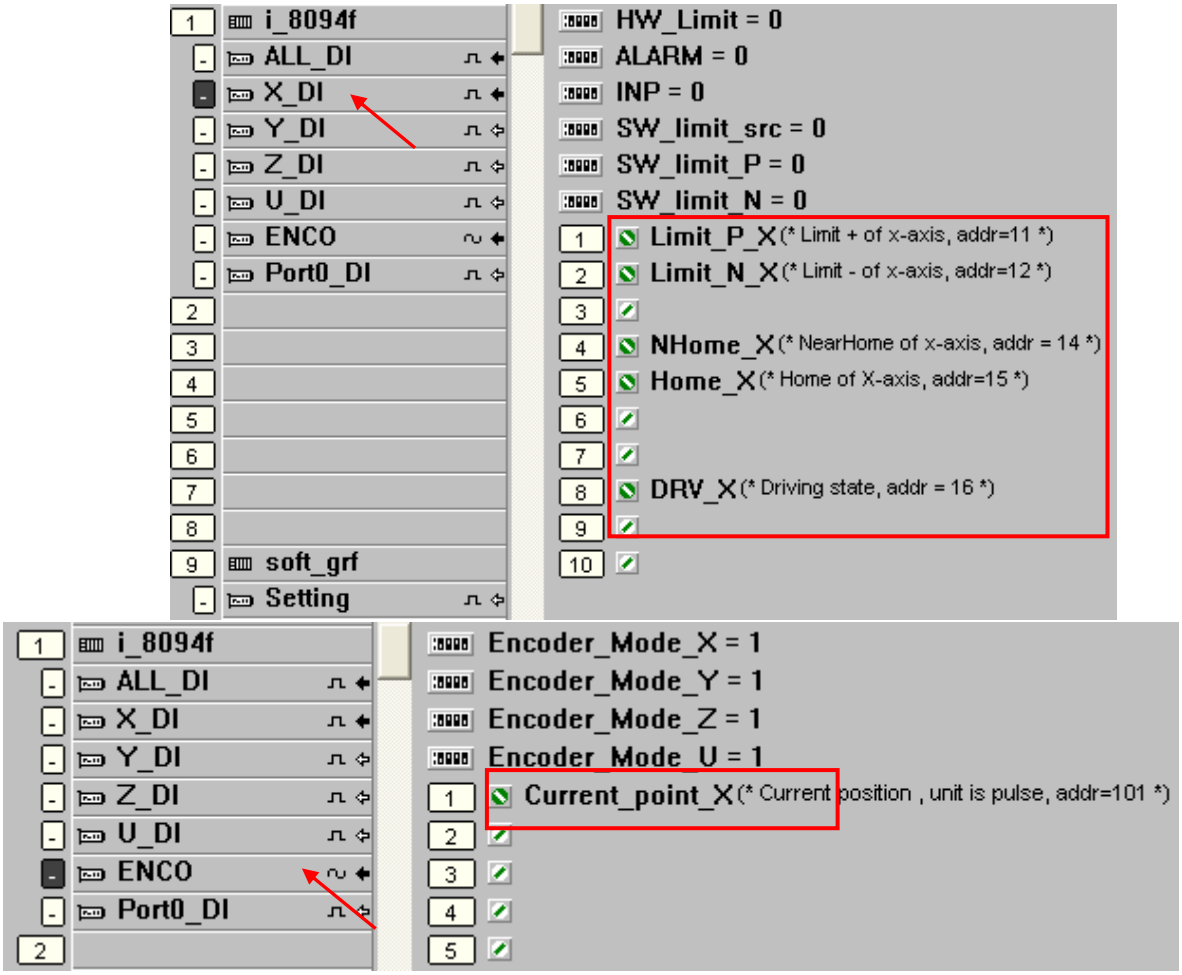
1.3.2 Set up I/O connection：

Step 1 : Click [Project] > [I/O connection] or the tool icon to open the setting window. Select “Equipments” and then select "I_8094f: for I-8094F or I-8094" I/O module.



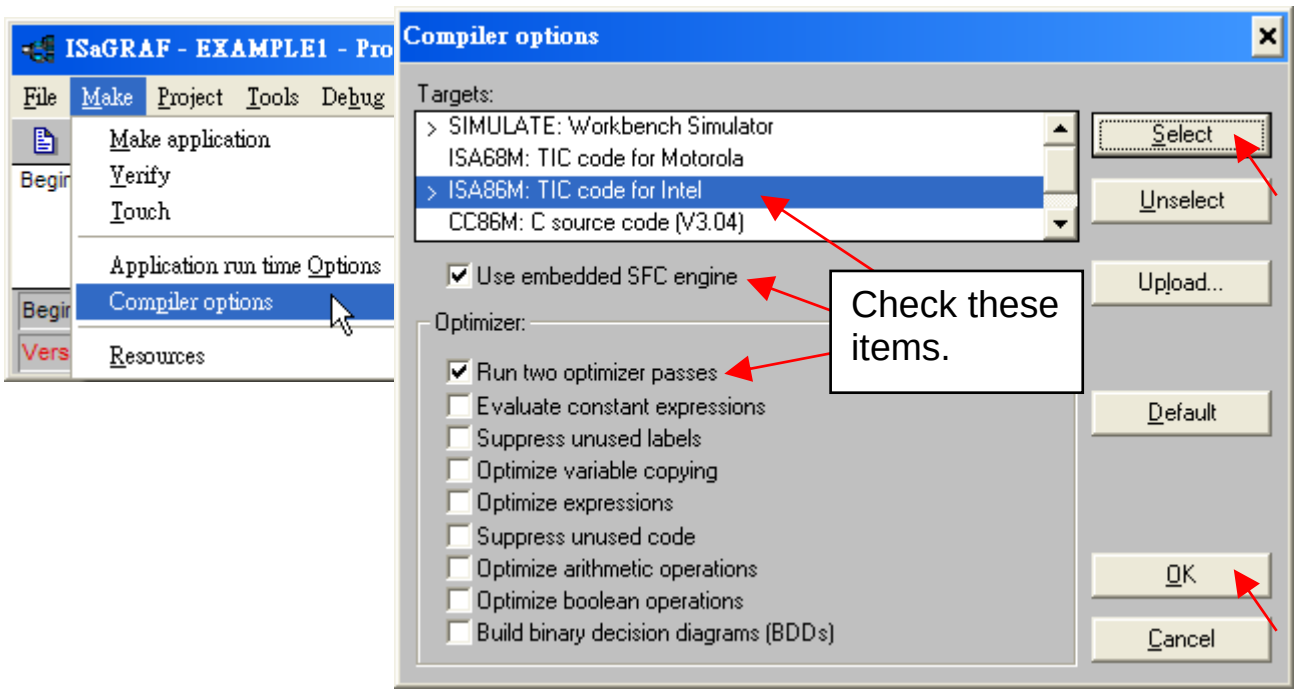
Step 2 : Set up the parameters and variables for I/O connection. For this example, setup the “ALL_DI”, “X_DI” and “ENCO”.





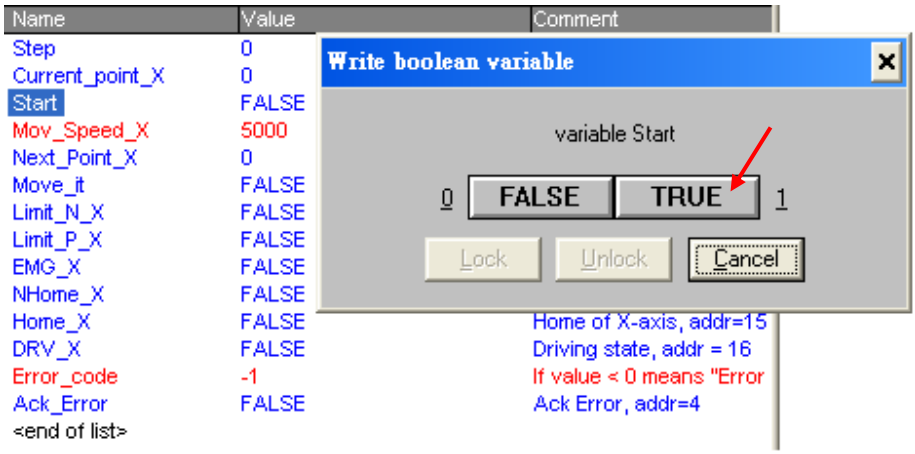
1.3.3 Compile, Download and execute the project：

Step1. Set up compiler Options: click [Make] > [Compiler options]

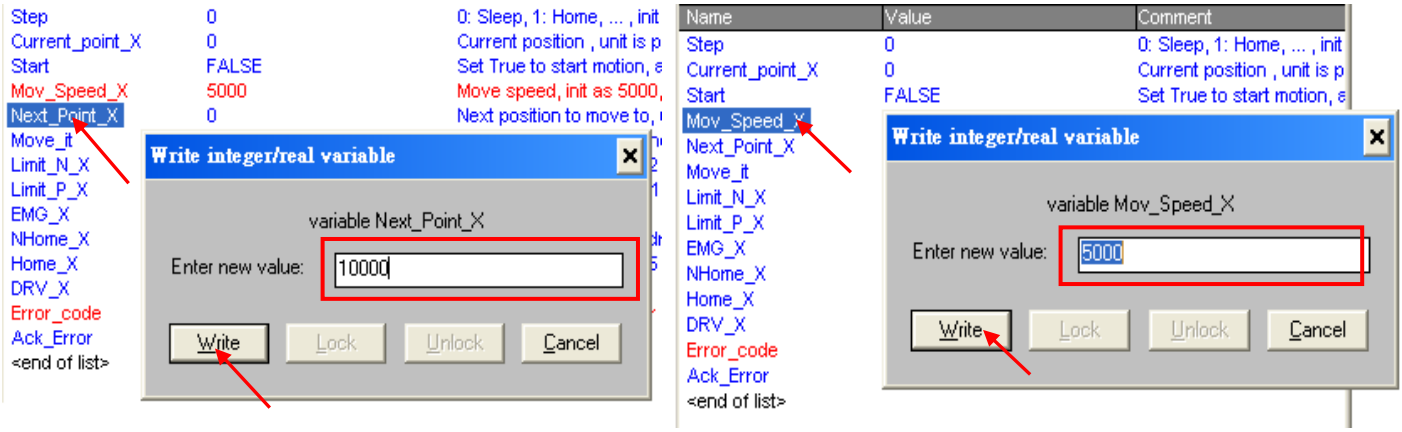


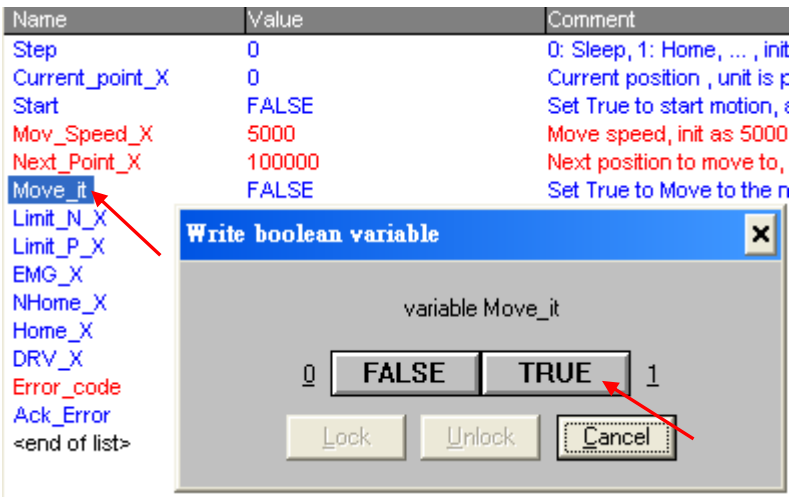
Step 2 : Compile & download: Click [Make] > [Make Application] , then download the project into XPAC in the [Debug] mode.

Step 3 : Execute: Double click “start”, select “True”, and notice the variables’ value changing.



Step4: Test: Double click “Next_Point_X”, enter the next position to move to. Double click “Mov_Speed_X”, enter the move speed. Double click “Move_it” and select “True” to start motion.

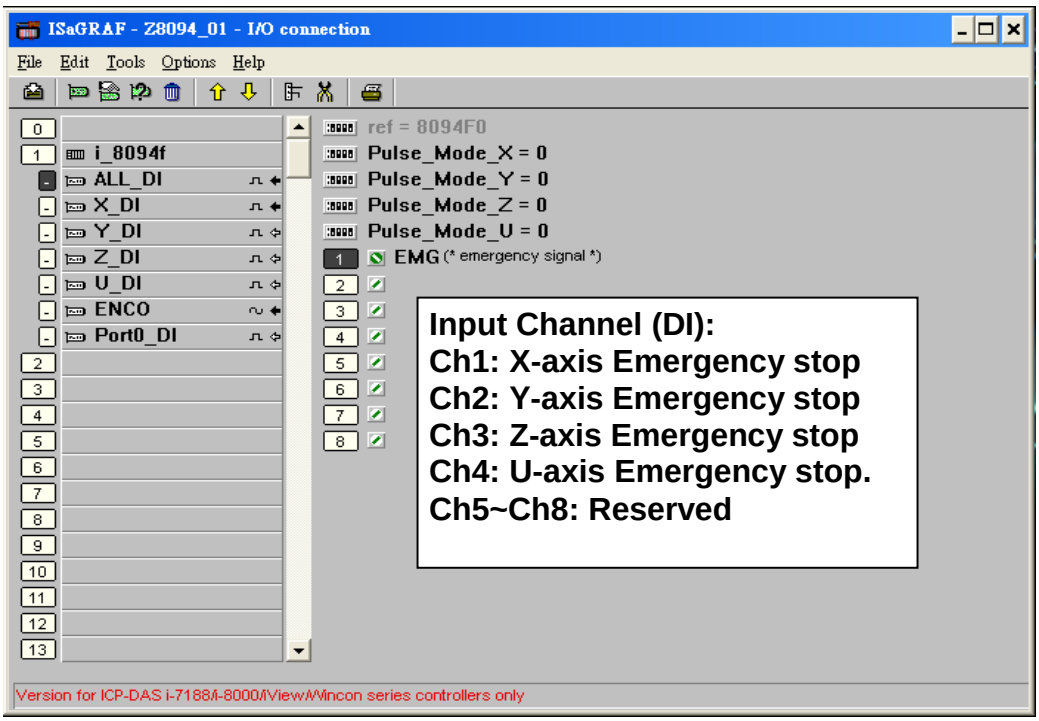




1.4 Descriptions for the Setting of I/O Connection

We use the I-8094F module as an example to illustrate the motion settings of I/O connection. Differ from the I-8094F, the 2-axis motion module I-8092F has the settings about X-axis and Y-axis only, without the settings about Z-axis and U-axis.

