Electronic Displays, Inc.
EDV111 Series LED Signs
Siemens TIA Portal 11, Step 7 Pro
Function Block Software Manual

Version Control

Version	Date	Author	Change Description
1.0	11/21/2014	d.fox	Initial release

EDV111 Series - LED Signs
Firmware Protocol 3.1

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1.0 INTRODUCTION

This manual is provided as a guide for using EVD111 series LED Signs with TIA Portal 11 (Step 7 Pro v11) software by Siemens. This manual provides instructions for configuring Profinet I/O and importing function blocks to Step 7 Pro v11 software projects.

1.1 Supported PLC Controllers

Siemens controllers that support Profinet I/O in Step 7 software are supported, such as S7-300, S7-400, S7-1200. A sample project is available through the Electronic Displays, Inc. website www.electronicdisplays.com.

Other Siemens PLC's are not covered in this document. Typically, these devices may be connected to a display using a serial port. Please refer to the ASCII protocol manual for examples.

1.2 Function Block

Use the function block described in this manual to easily control an LED sign.
The function block (FB) and data block (DB) may be imported into Step 7 software for use in your program.

1.3 Supported LED Signs

• EDV111-3280-IND, EDV111-16160-IND, EDV111-16128-IND
• EDV111-1680-IND, EDV11132340-IND, EDV111-16240-IND
• EDV111-24160-IND

2.0 SYSTEM BLOCK DIAGRAM
The EDV111 LED signs is supplied with a Profinet I/O gateway device that converts the
Profinet I/O protocol into ASCII serial strings that are compatible with the LED signs. In this way, a LED
sign may be connected using a CAT5 Ethernet cable, and not limited to a short distance RS-232 cable.

2.1 Typical Connection Diagram
 Siemens S7-nnn PLC > CAT5 Ethernet Cable > Industrial Network Switch > CAT5 Ethernet Cable >
Profinet I/O Gateway (Default IP address 192.168.1.11) > RS-232 Shielded Cable > EDV111 Series LED
Sign
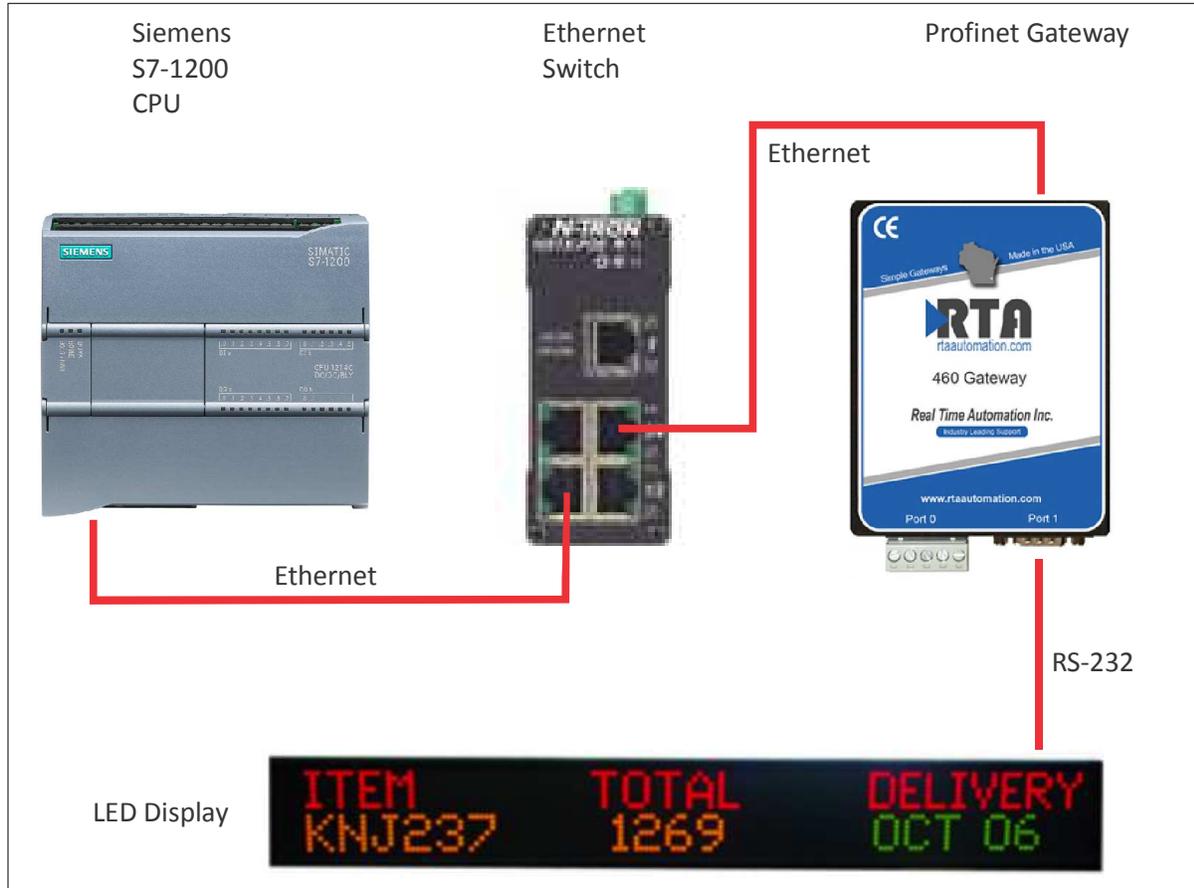
2.2 Single Sign Connection
Single sign connection requires (1) one gateway device.
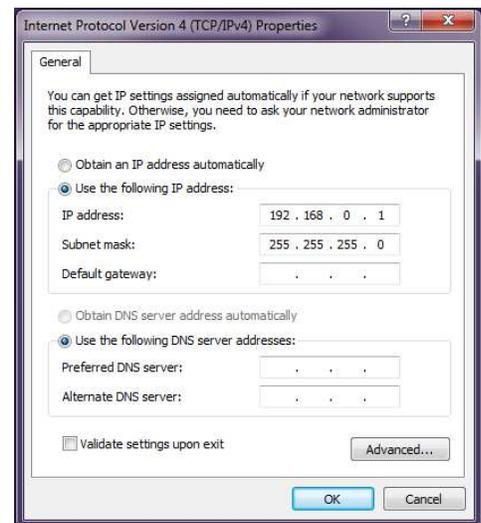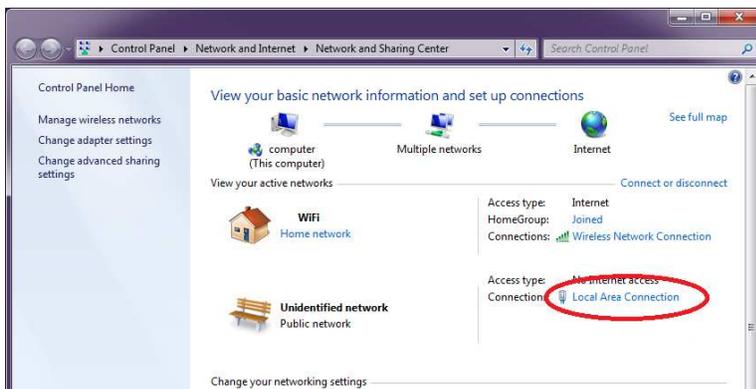
2.3 Multiple Sign Connection (More than 50 Feet apart)
Each sign requires (1) one gateway device as shown in 2.1

### 3.0 CONFIGURE RTA 460PSA Profinet Gateway
3.1 Configure PC Communications

On a PC, use the Microsoft Windows "Network and Sharing Center" to configure the "Local Area Connection" to static IP address 192.168.0.1:

   a. In Windows 7, click the START button > Control Panel > Network and Internet > Network and Sharing Center.

   b. Click on the "Local Area Connection" that represents the Ethernet connector that you are connecting to the gateway.

   c. On the "Local Area connection Status" dialog box, click the Properties button.

   d. On the "Local Area Connection Properties" dialog box, select "Internet Protocol Version 4 (TCP/IPv4), then click "Properties".

   e. Select the radio box "Use the following IP address:".

   f. In "IP address:", enter 192.168.0.1

   g. In "Subnet mask:", enter 255.255.255.0

   h. Verify DNS servers are empty and click OK.

