Application Note

AC500 PLC and ABB ACS355 Drive via Modbus TCP/IP with ABB Standard Library

1 Description

This application note will take you through the hardware installation and configuration of ABB ACS355 Drives and eCo PLC in order to prepare for Modbus TCP/IP protocol control. AC500 ABB-specific ready-made function blocks and visualizations from the PS553- DRIVES library will be used for the control of the drives.

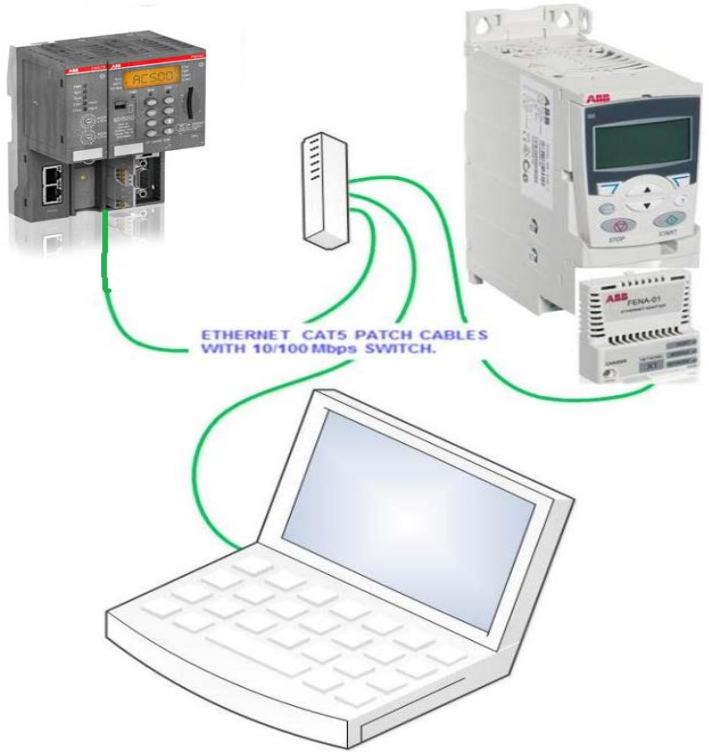
2 Objectives:

In this aplication note, we use an AC500 eCo PLC and ACS355 drive with Modbus TCP/IP communication. The personal computer will connect to PLC and drive via unmanaged switch box. The eCo PLC controls drive via Modbus TCP/IP connection.

Equipment List

Description	*Quantity*
PC with AB V1.0 software installed	1
ABB eCo CPU PM556 ETH CPU	1
CAT5 Ethernet Patch cable	3
FENA-01 Fieldbus module	1
Unmanaged switch	1

3 Connection diagram



1. Install the FENA-01 field bus module into this ACS355 drive
2. Connect the Ethernet cable from PC to PM583 ETH CPU to unmanaged switch box
3. Connect the Ethernet cable from ACS355 drive's FENA-01 to unmanaged switch box

4 ACS355 drive's parameter setup

All parameter settings are based on drive default settings. If the drive has been parameterized previously, return to default settings before continuing. It can be done by:

Changing macro (and then changing back again) in parameter 99.02 for ACS355 drive

- Power up the drive
- Enter/verify the parameters as shown below

Minimum required parameter settings (based on factory default)

Parameter	Description	Setting	Comment
98.02	COMM PROT SEL	EXT FBA	Activates fieldbus module
51.01	FBA TYPE	ETHERNET	Type of the connected fieldbus module. Read only
51.02	PROTOCOL / PROFILE	1	0=ModbusTCP ABB Drives profile classic 1= ModbusTCP ABB Drives profile enhanced
51.03	COMMRATE	0	Bit rate for the Ethernet interface.
51.04	IP CONFIGURATION	0 (Static IP)	Sets the method for configuring the IP address. 0 = Disable DCHP –>static IP address
51.05	IP ADDRESS 1	[IP address 1]	192
51.06	IP ADDRESS 2	[IP address 2]	168
51.07	IP ADDRESS 3	[IP address 3]	3
51.08	IP ADDRESS 4	[IP address 4]	66
51.09	SUBNET CIDR	[Subnet	24 = 255.255.255.0
54.01		102	Speed (rpm)
54.02		104	Current (A)
54.03		105	Torque (%)
54.04		106	Power kW
51.20	MODBUS/TCP TIMEOUT	20 *)	Timeout = (MODBUS/TCP Timeout value) * 100 milliseconds.*) 20 = 2 seconds
51.27	REFRESH	1	Updates fieldbus settings (groups 51 to 55)

10.01	EXT 1	COMM	Fieldbus interface as source for start and stop
11.02	EXT1/EXT2 SEL	COMM	Fieldbus interface as source to switch to EXT2
11.03	REF1 SELECT	COMM	Fieldbus interface as source for speed reference
16.04	FAULT RESET SEL	COMM	Fieldbus interface as source for fault reset
11.05	REF1 MAX		Max speed/frequency scaling value. Must be less or equal

5 Create new PLC project in Automation Builder software tool:

5.1 Double click on ABB Automation Builder software tool icon on the desktop.

(If Automation Builder icon is not available on your desktop, click **Start**, go to **All Programs**, select **ABB** folder and click on **Automation Builder** software tool.)

5.2 The Automation Builder Screen will appear as shown below, if Internet access is available Automation Builder will show the default ABB homepage for PLC products

5.3 Create a new project by clicking the New button or selecting the **File > New Project**

5.4 Enter project name as shown in example below: **AC500 and ACS355 with Modbus RTU project**

5.5 Select the location to store the project in PC

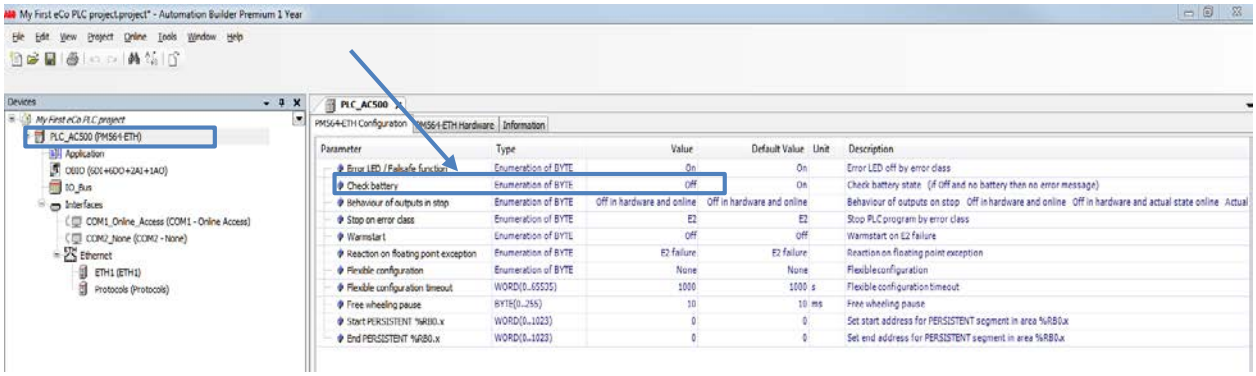
5.6 Select **OK** to start the project

6 Specifying the hardware configuration:

To specify the hardware configuration, the I/Os and their symbolic names have to be defined. Configure your I/O by double clicking I/O (Onboard I/Os) and refer to the mapping tab window opened on the right side where you can give variable names to each I/O points.