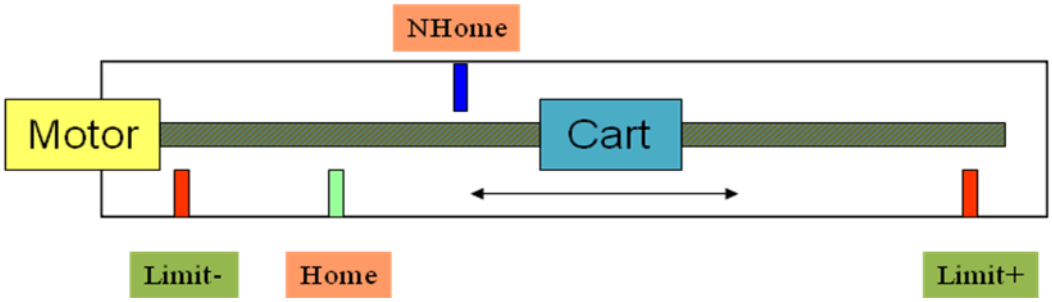
ALL_DI

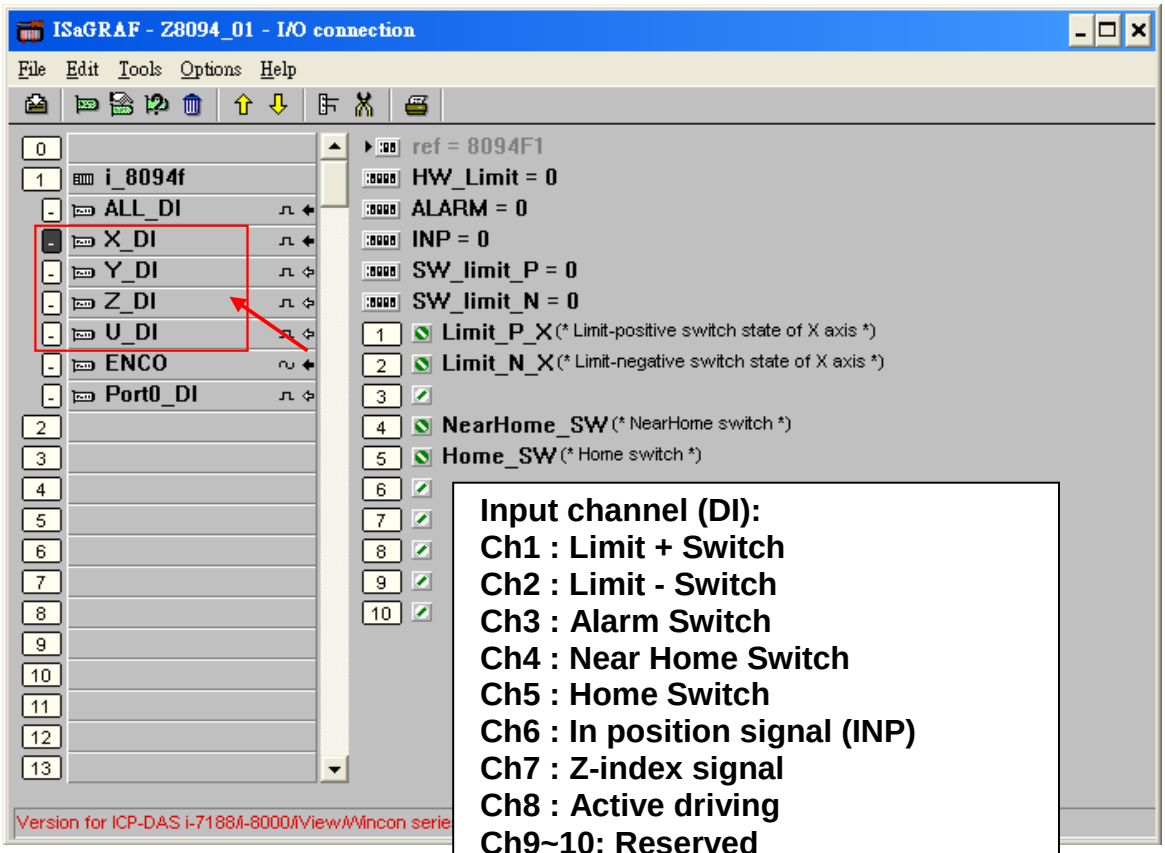


Pulse_Mode_X: Set the X-axis pulse output mode
Pulse_Mode_Y: Set the Y-axis pulse output mode
Pulse_Mode_Z: Set the Z-axis pulse output mode
Pulse_Mode_U: Set the U-axis pulse output mode

0： CW/CCW (Active Low); The default setting.
1： CW/CCW (Active High)
2： Pulse (Active High) / Dir+ (Active Low)
3： Pulse (Active Low) / Dir.+ (Active Low)
4： Pulse (Active High) / Dir.+ (Active High)
5： Pulse (Active Low) / Dir.+ (Active High)。

X_DI, Y_DI, Z_DI, U_DI :





Input channel (DI):
Ch1 : Limit + Switch
Ch2 : Limit - Switch
Ch3 : Alarm Switch
Ch4 : Near Home Switch
Ch5 : Home Switch
Ch6 : In position signal (INP)
Ch7 : Z-index signal
Ch8 : Active driving
Ch9~10: Reserved

HW_Limit：Setting the hardware limit positions (Limit+ and Limit-)

0 : Active Low, slowdown stop; The default setting.
1 : Active Low, suddenly stop
2 : Active High, slowdown stop
3 : Active High, suddenly stop

ALARM：Setting the hardware alarm

0: Disable alarm; The default setting.
1: Enable alarm, active Low.
2: Enable alarm, active High.

INP：Setting INP status.

0: Disable INP; The default setting.
1: Enable INP, active low.
2: Enable INP, active high.

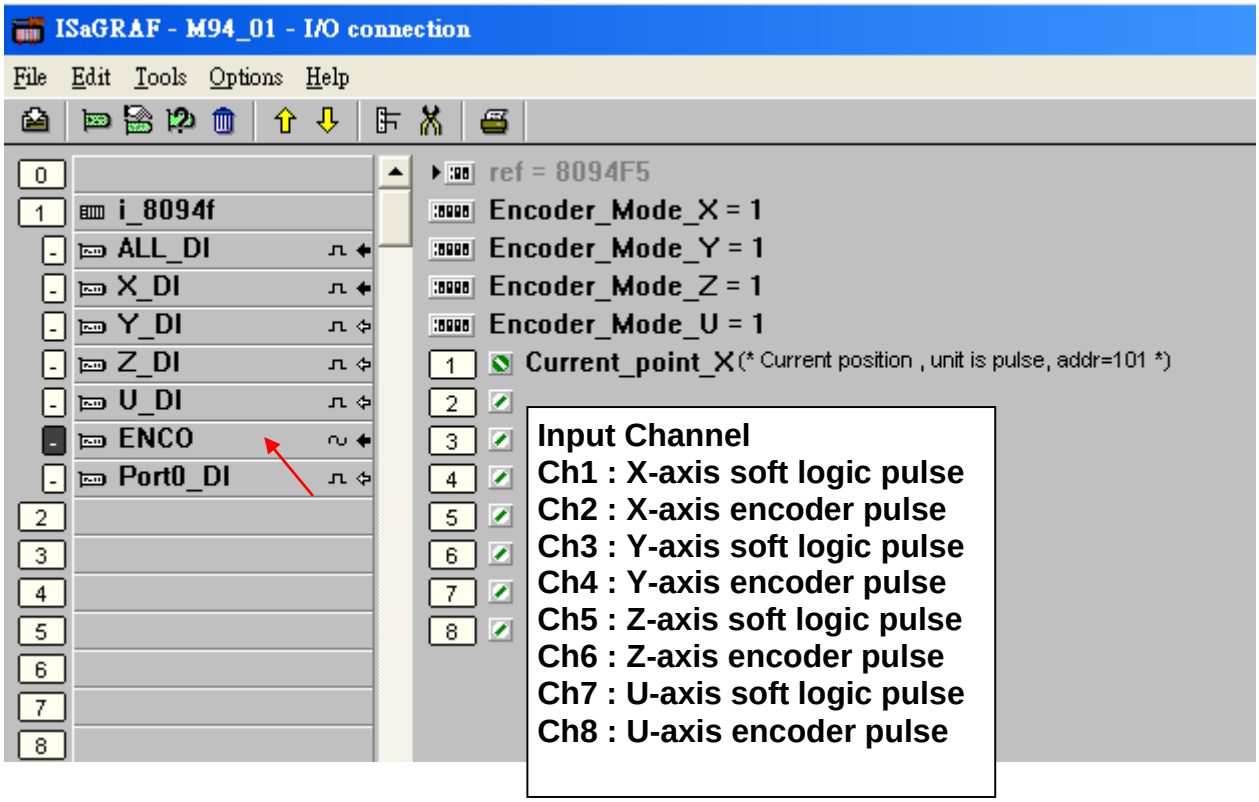
SW_limit_P : Setting software Positive Limit position (Limit+, unit: pulse)

0: Disable Limit+; The default setting.

SW_limit_N : Setting software Negative Limit position (Limit-, unit: pulse)

0: Disable Limit-; The default setting.

ENCO :



Encoder_Mode _X：Setting X-axis Encoder
Encoder_Mode _Y：Setting Y-axis Encoder
Encoder_Mode _Z：Setting Z-axis Encoder
Encoder_Mode _U：Setting U-axis Encoder

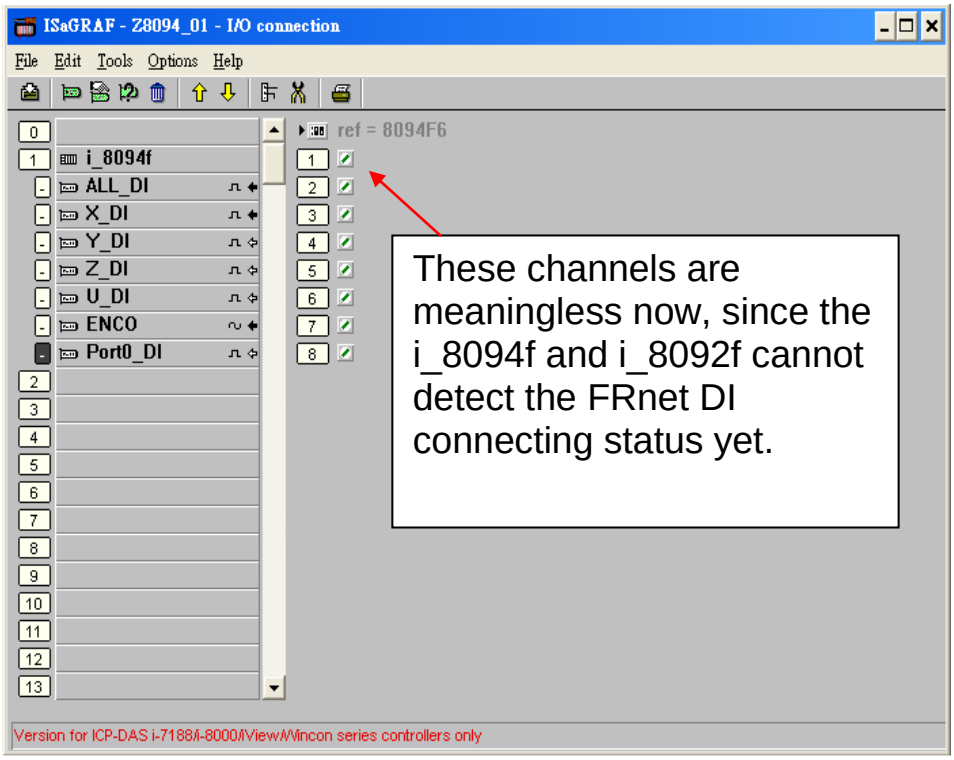
0: CW/CCW mode; The default setting.
1: 1/1 AB phase
2: 1/2 AB phase
4: 1/4 AB phase
Other values: Auto setting to 0: CW/CCW mode.

Port0_DI :

There is one FRnet port in the I-8094F or I-8092F module to connect with the FRnet I/O.

For writing the programs to connect with the FRnet I/O, please refer to FAQ-082 about using "FR_16DO", "FR_16DI" and "FR_B_A" C-function-blocks.

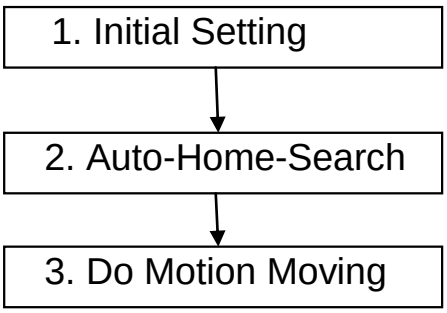
FAQ-082 : http://www.icpdas.com/faq/isagraf/082.htm



1.5 The Motion Control Programming Steps for ISaGRAF

1.5.1 The Motion Control Steps：

The Motion control programming steps for ISaGRAF are the steps to use the axis cards to control the motor moving. The basic flow chart is as below：



Step 1. Initial Setting：

It includes the initial setting of the range for speed (rate), the hardware active, the Auto-Home-Search, the servo motor etc. In ISaGRAF programming, the **Near Home/NORG**, **Home/ORG** and **Z-index** are set in the motion functions and the other hardware settings are set in the I/O connection.

The initial setting functions：

Function Usage	I-8092F	I-8094F / I-8094
Speed (rate) range initial setting	Z_S_RANG( )	
Auto-Home-Search initial setting	Z_S_HOME( )	
Servo motor initial setting	Z_SRV_ON( )	

Step 2. Auto-Home-Search：

This step will search and check **Near Home**, **Home** and **Z-index** signals automatically before the motion moving. The Z-index may not be searched in this step if it's set not to search the Z-index in the initial setting.

The Auto-Home-Search functions：

Function Usage	I-8092F	I-8094F / I-8094
1. Search Hear Home	Z_NHO_SH( )	Z_HOME( )
2. Check if succeeds	Z_DONE( ): return 256	
3. Search Home	Z_HOM_SH( )	
4. Check if succeeds	Z_DONE( ): return 512	
5. Search Z-index	Z_PHA_SH( )	
6. Check if succeeds	Z_DONE( ): return 1024	Z_DONE( ): return 256

Step 3. Do Motion Moving：

Start to do the motion moving. The I-8094F, for instance, can do the single-axis motion, 2/3-axis interpolation motion, 2-axis circular interpolation…etc.

