HIWIN® MIKROSYSTEM

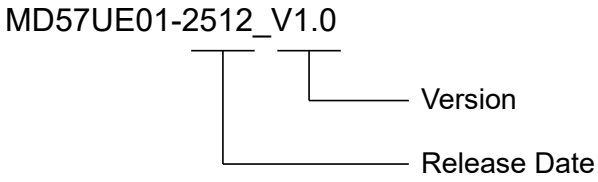
Application Note

E Series EtherCAT Drive Complete Setup with ACS SPiiPlus MMI Application Studio

www.hiwinmikro.tw
MD57UE01-2512_V1.0

Revision History

The version of the manual is also indicated on the bottom of the front cover.



Release Date	Version	Applicable Product	Revision Contents
Dec. 17th, 2025	1.0	E Series EtherCAT Drive	First edition.

Related Documents

Through related documents, users can quickly understand the positioning of this manual and the correlation between manuals and products. Go to HIWIN MIKROSYSTEM's official website → Download → Manual Overview for details (https://www.hiwinmikro.tw/Downloads/ManualOverview_EN.htm).

Preface

This manual explains the operation of software SPiiPlus MMI Application Studio when E series EtherCAT drive is used with ACS controller. The contents in this manual, including project creation of controller, communication setup, parameters setup, test run, are arranged in accordance with the procedure of complete machine setup. For detailed information on E series servo drive, please refer to the related user manuals.

Specifications of Software/Hardware

Name	Version of Software/Firmware
E1 Series EtherCAT Drive	Software (Thunder): 1.13.7.0 or above Firmware: 2.13.6 or above ESI file: HIWINMIKROSYSTEM_ED1F_20250107 or above
E2 Series EtherCAT Drive	Software (Thunder): 1.13.7.0 or above Firmware: 3.13.6 or above ESI file: HIWINMIKROSYSTEM_ED2F_20250107 or above
ACS SPiiPlusEC	Software (SPiiPlus MMI Application Studio): 3.13.01 or above Firmware: 3.13.01 or above

Table of Contents

1. Communication and Module Setup

1.1 Create new project

1. Open SPiiPlus MMI Application Studio and click “New workspace” icon.

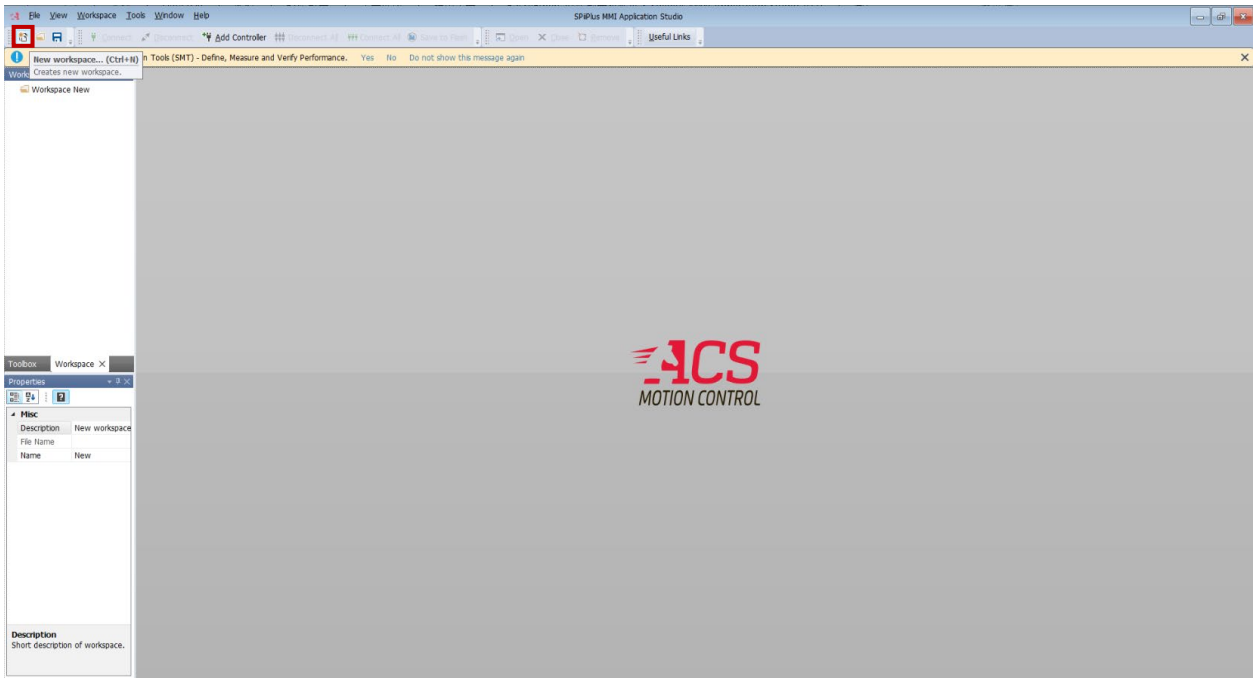


Figure 1.1.1

2. Click **Add Controller**, select **Ethernet**, and execute **Refresh** to search for the controller.
   Note: The controller's default IP address is 10.0.0.100. Correctly set the computer's IP address to ensure the device can be correctly identified.