6.1 Double click AC500 (PM564-ETH) on the left to open this hardware menu

6.2 Change the value of Check battery from **ON** to **OFF** (if no battery present for this example)



7 Setup the Ethernet communication in Windows:

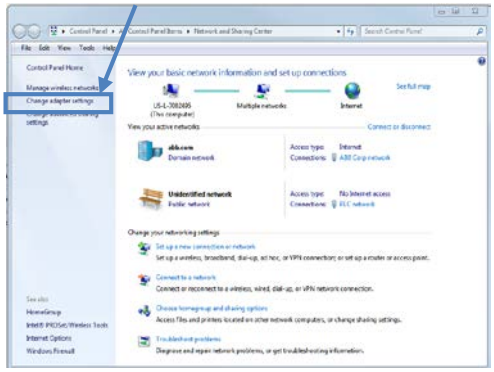
Before you are able to download the compiled program the first time from the PC to the PLC, you have to setup the communication parameter. There are two options you can use to login to the PLC, either with Ethernet or serial with TK503 USB cable.

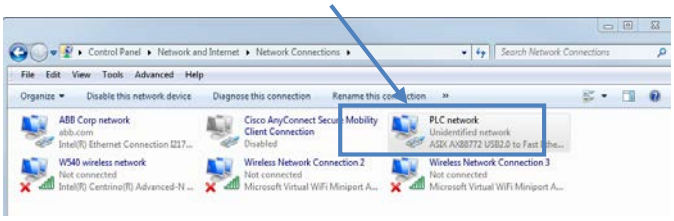
For this exercise, we are using Ethernet connection for online access to this PLC.

Make sure that your PC address is in the same class as the CPU's IP address. The factory setting of the CPU for IP address is **192.168.0.10.** Then the IP of the PC should be **192.168.0.x**, **x** should be different number than **10** so that it will not have an IP conflict with the CPU. Subnet mask should be **255.255.255.0.**

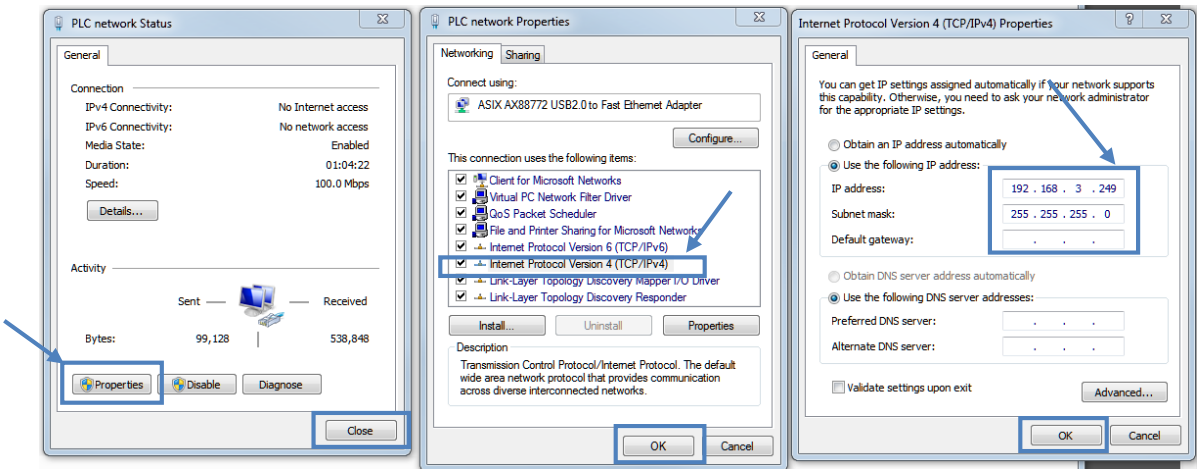
To change the IP address in your PC:

7.1 Windows Control Panel > Network and Internet > Network and Sharing Center
7.2 Click on Change adapter settings
7.3 Select Local Area Connection (in this example is PLC network connection below) and right click it to open the menu.



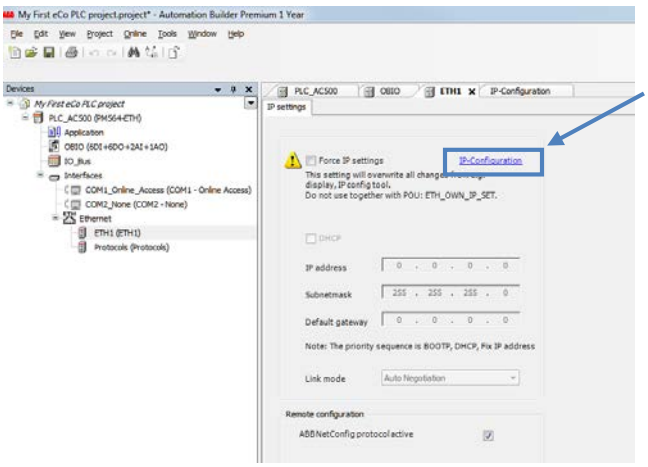


Choose Properties (the status is active when the Ethernet connection between PC and PLC is active)
7.4 Select Internet Protocol Version 4 (TCP/IPv4) and double click to see properties.
7.5 Type in your desired IP address and subnet mask then click OK.

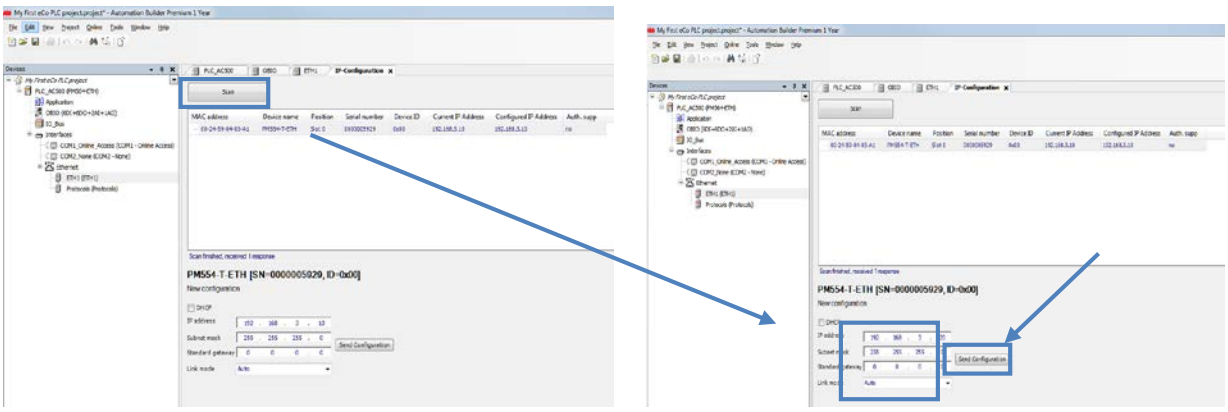


8 Setup the IP address in Automation Builder software:

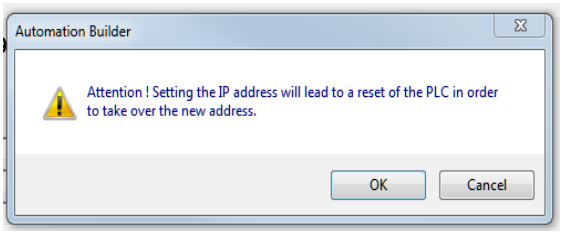
8.1 Make sure the CPU's RUN switch is STOP position
8.2 Click IP-Configuration to access Scan tool



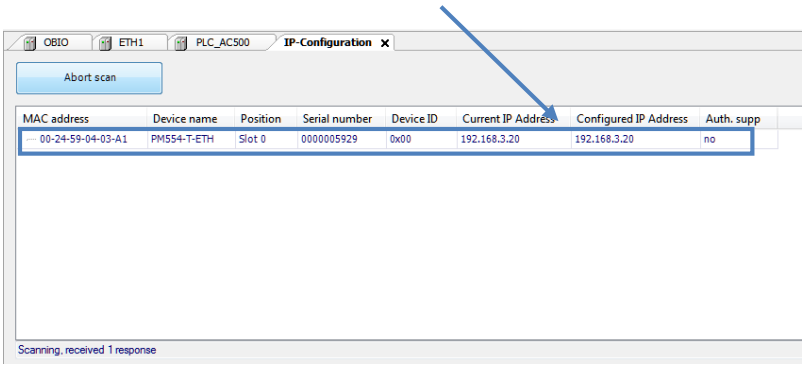
8.3 Click on Scan button for searching active PLC on the network
8.4 Highlight the active IP address in the search window
8.5 Change the IP address to new IP address such as **192.168.3.20**
8.6 Click on Send Configuration button to send new IP address to PLC.