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3.2 Configure Gateway
  a. Connect the power supply to the gateway.
  b. Connect an Ethernet crossover cable between the PC. Instead, an unmanaged Ethernet switch can be used with straight-through Ethernet cables. A managed switch can be used, but configuration is outside the scope of these instructions.
  c. Use Microsoft Windows Explorer or another web browser. In the address bar, type the default address (192.168.0.100) and press Enter to connect to the gateway.
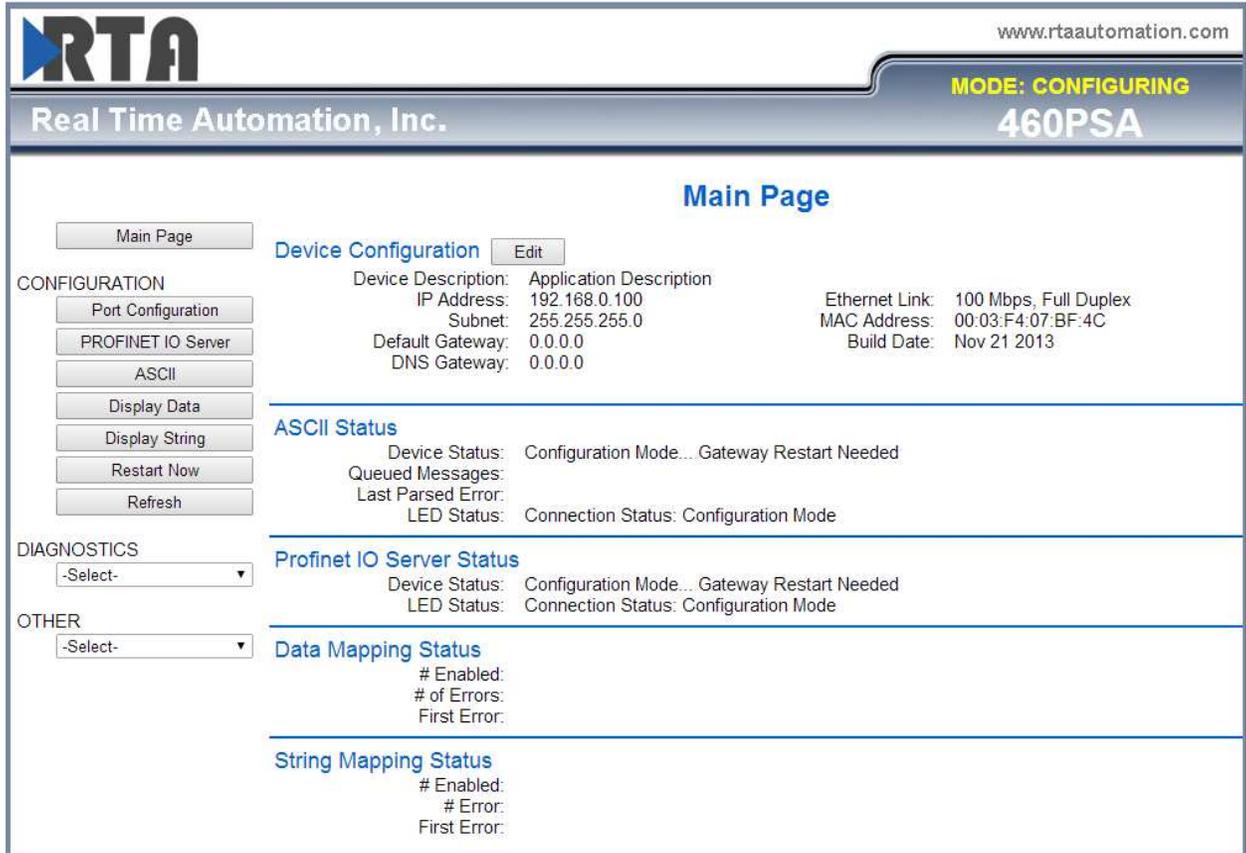
  d. In the upper-right corner of the web page, find "MODE". If the mode is not "CONFIGURING", click the "Configuration Mode" button that appears on the top left, then OK, OK.

e. On the "Main Page", review the network settings. To change values, click the "Device Configuration" "Edit" button.


1. Change "Device Description" to a name that represents how the gateway is being used, for example, "EDI Display".
2. Change "IP Address", "Subnet", "Default Gateway", "DNS Gateway" and "Ethernet Link" to values that are compatible with the associated control system. (Usually, subnet = 255.255.255.0, default and DNS gateway = 0.0.0.0, Ethernet link = Auto-negotiate)
3. Click the "Save Parameters" button to make the change. These settings take effect when the gateway power is removed and restored.

f. Click the "Port Configuration" button.

1. Check "Enable Port 0" or "Enable Port 1" but not both.
2. Required settings are
    - Mode: RS232
    - Serial Baud: 9600
    - Parity: None
    - Data Bits: 8
    - Stop Bits: 1
    - Flow Control: None
    - RTS: High
    - DTR: High
3. Click the "Save Parameters" button to make the change. These settings take effect when the "Restart Now" button is pressed or the gateway power is removed and restored.

g. Click the "PROFINET IO Server" button.
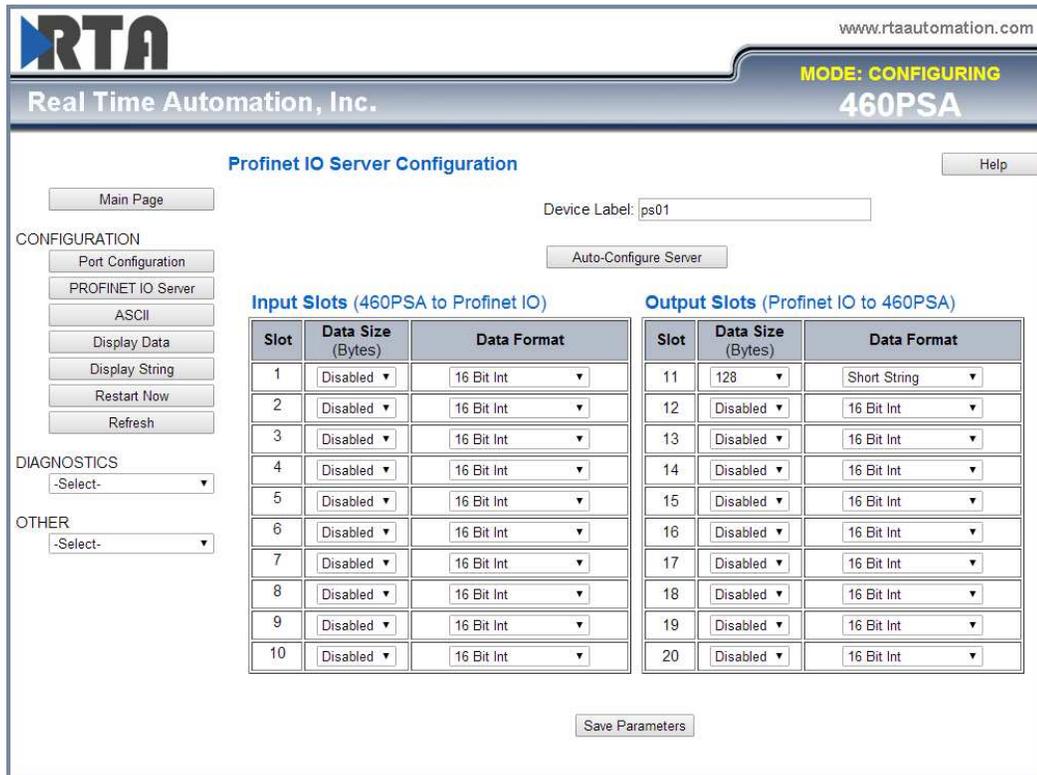
1. Change "Device Label" to "ps01", without the quotation marks. This name is also used in the Siemens Step 7 software, and they must match exactly.
2. If the data values are greyed-out, click the "Edit Data Groups" button, OK, OK, OK to change the following values:
   - "Data Size" for all slots except "Slot" 11 should be disabled.
   - "Data Format" for all slots except "Slot" 11 should be 16 Bit Int.
   - "Slot" 11 "Data Size bytes" is 128, "Data Format" is "Short String".
3. Click the "Save Parameters" button to make the change. These settings take effect when the "Restart Now" button is pressed or the gateway power is removed and restored.

h. Click the "ASCII" button.