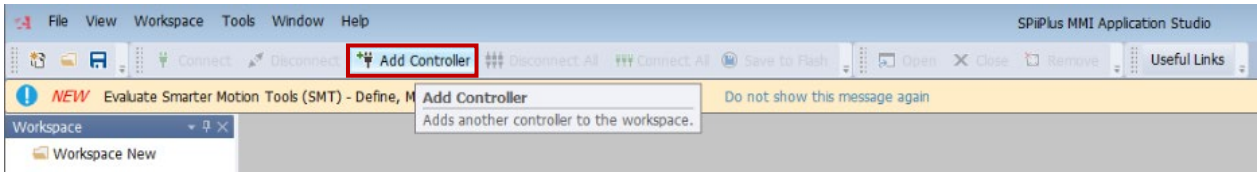


Figure 1.1.2

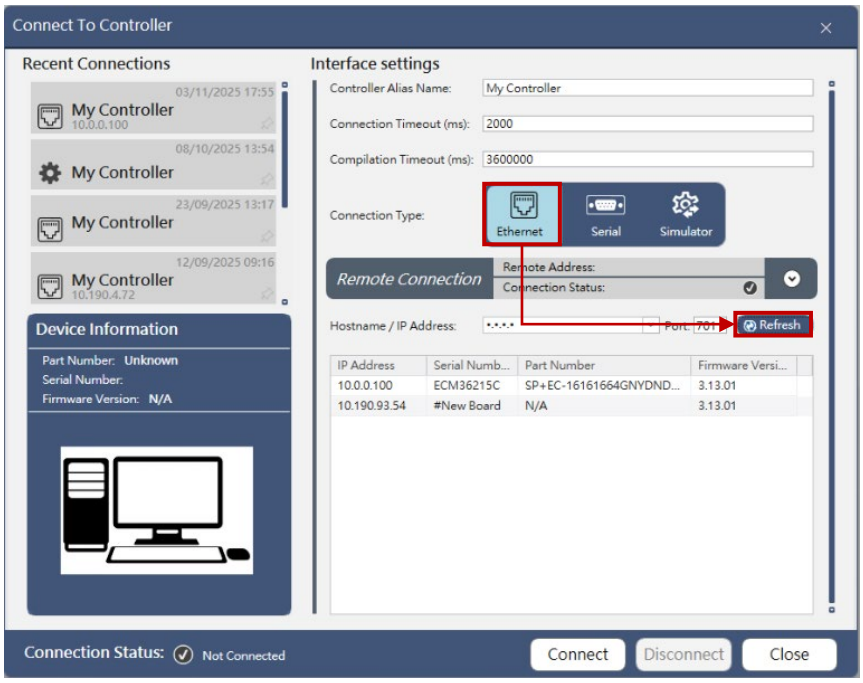


Figure 1.1.3

3. Select the controller and click **Connect**. Then, the connection will be successfully established.

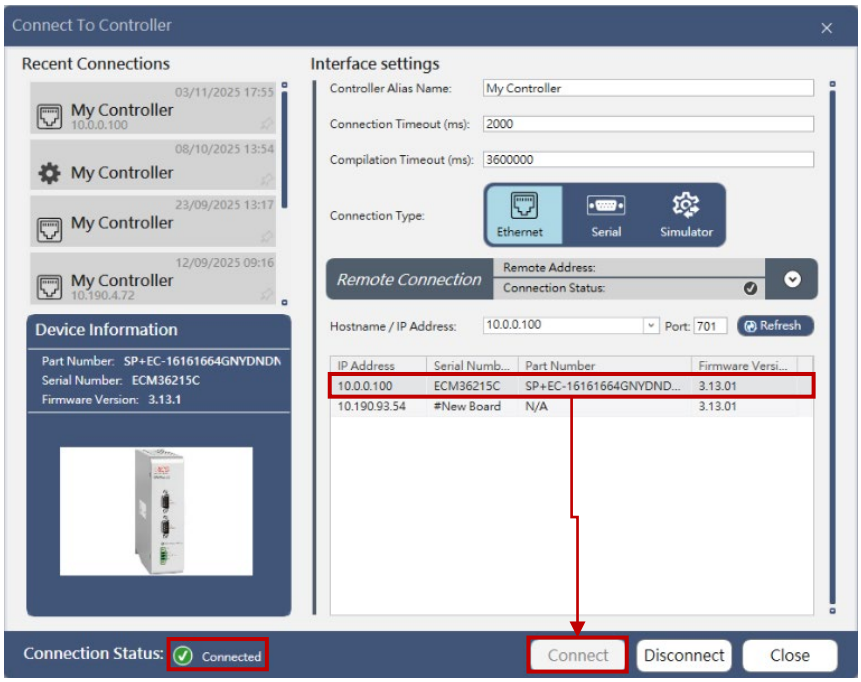


Figure 1.1.4

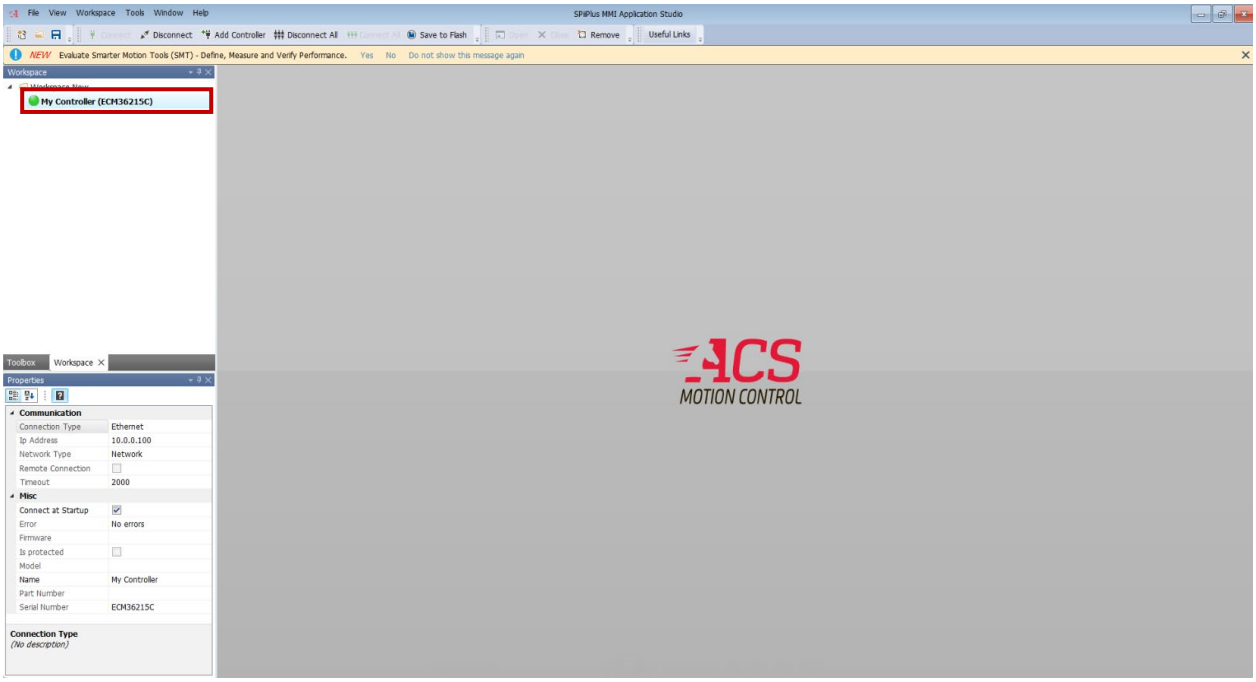


Figure 1.1.5

1.2 Load ESI file

1. Right-click **My Controller** and select **Add Component→Setup→System Setup**.

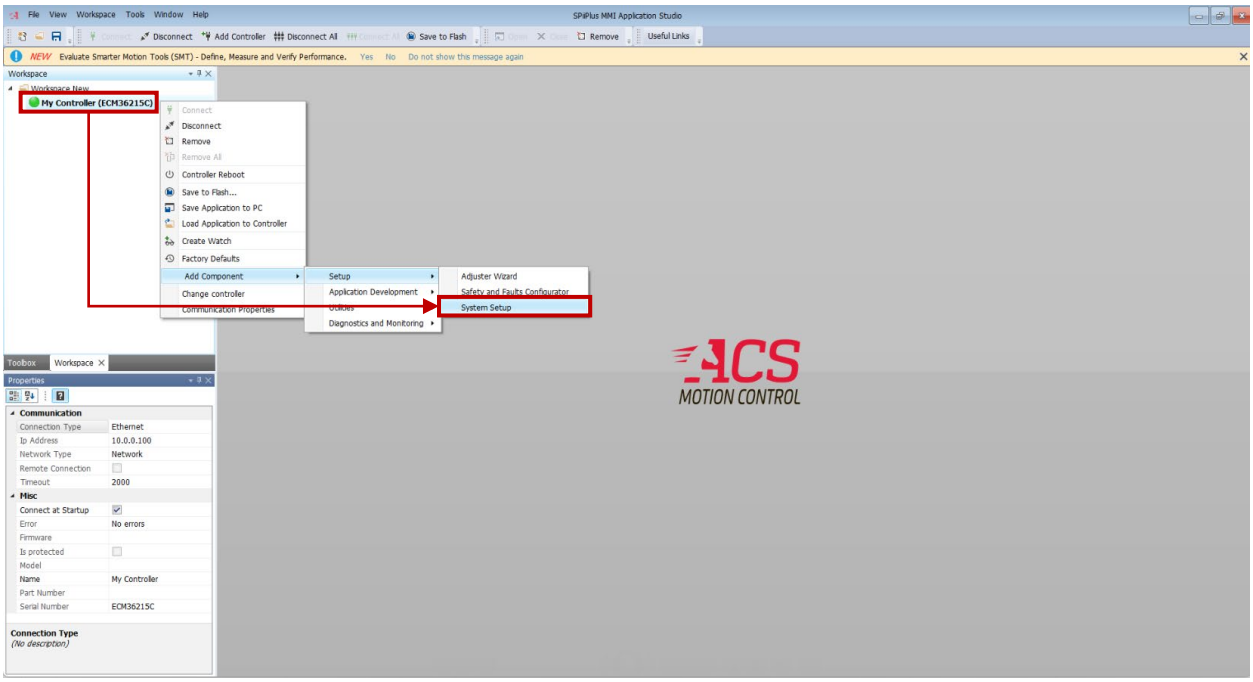


Figure 1.2.1

2. Double-click **System Setup** to get the path where the ESI file should be placed from “Properties” column below.

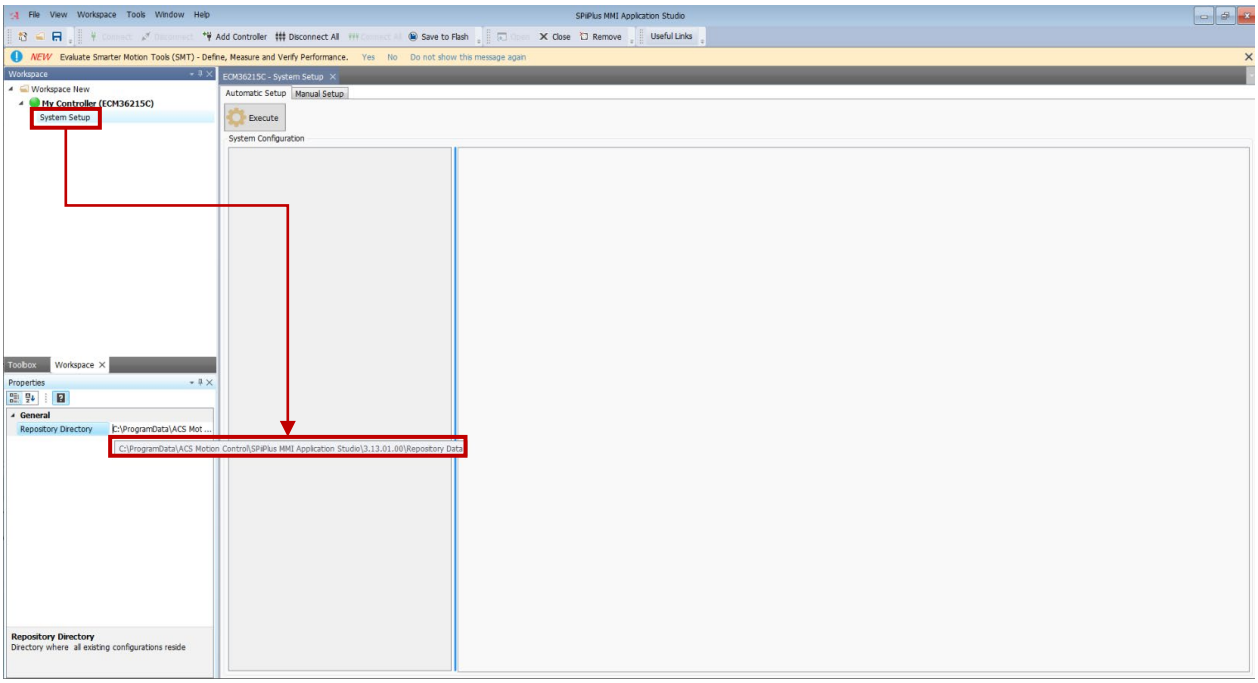


Figure 1.2.2

3. Open the EtherCAT folder under the Repository Data path and place E series servo drive's ESI file in this path.

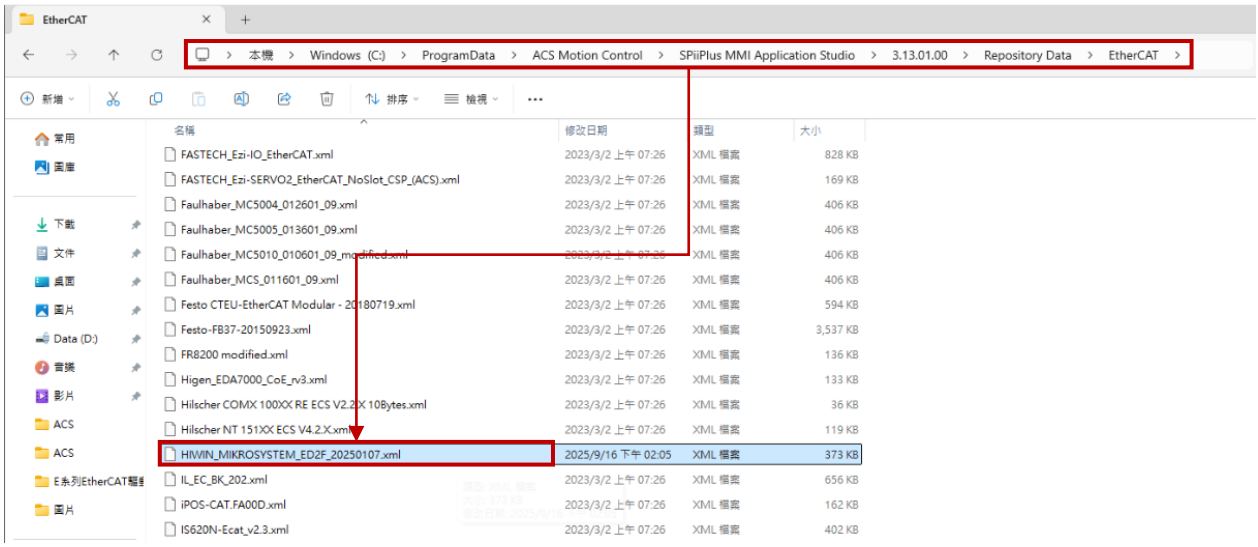


Figure 1.2.3

1.3 Search for the connected device

1. Double-click **System Setup** and click **Execute** to perform the configuration scan of the connected device.

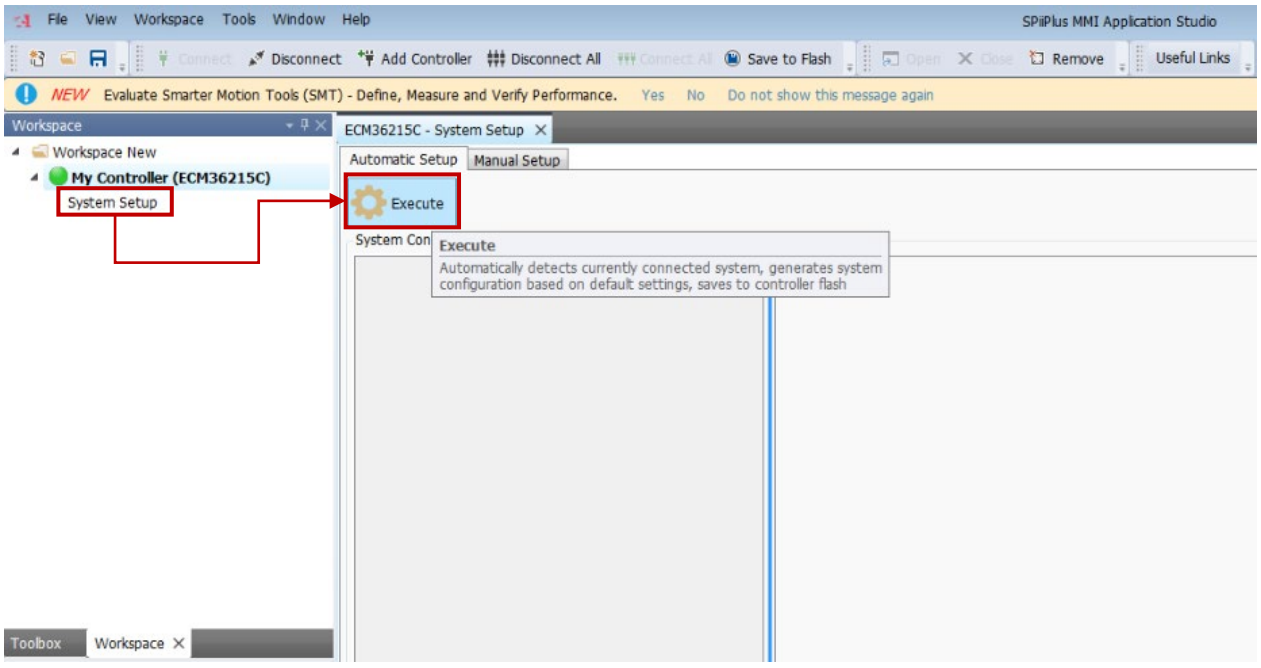


Figure 1.3.1

2. Click **Yes** to start the configuration scan. The scanning process is shown in the figure below.

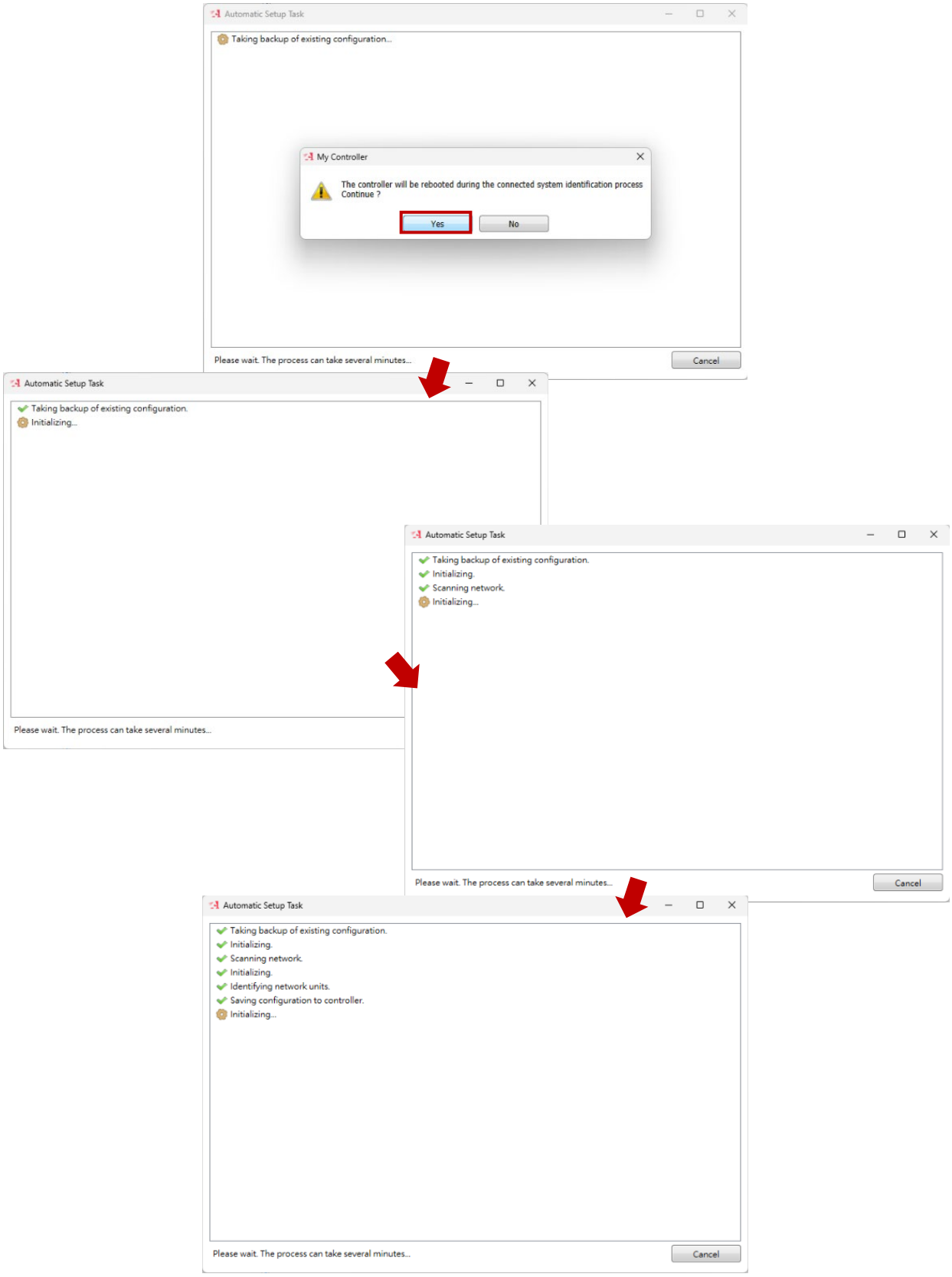


Figure 1.3.2

3. After the configuration scan is completed, ensure that all tasks in “Automatic Setup Task” window are checked, then click **OK**. Once the device is correctly identified, System Configuration will display the device name and axis number.

   Note:

   (1) If an error occurs during the configuration scan, re-check the device wiring and execute System Setup again.

   (2) Ensure the controller supports third-party EtherCAT drive by executing #SI in Communication Terminal.