- The warning message window display is shown below for this change.
- This screen shows the progress of IP address settings is sending to CPU. Wait about 30 seconds for CPU to register new IP address (the RUN and ERR lights are flashing during this process).
- Click OK to accept this new IP address for this CPU.



- Press "**Scan**" button again to verify the IP address of CPU. This window shows the Configured IP address sent to CPU successfully. This IP address will be used in IEC 61131-3 CoDeSys to download your PLC project to CPU.

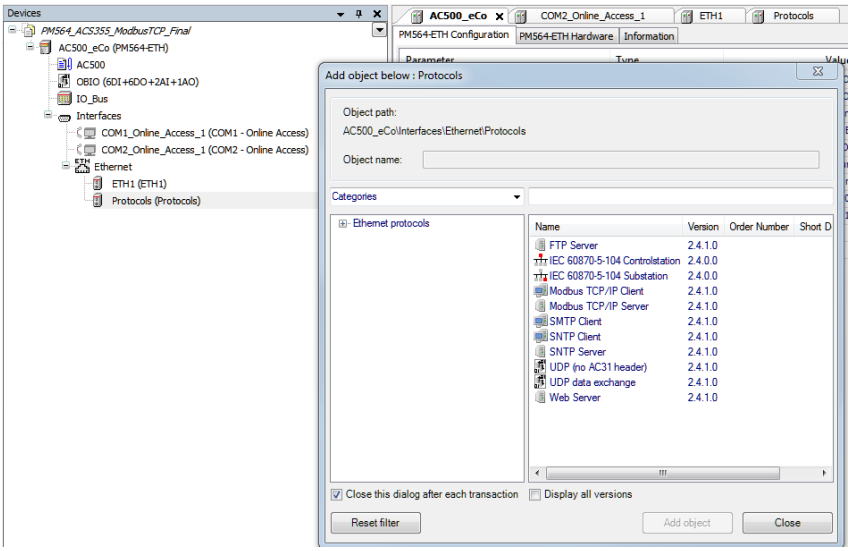


8.7 Click **File > Save Project** to save the configuration settings for this lab.
8.8 Right on **AC500** > **Create Configuration data** to save the settings before go to CoDeSys window.

9 Modbus TCP/IP configuration:

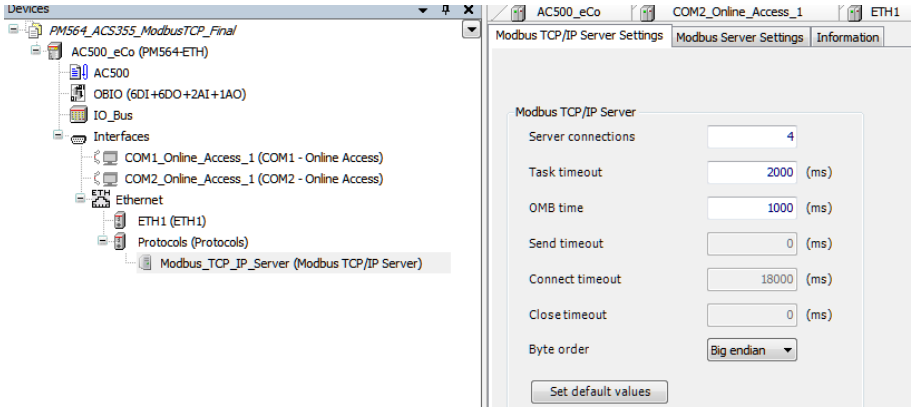
9.1 Right click on **Protocols** > **Add object** to access Protocols menu

9.2 Select Modbus TCP/IP Server for this connection



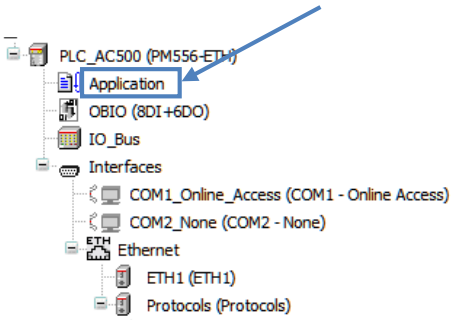
9.3 Set Server connections = 4.

Note: Server Connections are for Maximum number of logical parallel connections, that are kept for connection requests by clients in operation mode as server.

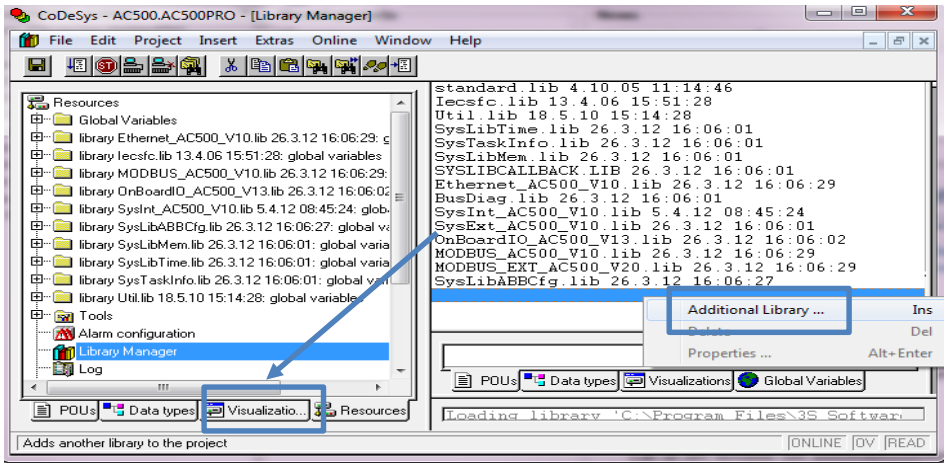


10 IEC61131-3 Application (CoDeSys):

10.1 Double-click "**Application**" from the Device tree in Automation Builder project to access the IEC61131-3 application (CoDeSys)



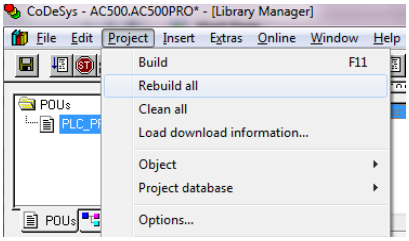
10.2 Open the Library Manager by double-clicking "**Library Manager**" from "**Resources**" tab
10.3 Right-click in the library field and choose "**Additional Library**"



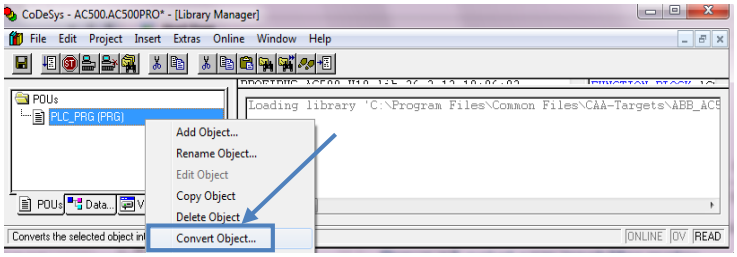
10.4 Select the "ACSDrivesBase_AC500_V20.lib" and "ACSDrivesComModTCP_AC500_V22.lib" from the PS553-DRIVES folder (under the standard CODESYS library folder)
10.5 Click "**Open**" to add the libraries to the project

