Application Note

AC500 PLC and ABB ACS355 Drive via Modbus RTU with ABB Standard Library

1 Description

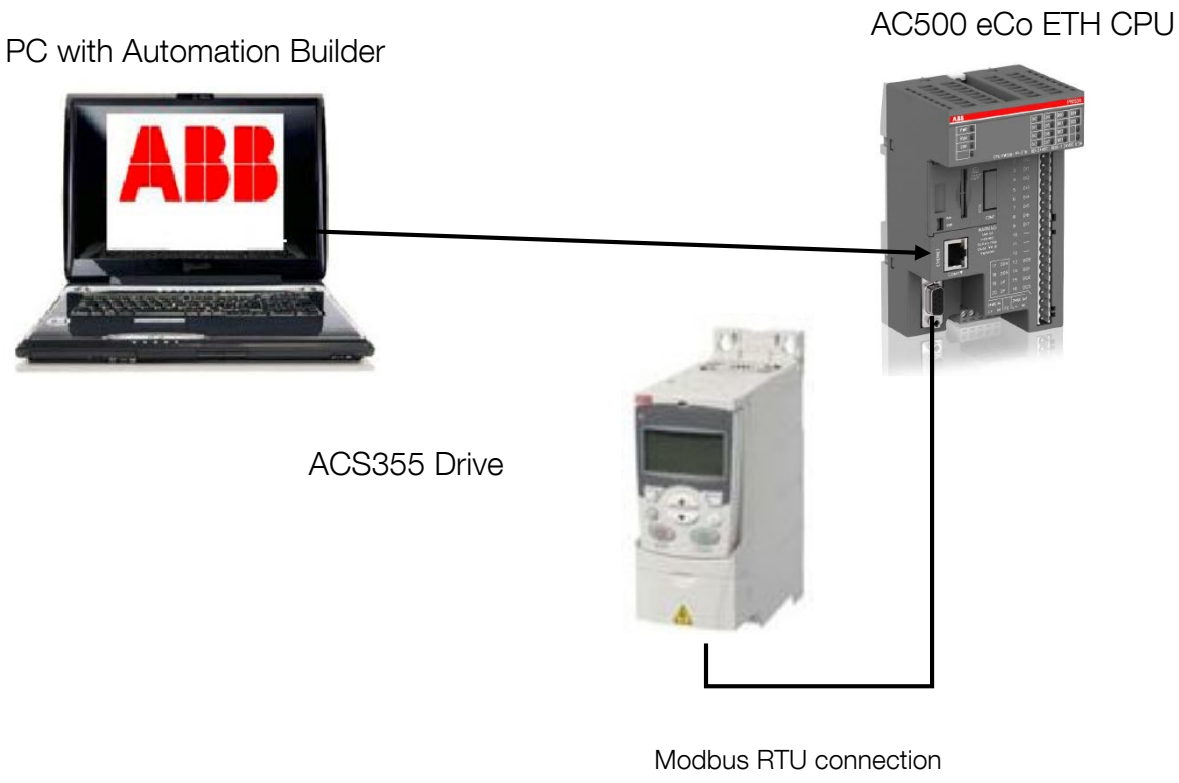
This application note will take you through the hardware installation and configuration of ABB ACS355 Drives and eCo PLC with Modbus RTU communication. The AC500 ABB-specific ready-made function blocks and visualizations from the PS553- DRIVES library will be used for the control of the drives.

2 Objectives:

The personal computer will connect to PLC via Ethernet port and eCo PLC control drive via Modbus RTU connection. Here is the equipment list for this application note

Description	*Quantity*
PC with Automation Builder V1.x software installed	1
ABB eCo CPU PM556 ETH CPU	1
CAT5 Ethernet Patch cable	1
ACS355 Drive with FMBA-01 adapter card	1
Twisted pair shielded cable for RS-485 connection	1

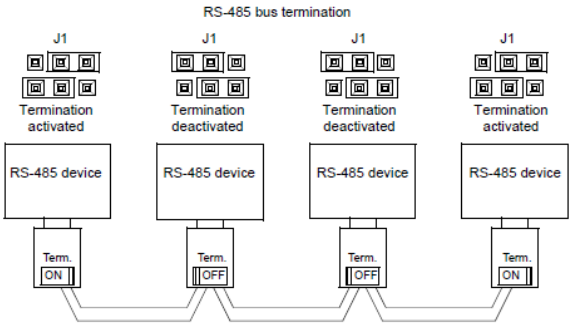
3 Connection diagram



4 Wiring diagram:

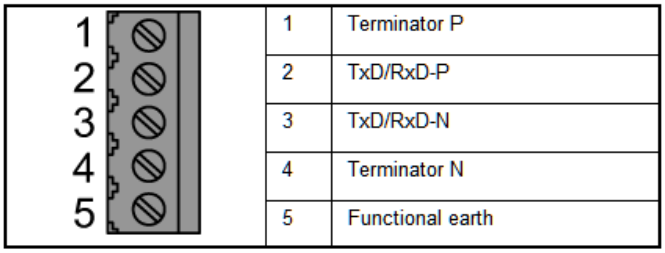
ACS355 drive's FMBA-01 adapter card

X1			Description
1 2 3 4	1	SHLD	Bus cable shield. Connected internally to GND_B via an RC filter and directly to CH_GND (chassis).
	2	DATA_B	Data positive
	3	DATA_A	Data negative
	4	GND_B	Isolated signal ground



AC500 eCo CPU's COM2 Modbus RTU wiring diagram:

The pin assignment of the serial interface COM2:



1	Terminator P
2	TxD/RxD-P
3	TxD/RxD-N
4	Terminator N
5	Functional earth

4.1 Connect ACS355 drive's pin 2 to PLC's pin 2
4.2 Connect ACS355 drive's pin3 to PLC's pin 3
4.3 Connect ACS355 drive's pin4 to PLC's pin 7
4.4 Connect the shield to drive's pin 5
4.5 Jumper PLC's pin1 to pin 2
4.6 Jumper PLC's pin3 to pin 4
4.7 Verify the wiring and terminators are active
    a. Jumpers on the FMBA-01
4.8 Wire terminals 1&2 and 3&4 (optional) Using just the CPU, apply power to the PLC
4.9 Launch Automation Builder and create a new project

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

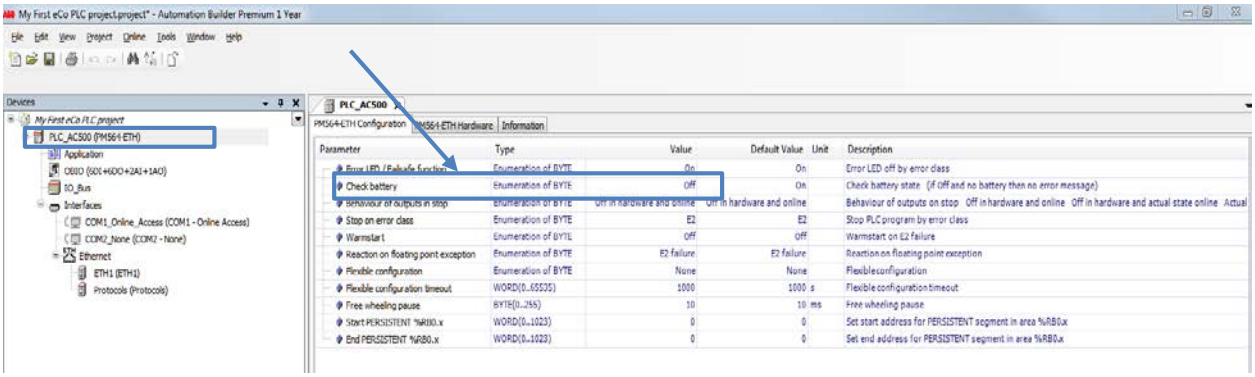
5.6 Select **OK** to start the project

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:

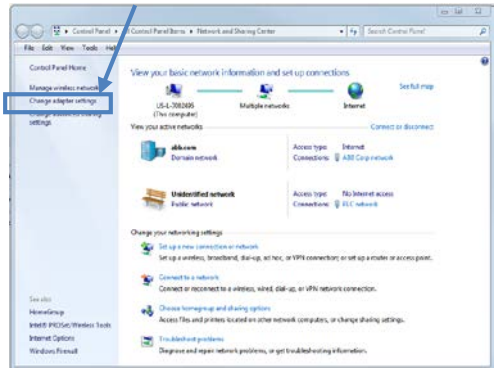
Before you are able to download the compiled program the first time from the PC to the PLC, you have to setup the communication parameter. There are two options you can use to login to the PLC, either with Ethernet or serial with TK503 USB cable.

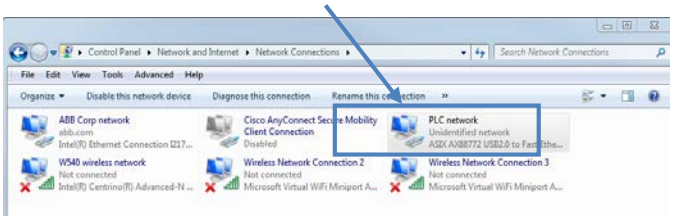
For this exercise, we are using Ethernet connection for online access to this PLC.

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:

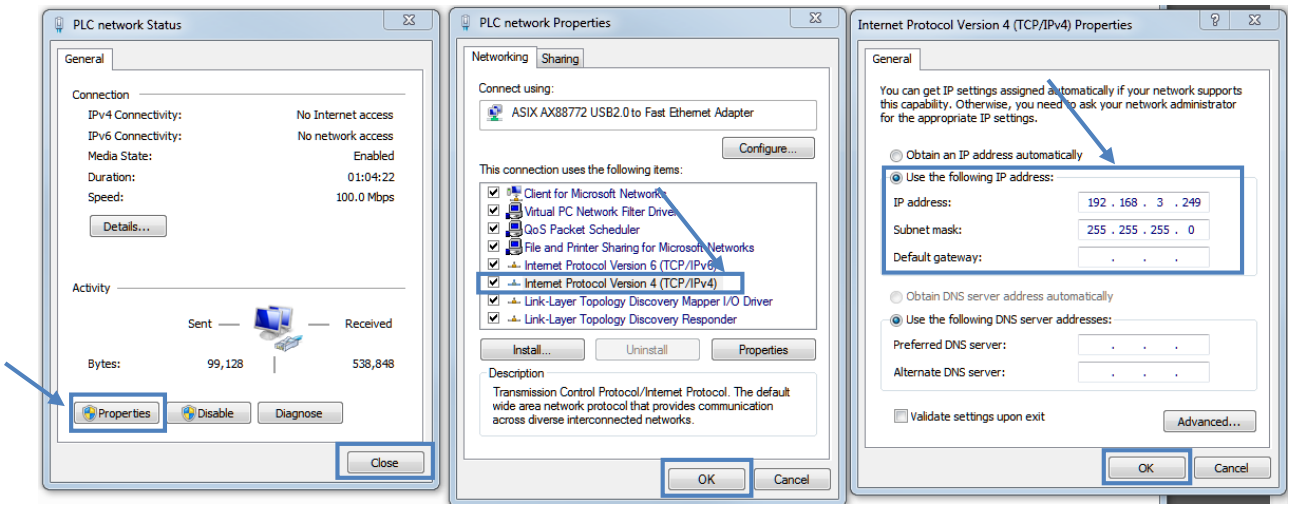
7.1 **Windows Control Panel** > **Network and Internet** > **Network and Sharing Center**
7.2 Click on **Change adapter settings**
7.3 Select **Local Area Connection** (in this example is **PLC network** connection below) and right click it to open the menu.





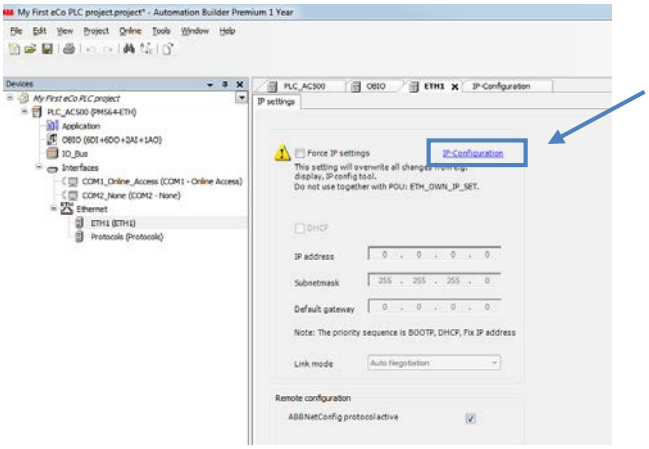
Choose **Properties** (the status is active when the Ethernet connection between PC and PLC is active)

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

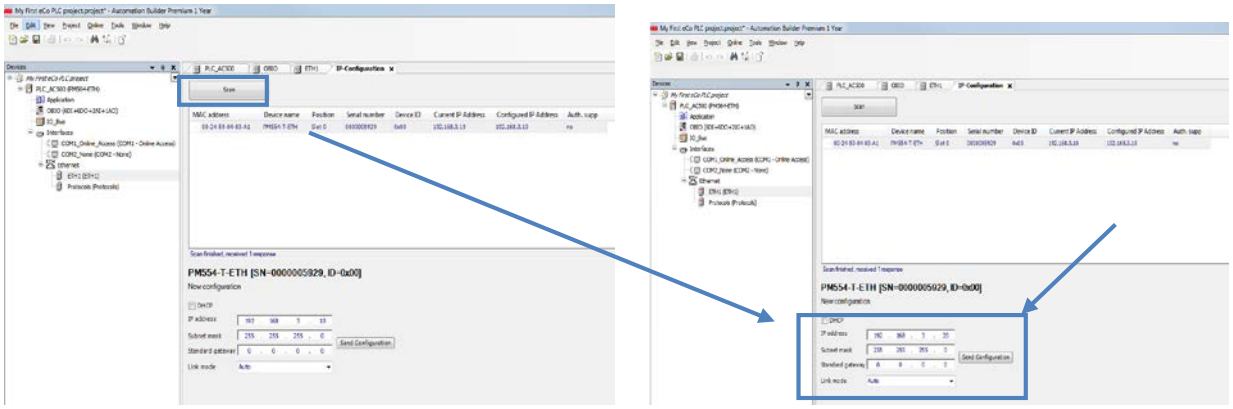


8.3 Click on Scan button for searching active PLC on the network

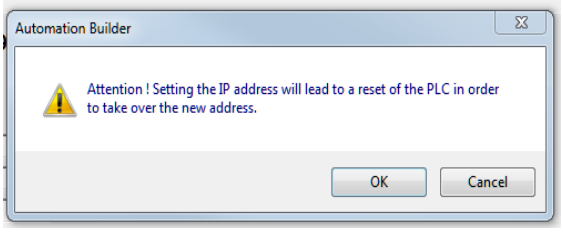
8.4 Highlight the active IP address in the search window