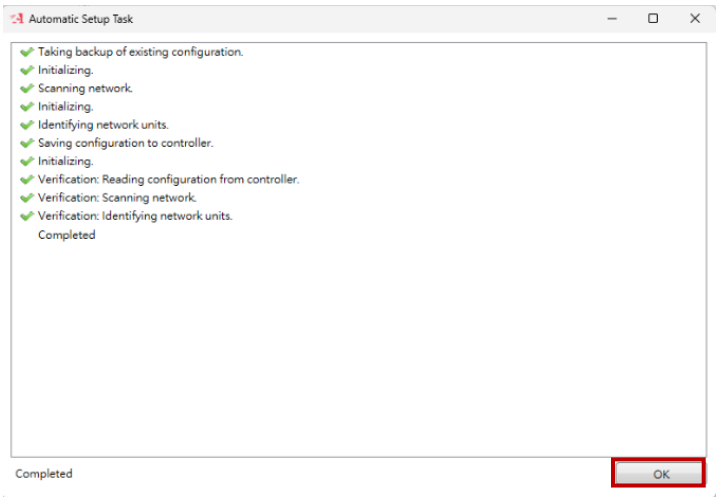


Figure 1.3.3

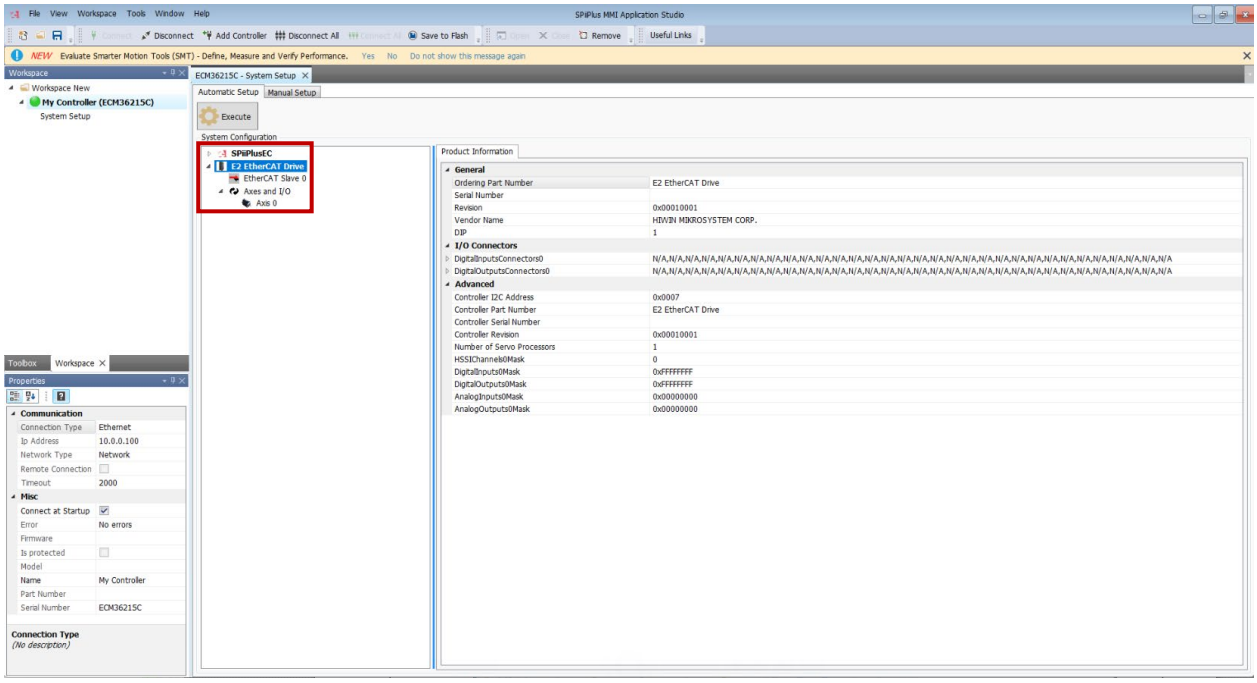


Figure 1.3.4

2. Parameters Setup

2.1 Select axis and unit

1. Right-click **My Controller** and select **Add Component→Setup→Adjuster Wizard**.

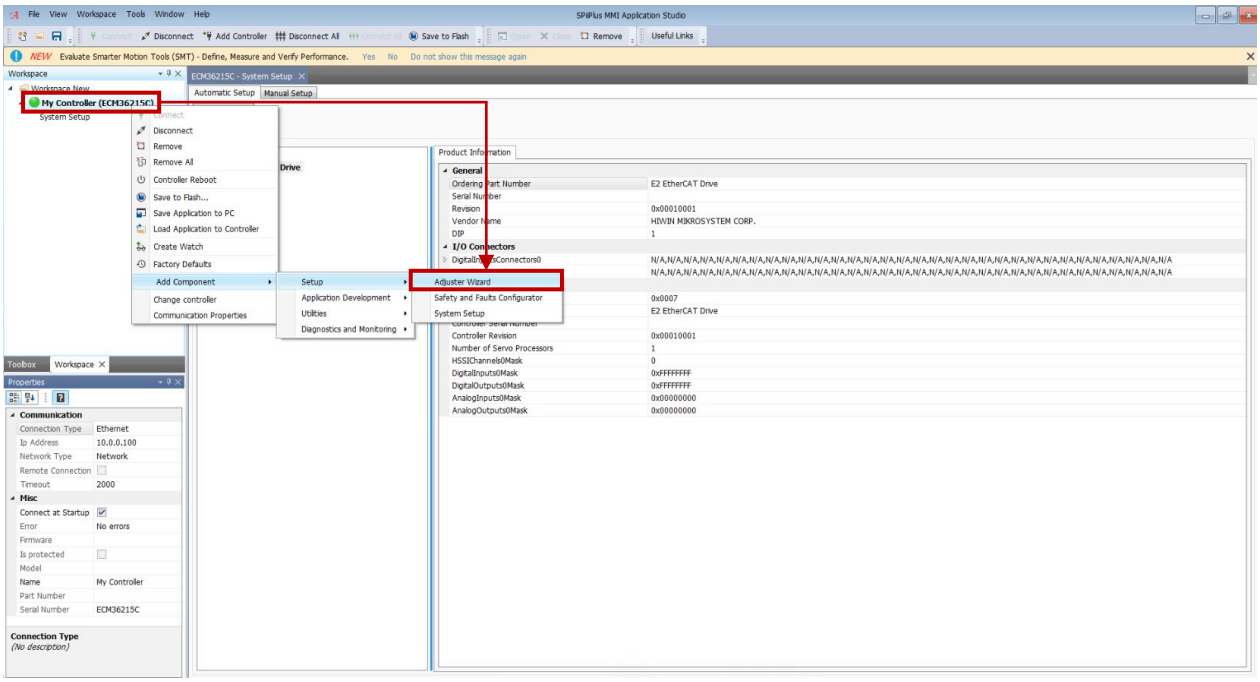


Figure 2.1.1

2. Double-click **Adjuster Wizard** to select the axis to be set. Here takes “Axis 0” as an example.

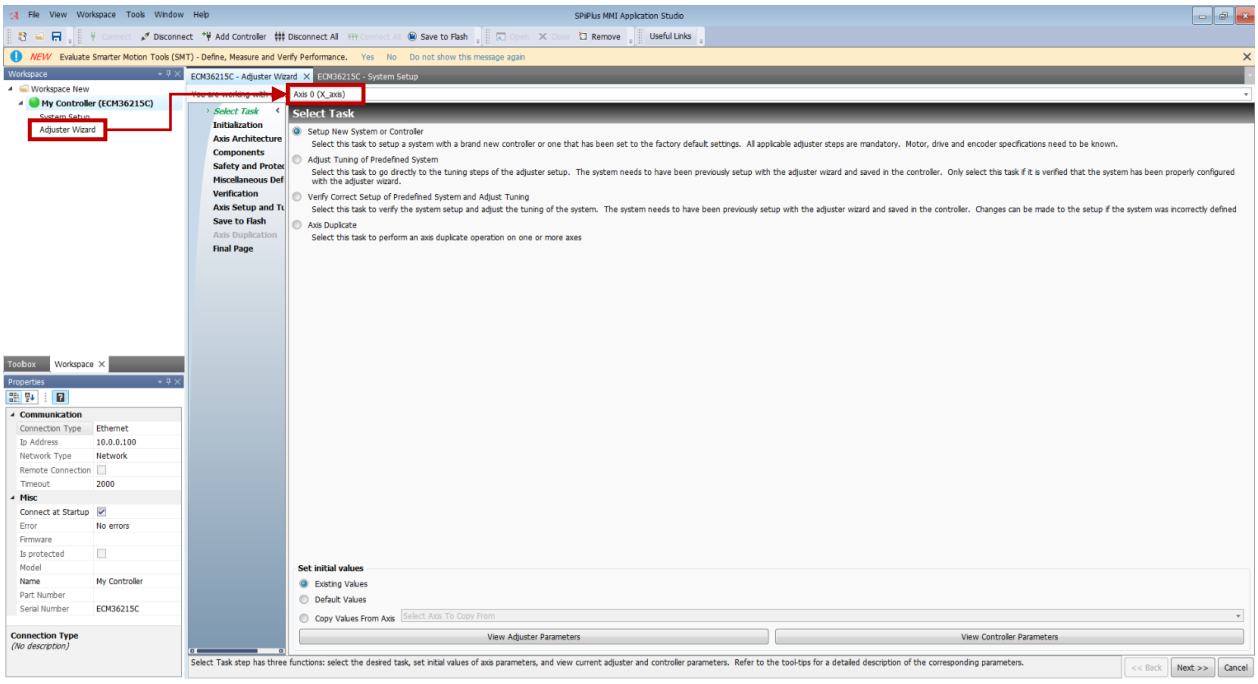


Figure 2.1.2

3. Click **Axis Architecture**, configure the structure based on the connected motor type, and select the user units.

■ Example of linear motor

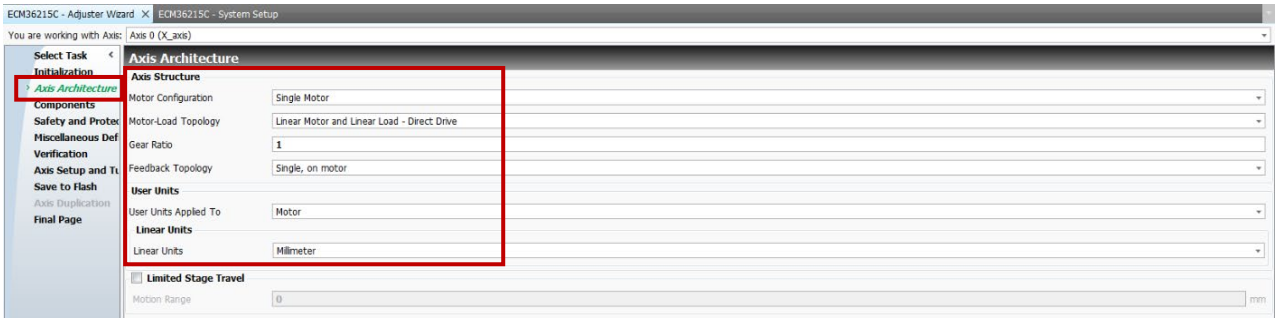


Figure 2.1.3

■ Example of rotary motor

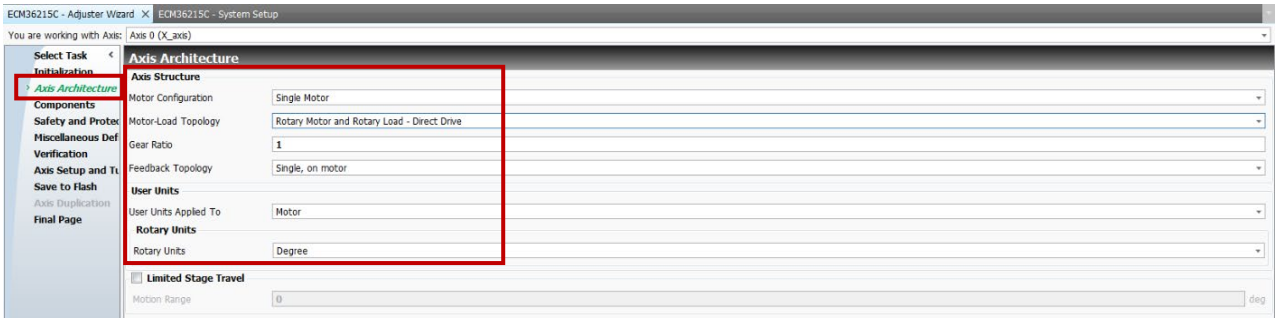


Figure 2.1.4

2.2 Set device parameters

1. In “Adjuster Wizard” window, go to “Components→Motor” page. Click the edit icon, complete the settings based on the motor specification, and click **Next >>** in the bottom-right corner.
   Here takes “rotary motor DMS03” as an example.

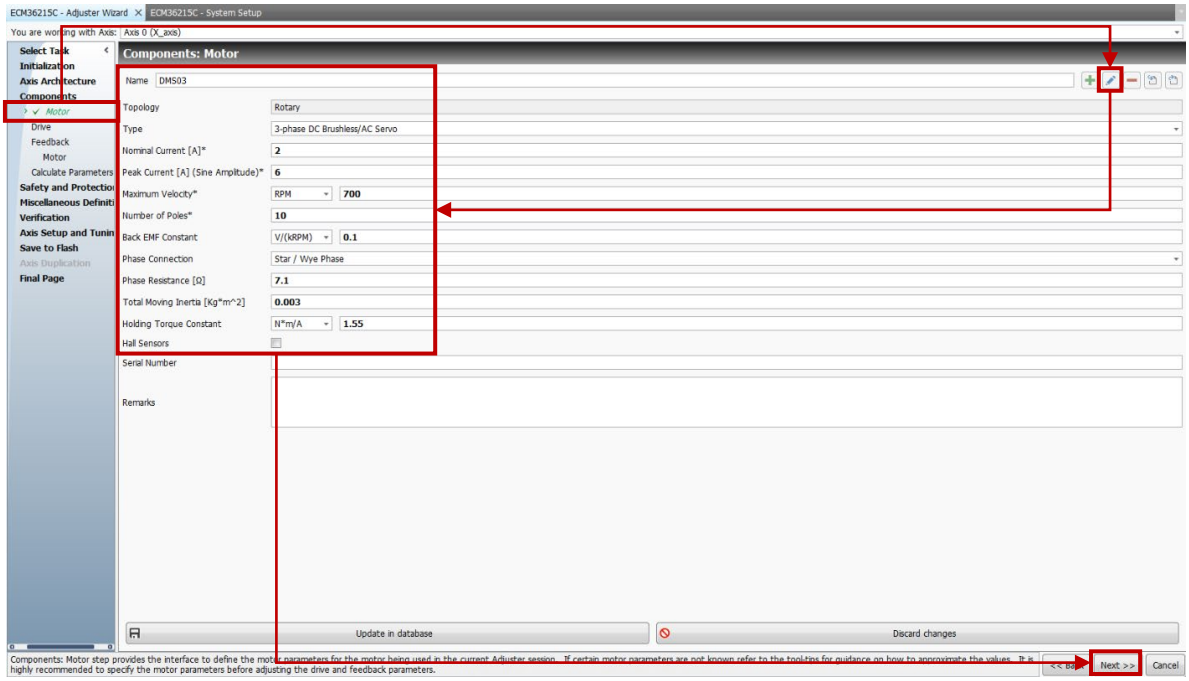


Figure 2.2.1

2. Go to “Components→Drive” page. Click the edit icon, complete the settings based on the specification of drive’s current, and click **Next >>** in the bottom-right corner. Here takes “E2-3A drive” as an example.

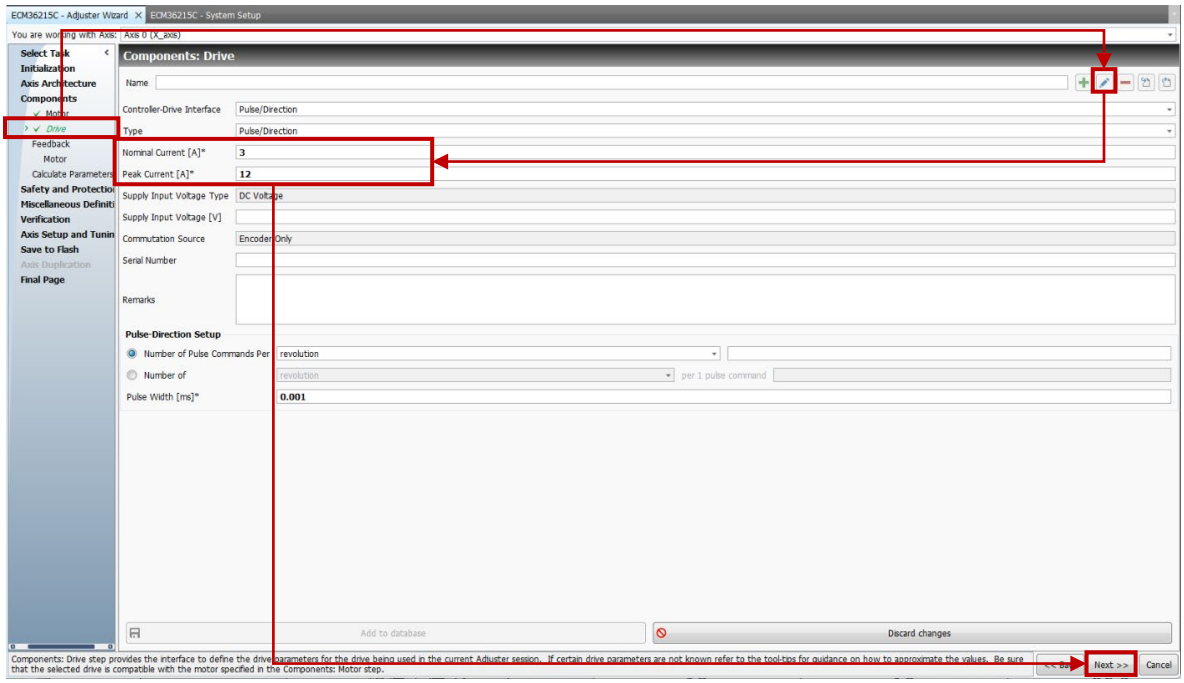


Figure 2.2.2

3. Go to “Components→Feedback→Motor” page. Click the edit icon, set the resolution based on the drive’s control unit, and click **Next >>** in the bottom-right corner.
Here takes “DMS03 motor, a resolution of 4325376 cnt/rev” as an example.