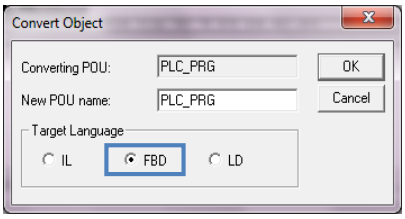
Create new PLC logic in FBD (Function Block Diagram)

10.6 Compile your project, choose "**Rebuild all**" from the "Project" menu.

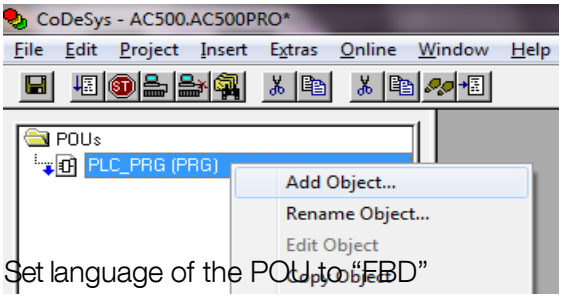


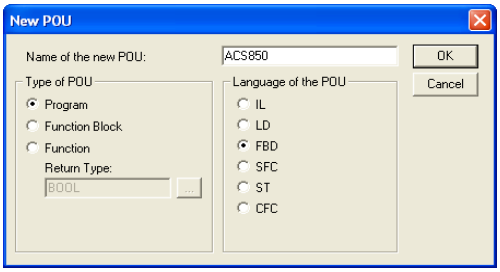
10.7 Right-click "**PLC_PRG**" in the "POUs" tab
10.8 Choose "**Convert Object**"
a. Choose Target Language **"FBD"**
10.9 Click **"OK"**





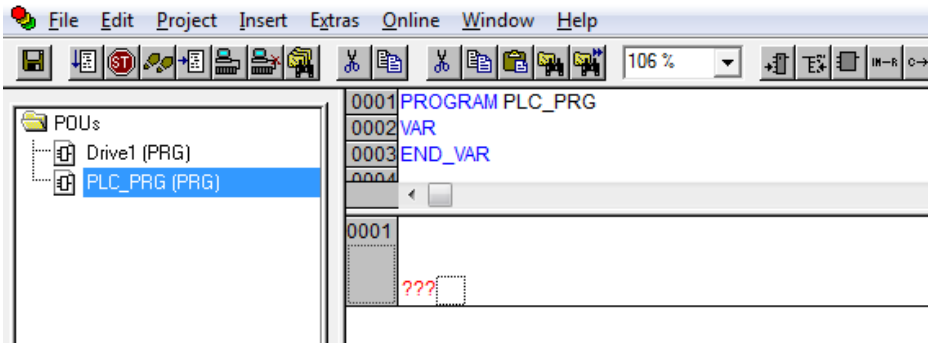
10.10 Right-click in the POUs field and choose "**Add Object**"
10.11 Set Type of POU to "Program"



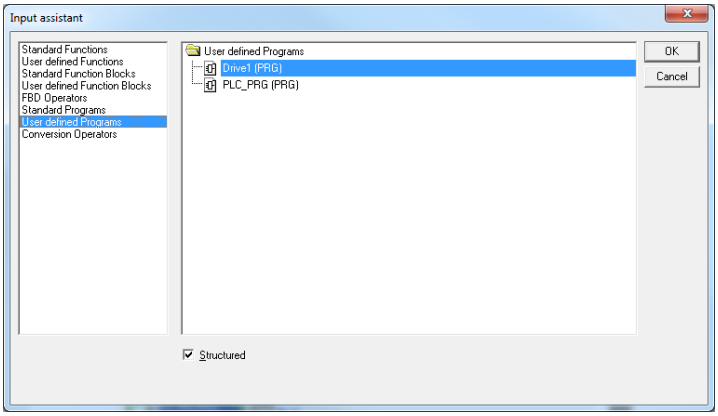


10.12 Set language of the POU to "FBD"

10.13 Name the Program and click “OK” e.g. “**Drive1**”
10.14 Double-click “**PLC_PRG**” to open the main program
10.15 Select the dotted box in Network 0001
10.16 Right-mouse Click to insert a box



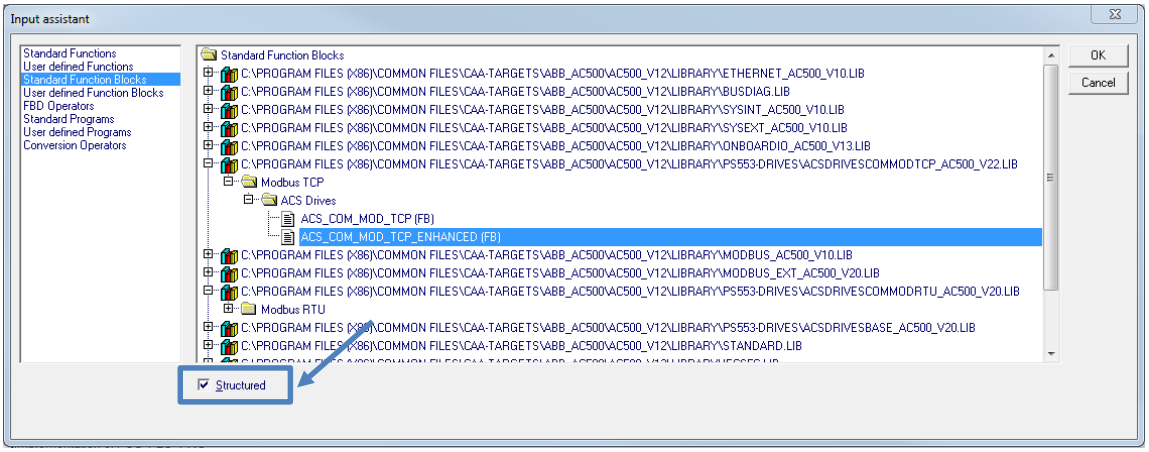
10.17 Press the F2 key and select your program from the list as shown below



11 ACS_COM_MOD_TCP Function Block Creation

11.1 Double-click your new program: **Drive1**
11.2 Add a box
11.3 Press F2 while the block title is selected
11.4 Choose “**ACS_COM_MOD_TCP_ENHANCED**” from “Standard Function Blocks”,
11.5 Click “OK”

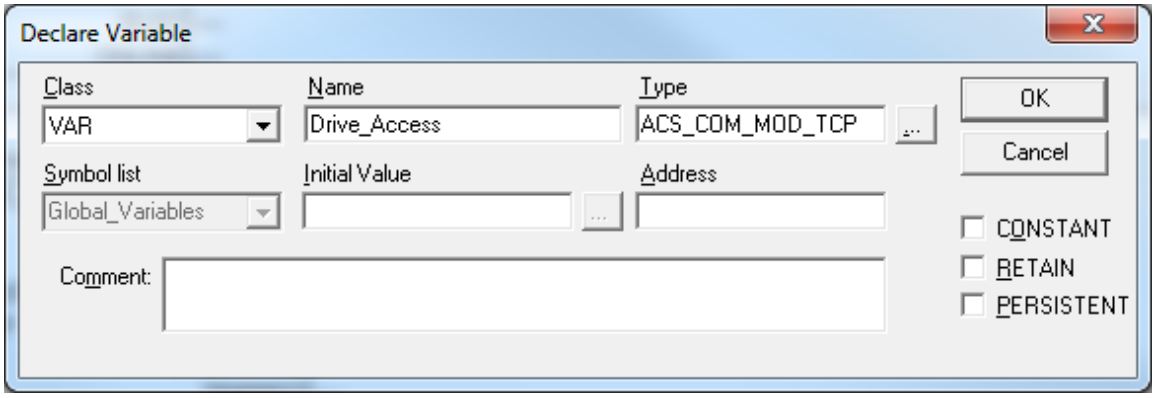
Tip: Check √ the “Structured” box in the Input assistant menu



11.6 Give the instance of the drive communication block a name

11.7 Declare it as of type “ACS_COM_MOD_TCP”

a. The type is automatically listed after the function block is selected.