8.5 Change the IP address to new IP address such as 192.168.3.20

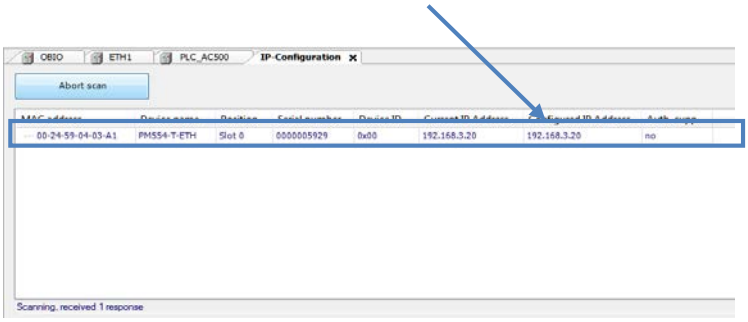
8.6 Click on Send Configuration button to send new IP address to PLC.



- 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.



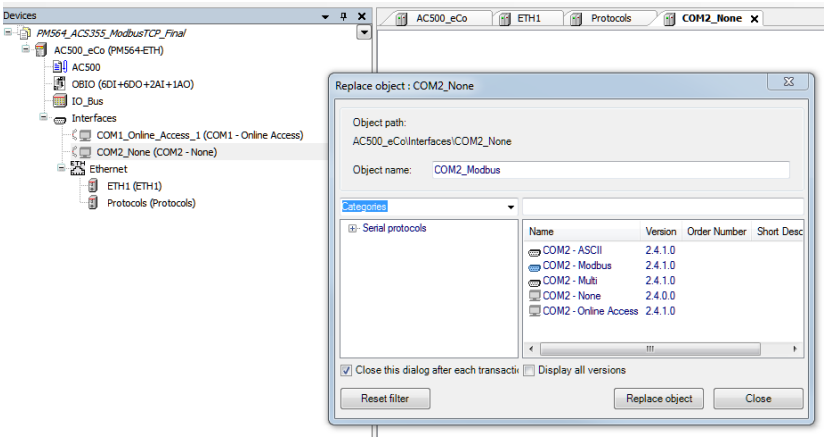
- Press "Scan" button again to verify the IP address of CPU. This window shows the Configured IP address sent to CPU successfully. This IP address will be used in IEC 61131-3 CoDeSys to download your PLC project to CPU.



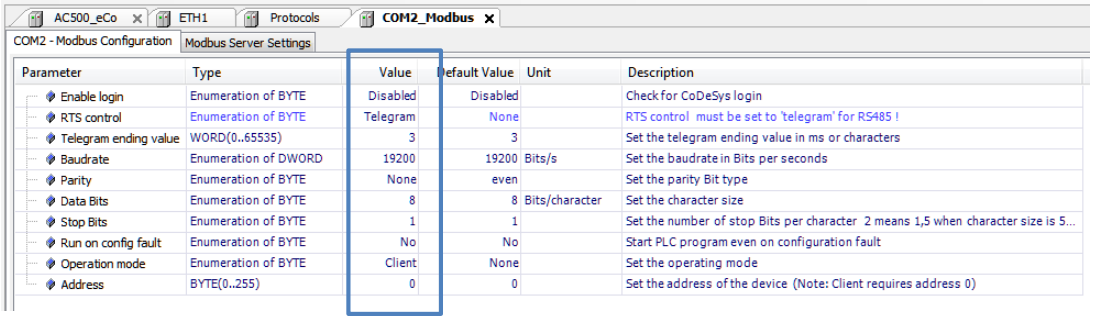
9 Modbus RTU setup in Automation Builder software

9.1 Right click on **COM2_None> Add Object**

9.2 Select **COM2-Modbus** then click **Replace object** to accept the changes.



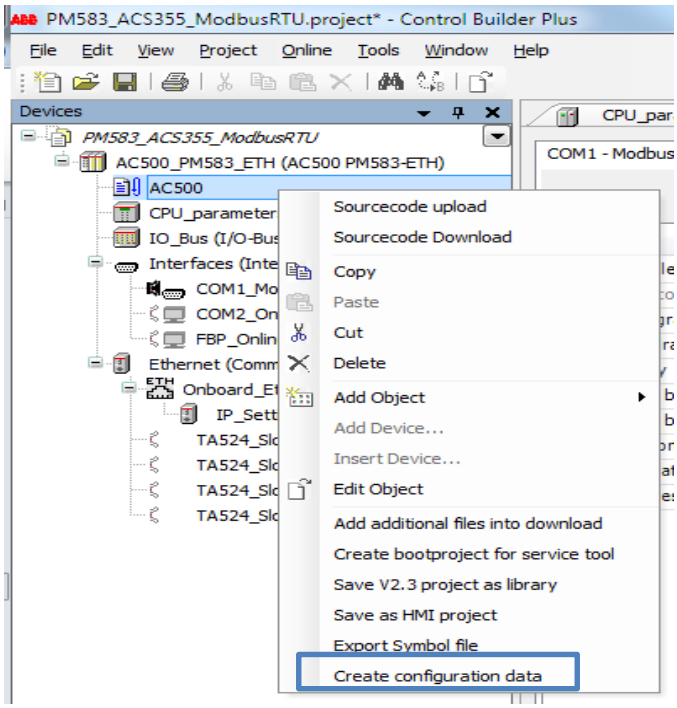
9.3 Set the configuration as shown below



9.4 **Click File > Save Project** to save the configuration settings for this lab.

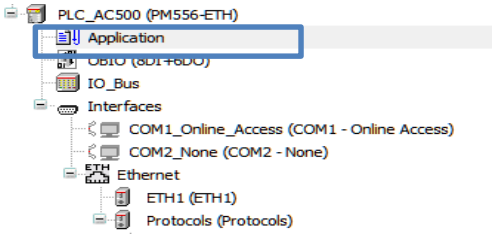
9.5 Right click on AC500.