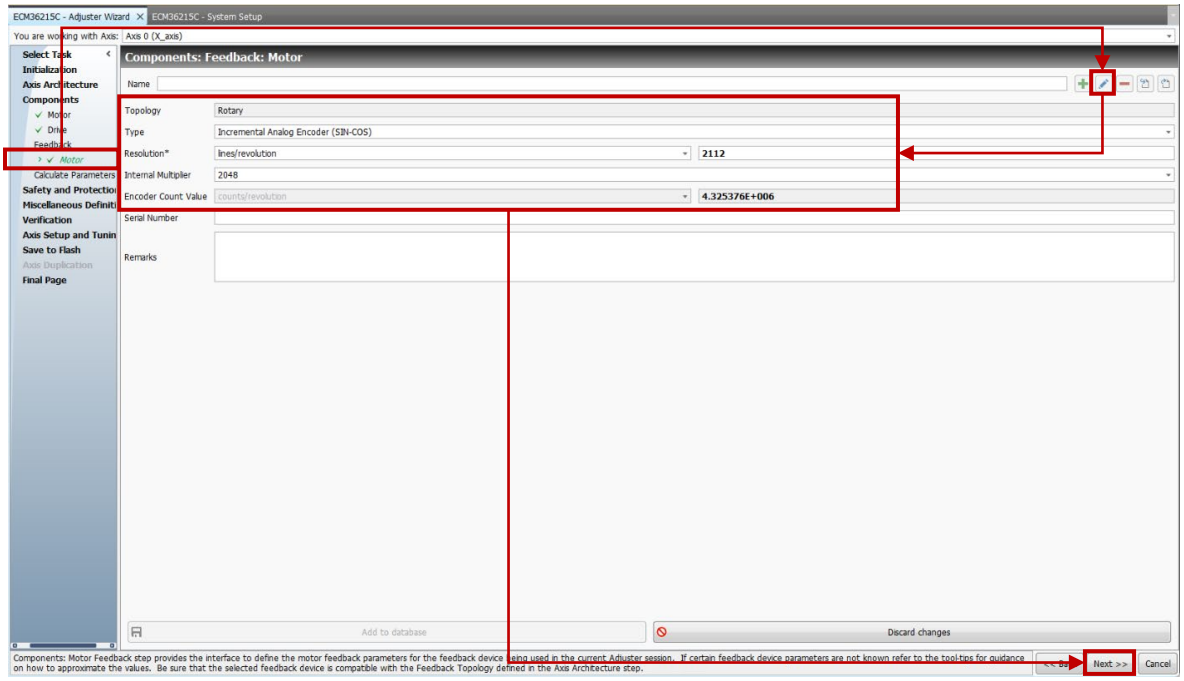


Figure 2.2.3

4. Go to “Components→Calculate Parameters” page to execute **Calculate Parameters**. After the calculation is completed, click **Apply Changes** to import the device parameters into the settings.

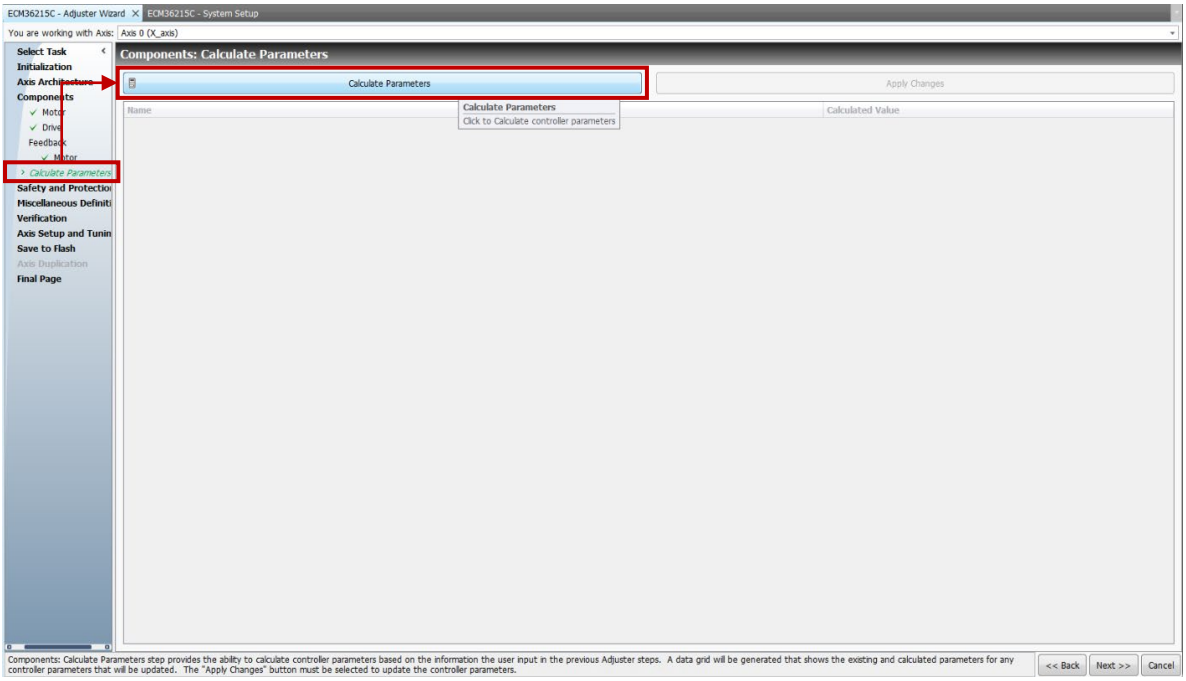


Figure 2.2.4

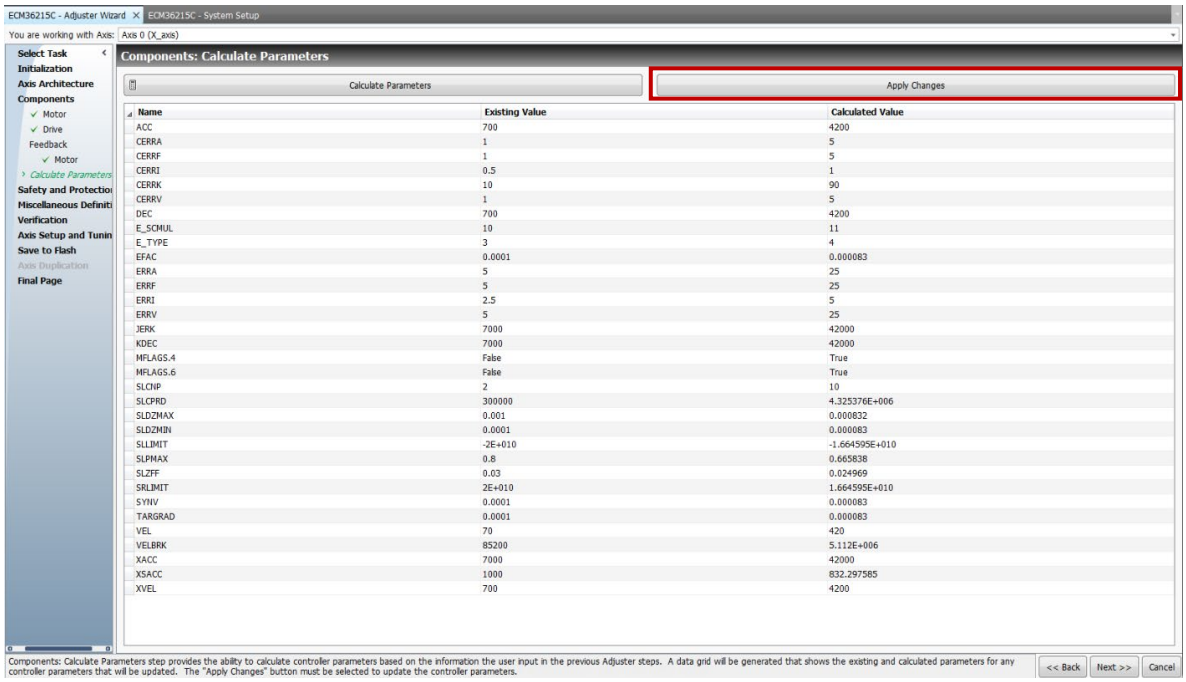


Figure 2.2.5

5. Go to “Miscellaneous Definition→Enable / Disable / Brake” page to set Enable Delay time based on the motor type. When using the drive’s electrical angle detection method of SW method 1, it is recommended to set Enable Delay to 2 seconds or more.

   Note:

   (1) The electrical angle detection method for absolute encoder or Hall sensor is different; the Enable Delay time can remain at the default value.

   (2) For linear motor or direct drive motor, the setting of Enable Delay must be adjusted. If not adjusted, an error (Error 5019) will be triggered when enabling the motor.

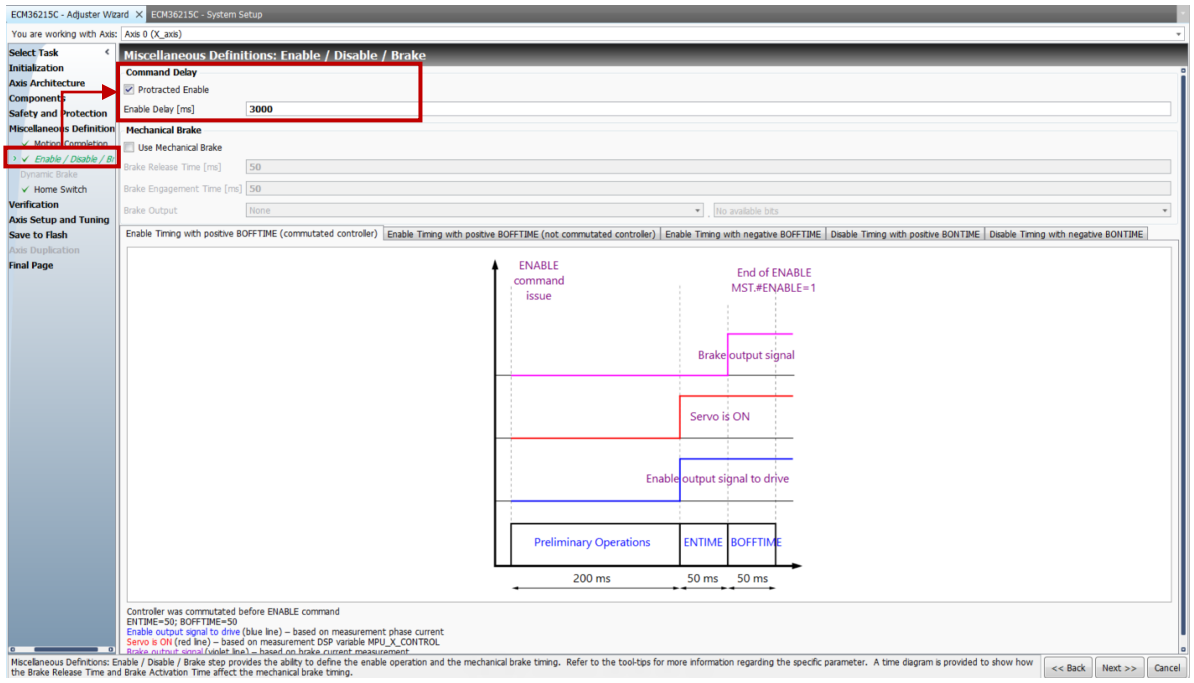


Figure 2.2.6

6. Go to “Verification→Feedback→Motor” page. Rotate the motor to ensure that the position feedback matches the control unit. Here takes “DMS03 motor, a resolution of 4325376 cnt/rev” as an example.

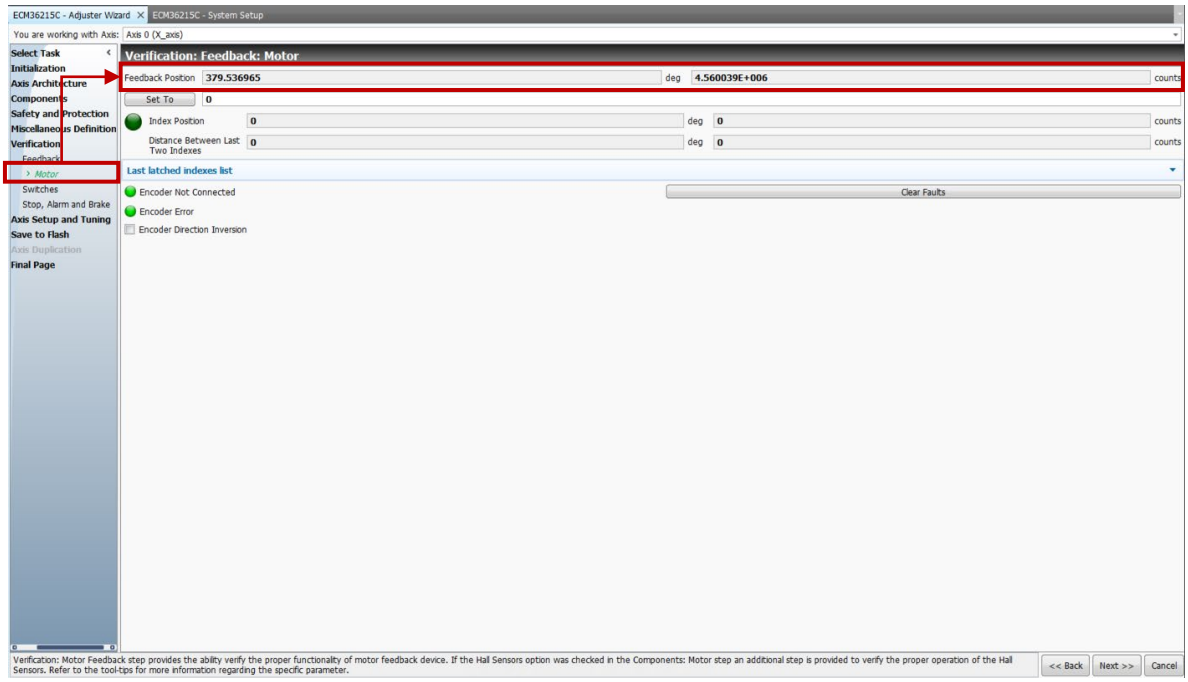


Figure 2.2.7

2.3 Download parameters setup to controller

1. In “Adjuster Wizard” window, go to “Save to Flash” page. Check the set axis, click **Save** to write the parameters to the controller, and click **Next >>** in the bottom-right corner.