Motion Moving functions：(Refer to Ch.1.6.2 for more functions)

Function Usage	I-8092F	I-8094F / I-8094
Fixed-pulse (Point-to-point) motion	Z_PT( ) Z_PT2( ) ZC_PT2( )	Z_PT( ) Z_PT2( ) Z_PT3( ) ZC_PT2( ) ZC_PT3( )
Circular motion	Z_ARC2( ) ZC_ARC2( )	
Speed-mode Motion	Z_CON_MV( ) Z_VEL_MV( )	

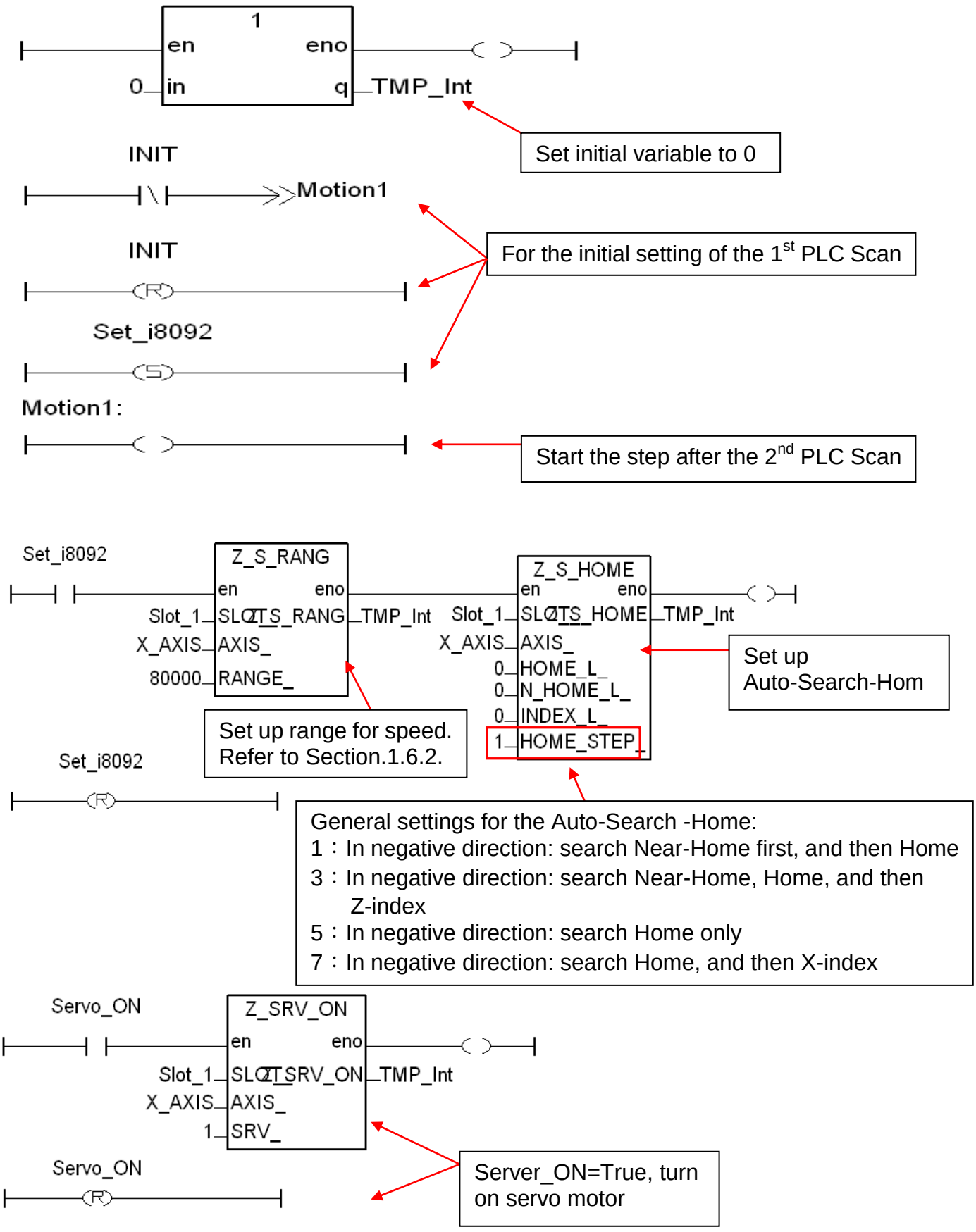
Accident Situation：

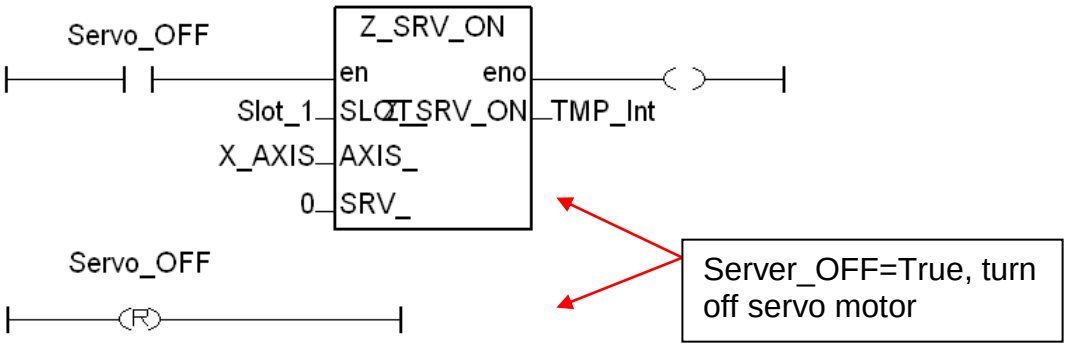
When the motion is moving, it will be stopped at once if some hardware signals are activated, such as Limit+, Limit- or EMG (emergency) signals.

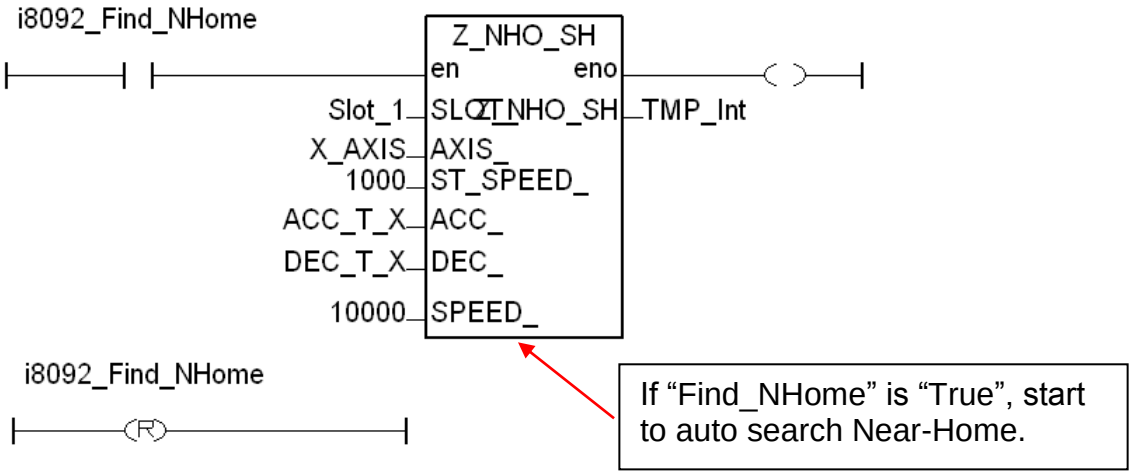
In the next section, we will explain the ISaGRAF motion steps by the examples written in LD program using I-8092F motion module.

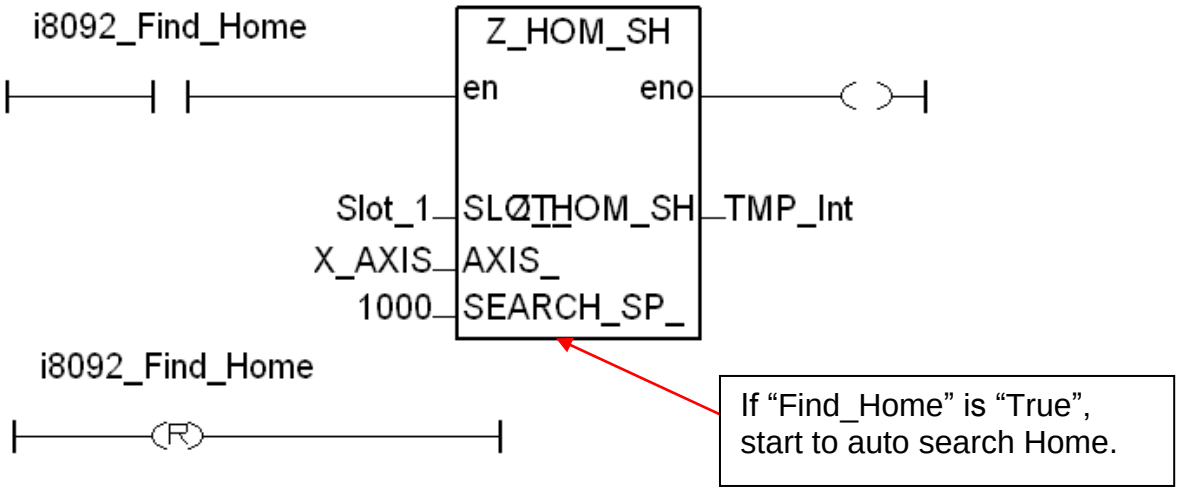
1.5.2 The I-8092F Example: m92_01 program LD1

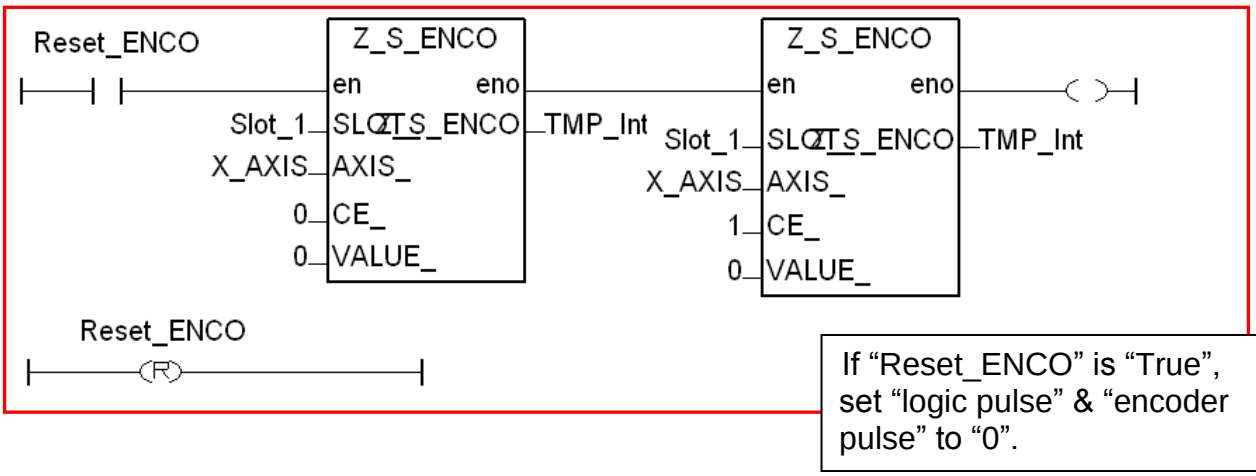
The motion example uses I-8092F module.



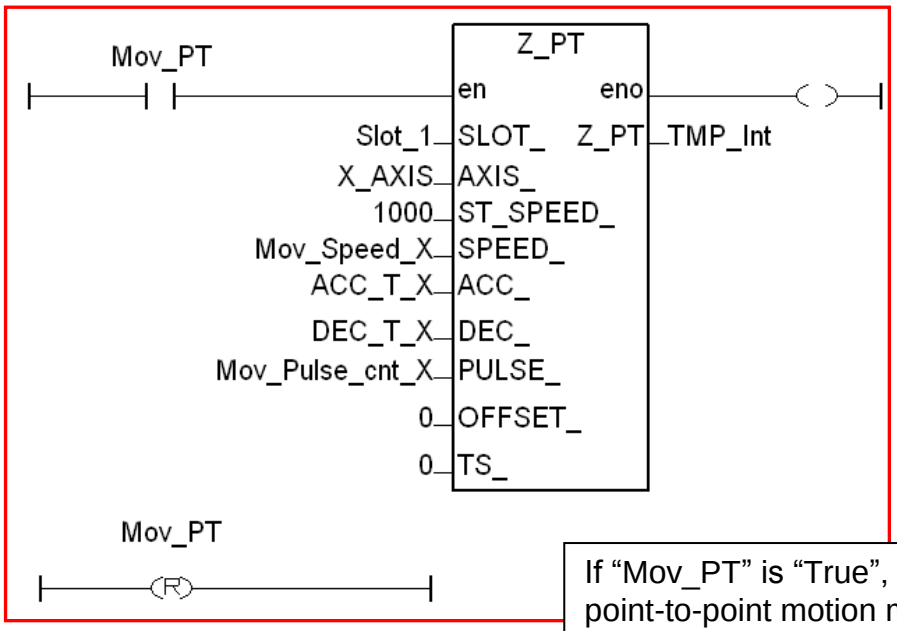

Servo_OFF
Z_SRV_ON
en
eno
Slot_1
SLOT
SRV_ON
TMP_Int
X_AXIS
AXIS_
0
SRV_
Servo_OFF
R
Server_OFF=True, turn off servo motor


i8092_Find_NHome
Z_NHO_SH
en
eno
Slot_1
SLOT
NHO_SH
TMP_Int
X_AXIS
AXIS_
1000
ST_SPEED_
ACC_T_X
ACC_
DEC_T_X
DEC_
10000
SPEED_
i8092_Find_NHome
R
If “Find_NHome” is “True”, start to auto search Near-Home.

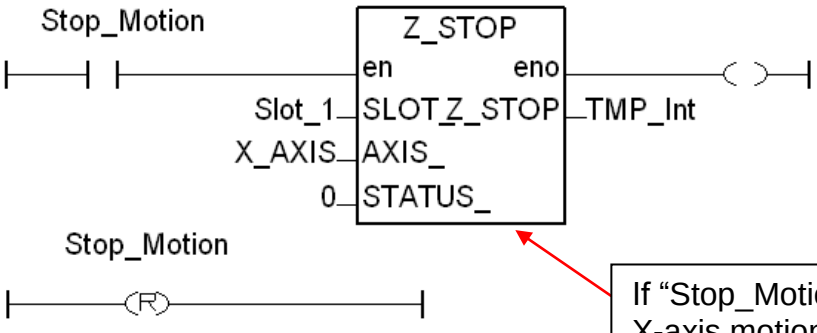

i8092_Find_Home
Z_HOM_SH
en
eno
Slot_1
SLOT
HOM_SH
TMP_Int
X_AXIS
AXIS_
1000
SEARCH_SP_
i8092_Find_Home
R
If “Find_Home” is “True”, start to auto search Home.