9.6 Click **Create Configuration data** to save the settings before go to CoDeSys window.



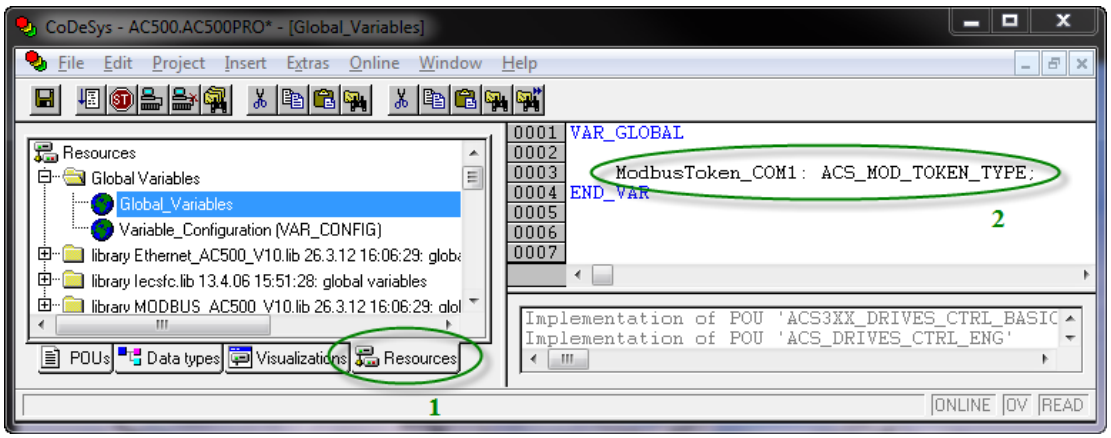
10 IEC61131-3 Application (CoDeSys):

10.1 Double-click “Application” from the Device tree in the Automation Builder project to open CODESYS.



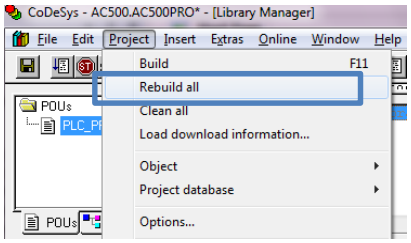
10.2 Create the variables in Global variables tab

- Double-click “Global Variables” in the “Resources” tab (1)
  a. Create a global variable for the Modbus token handling of type “ACS_MOD_TOKEN_TYPE” (2). This variable will be used for passing a token to all drives on the Modbus RTU line



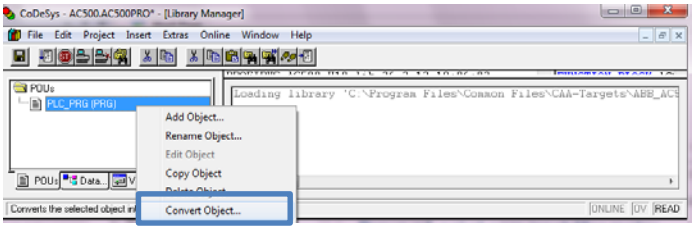
11 Create PLC logic

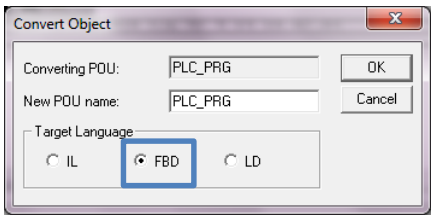
11.1 Compile your project, choose “**Rebuild all**” from the **“Project**” menu



11.2 Right-click “**PLC_PRG**” in the “**POUs**” tab and choose “Convert Object”

11.3 Choose Target Language “**FBD**” and click “OK”

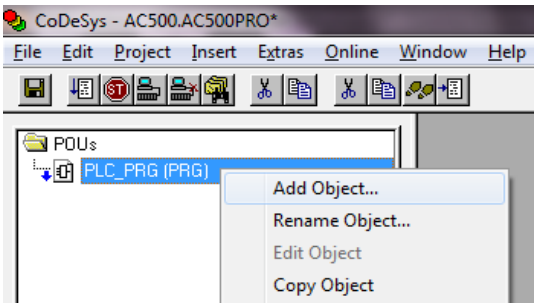


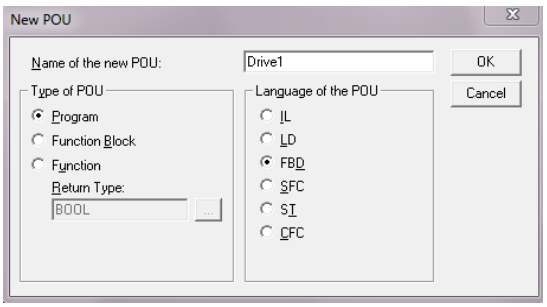


11.4 Right-click in the POUs field and choose “Add Object”

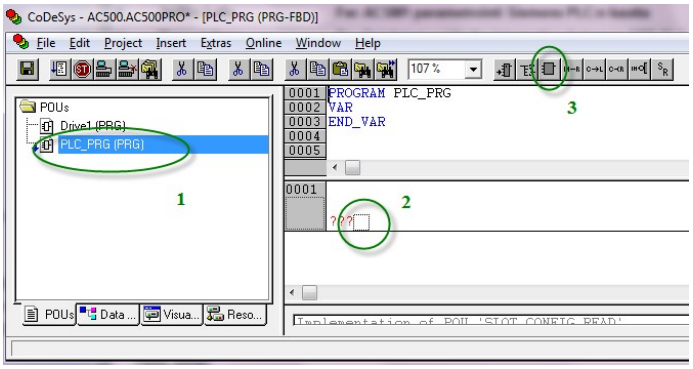
11.5 Set Type of POU to “Program” and Language of the POU to “FBD”

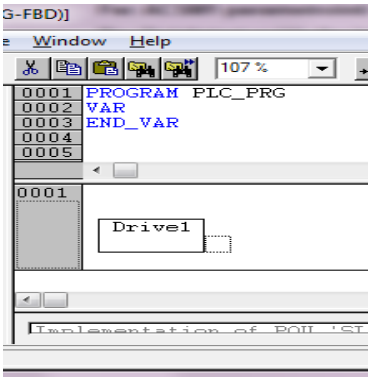
11.6 Give the new Program a suitable name
11.7 Click “OK”





11.8 Double-click “**PLC_PRG**” (1) to open the main program
11.9 Select the dotted box (2) in Network 0001 and insert a box(3)
11.10 Naming of your new Program : **Drive1** (PRG) in to call for it from the main program