11.8 Open the program again from the “POUs” tab and connect the function block inputs as shown

11.9 In the example below, the block will always be enabled

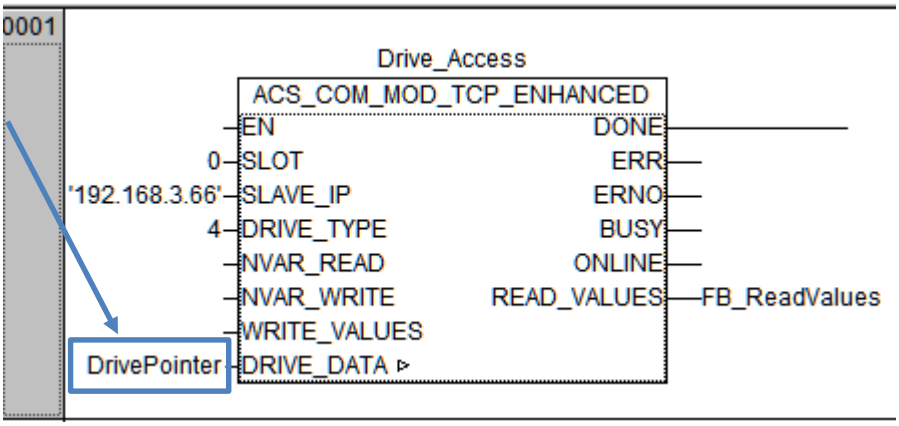
11.10 Slot 0 of the PLC is used for Modbus TCP/IP (Slot 0 is CPU’s onboard Ethernet port)

11.11 The drive’s IP Address **192.168.3.66**

11.12 Type number 4 as Drive type is for ACS355 drive

11.13 Connect the variable **DrivePointer** to DRIVE_DATA

a. **DrivePointer**: ACS_DRIVE_DATA_TYPE;



12 ACS_DRIVES_CTRL_STANDARD Function Block Creation

Create a second **Network After** (Ctrl +T) in the **Drive1** program

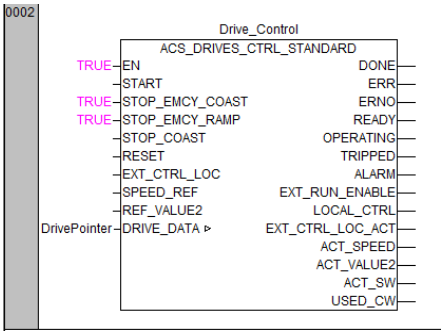
12.1 Add the block “**ACS_DRIVES_CTRL_STANDARD**” as shown previously

12.2 Name this function block is **Drive_Control**

12.3 Connect the function block inputs as shown below

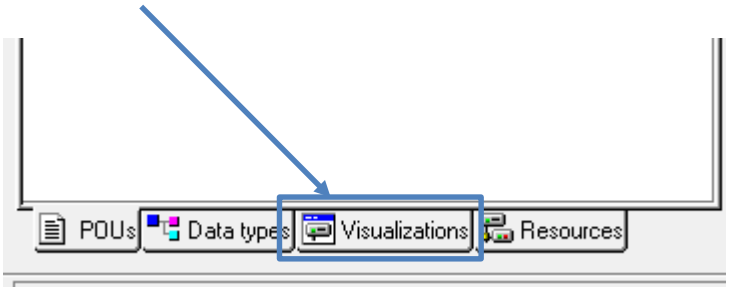
12.4 Other than Enable input the complete block will be controlled by using the Visualization.

NOTE: The variable connected to “**ACS_DRIVES_CTRL_STANDARD**” -> “**DRIVE_DATA**” must be the same as the one connected to “**ACS_COM_MOD_TCP**” -> “**DRIVE_DATA**” and must be of type “**ACS_DRIVE_DATA_TYPE**”.

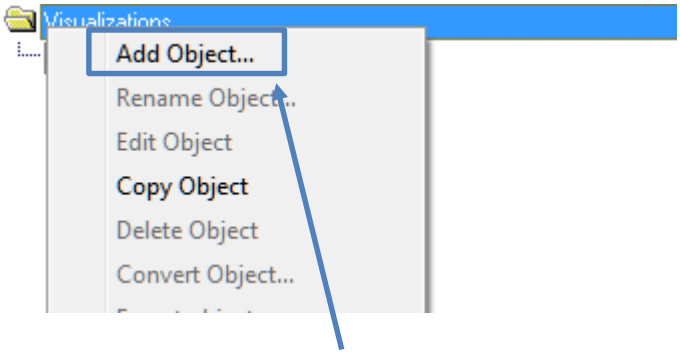


13 Create Visualizations to control ACS355 drive

13.1 Click **Visualizations** tab in the bottom left of IEC61131-3 programming environment

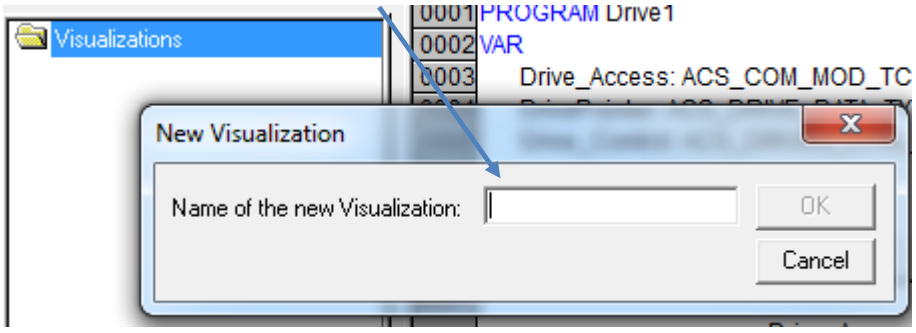


13.2 Right-click "**Visualizations**" in the "Visualizations" tab



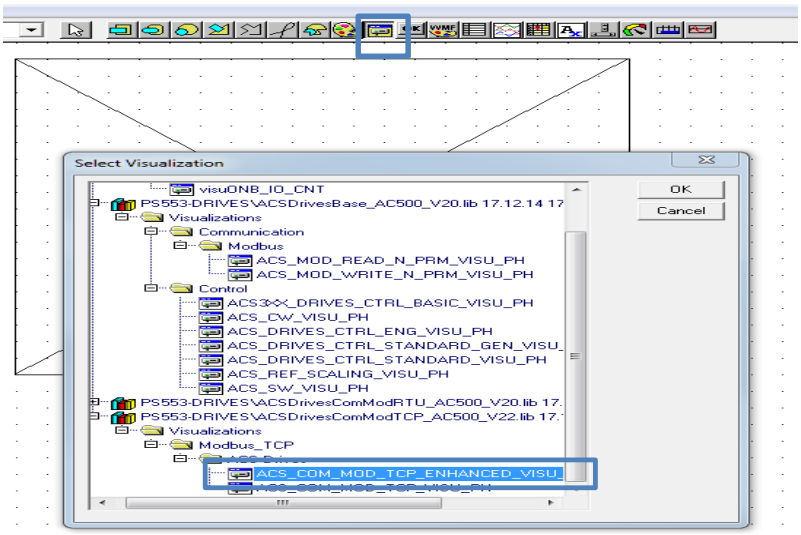
13.3 Choose "Add Object", give the visualization page a name