1. Use the "Add ASCII Device" button and the "Delete ASCII Device" buttons so that only one ASCII device exists named "ASCII Device 1". Use the << and >> buttons to navigate through existing ASCII devices.
2. Check the "Enable" checkbox.
3. Change "Port" to "Port 0 (T-strip)" or "Port 1 (DB9)" to match the selected port in "Port Configuration"
4. Under "Receive Data (ASCII to 460PSA)", uncheck "Enable".
5. Under "Transmit Data (460PSA to ASCII)",
   - Check "Enable"
   - "Max Message Length" = 128
   - "Transmit Timeout" = 0
   - Under "Add Delimiters"
     · Start = 0, [NUL] 0, [NUL] 0
     · End = 0, [NUL] 0, [NUL] 0
6. Click the "Save Parameters" button to make the change. These settings take effect when the "Restart Now" button is pressed or the gateway power is removed and restored.

    i.   Remove, then restore power to the gateway. If the IP address was changed, change the IP address of the PC to a compatible address using the instructions listed earlier in this manual named "Configure PC Communications".

    j.   After the gateway reboots, around ten seconds, enter the IP address of the gateway in the web browser address bar and press Enter.

    k.   In the upper-right corner of the web page, find "MODE: RUNNING". If the mode is not "RUNNING", review and verify the PROFINET IO Server settings.

3.3 Configure Siemens PLC
Note: These instructions are written for Siemens TIA Portal v11, and an S7-1200 CPU.

   3.3.1 On the "Start" tab of TIA Portal, open an existing project "in the project view", or create a new project with a compatible CPU, then open "in the project view".

   3.3.2 If an RTA Profinet Gateway device has not been configured before,

   a. Click the menu item: Options > Install general station description file (GSD).
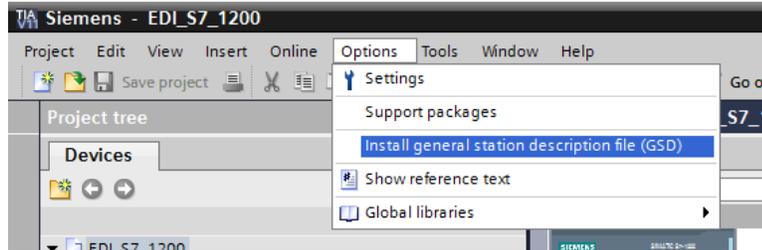
   b. Use the ellipsis (…) and browse to the folder where the GSD files are located.

   c. Check the item found and click "Install".
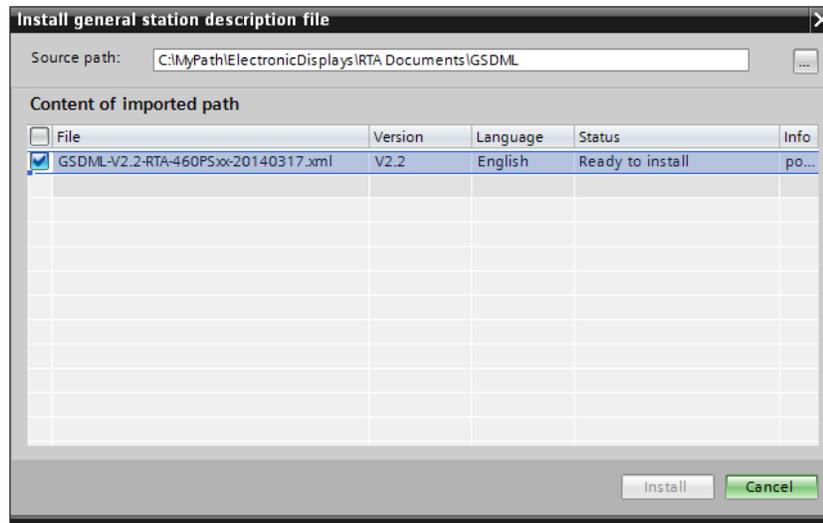
3.3.3 Add an RTA Profinet Gateway to the project
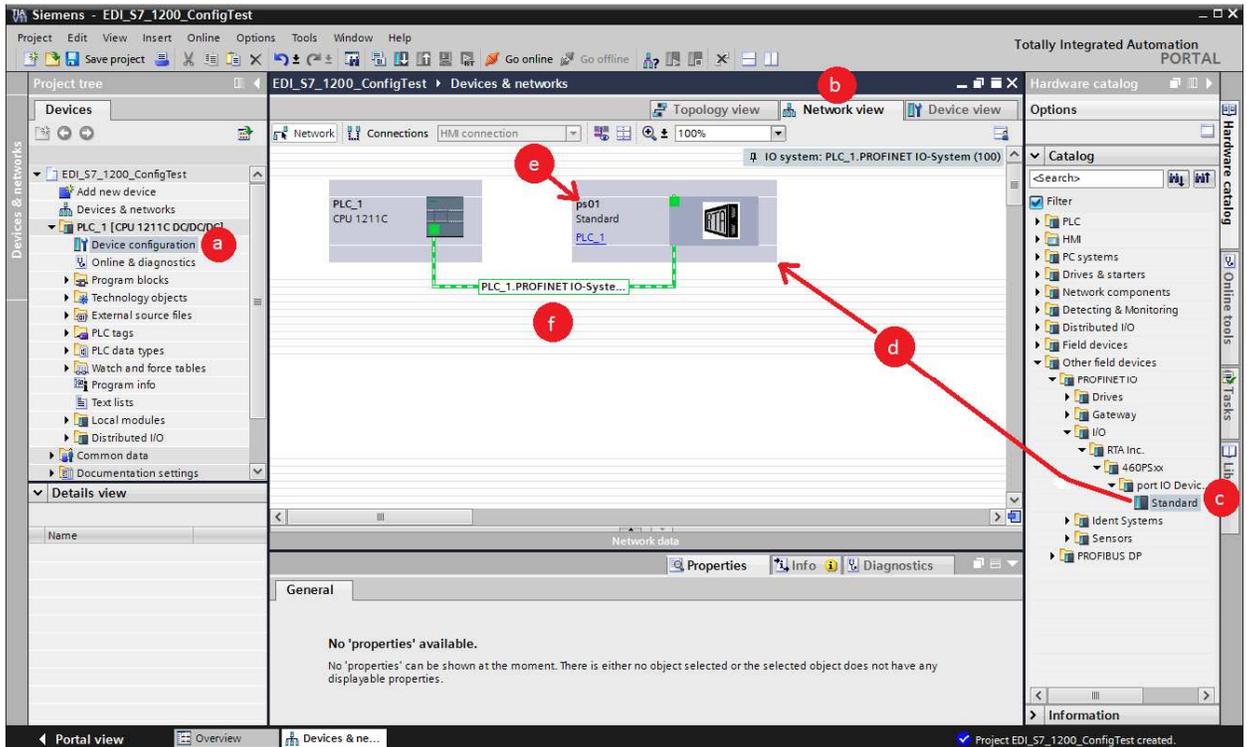
a. In the "Project Tree", expand the [Project name] > [PLC name] and double-click on "Device configuration".
b. On the [Project name] > "Devices & networks" window, click on the "Network view" tab.
c. In the "Hardware catalog" flyout, browse to "Other field devices" > "I/O" > "RTA Inc." > "460PSxx" > "port IO Device Conformance Test 1" > "Standard"
d. Drag "Standard" to an empty space in the "Network view".
e. Notice the name "ps01" is assigned, the same as configured on the gateway.
f. Drag a line from the green square of [PLC name] to the green square of "ps01".