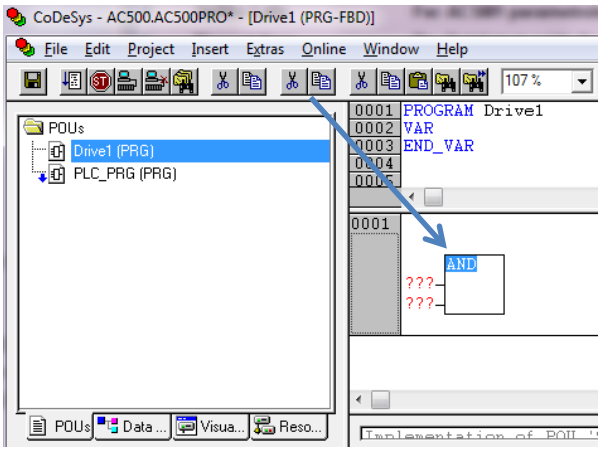


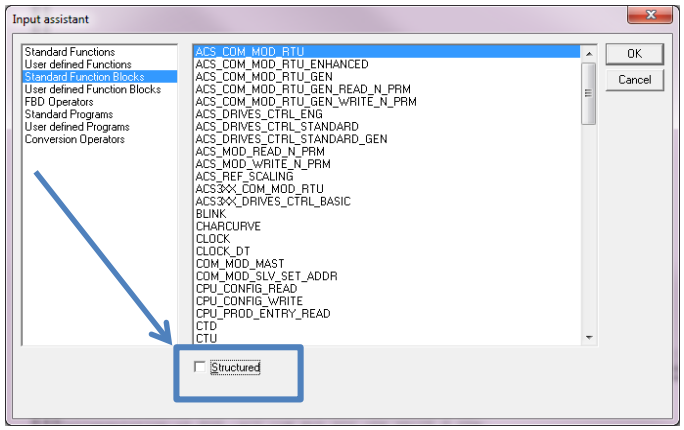


12 Create ACS_COM_MOD_RTU Function Block

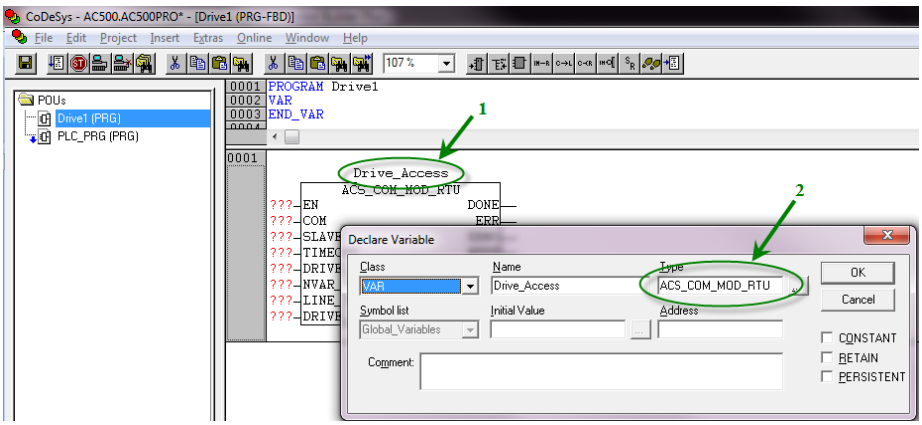
12.1 Double-click your new program and add a box as described previously
12.2 Press F2 while the block title is selected and choose “**ACS_COM_MOD_RTU**” from “Standard Function Blocks”
12.3 Click “OK”

(**Tip: uncheck** the “Structured” box in the Input assistant).





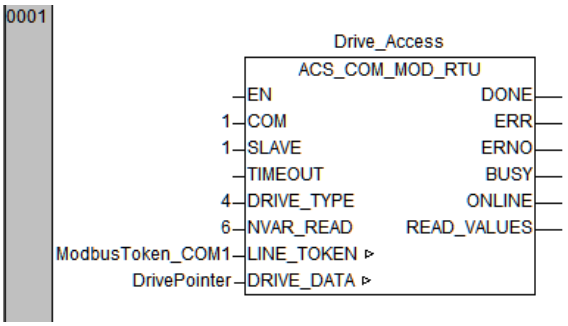
12.4 Give the instance of the drive access block a suitable name (1)
12.5 Declare the variable of type “ACS_COM_MOD_RTU” (2)



13 ACS_COM_MOD_RTU Function Block’s parameter setup

13.1 Set EN to TRUE
13.2 Set the com port to 1
13.3 Set the slave ID to 1
13.4 Set the drive type to 4 (ACS355)
13.5 Set “ACS_COM_MOD_RTU” block input “NVAR_READ” according to number of parameters to be read
13.6 Connect the global token (created earlier) to LINE_TOKEN
13.7 Connect the variable **DrivePointer** to DRIVE_DATA

a. Define DrivePointer: ACS_DRIVE_DATA_TYPE



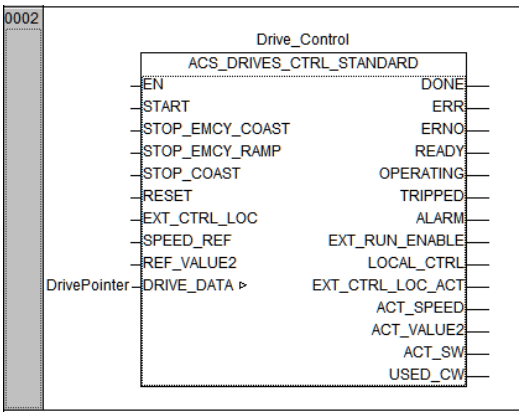
Create ACS_DRIVES_CTRL_STANDARD Function Block

- Create a second network (Ctrl +T) in the same program and add the block “ACS_DRIVES_CTRL_STANDARD” in the same way as for “ACS_COM_MOD_RTU”
- Setup the block as shown below.

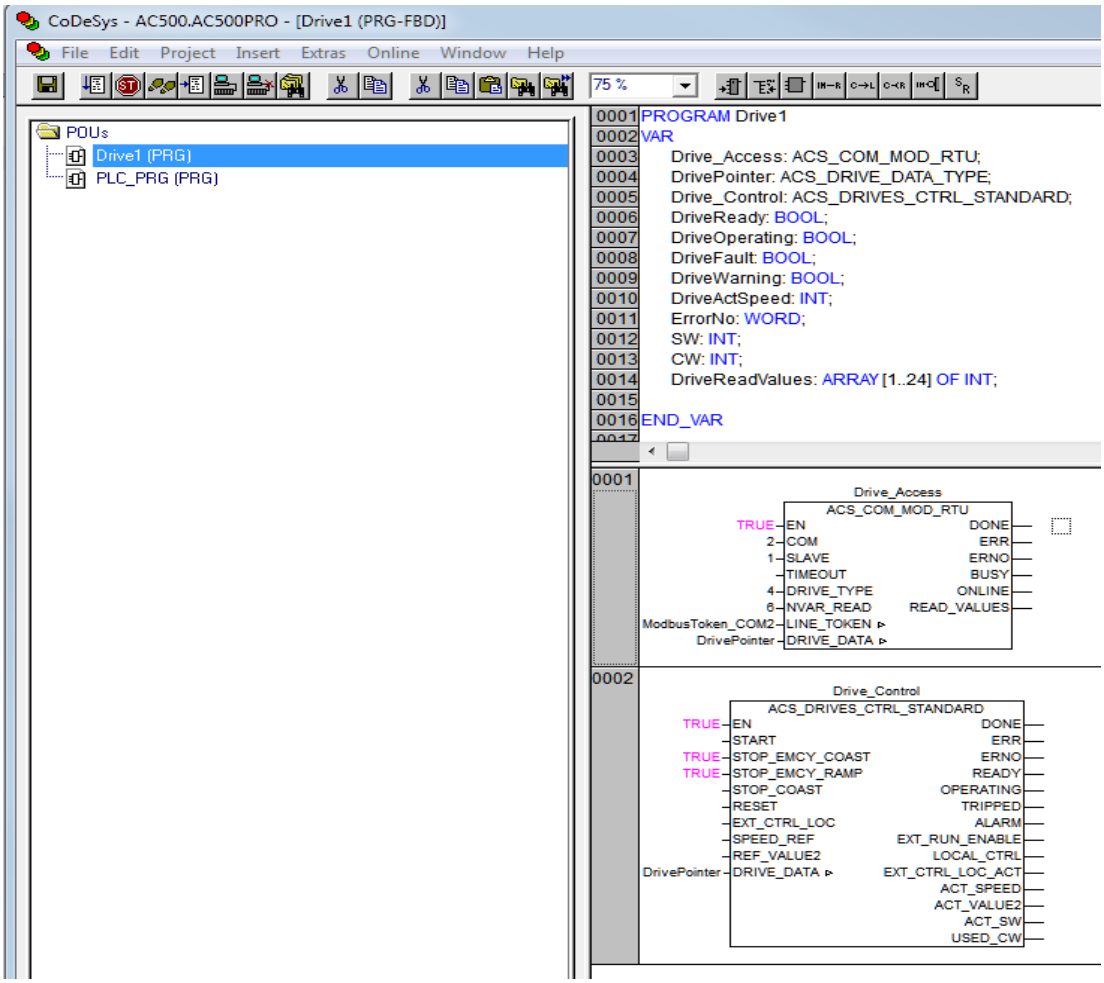
14 ACS_DRIVES_CTRL_STANDARD Parameter setup