a. E.g. **PLC_VISU**



13.4 From the new page, choose "Visualization" from the "Insert" menu and draw a box

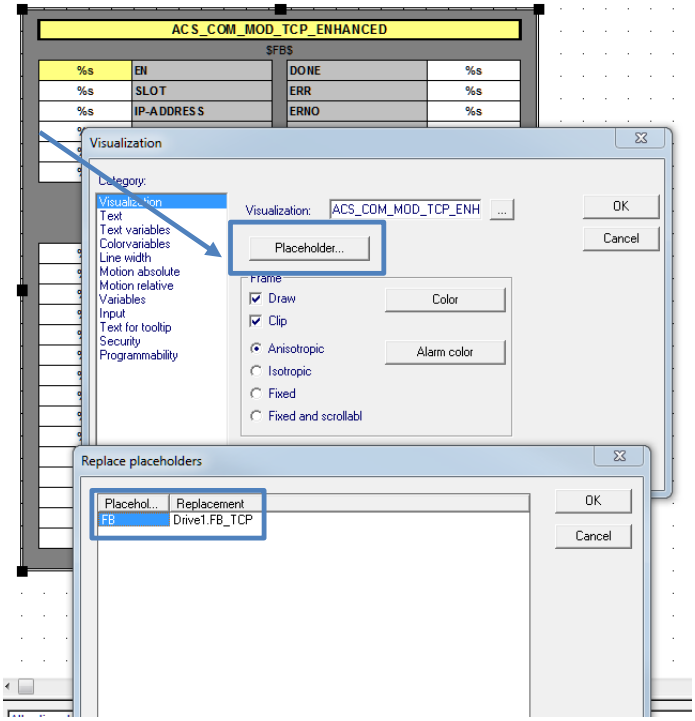
13.5 Select Visualization "ACS_COM_MOD_TCP_ENHANCED_VISU_PH" as shown below



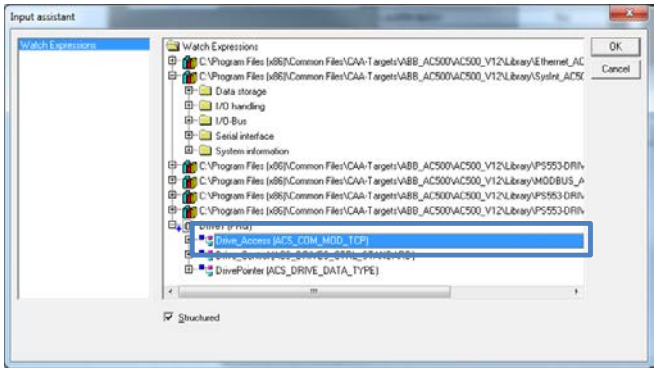
13.6 Double click on the visualization to view the configuration dialog

13.7 Select “Placeholder…”

13.8 Place the cursor in the “Replacement” Column, and press the F2 key



13.9 Select the Drive_Access object as shown below

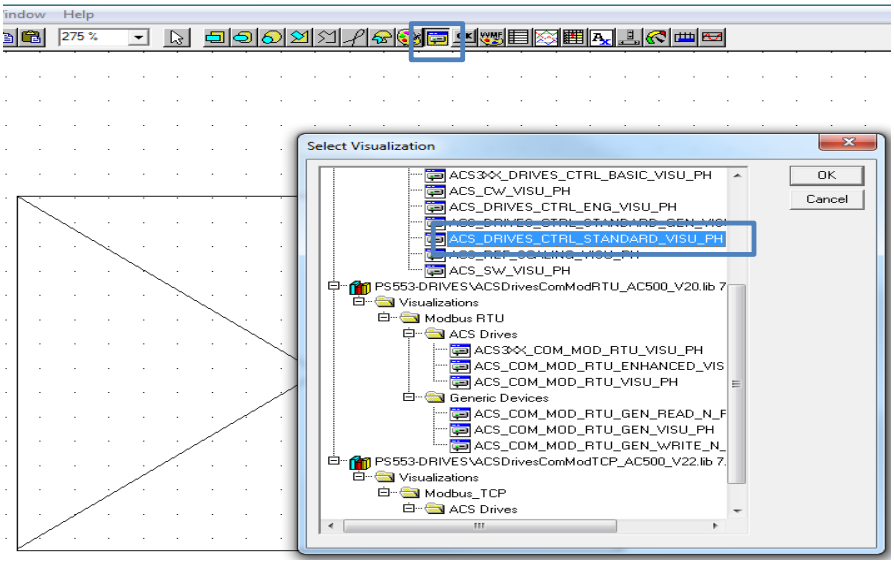


13.10 Press “OK” to accept and exit

14 Create ACS_DRIVES_CTRL_STANDARD Visualization template

14.1 From the same page as previously described, choose “**Visualization**” from menu and draw a box in visualization screen