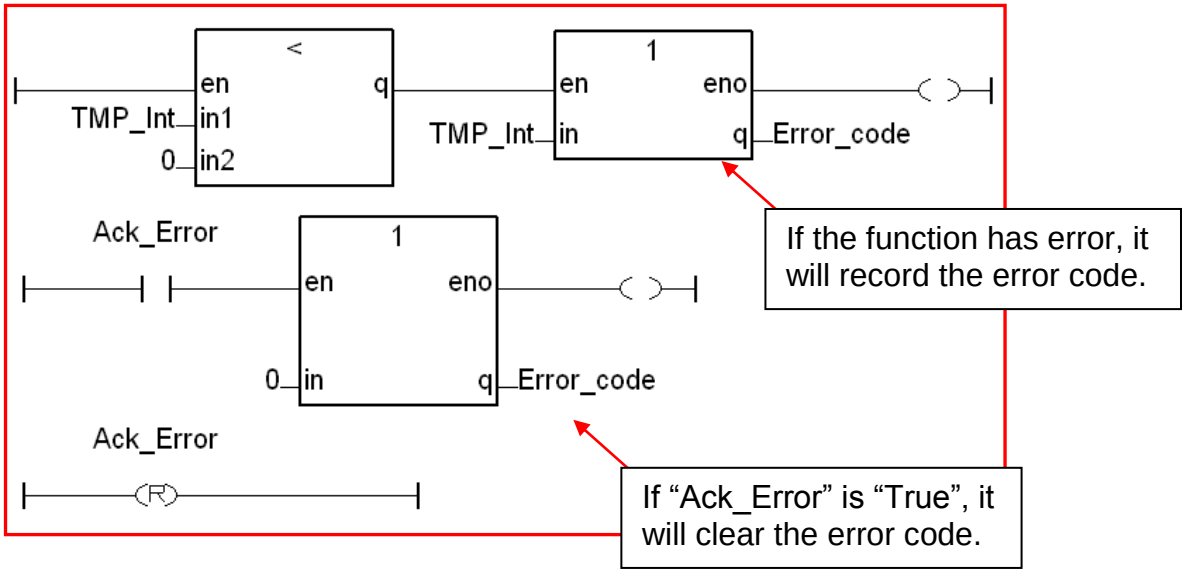
If “Reset_ENCO” is “True”, set “logic pulse” & “encoder pulse” to “0”.



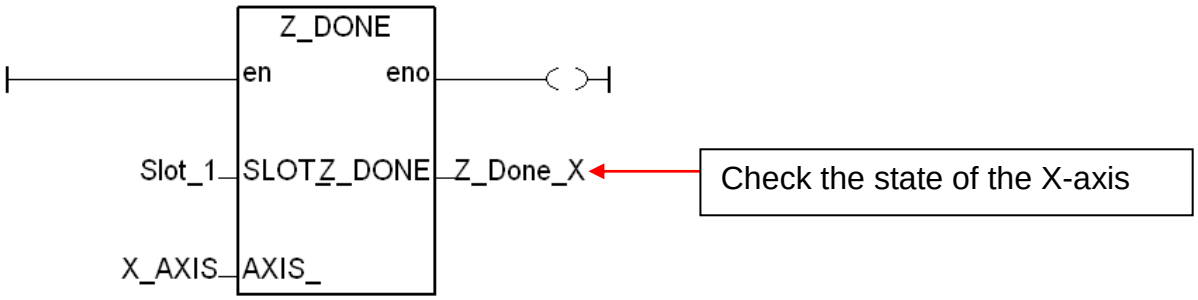
If “Mov_PT” is “True”, start the single-axis point-to-point motion moving.

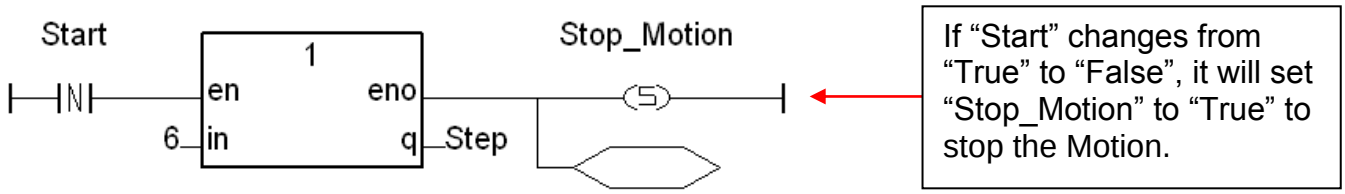


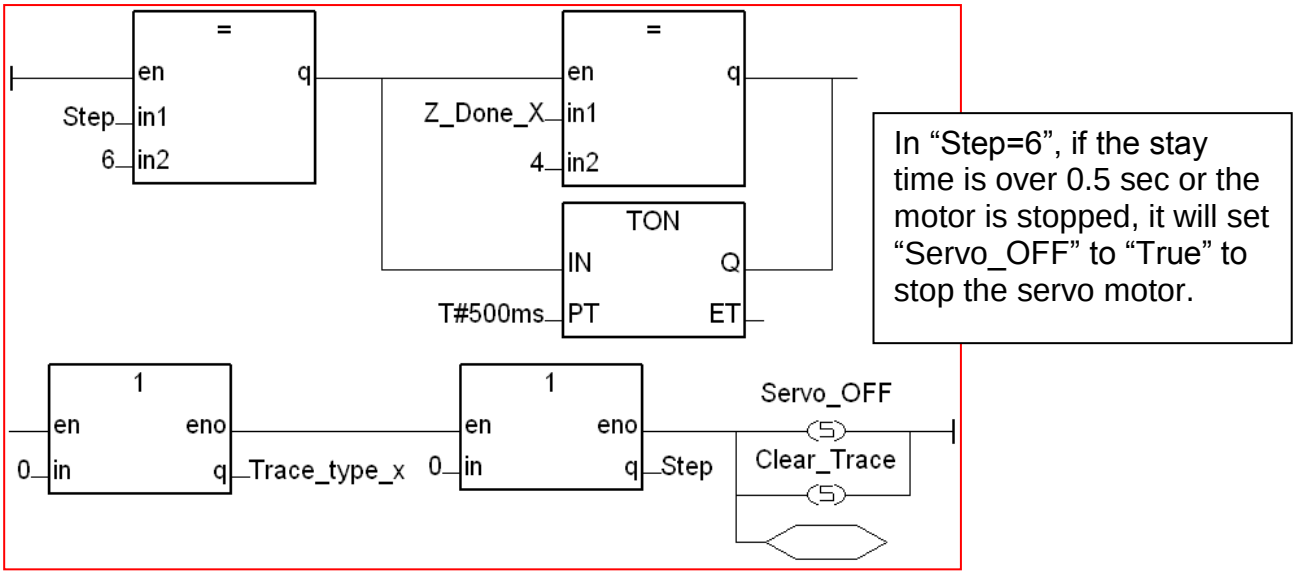
If “Stop_Motion” is “True”, stop the X-axis motion at once.

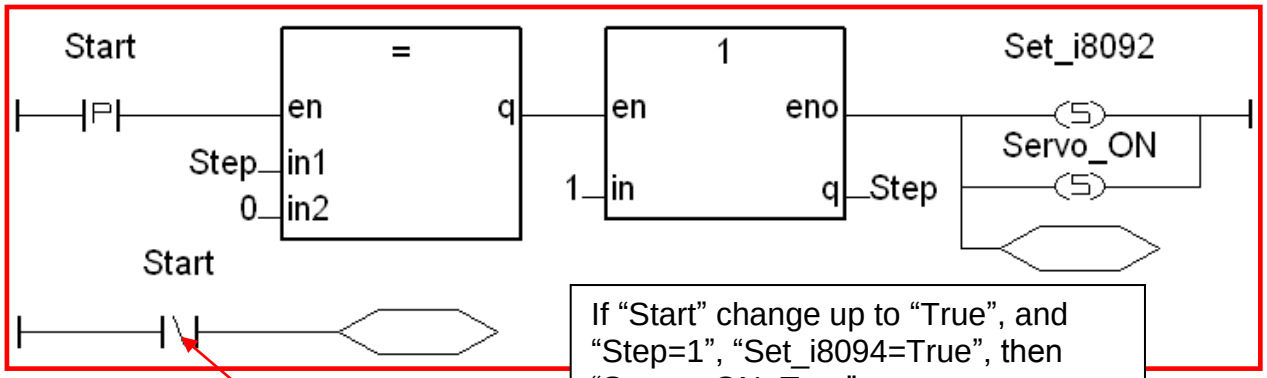


m92_01 Program LD2



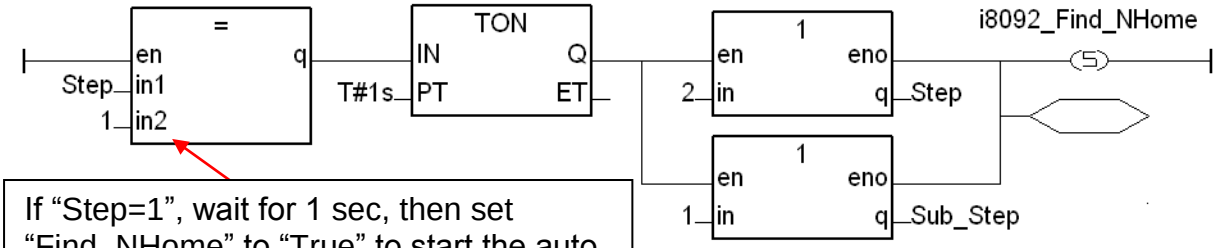




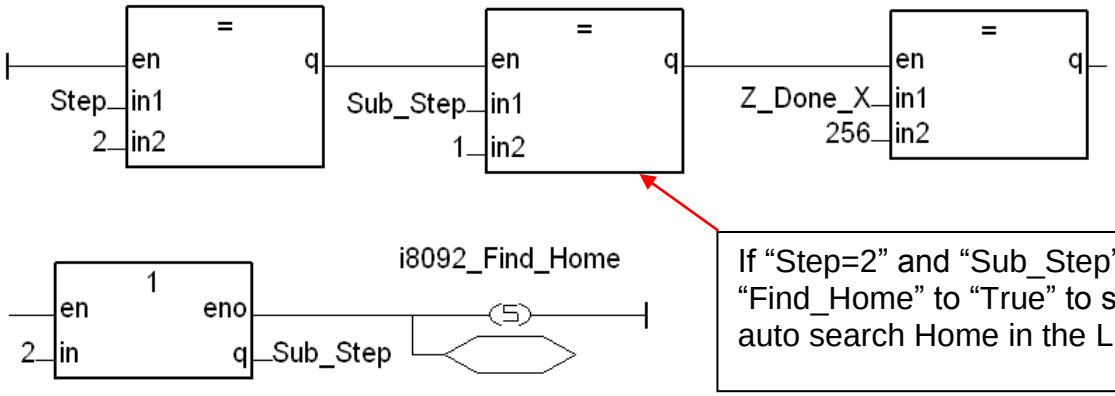


If “Start” change up to “True”, and “Step=1”, “Set_i8094=True”, then “Server_ON=True”;
if “Start= false”, then return directly.

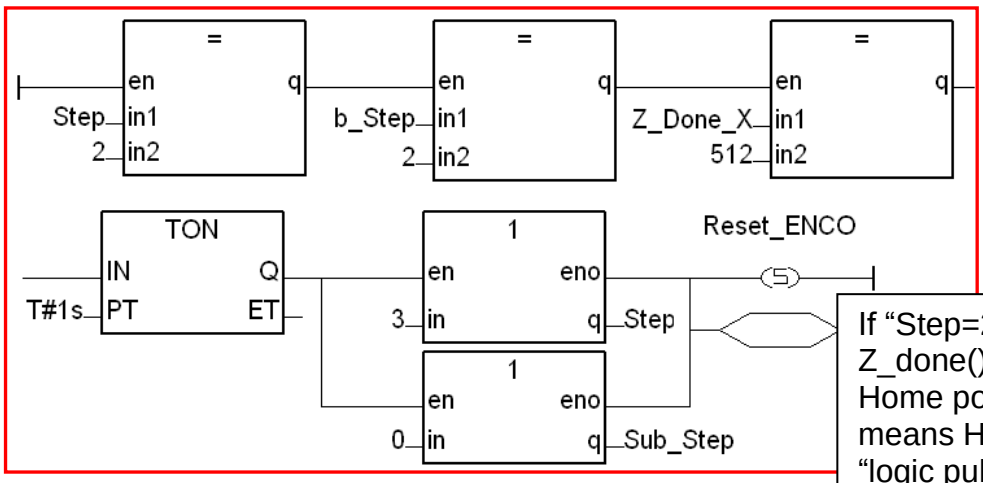
The following program is running only if “Start=True”.



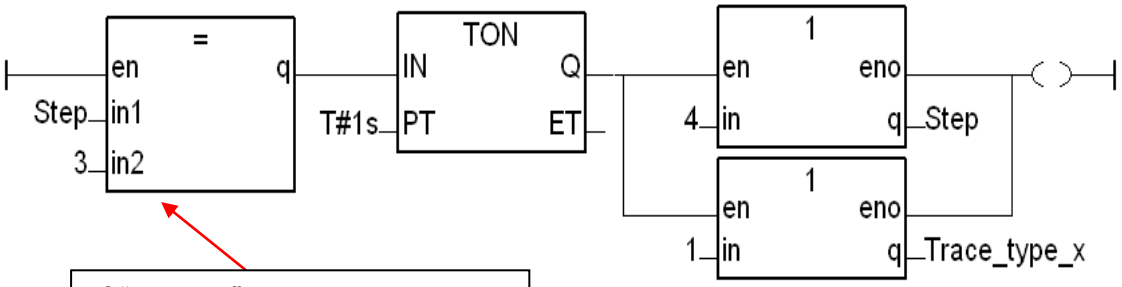
If “Step=1”, wait for 1 sec, then set “Find_NHome” to “True” to start the auto search Near-Home in the LD1.



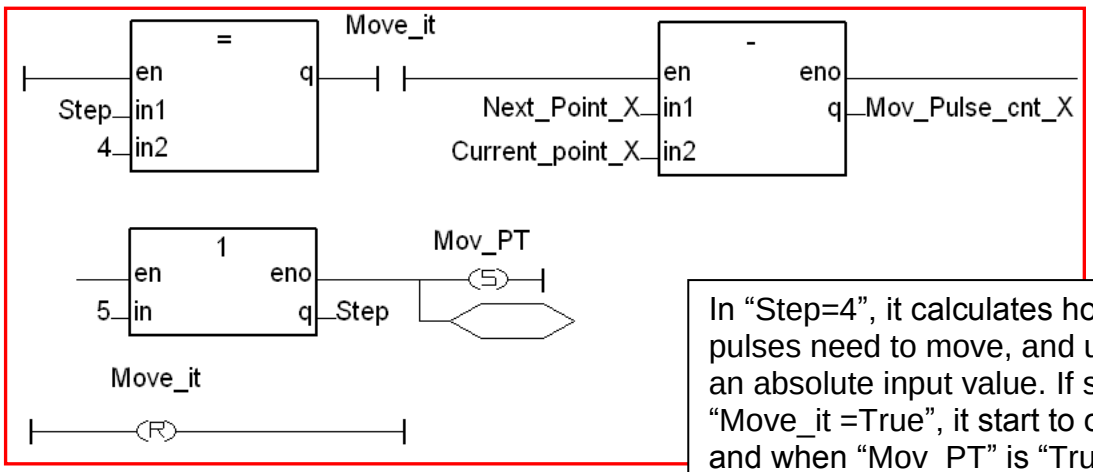
If “Step=2” and “Sub_Step” =1, set “Find_Home” to “True” to start the auto search Home in the LD1.