- Connect the variable **DrivePointer** to DRIVE_DATA
- Select DrivePointer: ACS_DRIVE_DATA_TYPE

Note! The variable connected to “ACS_DRIVES_CTRL_STANDARD” → “DRIVE_DATA” must be the same as the one connected to “ACS_COM_MOD_RTU” → “DRIVE_DATA” and must be of type “ACS_DRIVE_DATA_TYPE”



Here is the complete PLC codes for this project:



15 Create the ACS_COM_MOD_RTU Visualization screen:

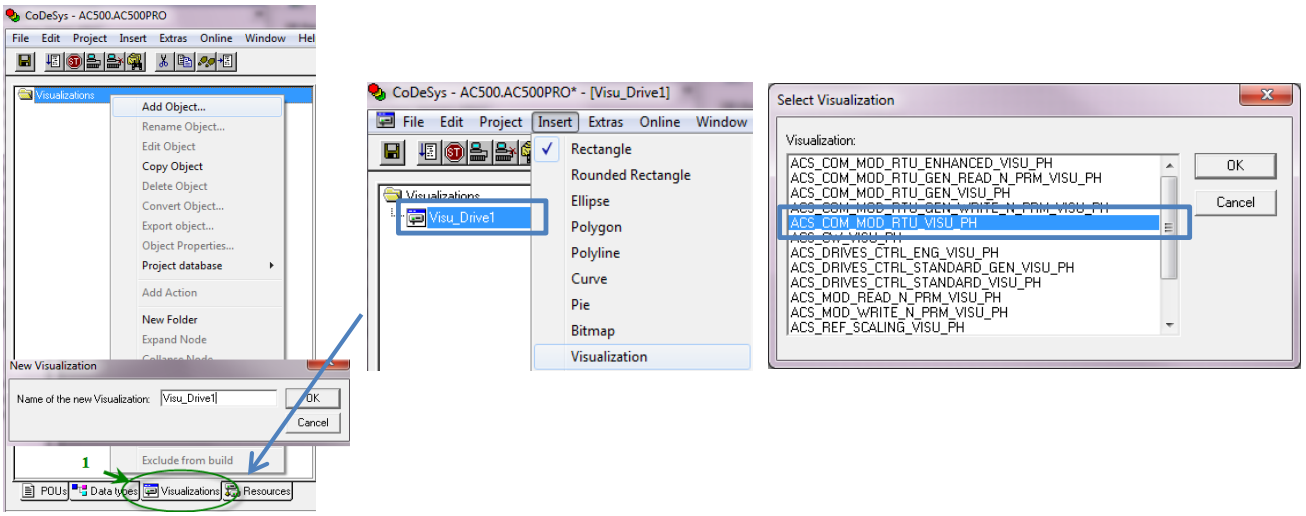
15.1 Right-click “**Visualizations**”  in the “Visualizations” tab (1)

15.2 Choose “**Add Object**”, give the visualization page a suitable name

a. E.g. Visu_Drive1

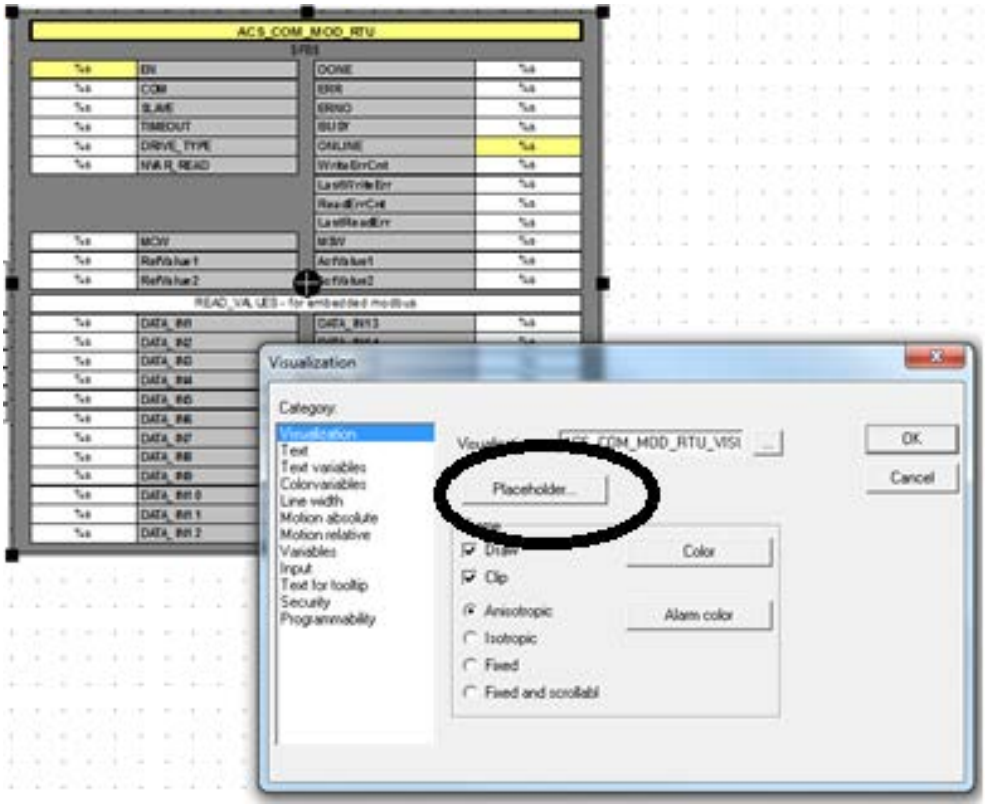
15.3 From the new page, choose “Visualization” from the “Insert” menu and draw a box