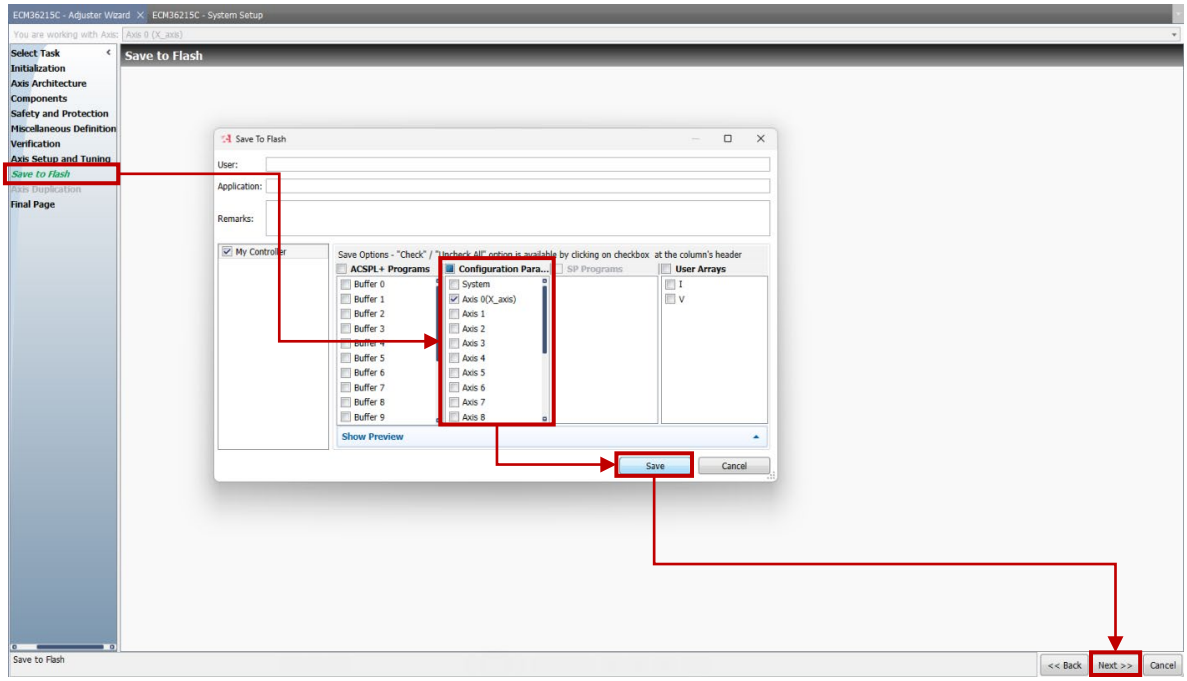


Figure 2.3.1

2. Go to “Final Page” page. Ensure that the Adjuster Wizard setup is completed and click **Finish** in the bottom-right corner.

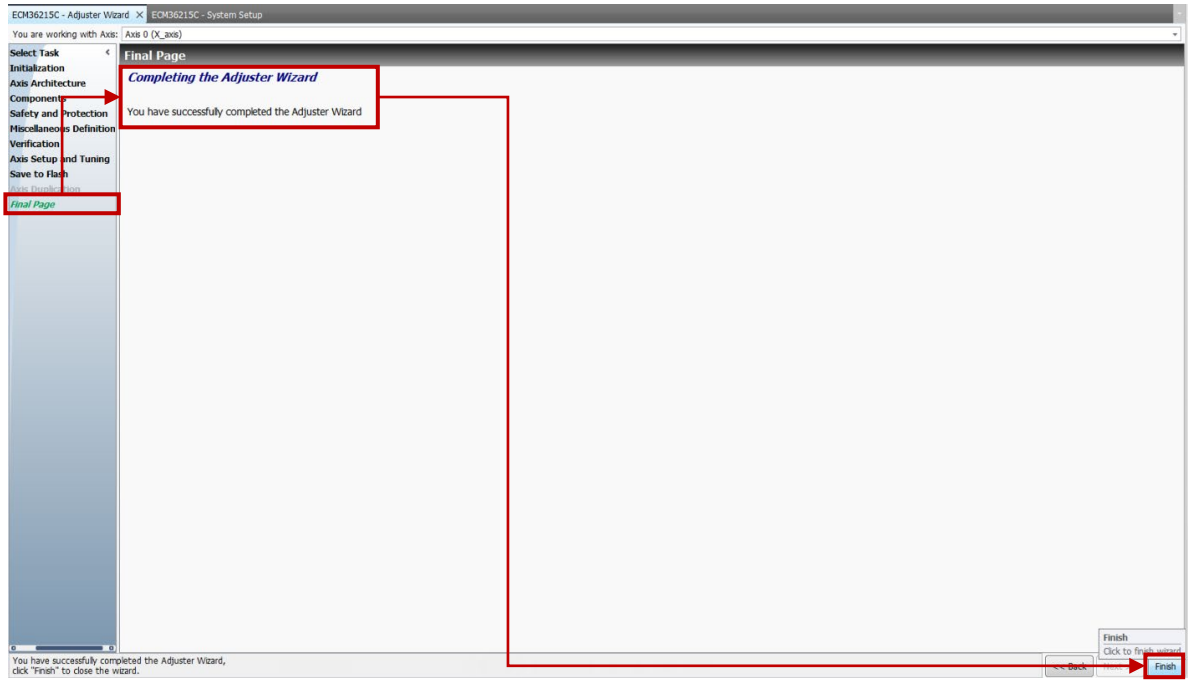


Figure 2.3.2

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3. Test Run

3.1 Motion Manager

1. Right-click **My Controller** and select **Add Component→Diagnostics and Monitoring→Motion Manager**.

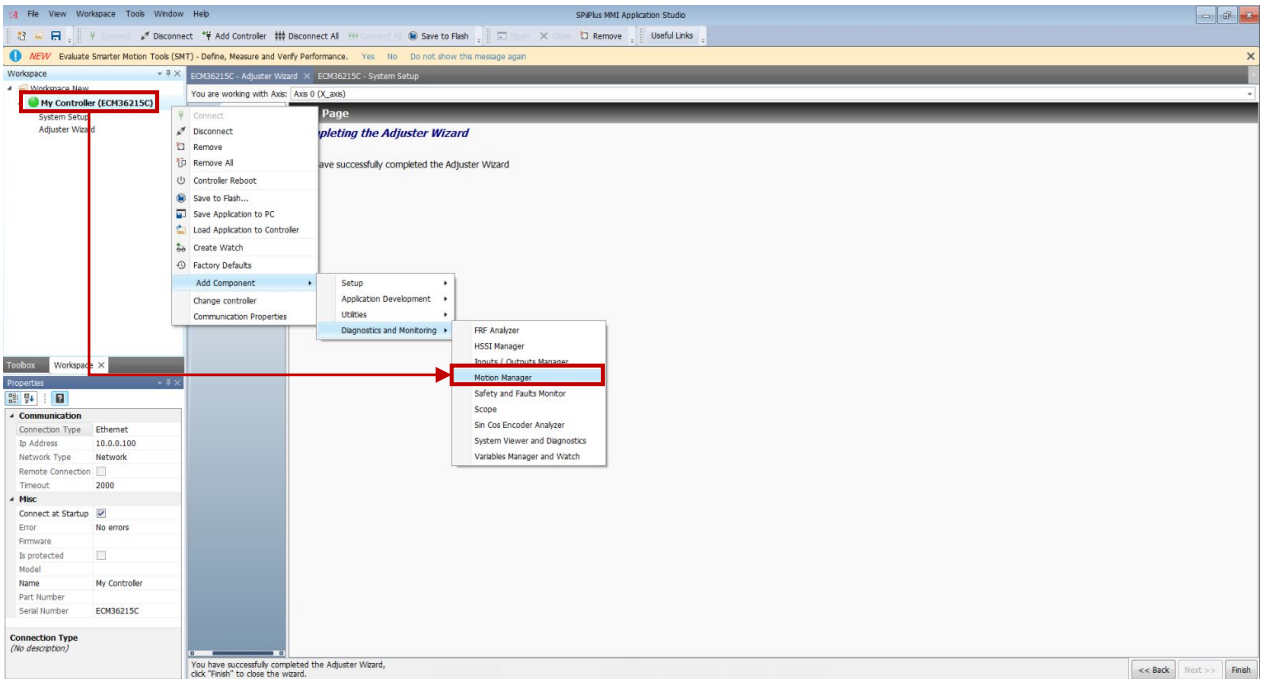

Figure 3.1.1

2. Open “Motion Manager” window and select the motion command based on the requirement.

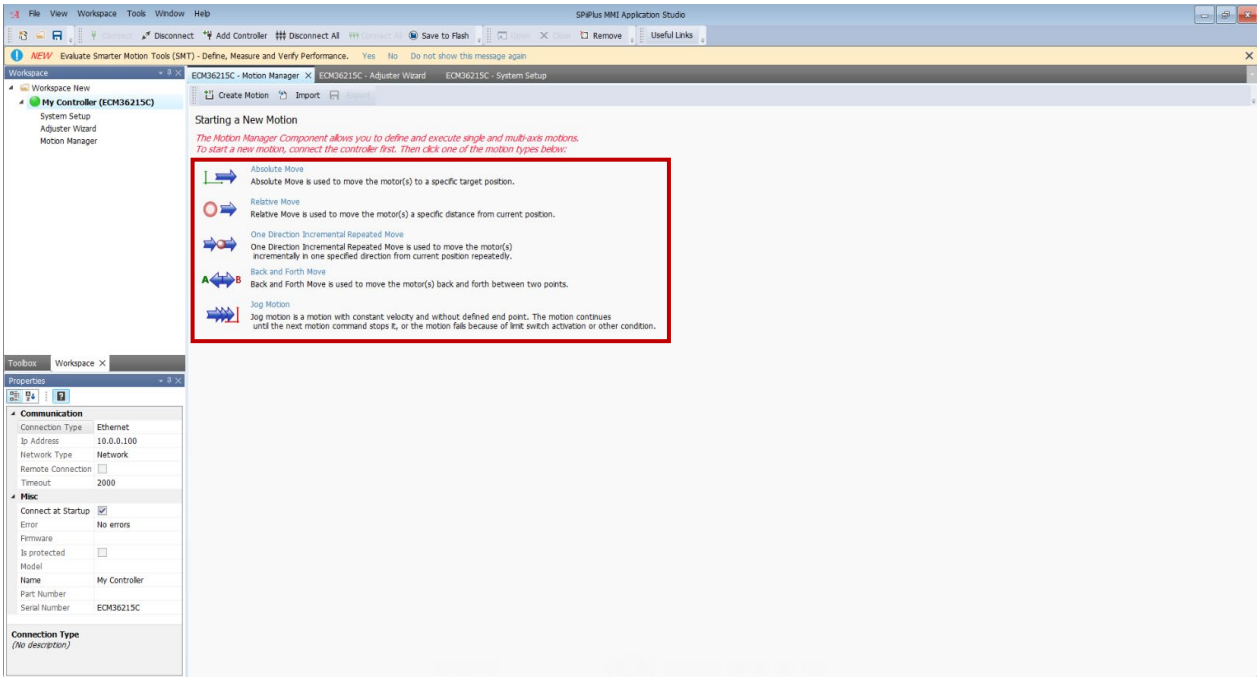

Figure 3.1.2

3.1.1 Jog Motion

1. Select the moving axis, set motion parameters, and click **Enable**.
   Here takes “Axis 0, a velocity of 60 deg/s” as an example.

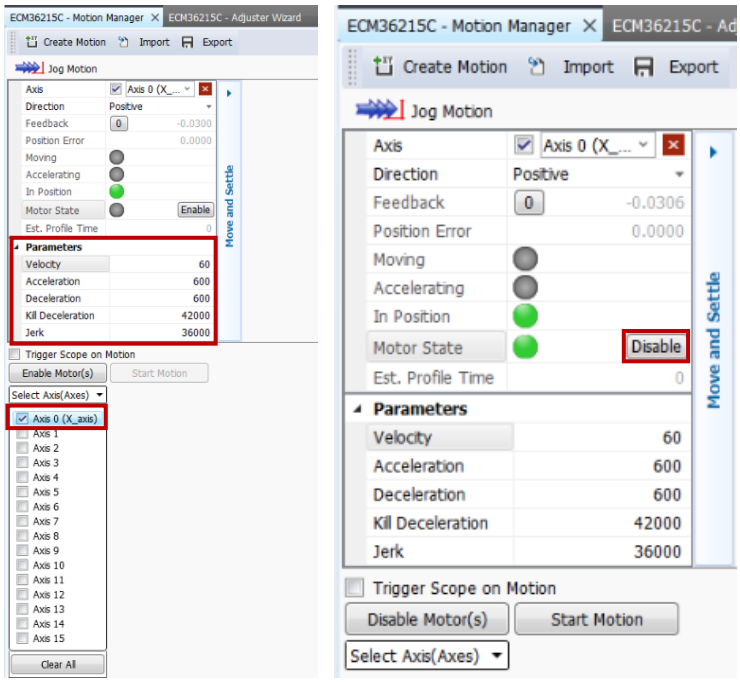

Figure 3.1.1.1

2. Click **Start Motion**. Ensure that the motor performs Jog movement with the velocity of 60 deg/s.

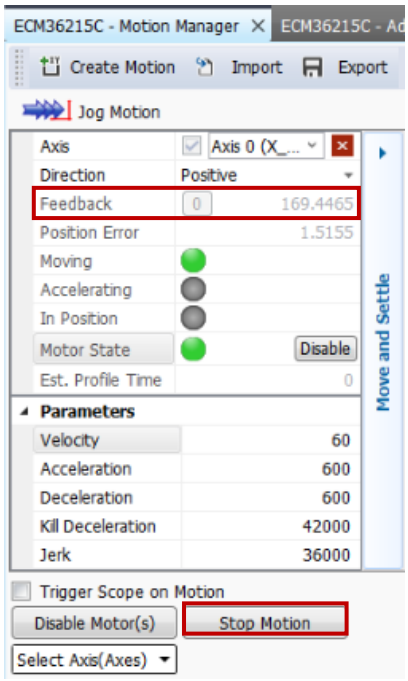

Figure 3.1.1.2

3.1.2 Relative Move

1. Click **Create Motion** and select **Relative Move**.

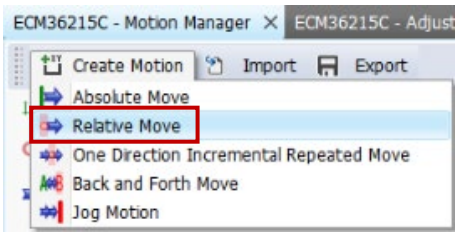

Figure 3.1.2.1

2. Select the moving axis, set motion parameters, and click **Enable**.
   Here takes “Axis 0, a velocity of 60 deg/s, relative move to the position of 360 deg” as an example.

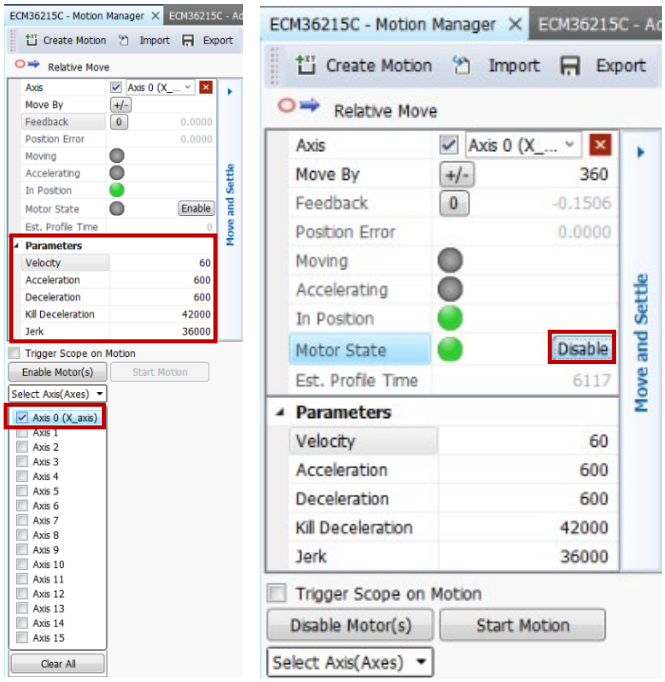

Figure 3.1.2.2

3. Click **Start Motion**. Ensure that the motor performs relative move to the position of 360 deg with the velocity of 60 deg/s.