3.3.4 Set the IP address of the CPU
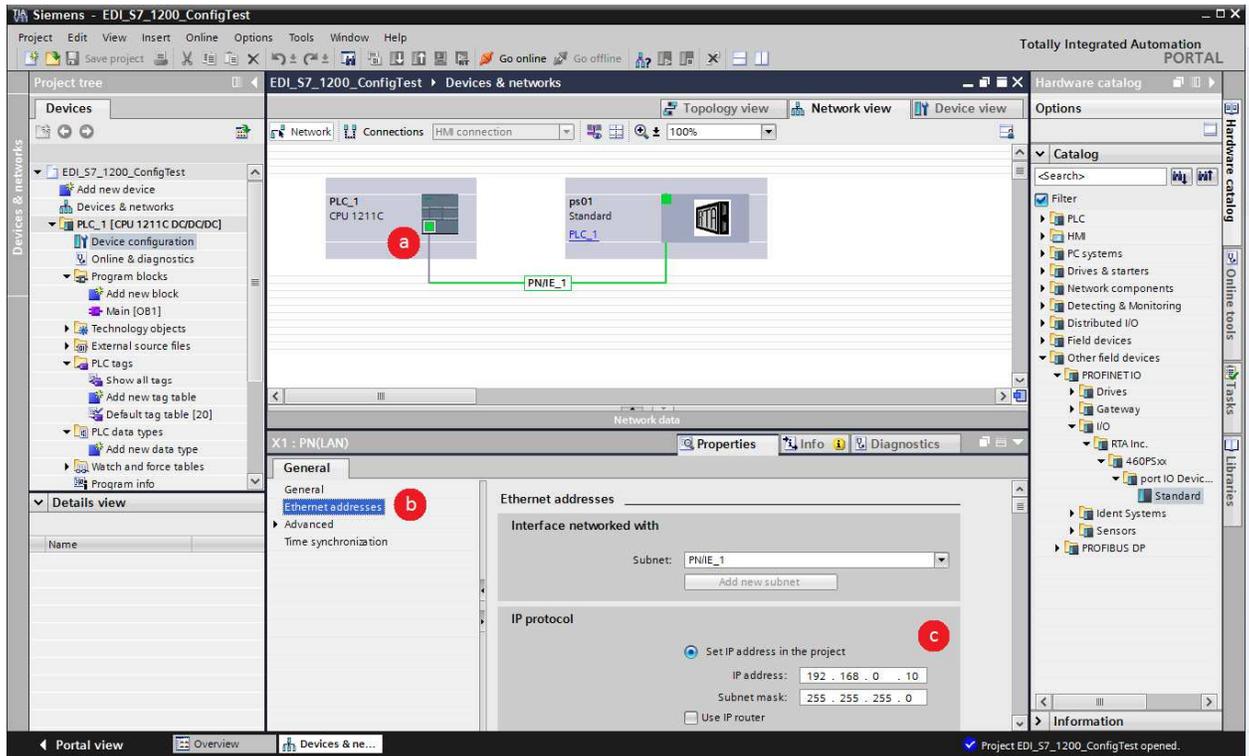
a. In the [PLC Name] graphic, right-click on the green square and select "Properties".
b. On the left side of the "Properties" view, click on "Ethernet addresses".
c. On the right side of the "Properties" view, enter values that are compatible with the associated control system. Normal values are
    "Interface networked with Subnet" = "PN/IE_1"
        Note: This is created by making the connection from the gateway to the CPU.
    "IP protocol" = "Set IP address in the project"
        "IP address" as needed, for example 192.168.0.10
        "Subnet mask" as needed, for example 255.255.255.0
        "Use IP router" = not checked
    "PROFINET", "Set PROFINET device name…" = not checked

3.3.5   Configure the RTA Profinet Gateway device

a.   In the "ps01" graphic, right-click on the green square and select "Properties".

b.   On the left side of the "Properties" view, click on "Ethernet addresses".

c.   On the right side of the "Properties" view, enter values that are compatible with the associated control system. Normal values are

    "Interface networked with Subnet" = "PN/IE_1"

        Note: This is created by making the connection from the gateway to the CPU.
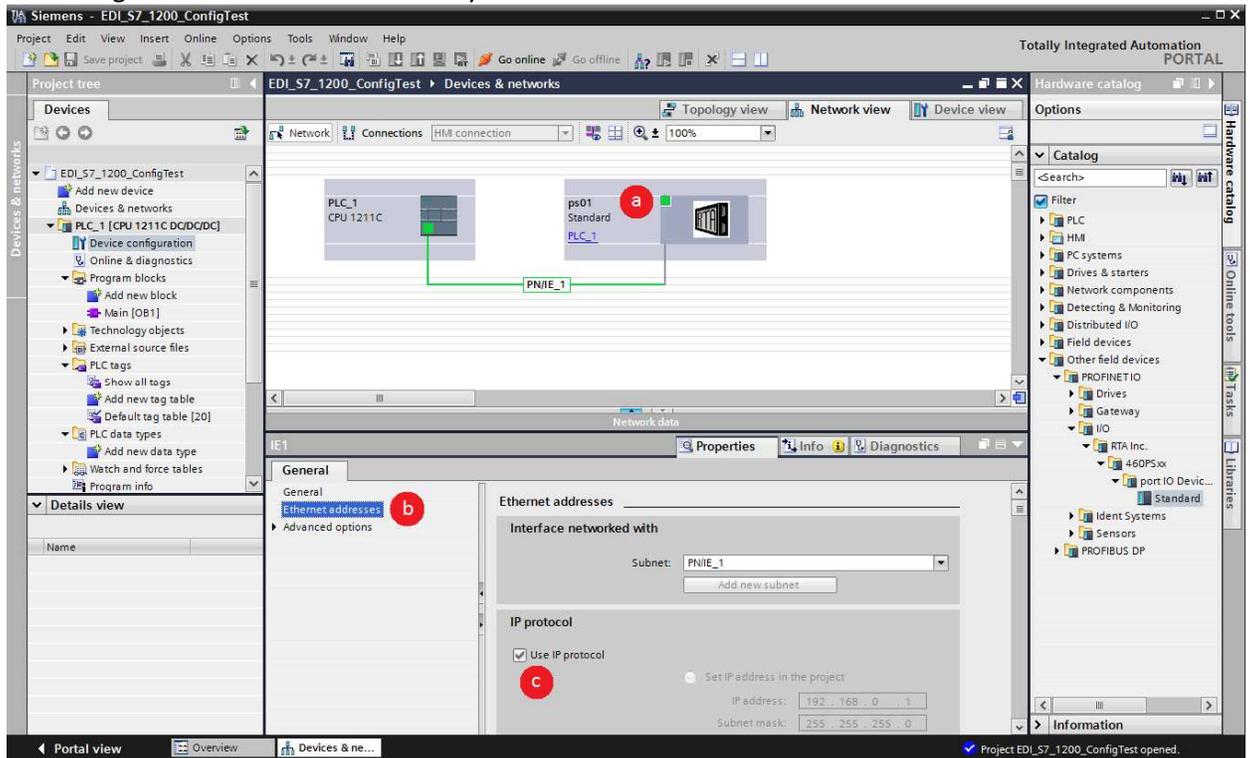
    "IP protocol" = "Use IP protocol"

        Other values are default or are not important.