14.2 Select Visualization **“ACS_DRIVES_CTRL_STANDARD_VISU_PH”** template

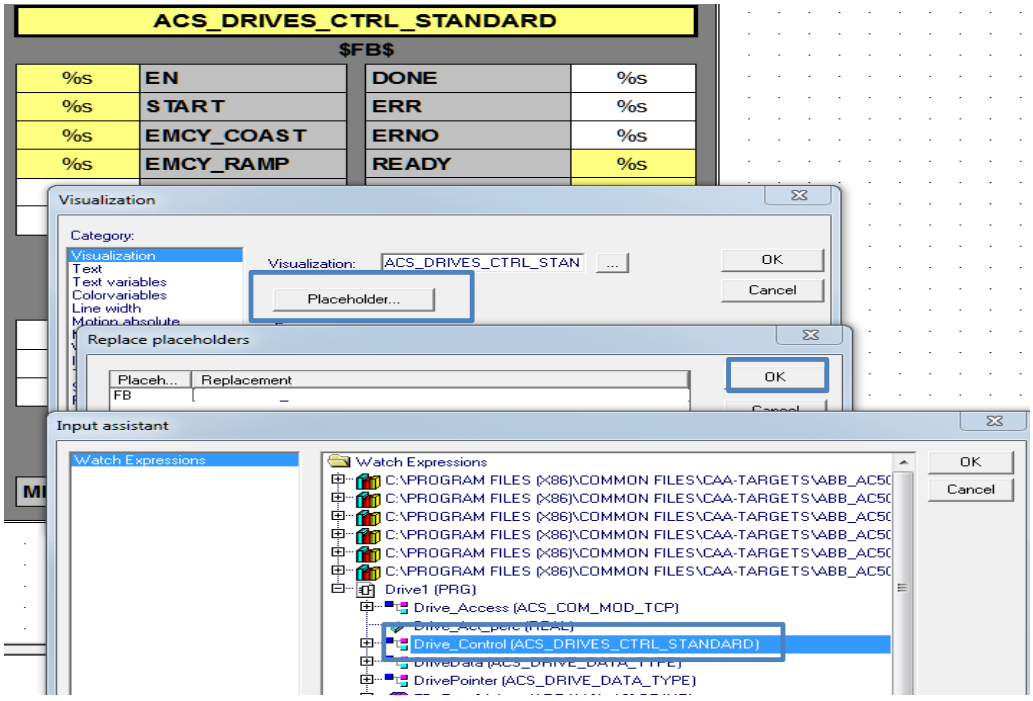


14.3 Double click on the visualization to view the configuration dialog

14.4 Select “Placeholder…”

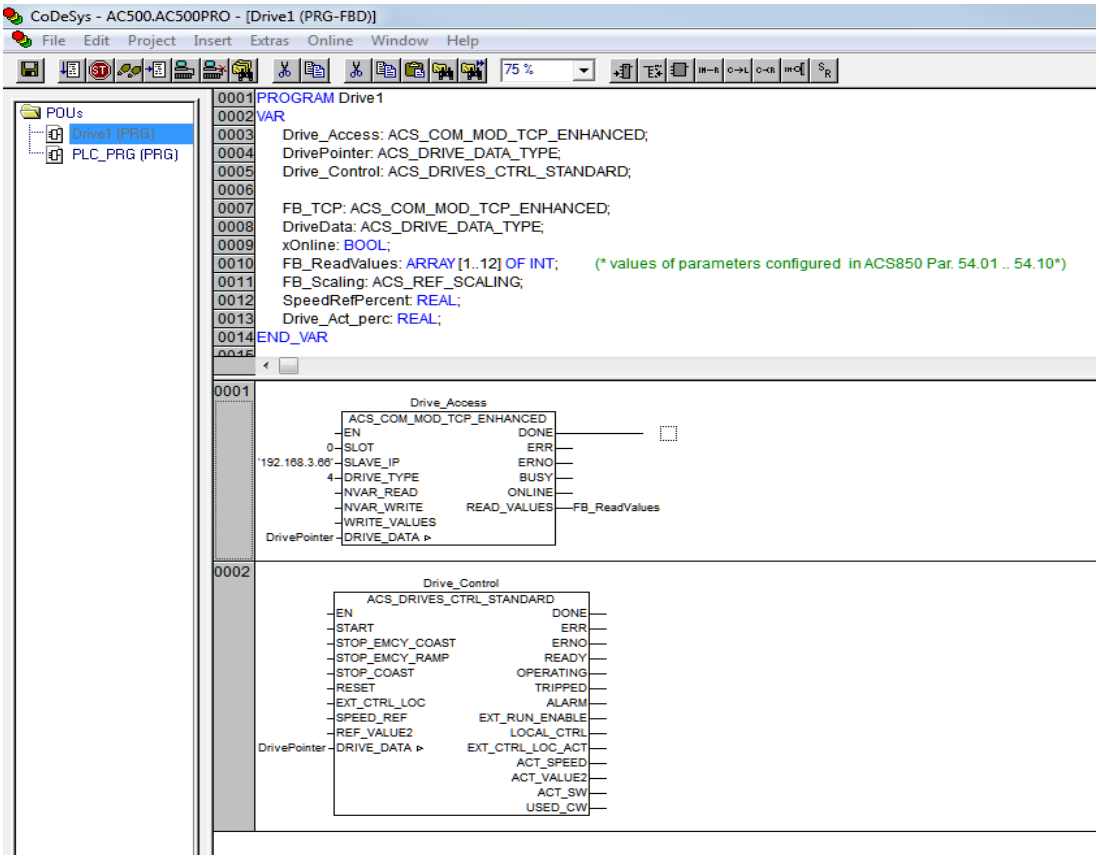
14.5 Place the cursor in the “**Replacement**” Column, and press the **F2** key

14.6 Select the Drive_Control object as shown below



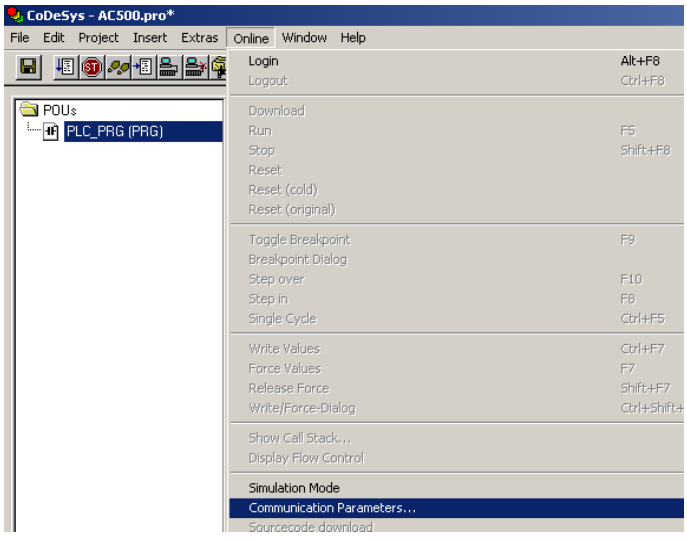
14.7 Press “OK” to accept and exit

Here is the complete PLC codes for this Application Note:



15 Download program to PLC and Go online:

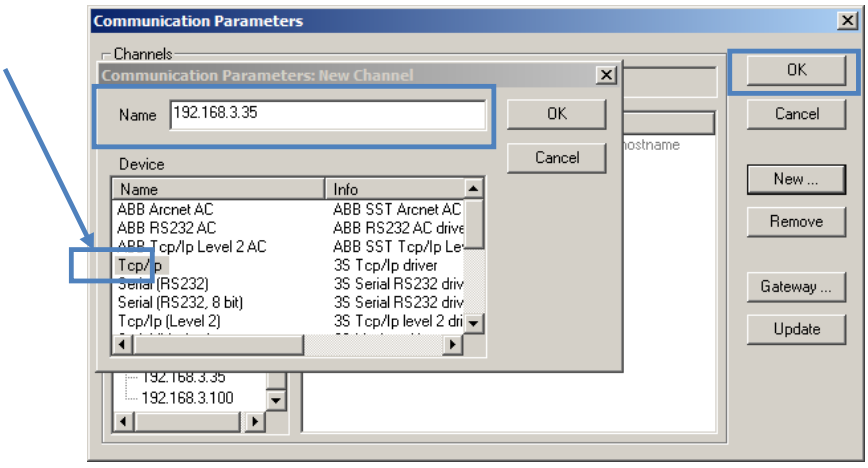
15.1 From **Online** menu, select **Communication Parameters**.



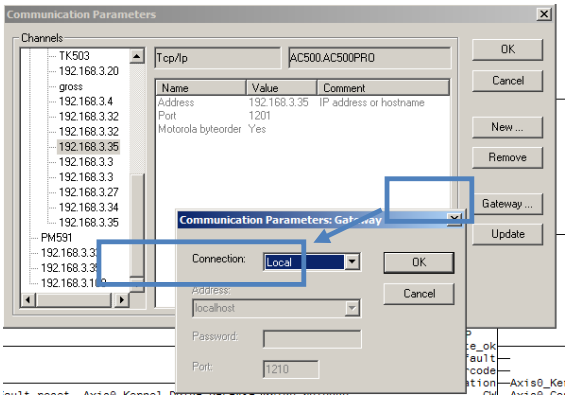
15.2 In the **Communication Parameter** dialog box, **click New…** button to add a new channel. Type the name for this channel. In this example below, **192.168.3.35** is the name for this channel.

15.3 In the popup **Communication Parameters: New Channel** dialog, fill in the "**Name**" field with **192.168.3.35**, **select TCP/IP** in Device window then **click OK**.

15.4 Double click in **Value** field, type **192.168.3.35** for PLC's IP address.



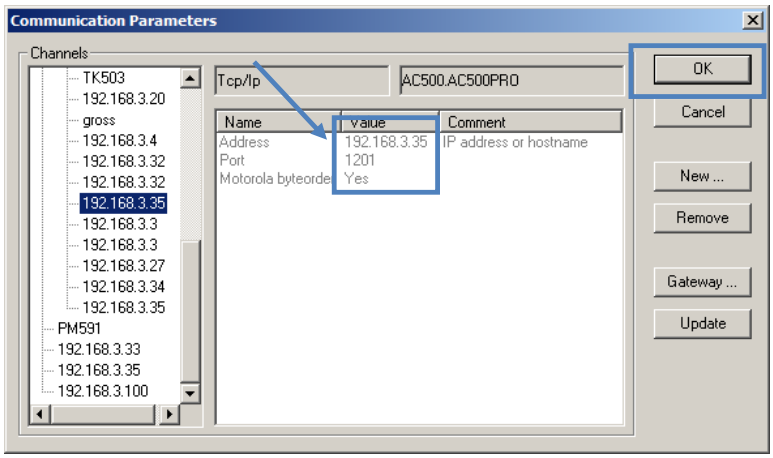
15.5 Click **Gateway** then select **Local** for **Connection** from popup **Communication Parameters: Gateway** window as shown below.