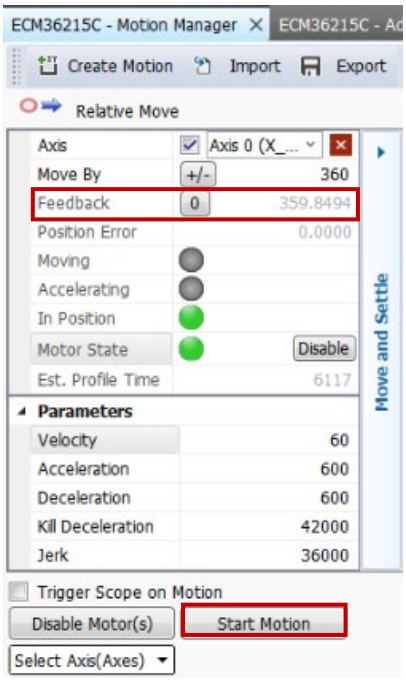

Figure 3.1.2.3

3.1.3 Absolute Move

1. Refer to the step of Relative Move. Click **Create Motion** and select **Absolute Move**.

2. Select the moving axis, set motion parameters, and click **Enable**.
   Here takes “Axis 0, a velocity of 60 deg/s, absolute move to the position of 360 deg” as an example.

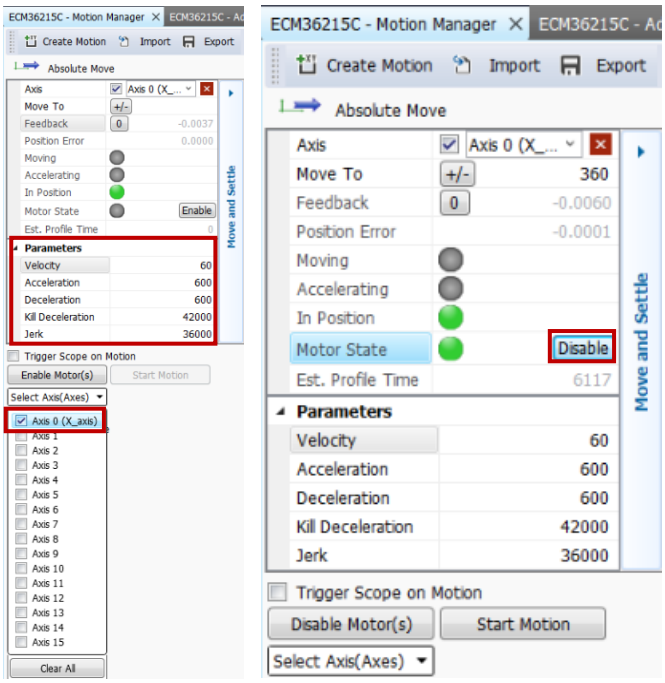

Figure 3.1.3.1

3. Click **Start Motion**. Ensure that the motor performs absolute move to the position of 360 deg with the velocity of 60 deg/s.

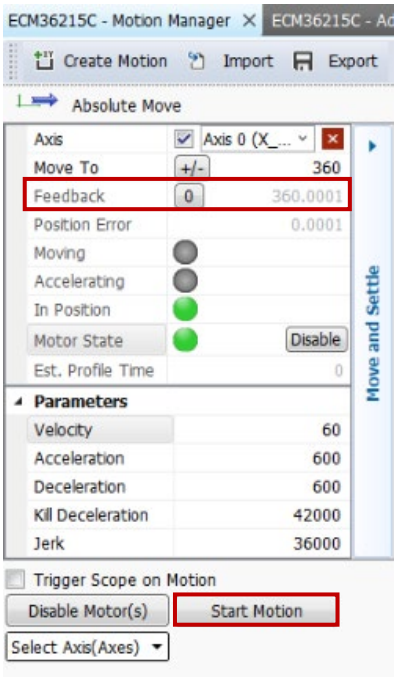

Figure 3.1.3.2

3.2 Homing

To perform homing, the ACSPL+Programming procedure must be used. Please request the homing program file (Single axis homing example.prg) from HIWIN MIKROSYSTEM or copy the following program to Program Manager's Buffer and D-Buffer.

◆ Buffer

```
!Single-axis HIWIN drive homing process ver1.0
!!****** Setting Parameter ******!!
LOCAL INT    X_HmMethod,X_HmType
LOCAL REAL X_HmVel,X_IndVel,X_HmAcc,X_HmOffset,X_CunitDmt,X_CunitNum,X_UnitType,X_Resolution
LOCAL INT    ZONE0
AXISDEF X_axis=0
!!************************************************************ Operation Unit*************************************************************************!!
X_UnitType = 1                                                  ! 0 : Linear(mm). ; 1 : Rotary(deg).
X_CunitNum = 360                                                ! Enter the numerator of basic unit for Hiwin drive base on the X_UnitType parameter.
X_CunitDmt = 4325376                                            ! Enter the denominator of basic unit for Hiwin drive base on the X_UnitType parameter.
!!************************************************ Operation Unit Setup example ***********************************************************!!
!Linear motor with control unit 0.1 um. ***** !Rotary motor with control unit 0.0001 deg.
!X_UnitType = 0                                                 *****    !X_UnitType = 1
!X_CunitNum = 1                                                 *****    !X_CunitNum = 360
!X_CunitDmt = 10000                                             *****    !X_CunitDmt = 3600000
!!************************************************************ Basic Settings *************************************************************************!!
X_HmMethod = 33                                                 ! Enter the supported homing method.
X_HmType = 0                                                    ! 0 : HIWIN drive internal homing. ; 1 : Touch probe homing.
X_HmOffset = 0                                                  ! Homing offset base on the X_UnitType parameter.
X_HmVel = 30                                                    ! Homing Velocity for finding home sensor base on the X_UnitType parameter.
X_IndVel = 10                                                   ! Homing Velocity for finding home position base on the X_UnitType parameter.
X_HmAcc = 300                                                   ! Homing acceleration base on the X_UnitType parameter.
!!*****************************************************************************************************************************************************!!
!!************************************************************ Main program ***************************************************************************!!
FCLEAR X_axis
CALL ECATInOutOffset
CALL X_DetectDriverError
MFLAGS(X_axis).#HOME=0
IF X_HmType=0                                                   ! HIWIN drive internal homing.
        CALL InterHmProc
ELSE
        CALL TouchProbeHmProc                                   ! Touch probe homing.
END
DISP "Disable X_axis error compensation."
ERRORUNMAP X_axis, ZONE0
CALL RstMapping
ENABLE X_axis
TILL MST(X_axis).#ENABLED
WAIT 500
DISP"Axis is moving to home position....."
PTP/EV X_axis,0,X_HmVel
MFLAGS(X_axis).#HOME=1
FDEF(X_axis).#LL = 1
FDEF(X_axis).#SRL = 1
FDEF(X_axis).#SLL = 1
DISP"Axis Homing successful!!"
STOP
!!*****************************************************************************************************************************************************!!
!!************************************************************ InOut mapping **************************************************************************!!
ECATInOutOffset:
IF X_HmType = 0
        ECIN (ECGETOFFSET("Statusword",X_axis),X_StatusWord)
        ECIN (ECGETOFFSET("Error code",X_axis),X_ErrorCode)
        ECIN (ECGETOFFSET("Mode of operation display",X_axis),X_ModeOperDisp)
        ECOUT (ECGETOFFSET("Controlword",X_axis),X_ControlWord)
        ECOUT (ECGETOFFSET("Mode of operation",X_axis),X_ModeOper)
ELSE
        ECOUT (ECGETOFFSET("Touch probe function",X_axis),X_TouchProbFun)
END
RET
STOP
RstMapping:
ECUNMAPIN (ECGETOFFSET("Statusword",X_axis))
ECUNMAPIN (ECGETOFFSET("Error code",X_axis))
ECUNMAPIN (ECGETOFFSET("Mode of operation display",X_axis))
ECUNMAPOUT (ECGETOFFSET("Controlword",X_axis))
ECUNMAPOUT (ECGETOFFSET("Mode of operation",X_axis))
ECUNMAPOUT (ECGETOFFSET("Touch probe function",X_axis))
RET
!!*****************************************************************************************************************************************************!!
!!************************************************************ Drive internal homing process **********************************************************!!
InterHmProc:
DISABLE X_axis
TILL ^MST(X_axis).#ENABLED
WAIT 500
FDEF(X_axis).#LL = 0                                                    ! Motor is not disable when left limit signal rising.
FDEF(X_axis).#SRL = 0                                                   ! Disable software right limit response.
FDEF(X_axis).#SLL = 0                                                   ! Disable software left limit response.
ERRORUNMAP X_axis, -1                                                   ! Close all axis error compensation.
X_Resolution=1/(X_CunitNum/X_CunitDmt)
```

```
IF X_UnitType = 0                                                    ! Linear type
        DISP"Linear resolution is %g (cunit/mm)!!", X_Resolution;
ELSE                                                                 ! Rotary type
        DISP"Rotary resolution is %g (cunit/deg)!!", X_Resolution;
END
COEWRITE/1 (X_axis,0x6098,0,X_HmMethod)
COEWRITE/4 (X_axis,0x6099,1,X_HmVel/(X_CunitNum/X_CunitDmt))
COEWRITE/4 (X_axis,0x6099,2,X_IndVel/(X_CunitNum/X_CunitDmt))
COEWRITE/4 (X_axis,0x609A,0,X_HmAcc/(X_CunitNum/X_CunitDmt))
COEWRITE/4 (X_axis,0x607C,0,X_HmOffset/(X_CunitNum/X_CunitDmt))
X_ModeOper = 6                                                       ! Switch to homing mode
TILL X_ModeOperDisp=6                                                ! Homing mode switch done
WAIT 100
X_ControlWord=6
TILL X_StatusWord.0=1
WAIT 600
X_ControlWord=7
TILL X_StatusWord.0=1 & X_StatusWord.1=1
X_ControlWord=15
TILL X_StatusWord.0=1 & X_StatusWord.1=1 & X_StatusWord.2=1          ! Enabled
WAIT 100
X_ControlWord=31                                                     ! Start internal homing (Controlword Bit 4)
TILL (X_StatusWord.12=1 & X_StatusWord.10=1)|X_StatusWord.13=1       ! Home Finished
IF X_StatusWord.13=1
        CALL X_HomeFail
END
SET FPOS(X_axis) = COEREAD/4 (X_axis,0x6064,0)*(X_CunitNum/X_CunitDmt)
X_ControlWord=0
X_ModeOper=8                                                         ! Switch to CSP mode
TILL X_ModeOperDisp=8                                                ! CSP mode switch done
CALL RstMapping
WAIT 500
DISABLE X_axis
TILL ^MST(X_axis).#ENABLED
RET
STOP
!!*****************************************************************************************************************************************************!!
!!************************************************************ Touch probe homing process ************************************************************!!
!!Search for negative limit switch in reverse direction to find the index
TouchProbeHmProc:
DISABLE X_axis
TILL ^MST(X_axis).#ENABLED
WAIT 500
MFLAGS(X_axis).#OPEN = 0                                             ! Close loop control.
ERRORUNMAP X_axis, -1                                                ! Close all axis error compensation.
MFLAGS(X_axis).#GANTRY = 0                                           ! Turn off gantry mode (MFLAGS.25).
FDEF(X_axis).#SRL = 0                                                ! Disable software right limit response.
FDEF(X_axis).#SLL = 0                                                ! Disable software left limit response.
FDEF(X_axis).#LL = 0                                                 ! Motor is not disable when left limit signal rising.
ENABLEX_axis
TILL MST(X_axis).#ENABLED
WAIT 500
DISP"Start to find the left limit....."
JOG/V X_axis,-X_HmVel                                                ! Find the left limit in negative direction.
TILL (COEREAD/4 (X_axis,0x60FD,0)& 1) = 1
HALT X_axis                                                          ! if reach left limit , stop motion
DISP"Already found the left limit!!"
WAIT 100
DISP"Start to leave the left limit....."
JOG/V X_axis,X_IndVel
TILL (COEREAD/4 (X_axis,0x60FD,0)& 1) = 0
DISP"Already leave the left limit!!"
X_TouchProbFun = 0                                                   ! Reset touch probe funtion
WAIT 200
X_TouchProbFun = 21                                                  ! Start touch probe function
WAIT 200
DISP"Start to find the index in positive direction....."             ! Find the index in positive direction
TILL (COEREAD/2 (X_axis,0x60B9,0) = 3)                               ! Stop motion when index position is reached.
HALT X_axis
TILL ^MST(X_axis).#MOVE
DISP"Already found the index!!"
SET FPOS(X_axis) = (COEREAD/4 (X_axis,0x6064,0) - COEREAD/4 (X_axis,0x60BA,0))*(X_CunitNum/X_CunitDmt) + X_HmOffset        !Set index position as zero.
RET
STOP
!!*****************************************************************************************************************************************************!!
!!************************************************************** Error detection**********************************************************************!!
X_DetectDriverError:
IF X_ErrorCode<>0
        DISP "Drive has error %x , Please check the driver",X_ErrorCode
        CALL X_HomeFail
END
RET
STOP
X_HomeFail:
DISP"Homing process fail. "
HALT X_axis
X_ControlWord=0
WAIT 100
X_ModeOper = 8
TILL X_ModeOperDisp=8
WAIT 100
CALL RstMapping
STOP
```

◆ D-Buffer

```
GLOBAL INT X_TouchProbFun,X_StatusWord,X_ControlWord,X_ModeOper,X_ModeOperDisp,X_ErrorCode
global int I(100),I0,I1,I2,I3,I4,I5,I6,I7,I8,I9,I90,I91,I92,I93,I94,I95,I96,I97,I98,I99
global real V(100),V0,V1,V2,V3,V4,V5,V6,V7,V8,V9,V90,V91,V92,V93,V94,V95,V96,V97,V98,V99
```