3.3.6   Choose memory locations for the RTA Profinet Gateway device
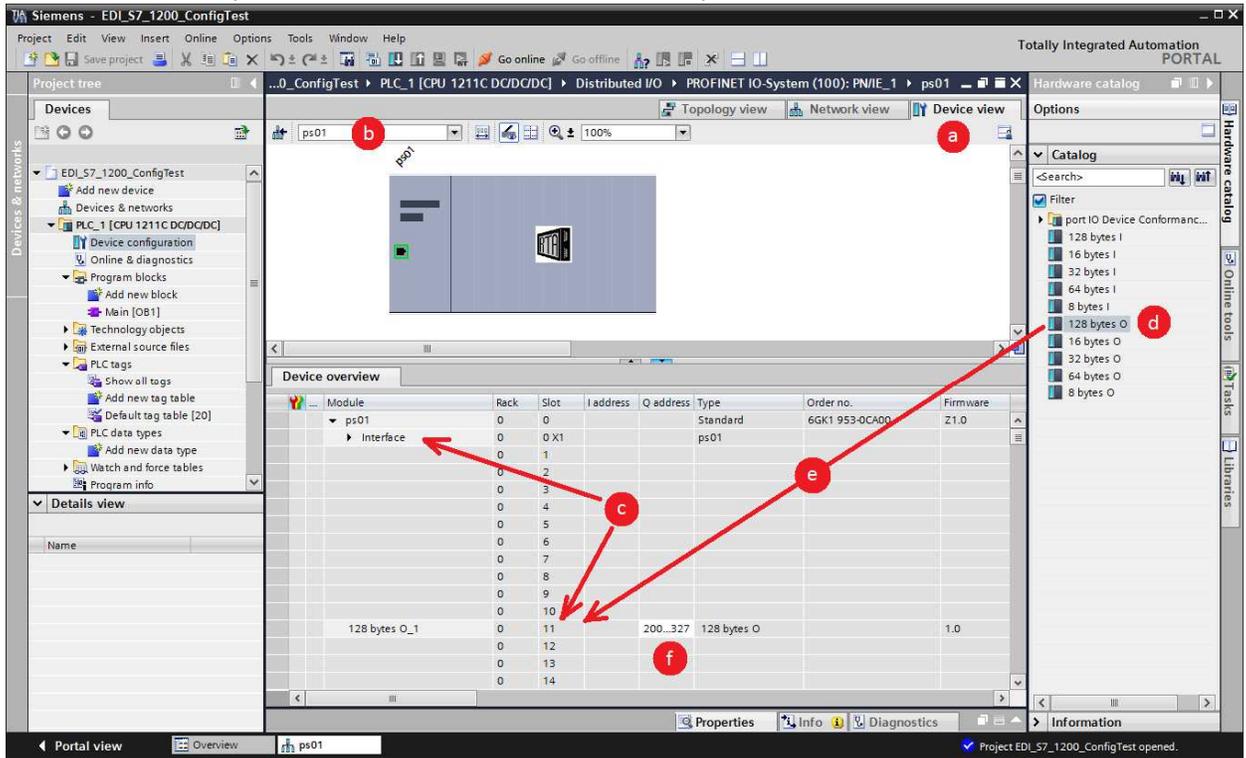
a. On the [Project name] > "Devices & networks" window, click on the "Device view" tab.
b. At the top-left of the view, select "ps01" from the "Device Selection" drop-down list.
c. Below the view, expand the "Device Overview" and expand "ps01" > Interface > Rack 0 Slot 11.
d. On the right, expand to find "Hardware Catalog" > "128 bytes O"
e. Drag "128 bytes O" onto "Rack 0 Slot 11"
f. In the "Q address" column, enter a start and end address that does not conflict with addresses already assigned in the system (Default addresses are 200...327). End address = start address + 127.

3.4 Import EDI Function Block, Database and PLC Tags
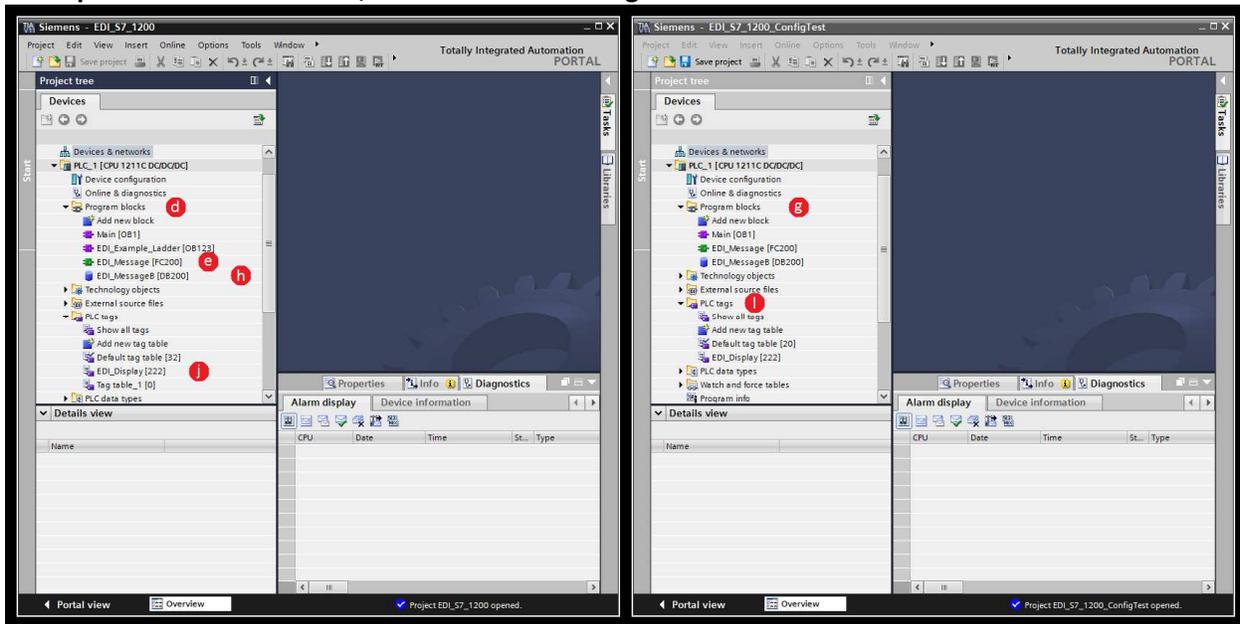
a. Start a second instance of TIA Portal software.
b. On the "Start" tab of TIA Portal, open the reference project named "EDI_S7_1200".
c. Click on the ">Project view" to see the project tree.
d. In the reference project , expand the Project tree to EDI_S7_1200 > PLC_1 > Program blocks.
e. Right-click on "EDI_Message[FC200]" and click "Copy".
f. In your target project, expand the Project tree [Project Name] > PLC_1 > Program Blocks.
g. Right-click on "Program blocks" and click "Paste".
h. Repeat steps e. through g. to copy "EDI_MessageB[DB200]" from the reference project to your project.
i. In the reference project, expand the project tree to EDI_S7_1200 > PLC_1 > PLC tags.
j. Right-click on "EDI_Display [222]" and click "Copy".
k. In your target project, expand the Project tree to [Project Name] > PLC_1 > PLC tags.
l. Right-click on "PLC tags" and click "Paste".

4.0 Use the EDI Function Block

The EDI function block lets the user send messages to an LED display using the MCS protocol v3.1. The complete specification for the MCS Protocol is available at www.electronicdisplays.com. Common use of the protocol is shown in the examples in this section.