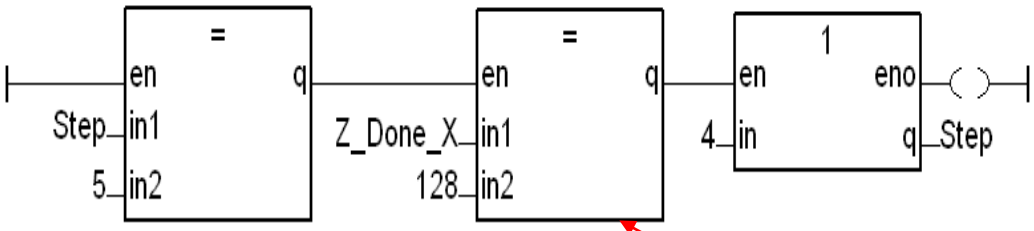
If “Step=2” and “Sub_Step=2”, use Z_done() to check if return to the Home position. If Z_Done_X=512, it means Home is found, then reset “logic pulse” & “encoder pulse” to “0”.



If “Step=3”, it means the Auto-Search-Home is done.



In “Step=4”, it calculates how much pulses need to move, and use it as an absolute input value. If set “Move_it =True”, it start to calculate, and when “Mov_PT” is “True”, it starts to do the point-to-point motion in the LD1.



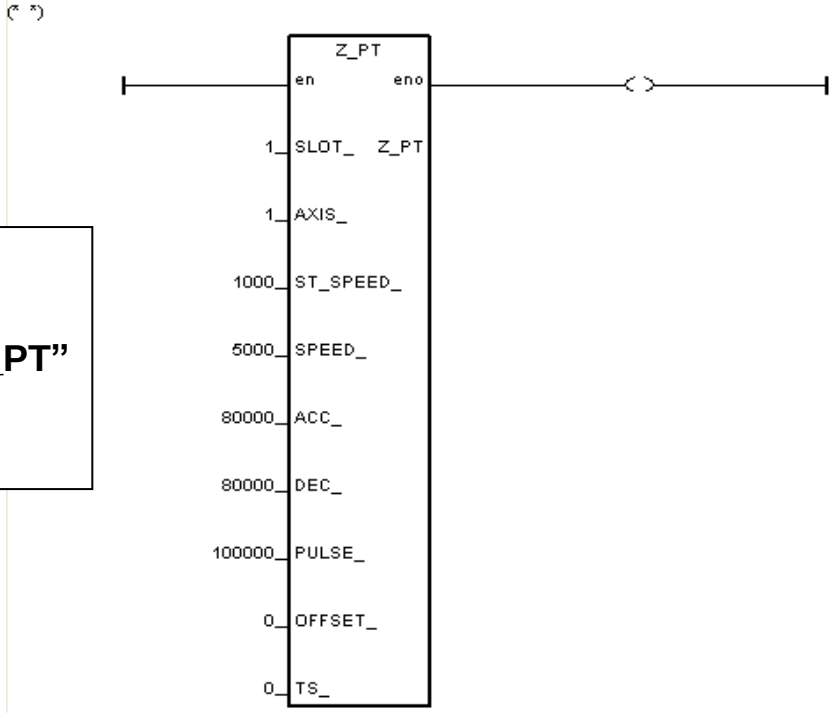
In “Step=5”, use Z_done to check if the motion is done. If done, return Z_Done_X=128, and set Step=4. Then return to the previous step.

1.6 ISaGRAF Function Descriptions

1.6.1 Notice in using motion functions：

1. In ISaGRAF, programmers often use the motion functions in **Sequential Function** or **Chart Structure Text** language. **<u>If user select the LD or FBD to use the functions, please note not to call the I-8094F/8092F/8094 functions in every PLC scan.</u>**
   Note the examples below:

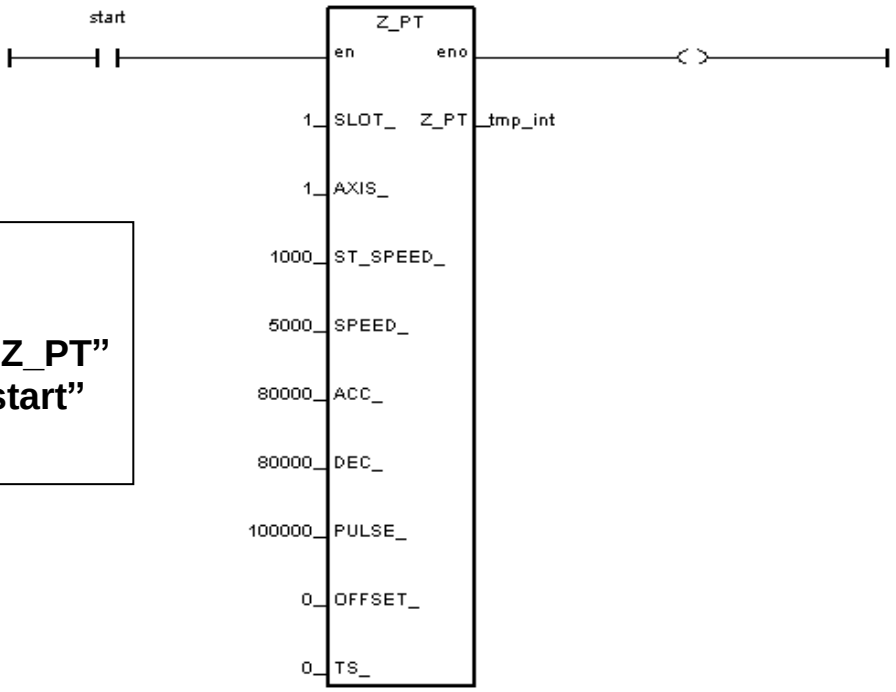
Wrong Using：



Dangerous !!

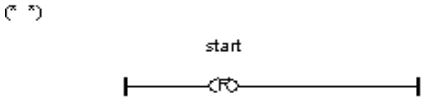
It calls function “Z_PT” in every PLC Scan.

Right Using：



Safe !!

It calls function “Z_PT” once when the “start” is “True”.



1.6.2 I-8094F / I-8092F / I-8094 Functions:

All parameters and returns of I-8094F/I-8092F/I-8094 functions are **Integer**.

Z_S_RANG： ■ **I-8094F** ■ **I-8092F** ■ **I-8094**

Description： This function changes the *Range* register to change the accuracy and valid-range of speed, acceleration (rate) or deceleration (rate).
Note: Remember to call this function before using motion moving functions. If not, the range_ default setting is 80000. Default ranges:
Range of start speed or drive speed: 100 ~ 800000
Range of acceleration or deceleration: 12500 ~ 100000000
Range of acceleration rate or deceleration rate: 95368 ~ 6250000000
(Max. value for software setting is 2147483647)

Parameters：

SLOT_ : The specific slot number that the motion module installed on.

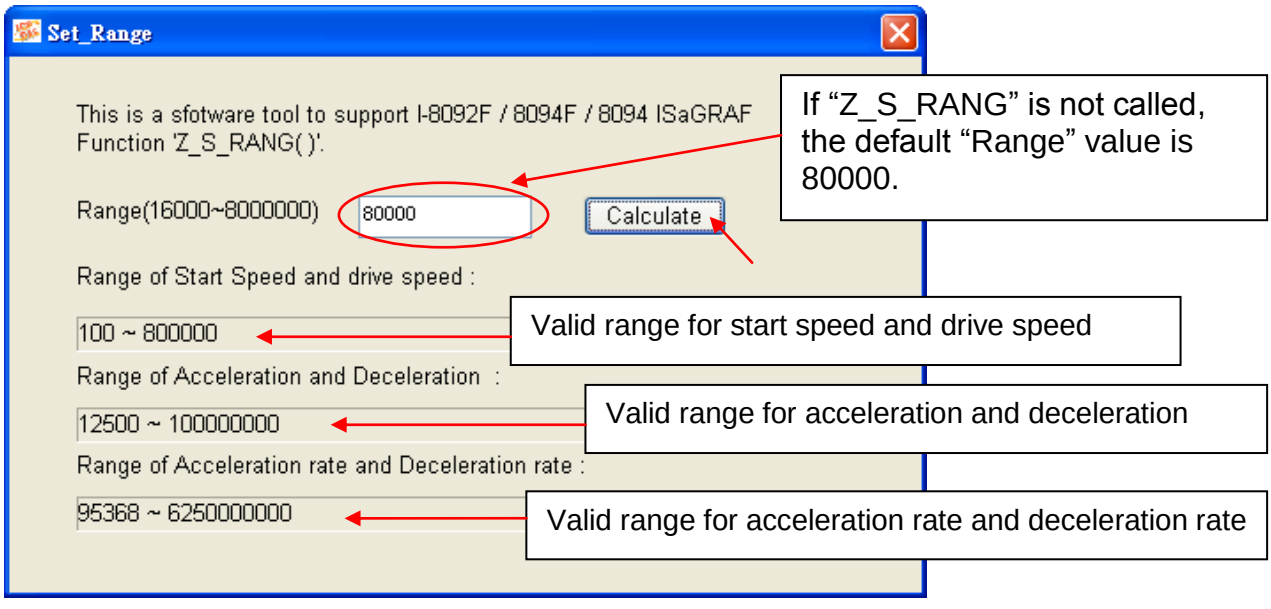
AXIS_ : Can be one of X-axis, Y-axis, Z-axis or U-axis. (X:1, Y:2, Z:4, U:8)

RANGE_ : The value to be assigned to the Range register (16,000 ~ 8,000,000)
RANGE_ : The R value of “multiple” in the expressions of speed, acceleration, deceleration, acceleration rate and deceleration rate. User can use the PC tool “Set_Range” to set the RANGE_, or give a suitable R value by referring the expressions of the I-8094F/8092F/8094.

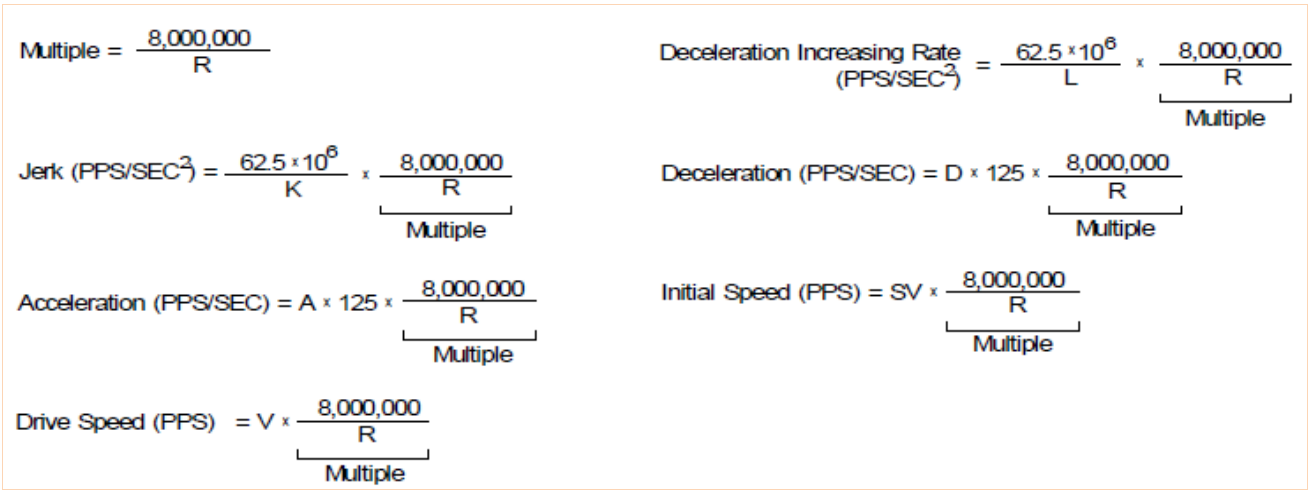
Return： 0: OK
Others: Error. Refer to Ch.1.6.3 for the error massage list.

Set_Range Software Tool & the Expressions:
To get “Set_Range.exe”, from XPAC CD: /napdos/isagraf/some_utility/i-8094-8092/ or download at: ftp://ftp.icpdas.com/pub/cd/xp-8xx7-ce6/napdos/isagraf/some_utility\i-8094-8092\

Run “Set_Range.exe” tool, enter a RANGE_ value in the “Range” column and click “Calculate” to show the ranges of start speed, drive speed, acceleration (rate) and deceleration (rate) that are the valid & safe ranges for the parameters in the motion moving functions. Please set a suitable “RANGE_” value.



The expressions of I-8094F/I-8092F/I-8094 motion modules to calculate the speed and rate are listed below. Please refer to the module manual for detail information.



The usual words table for the expressions and ISaGRAF functions :

In Expression	In ISaGRAF Function
Multiple	Multiple
R	R value (RANGE_)
Initial Speed	Start speed (ST_SPEED_)
Drive Speed	Drive speed (SPEED_)
Acceleration	Acceleration (ACC_)
Deceleration	Deceleration (DEC_)
Jerk	Acceleration rate (ACC_)
Deceleration Increasing Rate	Deceleration rate (DEC_)
L, K, D, A, SV, V	These values will be transferred into the modules. Users don't need to set in the ISaGRAF, so there are no corresponded words.

Z_S_HOME：　■ I-8094F ■ I-8092F ■ I-8094

Description： This function configures the polarities of Near-Home (NORG), Home (ORG) and Z-index sensors. Also, the searching-steps of Auto-Home-Search are configured in this function.

Parameters：

SLOT_ : The specific slot number that the motion module installed on.

AXIS_ : Can be one of X-axis, Y-axis, Z-axis or U-axis. (X:1, Y:2, Z:4, U:8)

HOME_L_ : Home logic polarity. (0:Active Low; 1:Active High)

N_HOME_L_: Near Home logic polarity. (0:Active Low; 1:Active High)

INDEX_L_: Z-index logic polarity. (0:Active Low; 1:Active High)

HOME_STEP_ : The selections for Auto-Home-Search steps:
0：Do not execute the Auto-Home-Search steps.
1：In negative direction, trigger Near Home, and then Home.
2：In positive direction, trigger Near Home, and then Home.
3：In negative direction, trigger Near Home, Home and then Z-index.
4：In positive direction, trigger Near Home, Home and then Z-index.
5：In negative direction, trigger Home only.
6：In positive direction, trigger Home only.
7：In negative direction, trigger Home and then Z-index.
8：In positive direction, trigger Home and then Z-index.

Return： 0: OK
Others: Error. Refer to Ch.1.6.3 for the error massage list.

Z_SRV_ON：　■ I-8094F ■ I-8092F ■ I-8094

Description： This function turns on/off the servo motor.

Parameters：

SLOT_ : The specific slot number that the motion module installed on.

AXIS_ : Can be one of X-axis, Y-axis, Z-axis or U-axis. (X:1, Y:2, Z:4, U:8)

SRV_ : The setting turns on/off the Servo, and sets up how to turn off the servo if the ISaGRAF program stops.
0: Servo off.
1: Servo on, and turn off automatically.
2: Servo on, and turn off manually.

Return： 0: OK
Others: Error. Refer to Ch.1.6.3 for the error massage list.