15.4 Select Visualization “ACS_COM_MOD_RTU_VISU_PH”

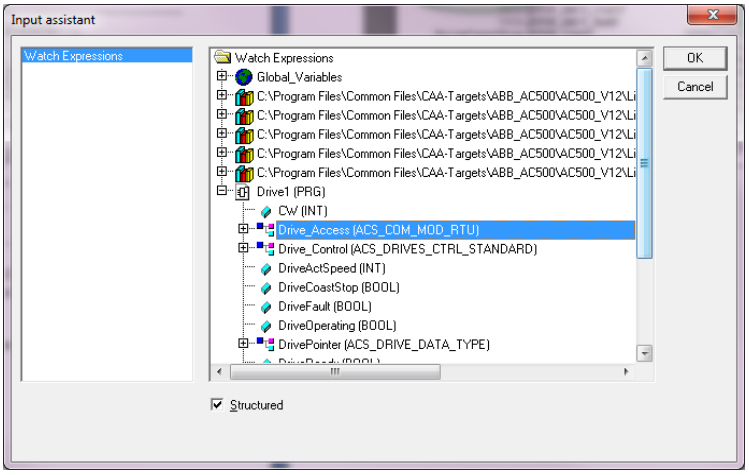


15.5 Double-click the new visualization object for Settings and click “Placeholder”

15.6 Select the “Replacement” field and press F2



15.7 Select the function block as shown below

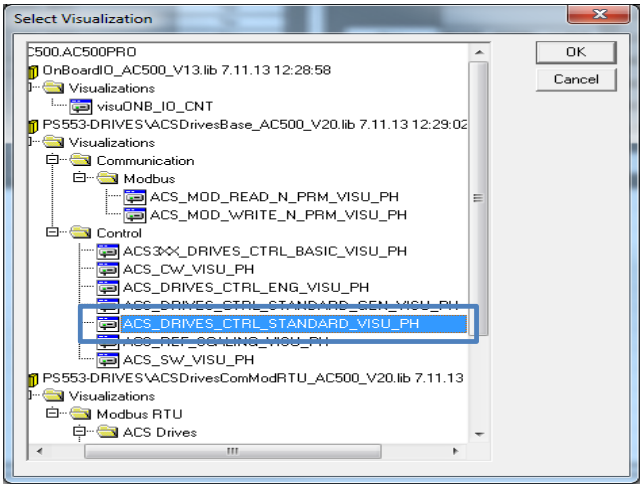


16 The ACS_DRIVES_CTRL_STANDARD Visualization

16.1 On the same page, create a visualization window for the drive control

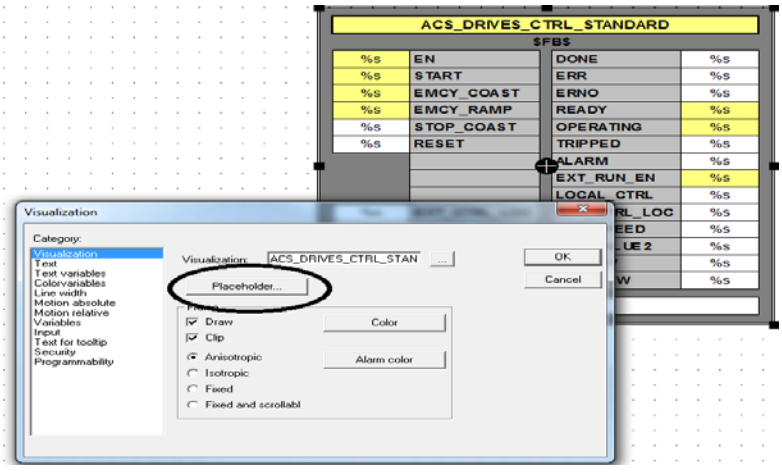
16.2 Repeat the previous steps to insert a visualization object

16.3 Select Visualization “ACS_DRIVES_CTRL_STANDARD_VISU_PH”

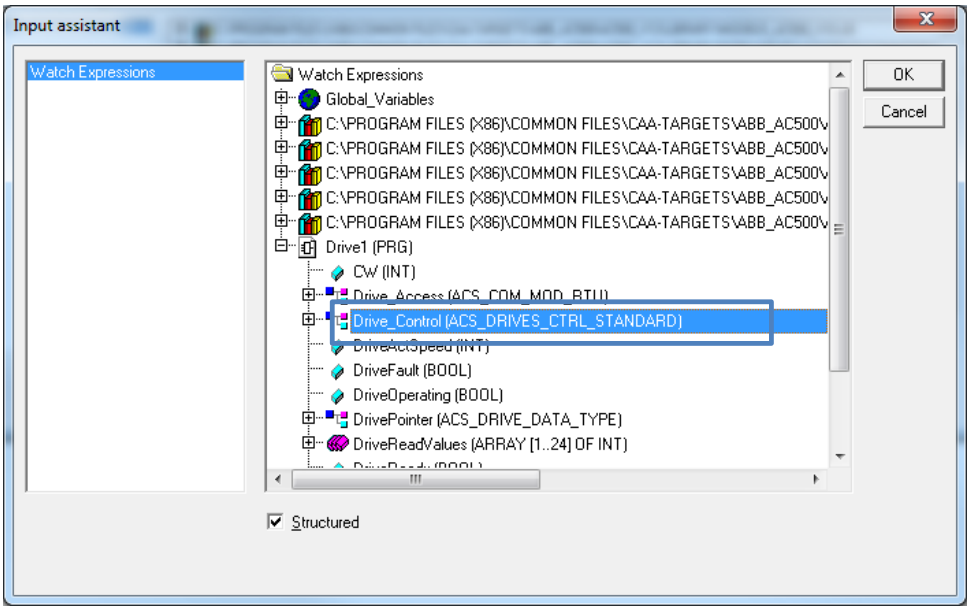


16.4 Double-click the new visualization object for Settings and click “Placeholder”.

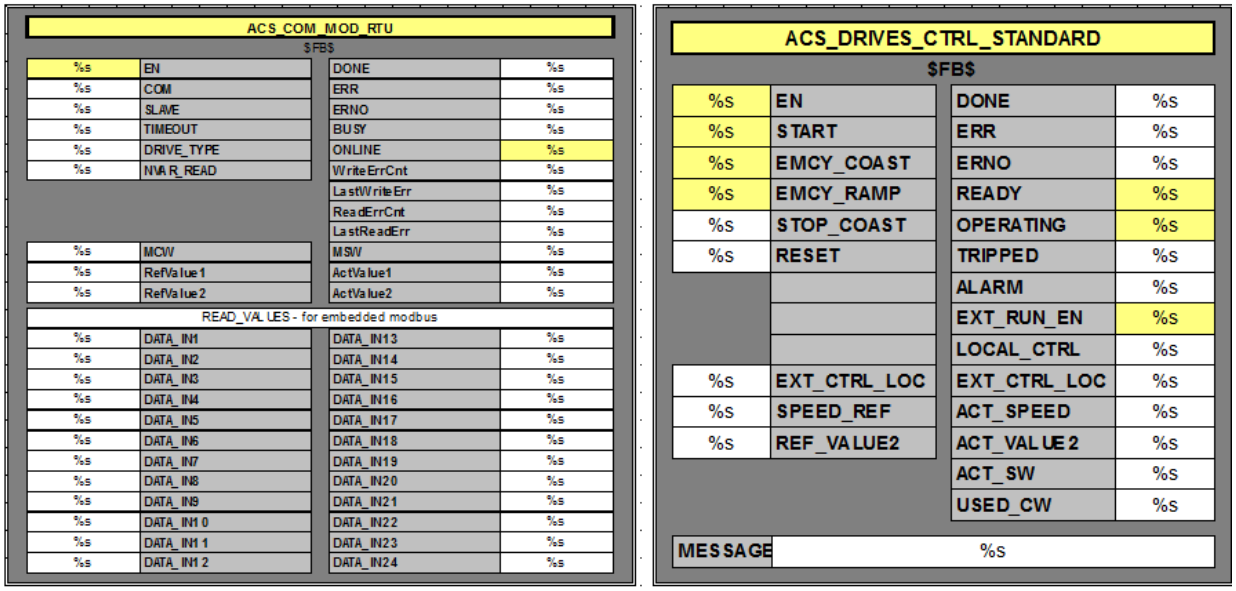
16.5 Select the “Replacement” field and press F2.