3.2.1 Program Manager

1. Right-click **My Controller** and select **Add Component→Application Development→Program Manager**.

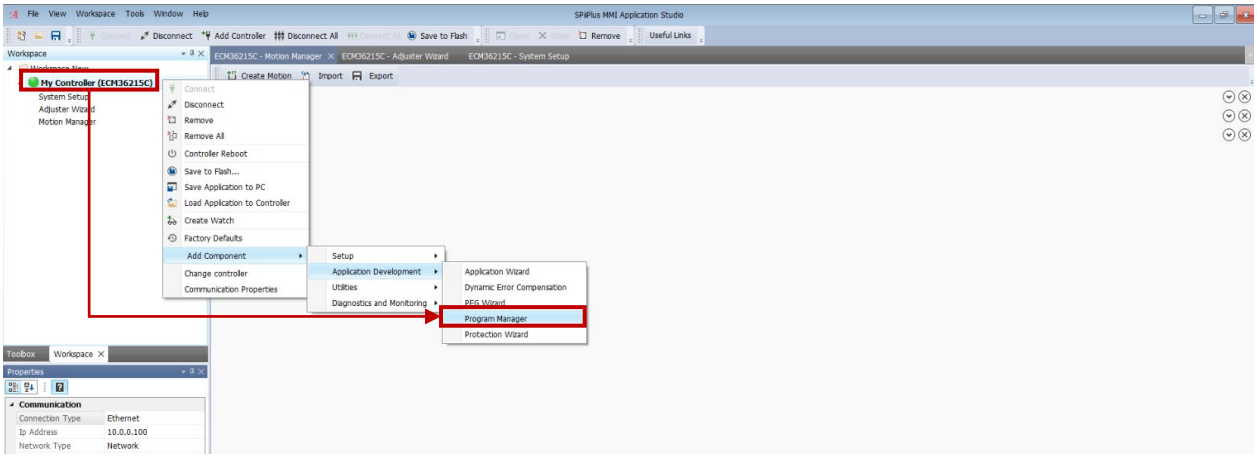

Figure 3.2.1.1

2. Click Program Manager's "Load from File" icon, select the homing program file, and click **Load**.

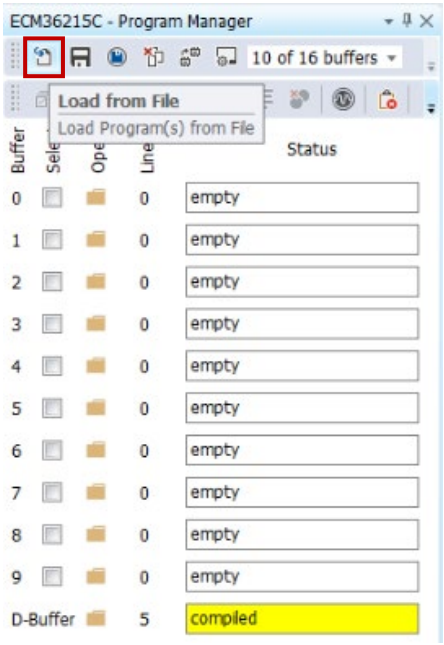

Figure 3.2.1.2

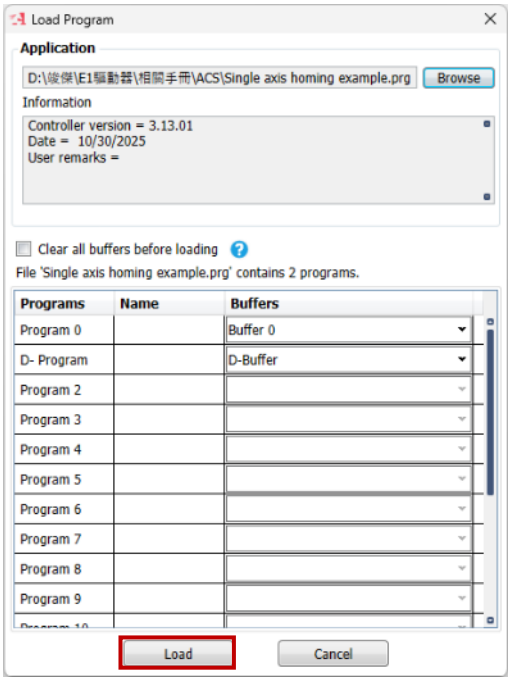

Figure 3.2.1.3

3. Click **OK** to load the homing program file.

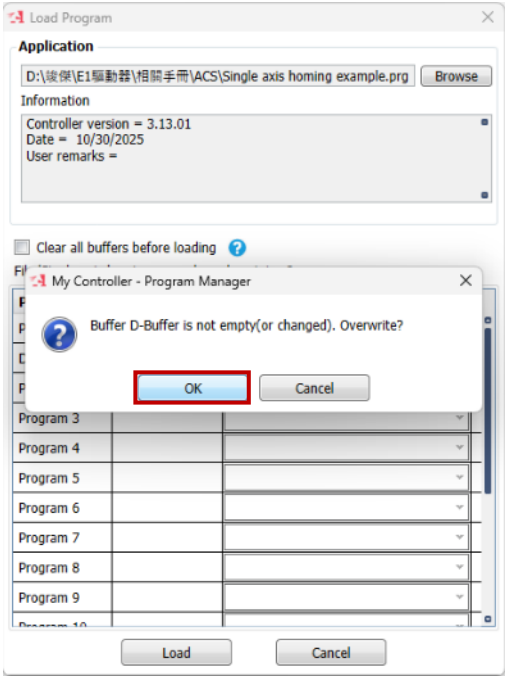

Figure 3.2.1.4

3.2.2 Communication Terminal

1. Right-click **My Controller** and select **Add Component→Utilities→Communication Terminal**.

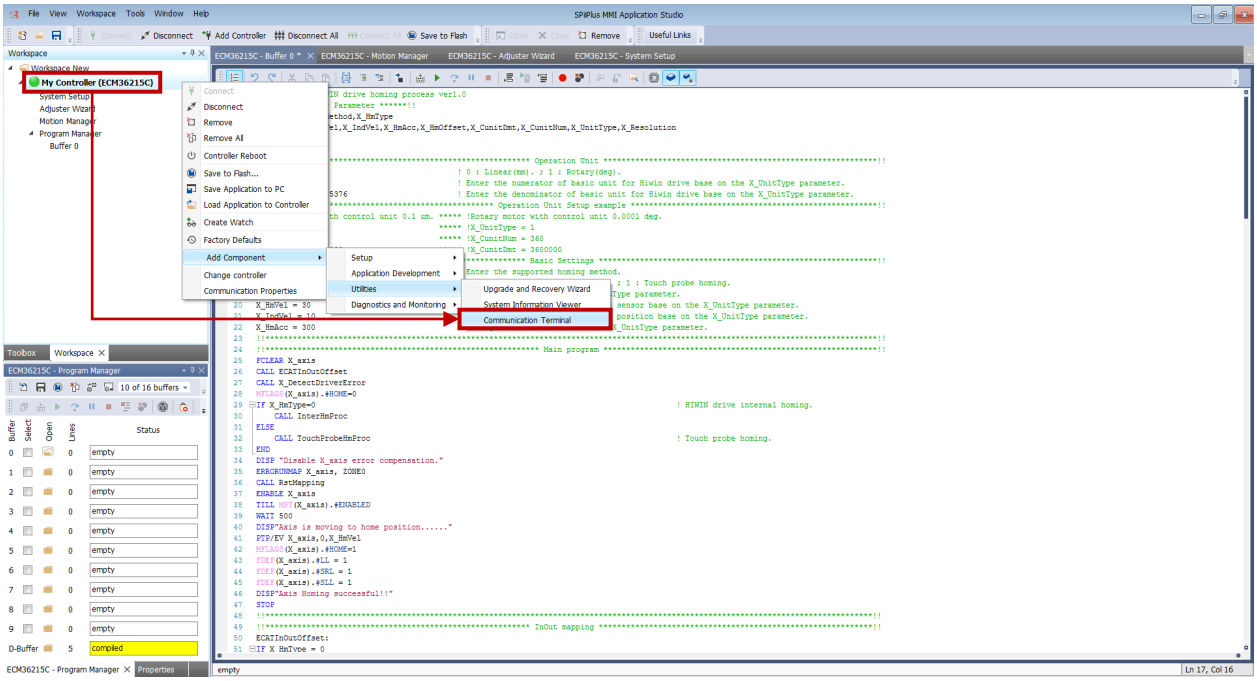

Figure 3.2.2.1

2. After successfully opening Communication Terminal, set Show Messages to **On**.

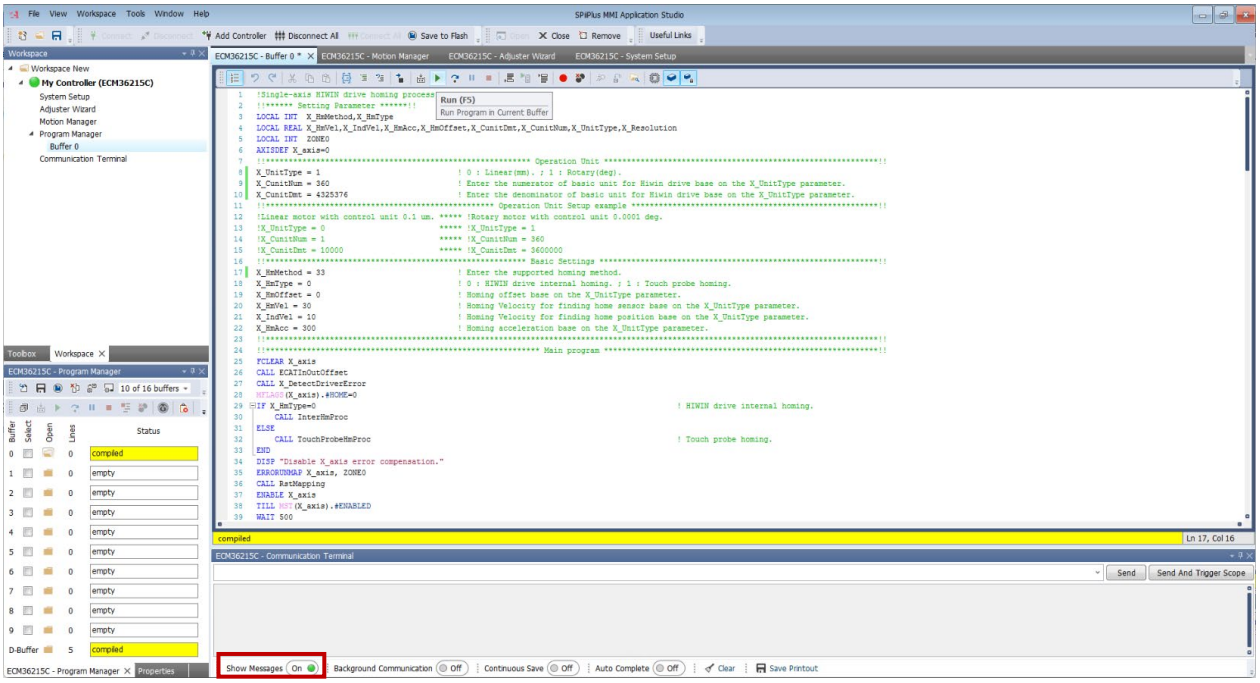

Figure 3.2.2.2

3.2.3 Execute homing

1. Click Program Manager's "Buffer" icon to complete homing's parameters setup and execute compilation. Here takes "DMS03 motor, a resolution of 4325376 cnt/rev, drive's internal homing method 33" as an example.

   Note:

   (1) Correctly set X_UnitType, X_CunitNum, X_CunitDmt, X_HmMethod, and X_HmType; otherwise, homing conditions may differ from the expected motion conditions.

   (2) "mm" is for linear unit; "deg" is for rotary unit. Set motion conditions with this fixed unit.

   (3) Set X_CunitNum and X_CunitDmt based on the drive's control unit. Refer to the homing program for the setting example.

   (4) X_HmType = 0 indicates the drive's internal homing; X_HmType = 1 indicates Touch Probe homing.

   (5) Do not key in the method unsupported by the drive's internal homing to X_HmMethod. The example of Touch Probe homing is fixed: search for Index position in the reverse direction after touching the negative limit.

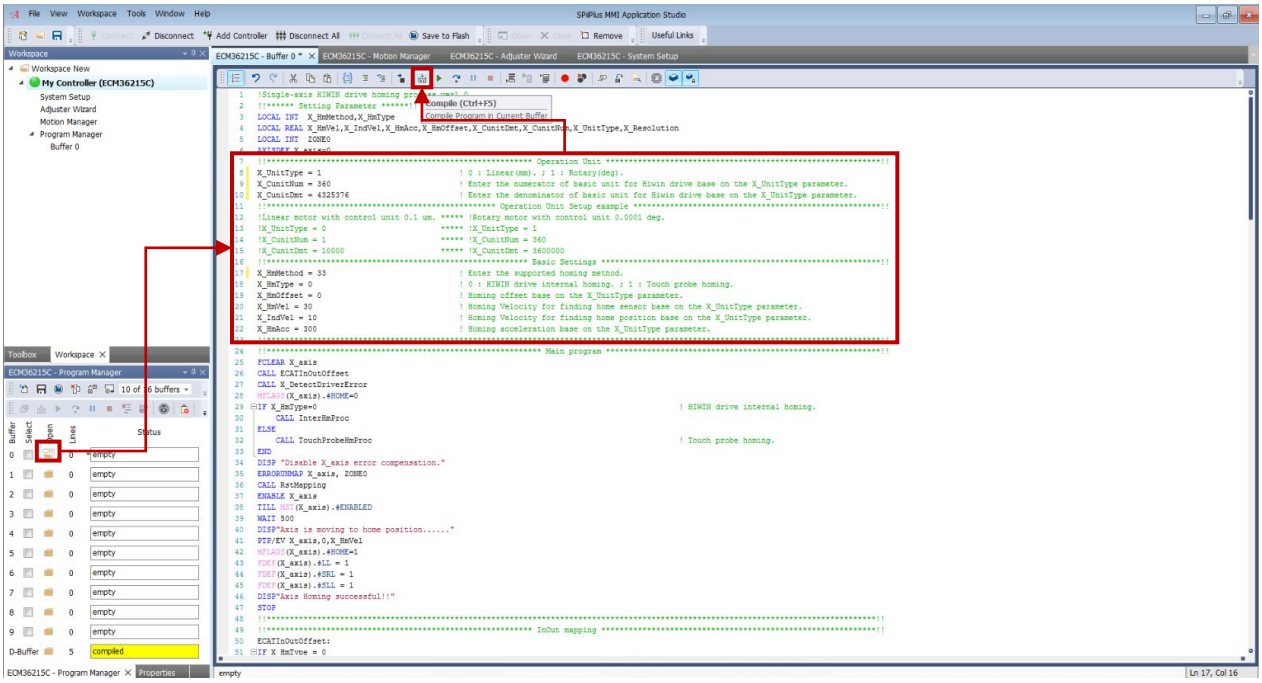

Figure 3.2.3.1

2. Click “Run” icon to start homing.

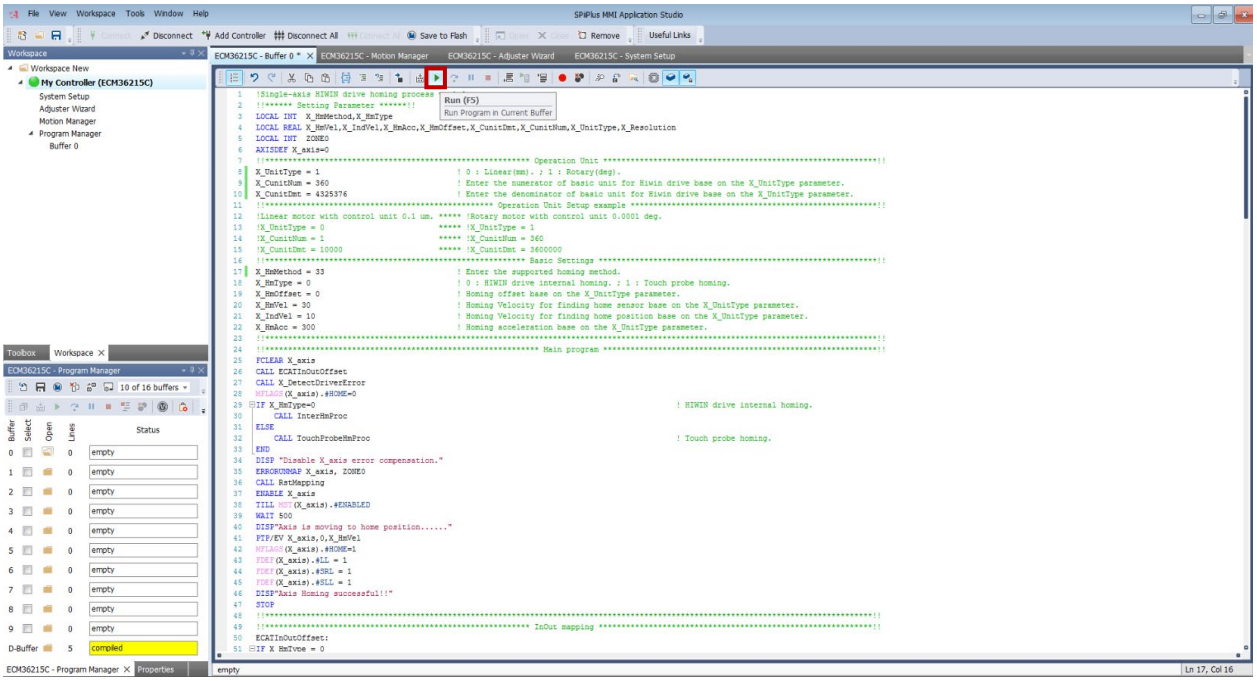

Figure 3.2.3.2

3. Homing starts. Use Communication Terminal to ensure that homing is successfully executed and that the motor has indeed returned to the home position.