Z_HOME：　■ I-8094F □ I-8092F ■ I-8094

Description： This function starts Auto-Home-Search motion with the Start-Speed, Acceleration, Deceleration, Near-Home-Search Speed and Home-Search Speed.

Parameters：

SLOT_ : The specific slot number that the motion module installed on.

AXIS_ : Can be one of X-axis, Y-axis, Z-axis or U-axis. (X:1, Y:2, Z:4, U:8)

S_SPEED_ : The Start Speed in the Auto-Home-Search motion. (Unit: PPS)

ACC_ : The Acceleration in the Auto-Home-Search motion. (Unit: PPS/SEC)

DEC_ : The Deceleration in the Auto-Home-Search motion. (Unit: PPS/SEC)

NH_SPEED_ : The Near-Home Search Speed (Drive Speed) in the Auto-Home-Search motion. (Unit: PPS)

H_SPEED_ : The Home Search Speed in the Auto-Home-Search motion. (Unit: PPS) This speed is recommended to be lower than the Start Speed.

Return： 0: OK
Others: Error. Refer to Ch.1.6.3 for the error massage list.

Z_DONE：　■ I-8094F ■ I-8092F ■ I-8094

Description： This function checks the completion of motion and returns the cause of motion-completion.

Parameters：

SLOT_ : The specific slot number that the motion module installed on.

AXIS_ : Can be one of X-axis, Y-axis, Z-axis or U-axis. (X:1, Y:2, Z:4, U:8)

Return：
1： reach software limit in positive direction and stop.
2： reach software limit in negative direction and stop.
4： the stop command “Z_STOP“ is executed.
128： complete the fixed-pulse (point-to-point) moving.
256： I-8094/8094F: complete the Auto-Home-Search moving.
I-8092F: complete the Near-Home(NORG) Search step.
512： I-8092F complete the Home(ORG) Search step.
1024： I-8092F complete the Z-index Search step.
4096： reach hardware limit in positive direction and stop.
8192： reach hardware limit in positive direction and stop.
16384：the driving is stopped because the ALARM is enabled.
32768：the driving is stopped because the Emergency is activated.

Others: Error. Refer to Ch.1.6.3 for the error massage list.

Z_NHO_SH：　☐ I-8094F ■ I-8092F ☐ I-8094

Description： This function is for I-8092F to start Near-Home-Search moving with the Start speed, Acceleration, Deceleration, Near-Home Searching Speed.

Parameters：

SLOT_ : The specific slot number that the motion module installed on.

AXIS_ : Can be one of X-axis or Y-axis. (X:1, Y:2)

ST_SPEED_ : The Start Speed in Near-Home-Search. (Unit: PPS)

ACC_ : The Acceleration in Near-Home-Search. (Unit: PPS/SEC)

DEC_ : The Deceleration in Near-Home-Search. (Unit: PPS/SEC)

SPEED_ : The Near-Home Search Speed (Drive Speed) in Near-Home-Search. (Unit: PPS)

Return： 0: OK
Others: Error. Refer to Ch.1.6.3 for the error massage list.

Z_HOM_SH：　☐ I-8094F ■ I-8092F ☐ I-8094

Description： This function starts Home-Search procedure with the Home (ORG) Searching Speed.

Parameters：

SLOT_ : The specific slot number that the motion module installed on.

AXIS_ : Can be one of X-axis or Y-axis. (X:1, Y:2)

SEARCH_SP_ : The speed of Home (ORG) searching. (Unit: PPS)

Return： 0: OK
Others: Error. Refer to Ch.1.6.3 for the error massage list.

Z_PHA_SH： ☐ **I-8094F** ■ **I-8092F** ☐ **I-8094**

Description： This function starts Z-index-Search procedure with the Search_SP Speed.

Parameters：

SLOT_ : The specific slot number that the motion module installed on.

AXIS_ : Can be one of X-axis or Y-axis. (X:1, Y:2)

Search_SP_ : The speed of Z-Phase Searching. (Unit: PPS)

Return： 0: OK
Others: Error. Refer to Ch.1.6.3 for the error massage list.

Z_S_ENCO： ■ **I-8094F** ■ **I-8092F** ■ **I-8094**

Description： This function sets the values in the counter of logic pulse or encoder pulse.

Parameters：

SLOT_ : The specific slot number that the motion module installed on.

AXIS_ : Can be one of X-axis, Y-axis, Z-axis or U-axis. (X:1, Y:2, Z:4, U:8)

CE_ : 0: set up the Logic Pulse; 1: set up the Encoder Pulse

VALUE : The value to be set.

Return： 0: OK
Others: Error. Refer to Ch.1.6.3 for the error massage list.

Z_PT： ■ I-8094F ■ I-8092F ■ I-8094

Description： This function starts the fixed-pulse (point-to-point) motion in the Trapezoidal-profile or S-curve moving.

Parameters：

SLOT_ : The specific slot number that the motion module installed on.

AXIS_ : Can be one of X-axis, Y-axis, Z-axis or U-axis. (X:1, Y:2, Z:4, U:8)

ST_SPEED_ : The Start Speed in trapezoidal-profile and S-curve moving. (Unit: PPS)

SPEED_ : The Drive Speed in trapezoidal-profile and S-curve moving. (Unit: PPS)

ACC_ : The Acceleration (Unit: PPS/SEC) in trapezoidal-profile moving. Or The Acceleration Rate (Unit: PPS/SEC^2) in S-curve moving. And its Acceleration will be assigned to maximum automatically.

DEC_ : The Deceleration (Unit: PPS/SEC) in trapezoidal-profile moving. Or The Deceleration Rate (Unit: PPS/SEC^2) in S-curve moving. And its Deceleration will be assigned to maximum automatically.

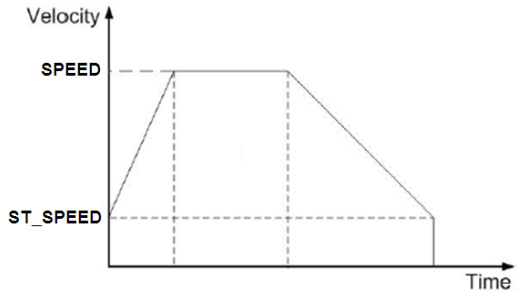
PULSE_ : The total numbers of output pulse. This parameter is a signed 32-bits variable, the negative value indicates motion in negative direction.

OFFSET_ : To configure the offset for Acceleration or Deceleration driving. OFFSET_ is optional and default setting is 0. (Unit: Pulse)

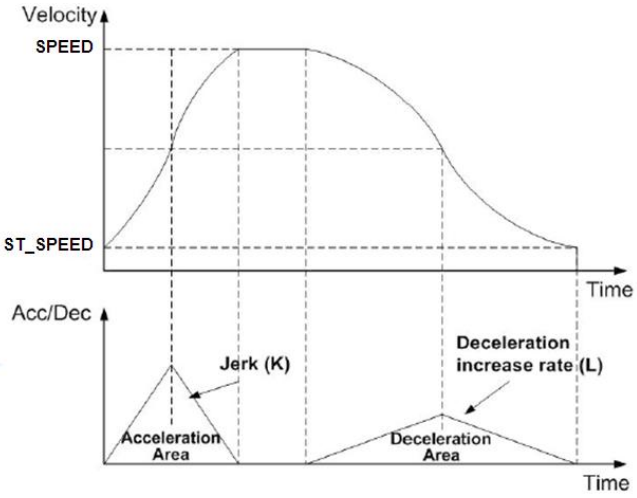
TS_ : 0: Set to Trapezoidal-profile moving
1: Set to S-curve moving

Return： 0: OK
Others: Error. Refer to Ch.1.6.3 for the error massage list.

Trapezoidal-profile moving:



S-curve moving:



Z_PT2： ■ **I-8094F** ■ **I-8092F** ■ **I-8094**

Description： This function starts the trapezoidal-profile or S-curve 2-dimension linear interpolation moving. The ST_SPEED_, SPEED_, ACC_ and DEC_ will be applied to the main-axis.

Parameters：

SLOT_ : The specific slot number that the motion module installed on.

MAIN_AXIS_ : Main-axis: one of X-axis, Y-axis, Z-axis or U-axis. (X:1, Y:2, Z:4, U:8)

SLAVE_AXIS_ : Slave-axis: one of X-axis, Y-axis, Z-axis or U-axis. (X:1, Y:2, Z:4, U:8)

Note：Above two parameters must assign to the different axis.

ST_SPEED_ : The Start Speed in trapezoidal-profile and S-curve moving. (Unit: PPS)

SPEED_ : The Drive Speed in trapezoidal-profile and S-curve moving. (Unit: PPS)

ACC_ : The Acceleration (Unit: PPS/SEC) in trapezoidal-profile moving. Or The Acceleration Rate (Unit: PPS/SEC^2) in S-curve moving.

DEC_ : The Deceleration (Unit: PPS/SEC) in trapezoidal-profile moving. Or The Deceleration Rate (Unit: PPS/SEC^2) in S-curve moving.

MAIN_FIN_ : The finish point of main-axis. This parameter is the relative offset to the current position. And the negative value indicates that the finish point is in negative-direction.

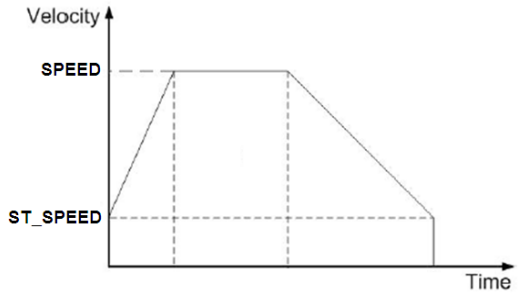
SLAVE_FIN_ : The finish point of slave-axis. This parameter is the relative offset to the current position. And the negative value indicates that the finish point is in negative-direction.

OFFSET_ : To configure the offset for Acceleration or Deceleration driving. OFFSET_ is optional and default setting is 0. (Unit: Pulse)

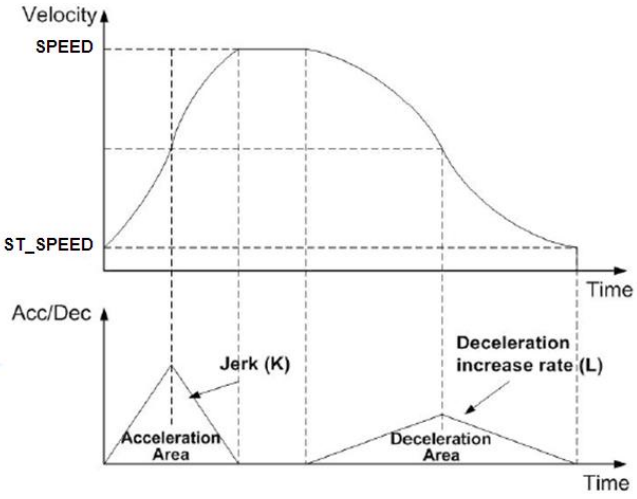
TS_ : 0: Set to Trapezoidal-profile moving
1: Set to S-curve moving

Return： 0: OK
Others: Error. Refer to Ch.1.6.3 for the error massage list.

Trapezoidal-profile moving:



S-curve moving:



Z_PT3： ■ **I-8094F** □ **I-8092F** ■ **I-8094**

Description： This function starts the trapezoidal-profile or S-curve 3-dimension linear interpolation moving. The ST_SPEED_, SPEED_, ACC_ and DEC_ will be applied to the main-axis.

Parameters：

SLOT_ : The specific slot number that the motion module installed on.

MAIN_AXIS_ : Main-axis: one of X-axis, Y-axis, Z-axis or U-axis. (X:1, Y:2, Z:4, U:8)

SLAVE_AXIS_ : Slave-axis: one of X-axis, Y-axis, Z-axis or U-axis. (X:1, Y:2, Z:4, U:8)

THIRD_AXIS_ : Third-axis: one of X-axis, Y-axis, Z-axis or U-axis. (X:1, Y:2, Z:4, U:8)

Note：Above three parameters must assign to the different axis.

ST_SPEED_ : The Start Speed in trapezoidal-profile and S-curve moving. (Unit: PPS)

SPEED_ : The Drive Speed in trapezoidal-profile and S-curve moving. (Unit: PPS)

ACC_ : The Acceleration (Unit: PPS/SEC) in trapezoidal-profile moving. Or The Acceleration Rate (Unit: PPS/SEC^2) in S-curve moving.

DEC_ : The Deceleration (Unit: PPS/SEC) in trapezoidal-profile moving. Or The Deceleration Rate (Unit: PPS/SEC^2) in S-curve moving.

MAIN_FIN_ : The finish point of main-axis. This parameter is the relative offset to the current position. And the negative value indicates that the finish point is in negative-direction.

SLAVE_FIN_ : The finish point of slave-axis. This parameter is the relative offset to the current position. And the negative value indicates that the finish point is in negative-direction.

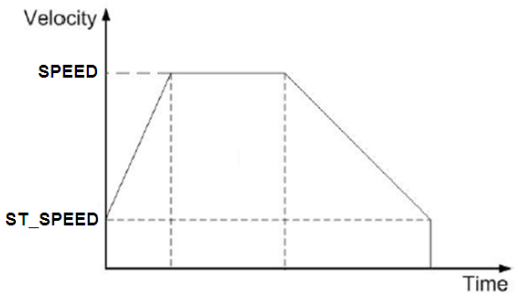
THIRD_FIN_ : The finish point of third-axis. This parameter is the relative offset to the current position. And the negative value indicates that the finish point is in negative-direction.

OFFSET_ : To configure the offset for Acceleration or Deceleration driving. OFFSET_ is optional and default setting is 0. (Unit: Pulse)

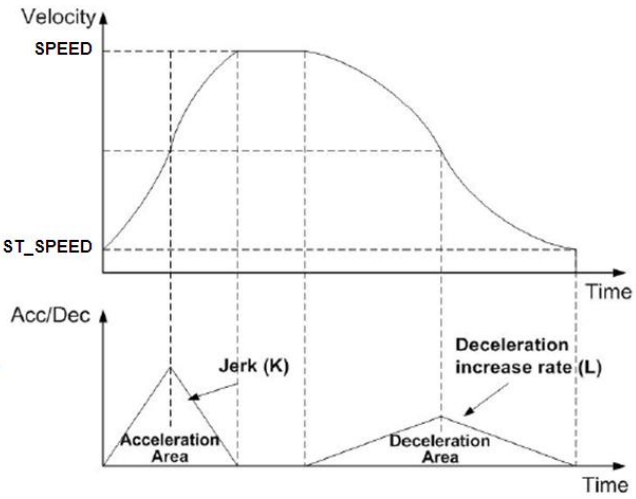
TS_ : 0: Set to Trapezoidal-profile moving. 1: Set to S-curve moving

Return： 0: OK
Others: Error. Refer to Ch.1.6.3 for the error massage list.