16.6 Select the function block as shown below



16.7 The screen should look as shown below

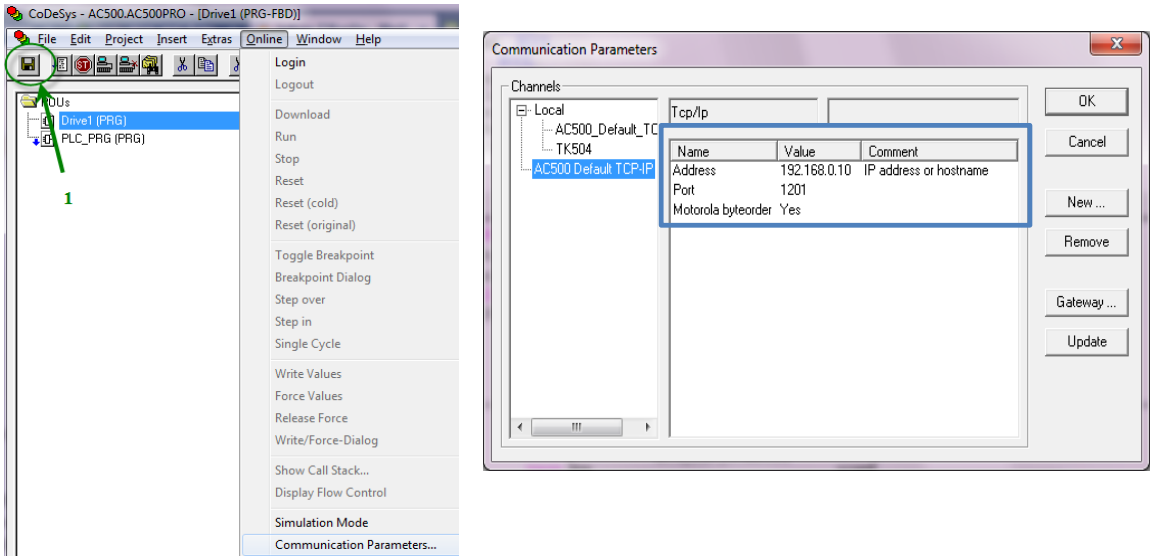


17 Download program to PLC

17.1 Save the program and choose “Communication Parameters” from the “Online” menu.

17.2 Set communication Parameters according to your online connection

17.3 The CPU’s IP address will be assigned per user’s choice.

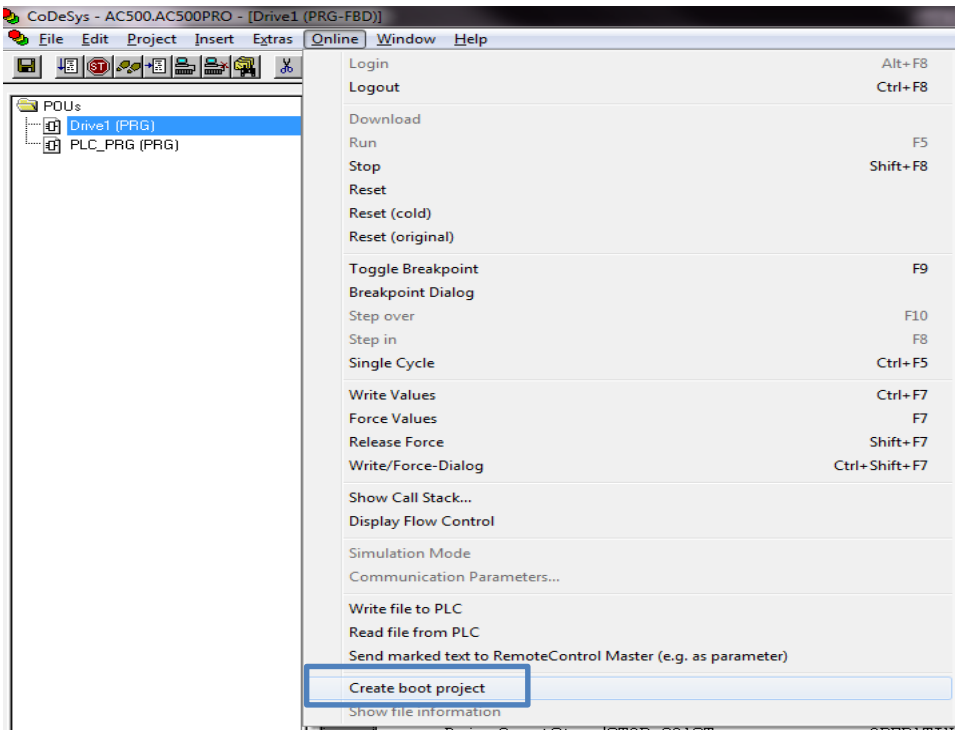


17.4 Choose “Login” from the “Online” menu and in the following pop-up window, click “Yes”
17.5 Choose “Run” from the “Online” menu to start the PLC
17.6 Check that the PLC goes to “RUN” mode

Note! If the PLC does not go to “RUN” mode, you might have some PLC errors that you need to reset. You can do that either by pressing the “DIAG” button on the PLC itself (not in the eCo series) followed by the “OK” button until all errors are reset. You can also do it in online mode by using the “diagreset” command from the “PLC Browser” in the CODESYS “Resources” tab.

18 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 restarted



19 Run The Program

19.1 Go online
19.2 verify the PLC is in run mode
19.3 reset the Drive if needed
a. Click on the start button on ACS_DRIVES_CTRL_STANDARD block
b. Enter a SPEED_REF on ACS_DRIVES_CTRL_STANDARD block
c. The speed ref is in counts (+/- 20,000)
d. Refer to drive parameters 11.05 for scaling
19.4 Verify the motor running status.

20 ACS355 drive's parameters setup:

20.1 Power up the drive
20.2 Enter/verify the parameters as shown below
20.3 Drive power down and power up for the new fieldbus settings to take effect!

Parameter	Description	Value	Comment
98.02	COMM PROT SEL	STD MODBUS	Activates fieldbus module
53.02	EFB STATION ID	1	Modbus RTU node address of the drive
53.03	EFB BAUD RATE	19.2 kbit/s	Transfer rate of the link. Same baud rate must
53.04	EFB PARITY	8 NONE 1	Parity and stop bits. Same parity and stop bits
53.05	PROFILE	ABB DRV FULL	Communication profile "ABB Drives"
53.10	EFB PAR 10	101	Actual speed feedback
53.11	EFB PAR 11	303	Status Word
10.01	EXT 1 COMMANDS	COMM	Fieldbus interface as source for start and
11.02	EXT1/EXT2 SEL	COMM	Fieldbus interface as source to switch to
11.03	REF1 SELECT	COMM	Fieldbus interface as source for speed reference
11.05	REF1 MAX	1500rpm	Max speed/frequency scaling value (used in function block/visualization input "SPEED_REF_MAX"). Must be less or equal to drive parameter max speed/frequency.
16.04	FAULT RESET SEL	COMM	Fieldbus interface as source for fault reset
53.12	Bus Voltage (107)	107	Actual value
53.13	Temp Deg C (110)	110	Actual value
53.14	AI-1 % (120)	120	Actual value
53.15	Frequency (103)	103	Actual value
53.16	Current (104)	104	Actual value
53.17	Torque (105)	105	Actual value

NOTE: These parameter must be filled in or communications will not work correctly!

20.4 Cycle the drive power
20.5 Test the PLC codes with these parameters.