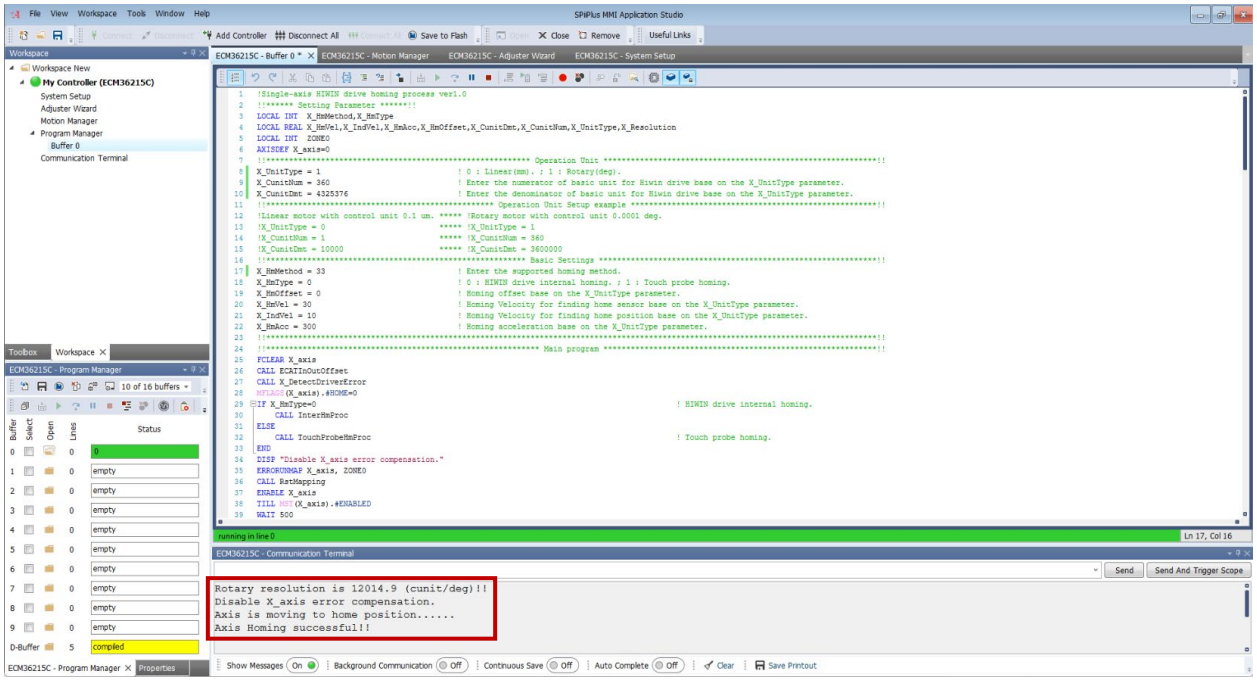

Figure 3.2.3.3

4. Read/Write Object Parameters

4.1 Read object parameters

EtherCAT communication objects can be read via COEREAD command in ACSPL+Commands. Refer to ACS's Knowledge Center for detailed command description.

1. Open Program Manager's Buffer and key in COEREAD command to read the object value. Here takes "reading drive parameter Pt100" as an example.

```
DISP "Pt100=%d",COEREAD/2 (0,0x2100,0);
STOP
```

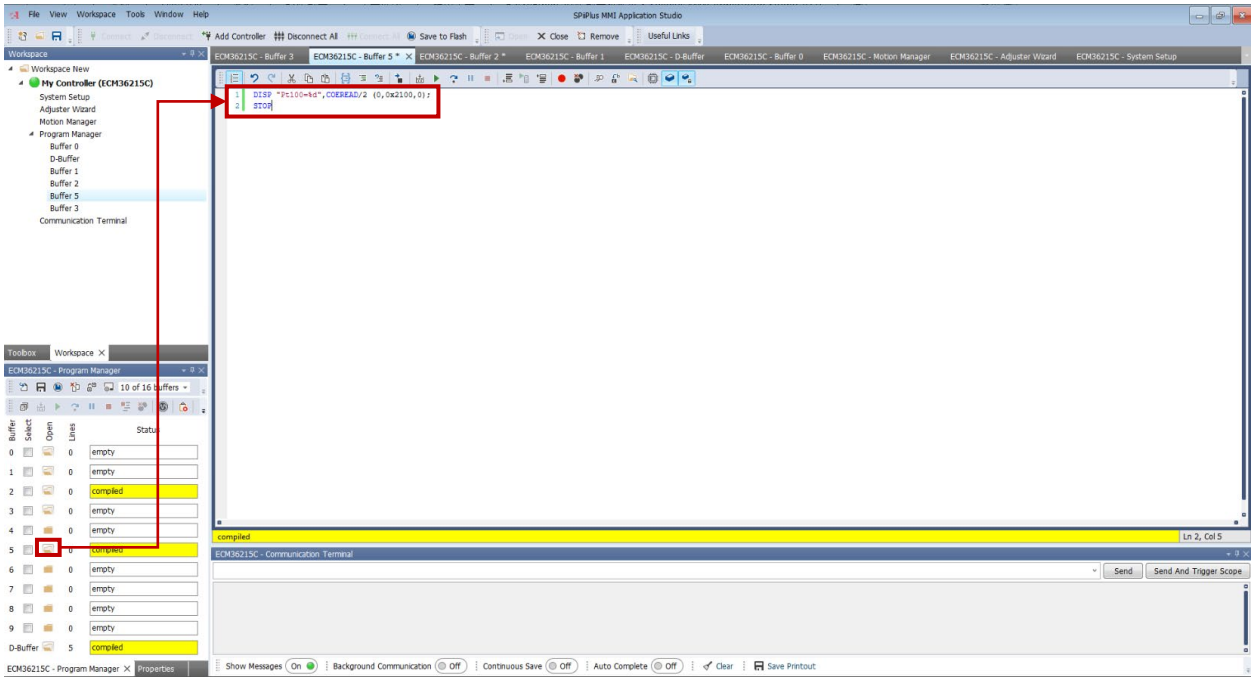

Figure 4.1.1

2. Compile it and click “Run” icon. The object value will be displayed in Communication Terminal.

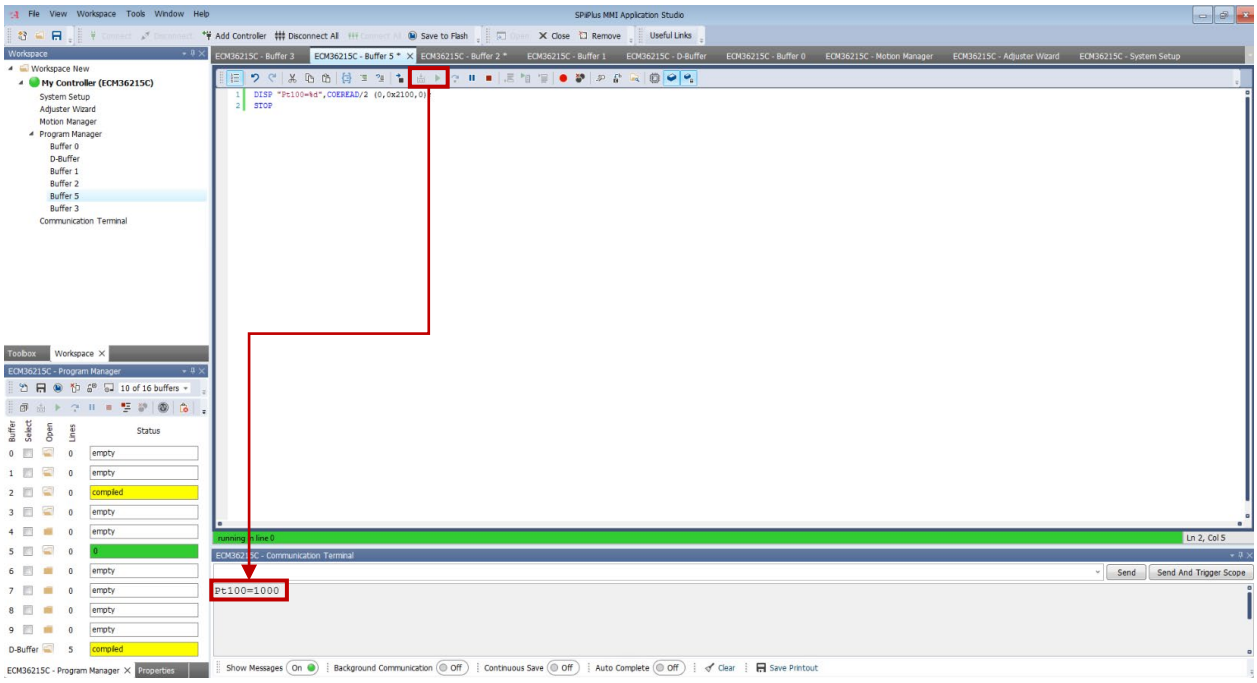

Figure 4.1.2

4.2 Write object parameters

EtherCAT communication objects can be written via COEWRITE command in ACSPL+Commands. Refer to ACS's Knowledge Center for detailed command description.

1. Open Program Manager's Buffer and key in COEWRITE command to modify the object value. Here takes "modifying drive parameter Pt100" as an example.

```
COEWRITE/2 (0,0x2100,0,1000)
STOP
```

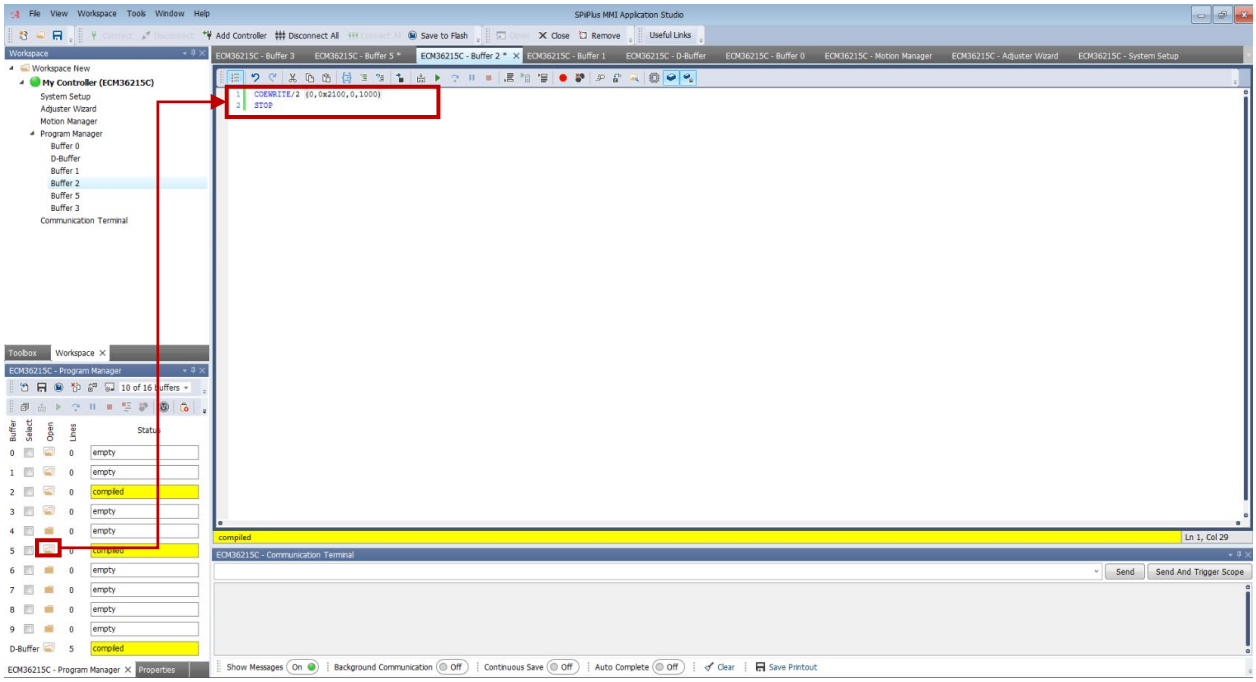

Figure 4.2.1

2. Compile it and click “Run” icon. Ensure that the value of parameter Pt100 has been correctly modified. The command of reading object parameters can be used for verification.

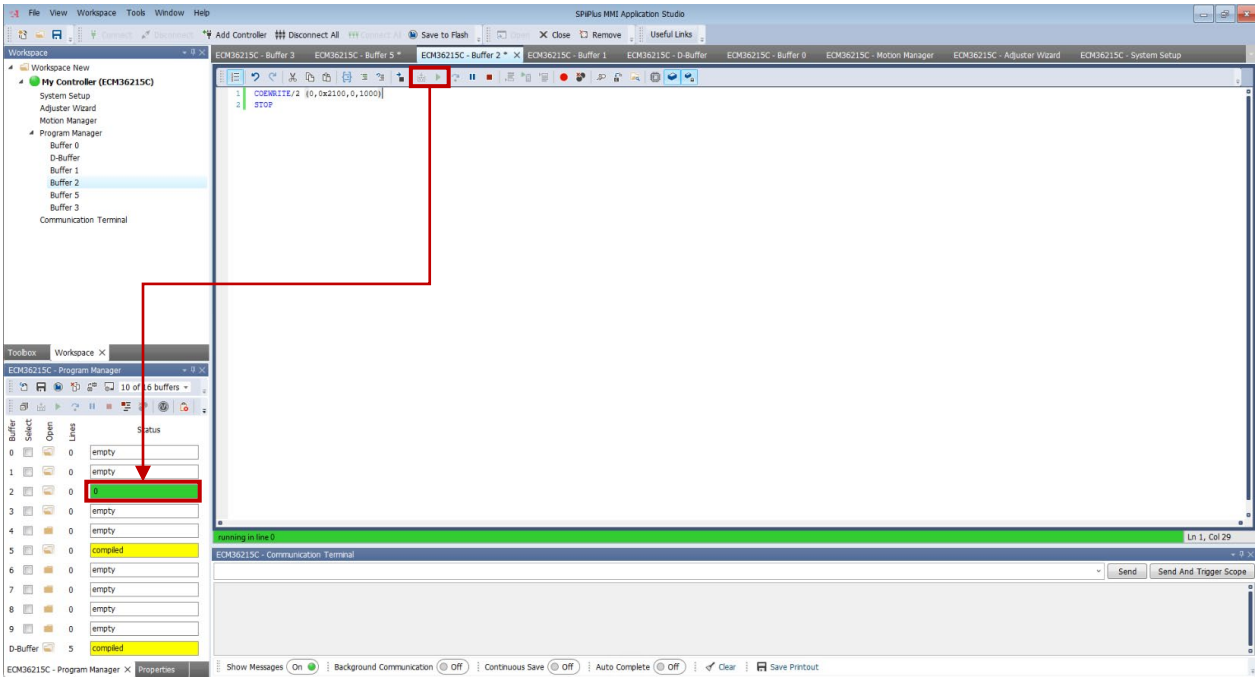

Figure 4.2.2