4.1 EDI_Message Function Block Description

```
              %FC200
           "EDI_Message"
  — EN                    ENO —
  — DB_Number              ER ⊣
  — QB                ErrorCode -
  — Clear
  — String1
  — String2
  — String3
  — String4
  — Complete


  — MessageBuffer
```
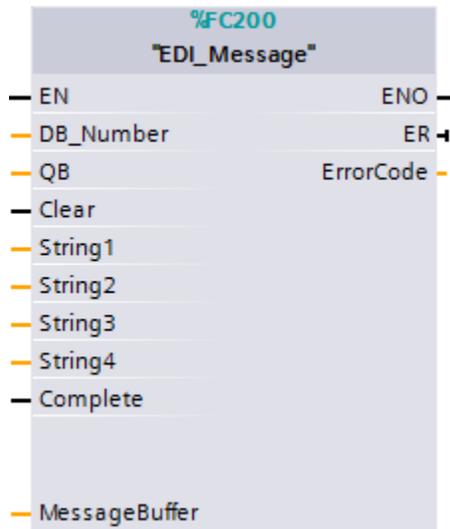
"EDI_Message" function block interface		
Interface Name	Data Type	Description
EN	Bool	Enable EN to transfer the input strings to the LED display.
DB_Number	Int	Set DB_Number to the data block that contains a string used as the PLC message buffer. This is used by this function block to assemble a message for the LED display. Default: The default datablock number is 200 (for DB200). This may be changed if data block DB200 is needed for something else. The first member of the datablock must be as follows: Name: Message Type: String[128] Offset: 0
QB	Int	Set QB to the associated I/O output start address that is configured in the project tree: Default: The default output address is 200 for (%QB200). This may be changed if output %QB200 is needed for a different purpose. 　　Address configuration: YourProjectName > YourPLCName > 　　　Distributed I/O > Profinet IO-System > ps01 > 　　　128 bytes O_1, Q address 200..327 　　　PLC_tag configuration: YourProjectName > YourPLCName > 　　　PLC_tags > EDI_Display[222] > EDI_Display type Char, 　　　Address %QB200
Clear	Bool	Use Clear to manage the PLC message buffer. 　Set to TRUE or FALSE to clear or retain the PLC message buffer. 　This allows more text to be added with another call to this function.
String1	String	Use String1 through String4 to add text to the PLC message buffer. 　If Clear is True, the buffer is cleared 　String1 is added to the buffer 　String2 is added to the buffer 　String3 is added to the buffer 　String4 is added to the buffer
String2		
String3		
String4		
Complete	Bool	Use Complete to send the PLC message buffer to the display Set to TRUE to send the PLC message buffer 　　1) The message buffer is copied to the specified %QB output. 　　2) The Profinet gateway receives the string 　　3) If the Profinet gateway recognizes a change in the string (different than previous message), the string is transmitted by RS232 to the display. Set to FALSE to prevent the message from being sent to the buffer. For example, if three EDI_Message blocks are used to build a message, only the last has the Complete bit TRUE.
MessageBuffer	String	Set MessageBuffer to the PLC message buffer string 　The default string is DB200.Message which is named in the 　reference project, "EDI_MessageB".Message
ER	Bool	True when the function encounters an error during processing.
ErrorCode	Bool	0 = No error; 1 = Overflow (Max Length = 128 characters)

4.2 Simple use of the EDI_Message Function Block

On a new network, add a positive signal edge contact -|P|-. Then drag the EDI_Message [FC200] block onto the rung. Populate the inputs and outputs like this example:
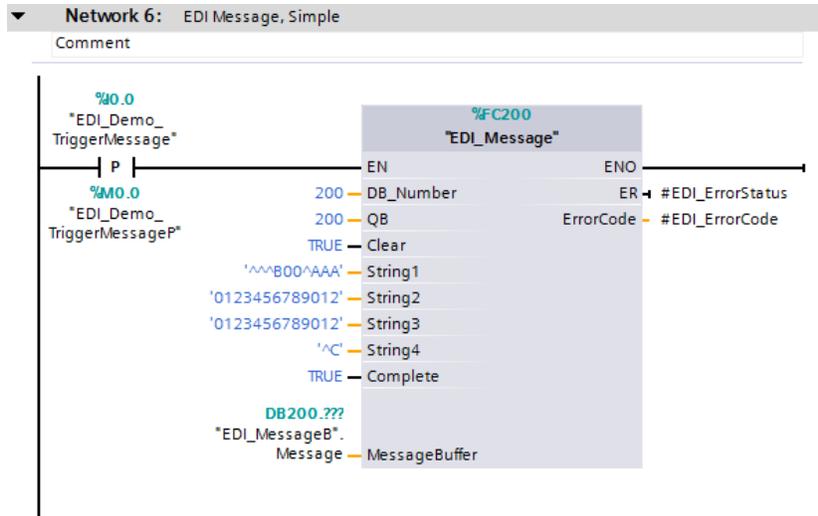
a. DBNumber: Datablock DB200

b. QB: Output byte %QB200

c. Clear: TRUE to clear the function block buffer and start a new message

d. String1: ^^^B00^AAA includes the MCS protocol items needed to begin a message.

    ^^^   Header required for gateway memory alignment

    ^B   Start of transmission (STX)

    00   Address 00

    ^A   Start command

    A   Command: Write to text file

    A   Text filename A

e. String1, String2: This the text for display on the LED display.

f. String4: End of transmission (ETX)

g. MessageBuffer: "EDI_MessageB".Message is the first element of DB200.

h. ER: FALSE if the message size is not ok.

i. ErrorCode: 0 = No error; 1 = Overflow (Max Length = 128 characters)

Note: The message can organized as desired, with unused inputs empty (''). For example, this message could be '^^^B00^AAA012345678901201234567890112^C" placed into String1, with the same results as the example shown above.

4.3 Advanced use of the function block

The MCS protocol includes many codes used to change colors and display styles. The codes may be manually entered similar to the ones in example 4.2. Because this might become complicated, the reference project also comes with a tag table that contains constants for the MCS protocol. These constants are located in the project tree > [YourProjectName] > [YourPLCName] > PLC Tags > EDI_Display[222], on the tab named "User constants". The list is also located in the files **EDI_PLC tags.pdf** and **EDI_PLC tags.xls**, where they are grouped for easier view.

Name	Value	Comment
EDI_Header	'^^^'	Header required for Profinet Gateway memory alignment
EDI_STX	'^B'	Start of transmission
EDI_Address	'00'	Address of sign, always 00
EDI_SOH	'^A'	Start of command
EDI_CommandWrite_TextFile	'A'	Command: Write to text file
EDI_CommandWrite_VariableFile	'B'	Command: Write to variable file
EDI_CommandWriteRead_SpecialFunction	'C'	Command: Write/read to/from special function
EDI_CommandWrite_TextFileWithoutRestart	'D'	Command: Write to text file without restart
EDI_EOT	'^D'	End of text
EDI_ETX	'^C'	End of transmission
EDI_CommandWrite_TextFile_ModeField_BEL	'^G'	Command: Write to text file, command code 'A' data area, Start of mode field (BEL)
EDI_CommandWrite_TextFile_ModeField_DisplayPosition_Middle	'M'	Command: Write to text file, command code 'A' data area, Display Position, Middle Line, centered
EDI_CommandWrite_TextFile_ModeField_DisplayPosition_Top	'T'	Command: Write to text file, command code 'A' data area, Display Position, Top Line, all lines used minus one
EDI_CommandWrite_TextFile_ModeField_DisplayPosition_Bottom	'B'	Command: Write to text file, command code 'A' data area, Display Position, Bottom Line, bottom begins after last top line
EDI_CommandWrite_TextFile_ModeField_DisplayPosition_Fill	'F'	Command: Write to text file, command code 'A' data area, Display Position, Fill All, centered
EDI_CommandWrite_TextFile_ModeField_DisplayPosition_Left	'L'	Command: Write to text file, command code 'A' data area, Display Position, Left, all lines used minus one.
EDI_CommandWrite_TextFile_ModeField_DisplayPosition_Right	'R'	Command: Write to text file, command code 'A' data area, Display Position, Right, all lines used minus one.
EDI_CommandWrite_TextFile_ModeField_ModeCode_Scroll	'S'	Command: Write to text file, command code 'A' data area, Mode Code, Scroll right to left
EDI_CommandWrite_TextFile_ModeField_ModeCode_Hold	'H'	Command: Write to text file, command code 'A' data area, Mode Code, Stationary
EDI_CommandWrite_TextFile_ModeField_ModeCode_Flash	'F'	Command: Write to text file, command code 'A' data area, Mode Code, Stationary, flashing
EDI_CommandWrite_TextFile_ModeField_ModeCode_SlideUp	'A'	Command: Write to text file, command code 'A' data area, Mode Code, Previous message slide up, replaced by new message
EDI_CommandWrite_TextFile_ModeField_ModeCode_SlideDown	'B'	Command: Write to text file, command code 'A' data area, Mode Code, Previous message slide down, replaced by new message
EDI_CommandWrite_TextFile_ModeField_ModeCode_SlideLeft	'C'	Command: Write to text file, command code 'A' data area, Mode Code, Previous message slide left, replaced by new message
EDI_CommandWrite_TextFile_ModeField_ModeCode_SlideRight	'D'	Command: Write to text file, command code 'A' data area, Mode Code, Previous message slide right, replaced by new message
EDI_CommandWrite_TextFile_ModeField_ModeCode_RollUp	'a'	Command: Write to text file, command code 'A' data area, Mode Code, Previous message roll up, replaced by new message
EDI_CommandWrite_TextFile_ModeField_ModeCode_RollDown	'b'	Command: Write to text file, command code 'A' data area, Mode Code, Previous message roll down, replaced by new message
EDI_CommandWrite_TextFile_ModeField_ModeCode_RollLeft	'c'	Command: Write to text file, command code 'A' data area, Mode Code, Previous message roll left, replaced by new message
EDI_CommandWrite_TextFile_ModeField_ModeCode_RollRight	'd'	Command: Write to text file, command code 'A' data area, Mode Code, Previous message roll right, replaced by new message

An simple way to use the constants is to copy the name from the .pdf or .xls and paste into the function block String1-String4 inputs.