15.6 **Double click** in each **Value** field to replace with

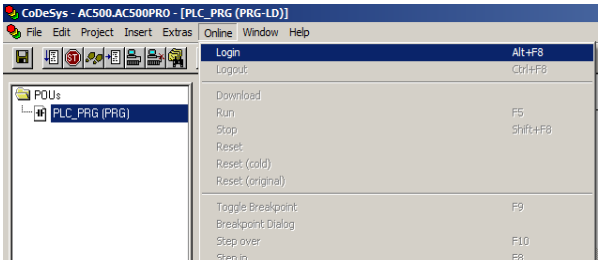
- Address: **192.168.3.35**
- Port: **1201**
- Motorola byteorder: **Yes**

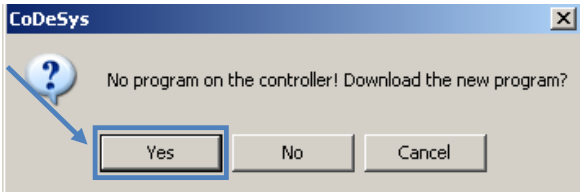
Click **OK** to accept these entries.



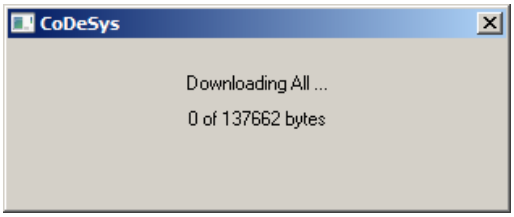
15.7 **Click Online>login** in top menu to download the changes and go online with CPU.

15.8 **Click Yes** when message appear below.



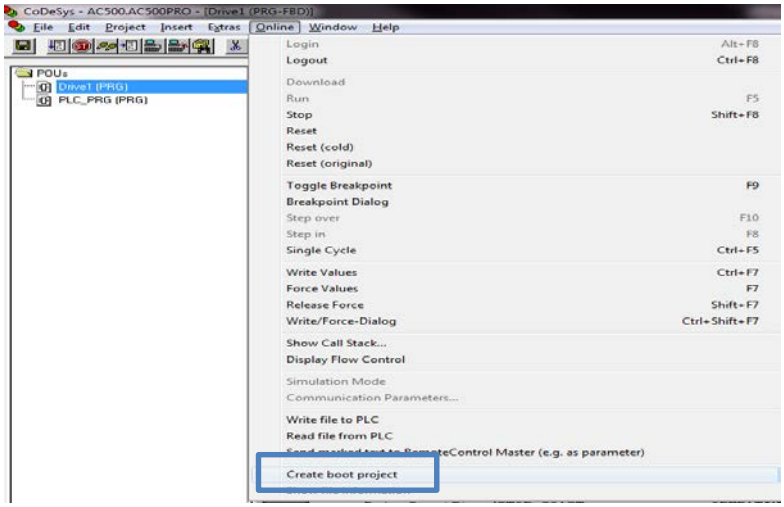


15.9 The download progress as shown below.



16 Create boot project

In "**Online**" mode (Login), choose "**Create boot project**" from the "Online" menu. With this command, the compiled project is stored to the flash in such a way that the PLC will load it automatically when CPU re-started.



17 Run PLC Program

17.1 Click **Online** then **Login** to go online with CPU

17.2 Click RUN to put CPU in RUN mode. Verify the PLC is in run mode at Status line in bottom right of the window.

17.3 Reset the Drive if needed

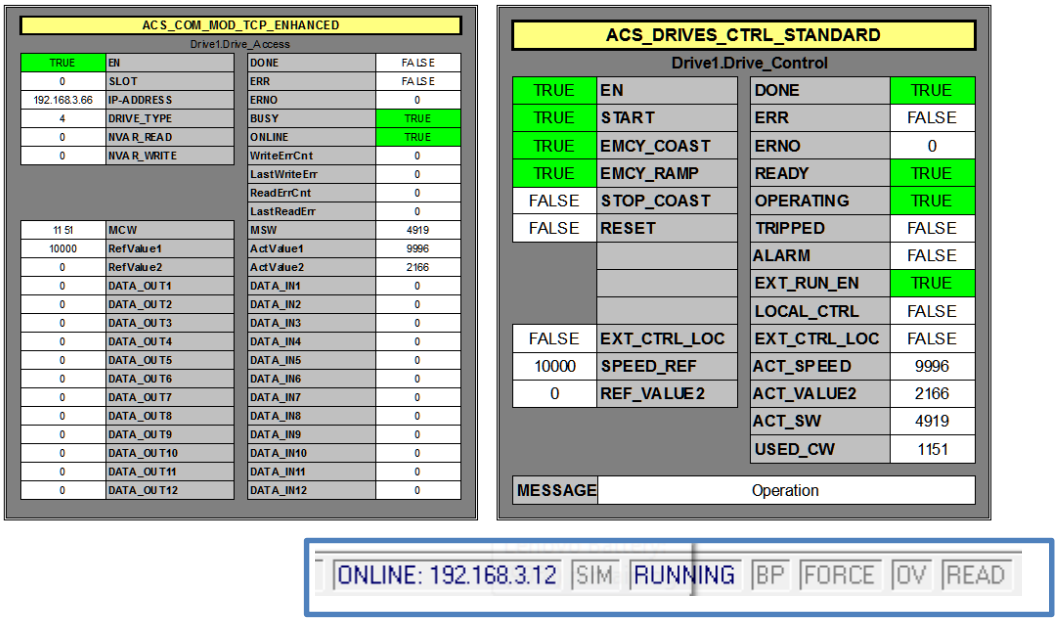
a. Click **Start** button in **ACS_DRIVES_CTRL_STANDARD** visualization template

17.4 Enter a **SPEED_REF**

a. The speed ref is in counts (+/- 20,000)
b. Refer to drive parameters **11.05** for motor speed RPM scaling

17.5 Verify the drive's motor running.

Here is the visualization for this project:



ACS_COM_MOD_TCP_ENHANCED

Drive1.Drive_Access

TRUE	EN	DONE	FALSE
0	SLOT	ERR	FALSE
192.168.3.66	IP-ADDRESS	ERNO	0
4	DRIVE_TYPE	BUSY	TRUE
0	NVAR_READ	ONLINE	TRUE
0	NVAR_WRITE	WriteErrCnt	0
		LastWriteErr	0
		ReadErrCnt	0
		LastReadErr	0
1151	MCW	MSW	4919
10000	RefValue1	ActValue1	9996
0	RefValue2	ActValue2	2166
0	DATA_OUT1	DATA_IN1	0
0	DATA_OUT2	DATA_IN2	0
0	DATA_OUT3	DATA_IN3	0
0	DATA_OUT4	DATA_IN4	0
0	DATA_OUT5	DATA_IN5	0
0	DATA_OUT6	DATA_IN6	0
0	DATA_OUT7	DATA_IN7	0
0	DATA_OUT8	DATA_IN8	0
0	DATA_OUT9	DATA_IN9	0
0	DATA_OUT10	DATA_IN10	0
0	DATA_OUT11	DATA_IN11	0
0	DATA_OUT12	DATA_IN12	0

ACS_DRIVES_CTRL_STANDARD

Drive1.Drive_Control

TRUE	EN	DONE	TRUE
TRUE	START	ERR	FALSE
TRUE	EMCY_COAST	ERNO	0
TRUE	EMCY_RAMP	READY	TRUE
FALSE	STOP_COAST	OPERATING	TRUE
FALSE	RESET	TRIPPED	FALSE
		ALARM	FALSE
		EXT_RUN_EN	TRUE
		LOCAL_CTRL	FALSE
FALSE	EXT_CTRL_LOC	EXT_CTRL_LOC	FALSE
10000	SPEED_REF	ACT_SPEED	9996
0	REF_VALUE2	ACT_VALUE2	2166
		ACT_SW	4919
		USED_CW	1151
MESSAGE	Operation		