Trapezoidal-profile moving:



S-curve moving:

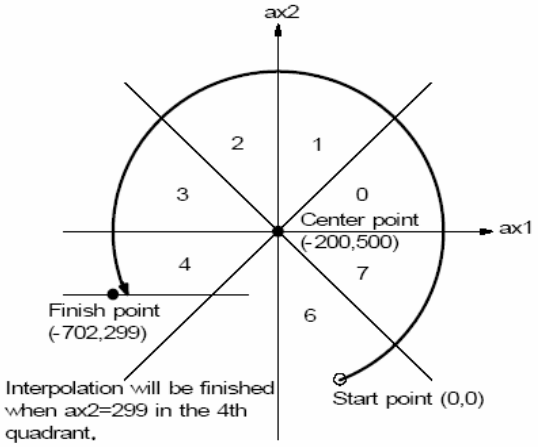


Z_ARC2：

■ I-8094F ■ I-8092F ■ I-8094

Description：

This function starts the trapezoidal-profile, 2-dimension circular interpolation moving and can only applied to the symmetric trapezoidal Acceleration or Deceleration. The start-point will be the *Origin* of circular-interpolation motion. The **MAIN_CEN_P_** & **SLAVE_CEN_P_** are *center* coordinates related to *Origin*; and **MAIN_FIN_P_** & **SLAVE_FIN_P_** are *finish* coordinates related to *Origin*. The position tolerance for the specified circular curve is ±1 within the interpolation range. When the value of finish-point reaches the coordinate of *short-axis*, the circular interpolation will be completed. It's showed as below.



Note:
The ST_SPEED_, SPEED_, ACC_ and DEC_ will be applied to the main-axis.

Parameters：

SLOT_ : The specific slot number that the motion module installed on.

AXIS_MAIN_ : Main-axis: one of X-axis, Y-axis, Z-axis or U-axis. (X:1, Y:2, Z:4, U:8)

AXIS_SLAVE_ : Slave-axis: one of X-axis, Y-axis, Z-axis or U-axis. (X:1, Y:2, Z:4, U:8)

Note：Above two parameters must assign to the different axis.

ST_SPEED_ : The Start Speed in trapezoidal-profile moving. (Unit: PPS)

SPEED_ : The Drive Speed in trapezoidal-profile moving. (Unit: PPS)

ACC_ : The Acceleration (Unit: PPS/SEC) in trapezoidal-profile moving.

DIR_ : Clockwise or Counter-Clockwise.(0 : Clockwise 1: Counter-Clockwise)

MAIN_CEN_P_ : The center point of main-axis. This parameter is the relative offset to the current position. And the negative value indicates that the finish point is in negative-direction.

SLAVE_CEN_P_ : The center point of slave-axis. This parameter is the relative offset to the current position. And the negative value indicates that the finish point is in negative-direction.

MAIN_FIN_P_: The finish point of main-axis. This parameter is the relative offset to the current position. And the negative value indicates that the finish point is in negative-direction.

SLAVE_FIN_P_ : The finish point of slave-axis. This parameter is the relative offset to the current position. And the negative value indicates that the finish point is in negative-direction.

Return：

0: OK
Others: Error. Refer to Ch.1.6.3 for the error massage list.

Z_CON_MV：

■ I-8094F ■ I-8092F ■ I-8094

Description： This function starts constant-speed, fixed-pulse (point-to-point) motion. No acceleration or deceleration is applied in this motion.

Parameters：

SLOT_ : The specific slot number that the motion module installed on.

AXIS_ : Can be one of X-axis, Y-axis, Z-axis or U-axis. (X:1, Y:2, Z:4, U:8)

SPEED_ : The Drive-Speed in constant-speed moving.

PULSE_ : The total numbers (32-bits) of output pulse.
The negative value indicates motion in negative-direction

Return： 0: OK
Others: Error. Refer to Ch.1.6.3 for the error massage list.

Z_VEL_MV：

■ I-8094F ■ I-8092F ■ I-8094

Description： This function starts velocity-move with drive speed continuously. The trapezoidal-profile moving will be applied to Acceleration. Call Z_STOP( ) to terminate the velocity-move.

Parameters：

SLOT_ : The specific slot number that the motion module installed on.

AXIS_ : Can be one of X-axis, Y-axis, Z-axis or U-axis. (X:1, Y:2, Z:4, U:8)

ST_SPEED_ : The Start Speed in trapezoidal-profile moving. (Unit: PPS)

SPEED_ : The Drive Speed in trapezoidal-profile moving. (Unit: PPS)

ACC_ : The Acceleration in trapezoidal-profile moving. (Unit: PPS/SEC)

DIR_ : 0: Move Direction Positive (Forward)
1: Move Direction Negative (Reverse)

Return： 0: OK
Others: Error. Refer to Ch.1.6.3 for the error massage list.

Z_DRV：

■ I-8094F ■ I-8092F ■ I-8094

Description： This function holds the motion-starting of the involved axes. And these involved axes will start moving simultaneously when HOL_STA_ is equal to 1.

Parameters：

SLOT_ : The specific slot number that the motion module installed on.

AXIS_ : Can be one of X-axis, Y-axis, Z-axis or U-axis. (X:1, Y:2, Z:4, U:8)

HOL_STA_ : 0: drive hold
1: drive start

Return： 0: OK
Others: Error. Refer to Ch.1.6.3 for the error massage list.

Z_STOP：

■ I-8094F ■ I-8092F ■ I-8094

Description： This function stops motion of multiple axes. Please call **Z_DONE** to make sure that all axes are stopped before starting next motion.

Parameters：

SLOT_ : The specific slot number that the motion module installed on.

AXIS_ : Can be one of X-axis, Y-axis, Z-axis or U-axis. (X:1, Y:2, Z:4, U:8)

STATUS_ : 0 : Slowdown stop
1 : Suddenly stop

Return： 0: OK
Others: Error. Refer to Ch.1.6.3 for the error massage list.

Z_MPG：　■ I-8094F ■ I-8092F ■ I-8094

Description： This function enables and configures the manual-pulse-generator feature. After enabling manual-pulse-generator feature, the constant-speed motion will be started when every pulse is sent from external manual-pulse-generator.

Parameters：

SLOT_ : The specific slot number that the motion module installed on.

AXIS_ : Can be one of X-axis, Y-axis, Z-axis or U-axis. (X:1, Y:2, Z:4, U:8)

CONFIG_ : 0: Disable , 1: AB_PHASE, 2 : CW_CCW

FIX_PULSE_ : Indicates the numbers of pulse will be output when each pulse is sent from manual-pulse-generator.
For instance, assigning 5 to this parameter, 5 pulses will be output when each pulse is sent from external manual-pulse-generator.

CONSTSP_ : The constant-speed of output pulse.

MPGFQ_ : The maximum frequency of the manual-pulse-generator.
Please check the datasheet of manual-pulse-generator.

Return： 0: OK
Others: Error. Refer to Ch.1.6.3 for the error massage list.

Z_GET_SP：　■ I-8094F ■ I-8092F ■ I-8094

Description： This function gets the speed of current motion.

Parameters：

SLOT_ : The specific slot number that the motion module installed on.

AXIS_ : Can be one of X-axis, Y-axis, Z-axis or U-axis. (X:1, Y:2, Z:4, U:8)

Return： 0: OK
Others: Error. Refer to Ch.1.6.3 for the error massage list.

Z_GET_AC：　■ I-8094F ■ I-8092F ■ I-8094

Description： This function gets the acceleration of current motion.

Parameters：

SLOT_ : The specific slot number that the motion module installed on.

AXIS_ : Can be one of X-axis, Y-axis, Z-axis or U-axis. (X:1, Y:2, Z:4, U:8)

Return： 0: OK
Others: Error. Refer to Ch.1.6.3 for the error massage list.

ZC_BEGIN：　■ I-8094F ■ I-8092F ■ I-8094

Description： This function configures the involved axes, the constant vector-speed in continuous interpolation moving.

Parameters：

SLOT_ : The specific slot number that the motion module installed on.

MAXIS_: The main-axis of interpolation moving.
Can be one of X-axis, Y-axis, Z-axis or U-axis. (X:1,Y:2,Z:4,U:8)

SAXIS_: The slave-axis of interpolation moving.
Can be one of X-axis, Y-axis, Z-axis or U-axis. (X:1,Y:2,Z:4,U:8)

TAXIS_: The third-axis of interpolation moving.
Can be one of X-axis, Y-axis, Z-axis or U-axis. (X:1,Y:2,Z:4,U:8)

Note：Above parameters must assign to the different axis.

CONSTSPEED_: The constant vector-speed in continuous interpolation.
This parameter should be less than 2,000,000 PPS

Return： 0: OK
Others: Error. Refer to Ch.1.6.3 for the error massage list.

Demo files： “M94_03.pia”, “M92_03.pia”

ZC_READY：　■ I-8094F ■ I-8092F ■ I-8094

Description： This function checks if the next interpolation segment is ready to be set.

Parameters：

SLOT_ : The specific slot number that the motion module installed on.

Return： 0: the next interpolation segment is not ready to be set.
1: the next interpolation segment is ready to be set.
Others: Error. Refer to Ch.1.6.3 for the error massage list.

Demo files： “M94_03.pia”, “M92_03.pia”

ZC_END：　■ I-8094F ■ I-8092F ■ I-8094

Description： This function completes the continuous-interpolation moving, and clears the related configurations kept in driver.

Parameters：

SLOT_ The specific slot number that the motion module installed on.

Return： 0: OK
Others: Error. Refer to Ch.1.6.3 for the error massage list.

Demo files： “M94_03.pia”, “M92_03.pia”

ZC_PT2： ■ **I-8094F** ■ **I-8092F** ■ **I-8094**

Description： This function starts the constant vector-speed, 2-dimension linear interpolation moving.

Parameters：

SLOT_ : The specific slot number that the motion module installed on.

MFINISH_: The finish point of main-axis.
This parameter is the relative offset to the current position. And the negative value indicates that the finish point is in reverse-way.

SFINISH_: The finish point of slave-axis.
This parameter is the relative offset to the current position. And the negative value indicates that the finish point is in reverse-way.

MOVEMODE_ 0: indicates the “begin” of continuous interpolation moving.
1: the interpolation segment is one part of continuous interpolation moving, and the interrupt of motion checking in involved implicitly.

Return： 0: OK
Others: Error. Refer to Ch.1.6.3 for the error massage list.

Demo files： “M94_03.pia”, “M92_03.pia” , “M94_04.pia” , “M94_05.pia”

Warning: Don't call "ZC_PT2" , "ZC_ARC2" and "ZC_PT3" if no movement for the next command. Please wait and call them until the next command has any pulse movement. Please refer to the "STEP5" program of the "m94_05.pia"

ZC_PT3： ■ **I-8094F** □ **I-8092F** ■ **I-8094**

Description： This function starts the constant vector-speed, 3-dimension linear interpolation moving.

Parameters：

SLOT_ : The specific slot number that the motion module installed on.

MFINISH_: The finish point of main-axis.
This parameter is the relative offset to the current position. And the negative value indicates that the finish point is in reverse-way.

SFINISH_: The finish point of second-axis.
This parameter is the relative offset to the current position. And the negative value indicates that the finish point is in reverse-way

TFINISH_ The finish point of third-axis.
This parameter is the relative offset to the current position. And the negative value indicates that the finish point is in reverse-way

MOVEMODE_ 0: indicates the “begin” of continuous interpolation moving.
1: the interpolation segment is one part of continuous interpolation moving, and the interrupt of motion checking in involved implicitly.

Return： 0: OK
Others: Error. Refer to Ch.1.6.3 for the error massage list.

Demo files： “M94_04.pia” , “M94_05.pia”

Warning: Don't call "ZC_PT2" , "ZC_ARC2" and "ZC_PT3" if no movement for the next command. Please wait and call them until the next command has any pulse movement. Please refer to the "STEP5" program of the "m94_05.pia"

ZC_ARC2： ■ **I-8094F** ■ **I-8092F** ■ **I-8094**

Description： This function starts the constant vector-speed, 2-dimension circular interpolation moving.

Parameters：

SLOT_ : The specific slot number that the motion module installed on.

DIR_: The direction. 0: Clockwise; 1: Counter-Clockwise

MCENTER_: The center point of main-axis.
This parameter is the relative offset to the current position. And the negative value indicates that the finish point is in reverse-way.

SCENTER_ The center point of slave-axis.
This parameter is the relative offset to the current position. And the negative value indicates that the finish point is in reverse-way.

MFINISH_ The finish point of main-axis.
This parameter is the relative offset to the current position. And the negative value indicates that the finish point is in reverse-way.

SFINISH_ The finish point of slave-axis.
This parameter is the relative offset to the current position. And the negative value indicates that the finish point is in reverse-way.

MOVEMODE_ 0: indicates the “begin” of continuous interpolation moving.
1: the interpolation segment is one part of continuous interpolation moving, and the interrupt of motion checking in involved implicitly.

Return： 0: OK
Others: Error. Refer to Ch.1.6.3 for the error massage list.