Notes: The following example sends this command to the LED display:
   ^^^B00^AAA^ES^H1^O0RedMessage^O1GreenMessage^C

While this command could be directly entered into a single function block, it might be easier to use when broken into pieces, with separate function blocks. The contants are not necessary, but can be used to allow the user to recognize what the program is doing.

Notice the first function block uses the Clear input to start, and the last function block uses the Complete input to finish. All others have inputs Clear and Complete as FALSE.

How to Choose between using the contants or manual entry of MCS protocol string:

If your project requires a large amount of interaction with the digital display, it might be better to type the command string. This way, the program size is reduced
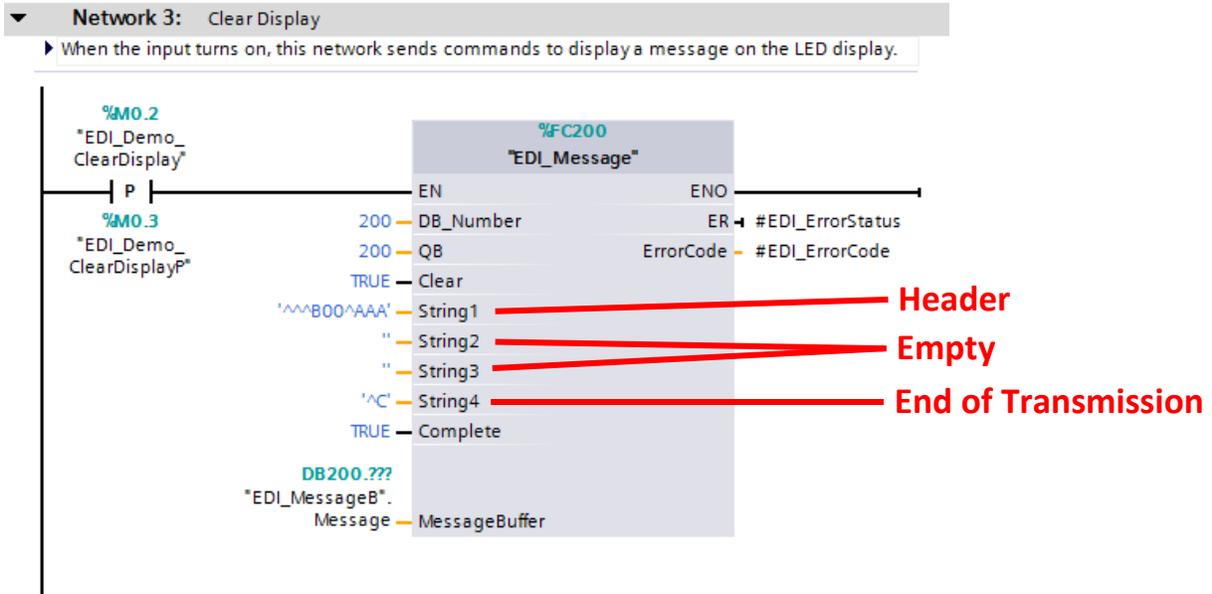
If your project only displays simple messages, like fault messages for a machine, it might be better to use the constants. This way the program is easier to understand and troubleshoot.

Network 2: EDI Message, Advanced

When the input turns on, this network sends commands to display a message on the LED display.
The message is ^^^B00^AAA^ES^H1^O0RedMessage^O1GreenMessage^C.
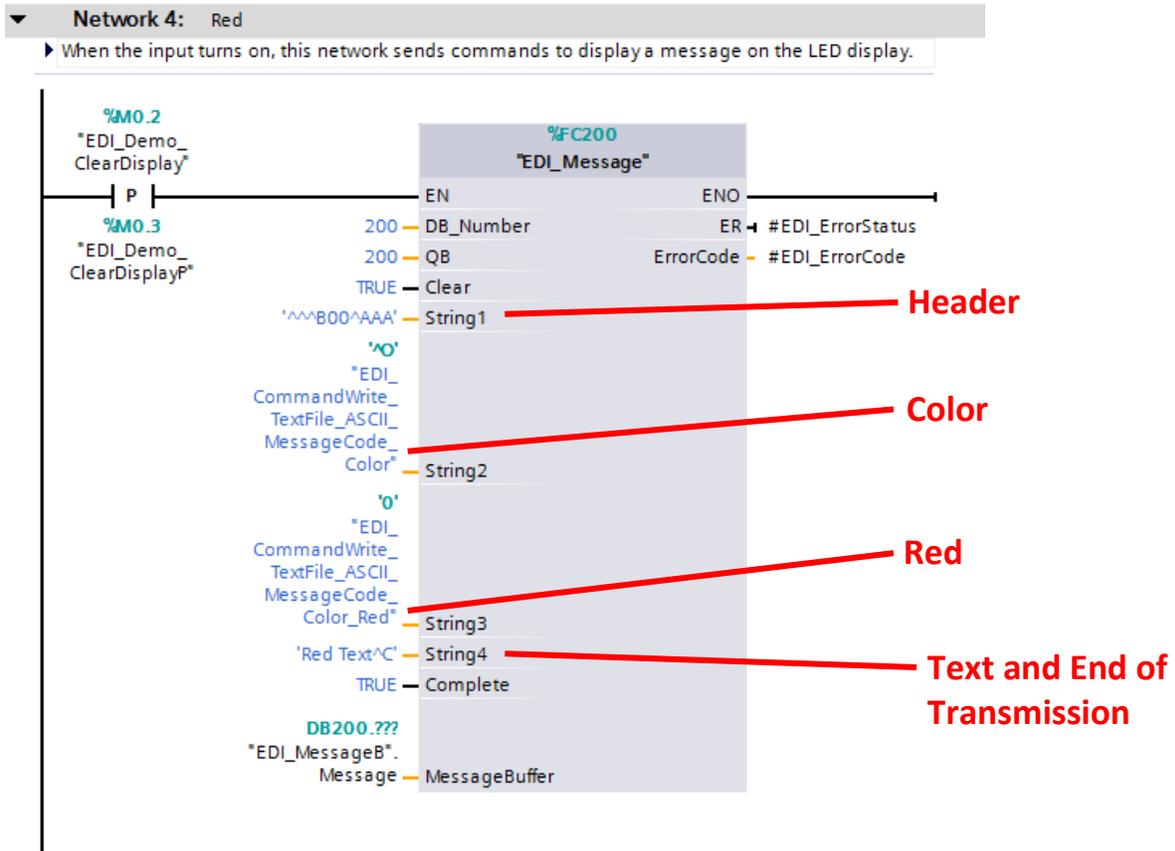
4.4 Example uses of the function block
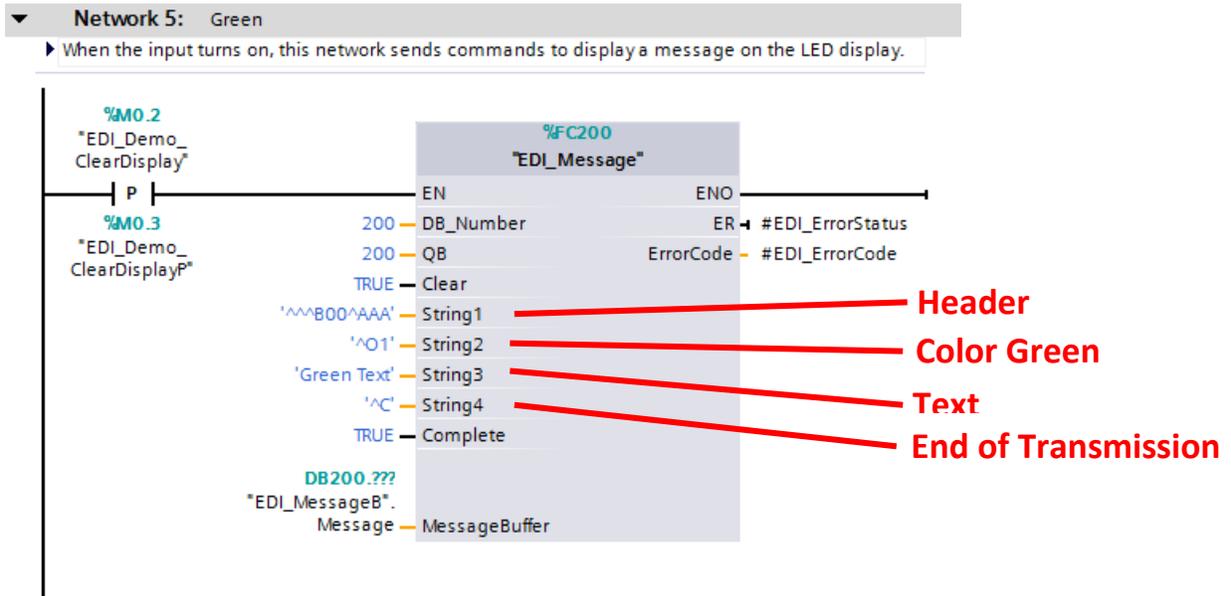### 4.4.1 Clear display (^^^B00^AAA^C)

4.4.2 Colors
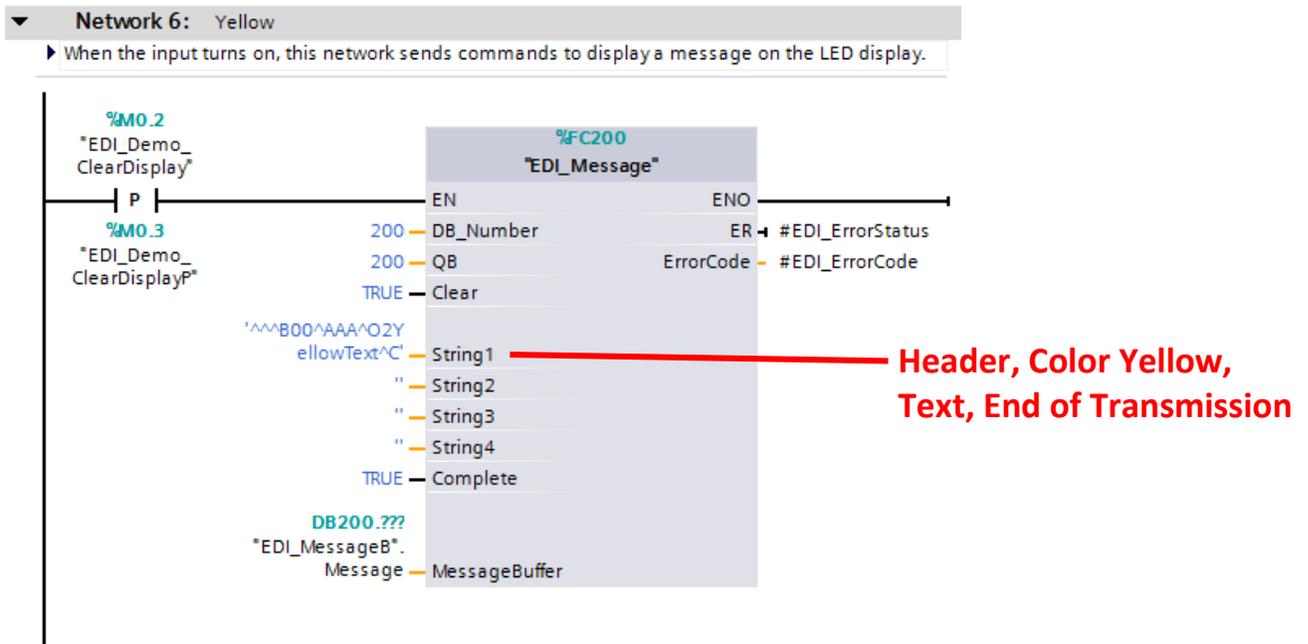
4.4.2.1 Red (^^^B00^AAA^O0Red Text^C)
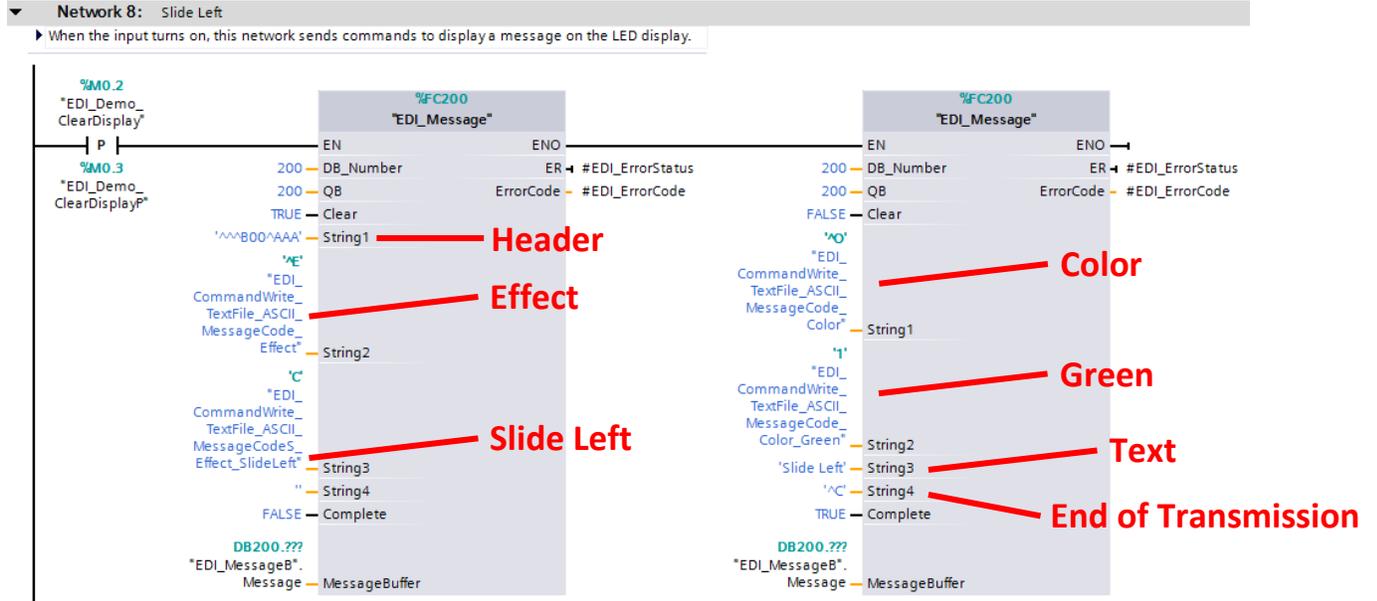
4.4.2.2 Green(^^^B00^AAA^O1Green Text^C)

4.4.2.2 Yellow(^^^B00^AAA ^O2Yellow Text^C)

4.4.3 Flashing (^^^B00^AAA ^H1^O0Flashing Red^C)

4.4.4 Slide Left (^^^B00^AAA ^EC^O1SlideLeft^C)

4.4.5 Right Justify (^^^B00^AAA ^PRRight Justify^C)