Demo files： “M94_03.pia”, “M92_03.pia” , “M94_04.pia” , “M94_05.pia”

Warning: Don't call "ZC_PT2" , "ZC_ARC2" and "ZC_PT3" if no movement for the next command. Please wait and call them until the next command has any pulse movement. Please refer to the "STEP5" program of the "m94_05.pia"

1.7 Motion Demo Programs

1.7.1 The List of ISaGRAF Motion Demos with Soft-GRAF HMI

The demos can be found in the XP-8xx7-CE6 CD (since ver. 1.09, 2010/10) :
/napdos/isagraf/xp-8xx7-ce6/demo/

Or download from the following FTP website :
ftp://ftp.icpdas.com/pub/cd/xp-8xx7-ce6/napdos/isagraf/xp-8xx7-ce6/demo/

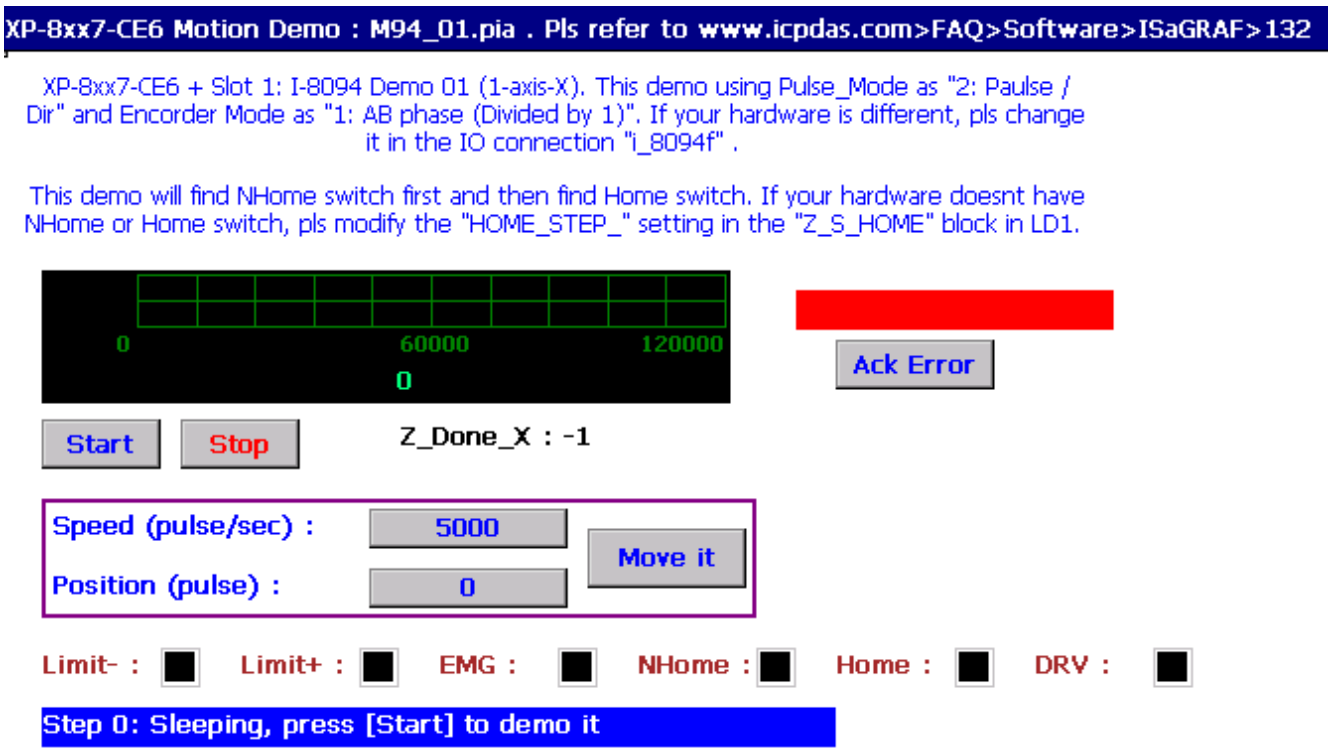
Or FAQ-132 : http://www.icpdas.com/faq/isagraf/132.htm

Program	Description
Samp809	A sample project which contains all motion functions.
M94_01	Use I-8094 card and LD language; Single-axis auto search Near-Home & Home, and do the point-to-point moving.
M94_01a	The same as “M94_01”, but use ST language.
M94_01b	Use I-8094 card and LD language; Single-axis auto search Home, and do the point-to-point moving.
M94_01c	Use I-8094 card and LD language; Single-axis auto search Home, do the point-to-point moving, and the manual-pulse-generator control.
M94_01d	Use I-8094 card and LD language; Single-axis auto search Home, do the point-to-point moving, and the FRnet
M94_02	Use I-8094 card and LD language; 2-axis auto search Near-Home & Home, and do the 2-axis 2-dimension interpolation moving.
M94_02a	The same as “M94_02a”, but use ST language.
M94_02b	Use I-8094 card and LD language; 2-axis auto search Home, and do the 2-axis 2-dimension interpolation moving.
M94_03	Use I-8094 card and LD + ST language; 2-axis auto search Home, do the 2-axis 2-dimension interpolation moving.
M94_04	Use I-8094 card and LD + ST language; 2-axis auto search Home, do the 2-axis 2-dimension interpolation moving and the 3-axis 3-dimension interpolation moving.

Program	Description
M94_05	Use I-8094 card and LD + ST language; 2-axis auto search Home, and read max. 250 (x,y) operating parameters for continuous motion from '\System_disk\Backup_integer_0.txt'.
M94_06	Use I-8094 card and LD + ST language; 2-axis auto search Home, and read more than 250 (x,y) operating parameters for continuous motion from '\System_disk\Backup_integer_0.txt'. Max. 10000 (x,y) operating parameters for this demo.
M92_01	Use I-8092 card and LD language; Single-axis auto search Near-Home & Home, and do the point-to-point moving.
M92_01a	The same as "M92_01", but use ST language.
M92_01b	Use I-8092 card and LD language; Single-axis auto search Home, and do the point-to-point moving.
M92_01c	Use I-8092 card and LD language; Single-axis auto search Home, do the point-to-point moving, and the manual-pulse-generator control.
M92_01d	Use I-8092 card and LD language; Single-axis auto search Home, do the point-to-point moving, and the FRnet.
M92_02	Use I-8092 card and LD language; 2-axis auto search Near-Home & Home, and do the 2-axis 2-dimension interpolation moving.
M92_02a	The same as "M92_02", but use ST language.
M92_02b	Use I-8094 card and LD language; 2-axis auto search Home, and do the 2-axis 2-dimension interpolation moving.
M92_03	Use I-8092 card and LD + ST language; 2-axis auto search Home, do the 2-axis 2-dimension interpolation moving.

Please refer to FAQ-131 for Soft-GRAF information:
www.icpdas.com > ISaGRAF PAC > FAQ > FAQ-131 。

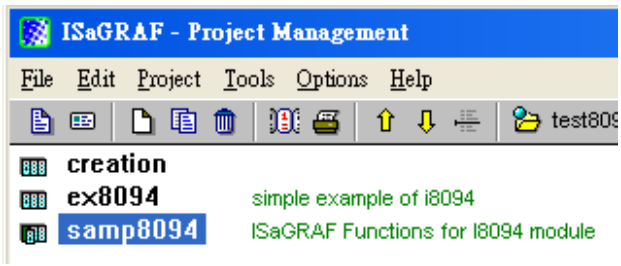
Example M94_01 :



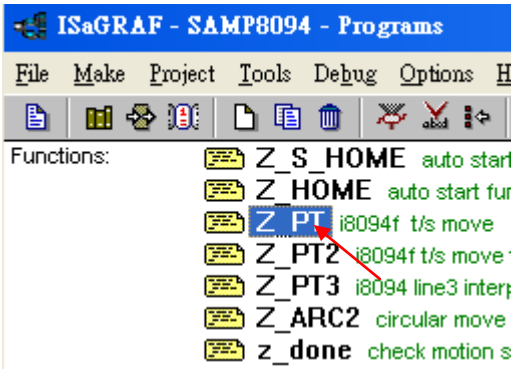
1.8 How to Copy One Single Motion Function

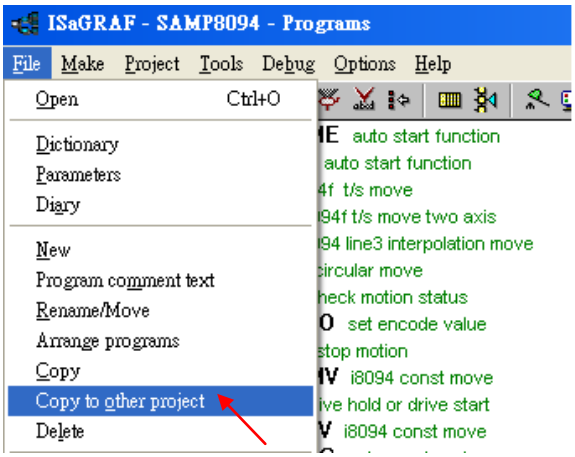
All the functions for I-8094F/8092F/8094 are collected in the “samp809” file. In Section 1.3.1, we show you how to copy the whole function file “samp809” to your new project, now we will show you how to copy one single Motion function to your project. Here, we will copy a function "Z_PT" from the “samp809” to the “ex_8094”.

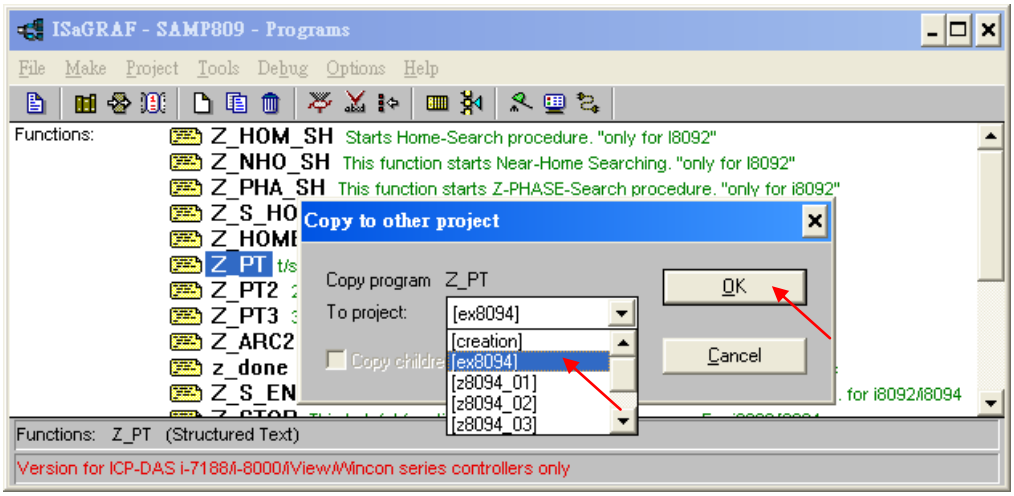
Step 1 : In the ISaGRAF Workbench, open the function file "samp809".



Step 2 : Select function "Z_PT", click [File] > [copy to other project], then select “ex_8094” to copy the "Z_PT" to the project “ex_8094”. Press “OK”.







1.9 Error Code List for the Function Return

Error Code List for the Function Return -- I-8092F/8094F/8094

Return Value	Description
-1	Fail to find the correct card in the specific slot or the card has not registered to the RegEdit file.
-102	Fail to open the device-node of I-8092F/8094F/8094. Please make sure no other process occupies that I-8092F/8094F/8094 module.
-103	Fail to close the device-node of I-8092F/8094F/8094.
-104	Cannot reset the Motion-Control ASIC.
-105	Cannot change the content of **RANGE**_ register
-106	Cannot change the output pulse mode
-107	Cannot change the input encoder mode.
-108	Cannot configure the hardware-limit sensor.
-109	Cannot set the INP configuration.
-110	Cannot set the ALARM configuration
-111	Cannot set the Servo output.
-115	Cannot configure the software-limit settings
-116	Cannot change the configuration of Auto-Home-Search
-118	Cannot start Auto-Home-Search.
-119	Cannot get motion-related digital inputs.
-121	Cannot set the logic-command counter.
-122	Cannot get the logic-command counter.
-123	Cannot set the encoder-position counter.
-124	Cannot get the encoder-position counter.
-125	Cannot get motion status.
-126	Cannot get the current speed.
-127	Cannot get the current acceleration.
-129	Cannot stop current motion.
-131	Cannot start motion of held axes.
-132	Cannot hold the motion-starting.
-133	Cannot enable/configure the variable-ring feature.
-134	Cannot enable/configure the manual-pulse-generator.
-140	Cannot start constant-speed motion
-141	Cannot start trapezoidal moving
-142	Cannot start S-curve moving.
-143	Cannot start trapezoidal 2D interpolation moving.

Return Value	Description
-144	Cannot start trapezoidal 3D interpolation moving.
-145	Cannot start S-curve 2D interpolation moving
-146	Cannot start S-curve 3D linear interpolation moving
-147	Cannot start circular interpolation moving.
-148	Cannot set up the multi-dimension interpolation moving.
-149	Cannot clear the related configurations kept in driver of the continuous interpolation moving.
-150	Cannot get the next-ready status for the next interpolation segment.
-151	Cannot start the constant vector-speed, 2-dimension linear interpolation moving.
-152	Cannot start the constant vector-speed, 3-dimension linear interpolation moving.
-153	Cannot start the constant vector-speed, 2-dimension circular interpolation moving.
-156	Cannot change total number of output pulse.
-201	There is no active i-8094 module on the given slot.
-204	The value to be assigned to **RANGE** register is invalid.
-210	The value to be assigned to **STATUS**_ in **z_stop()** is improperly. (0: slowdown stop, 1: suddenly stop)
-215	The value to be assigned to **SRV**_ in **z_srv_on()** is improperly. (0: off, 1: turn on auto-off, 2: turn on manual off)
-223	The value to be assigned to **DIR**_ in **z_vel_mv()** is improperly. (:0 forward, 1: reverse)
-224	The value to be assigned to **HOME_L**_ in **z_s_home()** is improperly. (0:Active Low, 1:Active High)
-225	The value to be assigned to **N_HOME_L**_ in **z_s_home()** is improperly. (0:Active Low ,1:Active High)
-226	The value to be assigned to **INDEX_L**_ in **z_s_home()** is improperly. (0:Active Low, 1:Active High)
-227	The value to be assigned to **HOME_SET**_ in **z_s_home()** is improperly.
-230	The value to be assigned to **CONFIG**_ in **z_mpg()** is improperly. (0 :disable, 1 :AB_PHASE, 2: CW/CCW)
-232	The value to be assigned to **H_SPEED**_ in **z_home()** is improperly.
-233	The value assigned to parameter **ACC**_ is out of range of Acceleration.
-234	The value assigned to parameter **DEC**_ is out of range of Deceleration.
-235	The value assigned to parameter **ACC**_ is out of range of Acceleration-Increasing-Rate.
-236	The value assigned to parameter **DEC**_ is out of range of Deceleration-Increasing-Rate.
-244	The value assigned to parameter **ST_SPEED** is out of range of Speed.

Return Value	Description
-245	The value assigned to parameter **Drive Speed** is out of range of Speed.
-247	The **Start Speed** is larger than **Drive Speed**.
-248	Multiple axes are assigned to parameter ***AXIS***_.
-249	No valid axis ID is assigned to parameter ***AXIS***_.
-250	The parameter **Slave Axis** includes the axis ID assigned to **Main Axis*.***
-251	The axis ID assigned to **Second Axis** and **Third Axis** is the same.
-253	The value to be assigned to **DIR**_ in **z_arc2()** is improperly. (0: clock wise, 1:counter clock wise)
-261	The value assigned to parameter **CONSTSP**_ is out of range of Speed or is less than ***2 * MPGFQ_* FIXEDPULSE***_.
-301~ -315	Indicates that some error happens to **AXIS X**, **AXIS Y**, **AXIS Z** or **AXIS U**.
-324	The Auto-Home-Search had not been configured.
-325	Indicates the previous motion is not completed. Please wait for completion of motion, or stop motion with z_stop().
-330	The path of circular moving is too small. Please try to increase the circular-path.
-333	The interpolation moving started before had not completed.
-334	The continuous interpolation moving is stopped because the next segment is not ready to be set, user can set **MOVEMODE**_ to “0” to continue the interpolation moving.
-335	Cannot start the 3-dimension continuous interpolation moving, the setting is for 2-dimension only.
-336	The motion control chip in the I-8094/8092 module does not permit to set the next interpolation segment, please call zc_ready() to check if ready to set.
-338	Indicates the Drive-Speed cannot be applied to S-curve moving.
-339	Indicates the Drive-Speed cannot be changed in non-constant speed area of trapezoidal-profile moving.
-341	Indicates the finish-point of interpolation moving cannot be changed dynamically.
-342	The axes that will to be started are not match to the axes that are held by z_drv().
-344	Indicates the previous Manual-Pulse-Generator setting is active. Please disable MPG settings with z_mpg().
-345	Indicates the some axes had been hold, please call z_drv() to release the hold-axes first.
-360	Cannot forward the Axes-checking command to system.
-361	Cannot get the settings of **RANGE**_ register.