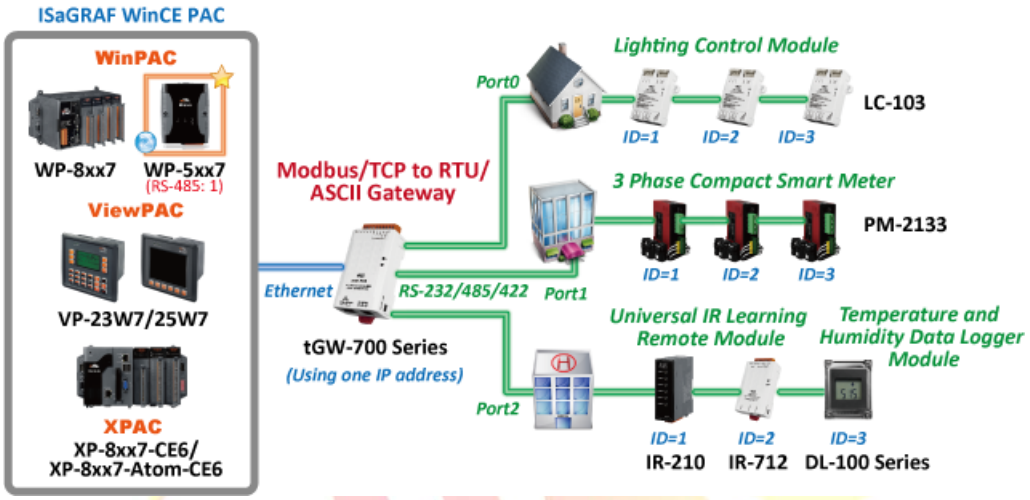
How to Use the tGW-700 Series, Modbus TCP to RTU/ASCII gateway, with the ISaGRAF PAC?

1. Application Introduction

Users sometimes have to choose lower speed transmission (lower baud rate) for long distance communication via Modbus RTU/ASCII over RS-485/RS-422. This often leads into a new problem of inefficient communication. The tGW-700 series gateway of ICP DAS can solve this problem. Using the tGW-700 series gateways can change the RS-485 to the high speed Ethernet and eliminate the cable length limitation of the RS-485 network to solve the problem about poor communication efficiency. This paper introduces the way to use the tGW-700 with the ISaGRAF PAC.



The following versions of the ISaGRAF PACs support to send Modbus TCP commands of different NET-ID to the same Modbus TCP Slave device (i.e. to the tGW-700 series).

ISaGRAF WinCE PAC	ISaGRAF Driver Version
WP-5xx7	1.02 or later version
WP-8xx7	1.52 or later version
VP-25W7/23W7	1.44 or later version
XP-8xx7-CE6	1.32 or later version
XP-8xx7-Atom-CE6	1.01 or later version

Download the Document and the Demo Programs:
https://www.icpdas.com/en/faq/index.php?kind=280#751 > FAQ-159 .
Download the ISaGRAF Drivers:
http://www.icpdas.com/en/download/show.php?num=368&nation=US&kind1=&model=&kw=isagraf
Download the ISaGRAF Product Data Sheet:
http://www.icpdas.com/en/download/index.php?nation=US&kind1=6&kind2=15&model=&kw=isagraf

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2. tGW-700 Series Modules

- **Introduction of tGW-700**

The tGW-700 is a Modbus TCP to Modbus/RTU or Modbus/ASCII gateway that enables a Modbus/TCP host (i.e. the WP-5147) to communicate with serial Modbus RTU/ASCII devices through an Ethernet network, and eliminates the cable length limitation of legacy serial communication devices.

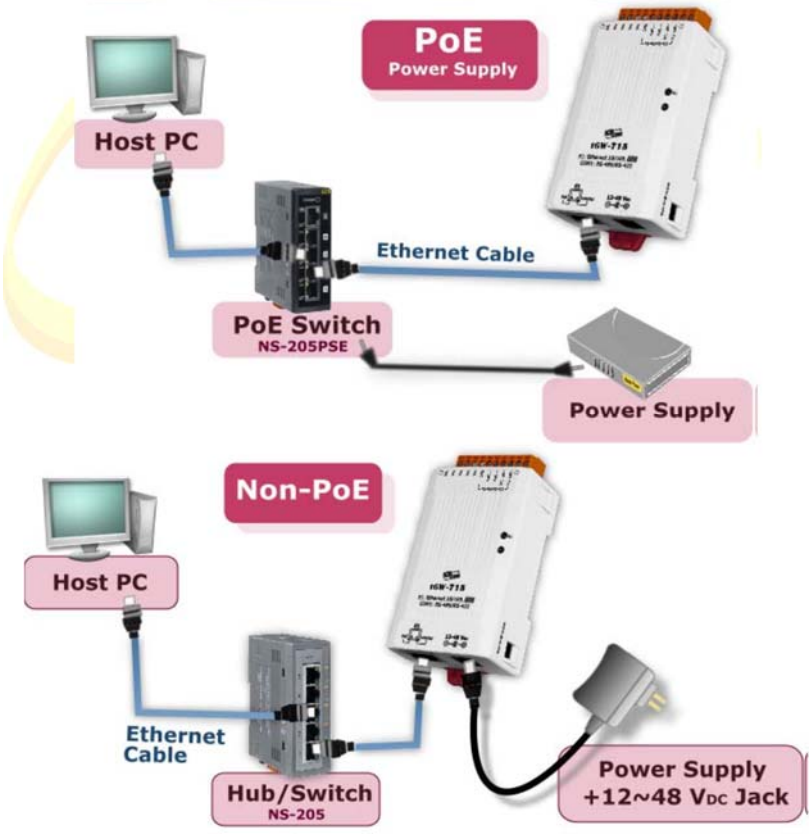


- **Installation & Configuration**

  - Connecting the power and Host PC

1. Make sure **Init/Run** switch is on **Run** position

2. Connect both the tGW-700 and PC to the same sub-network or the same Ethernet Switch and power on the tGW-700.



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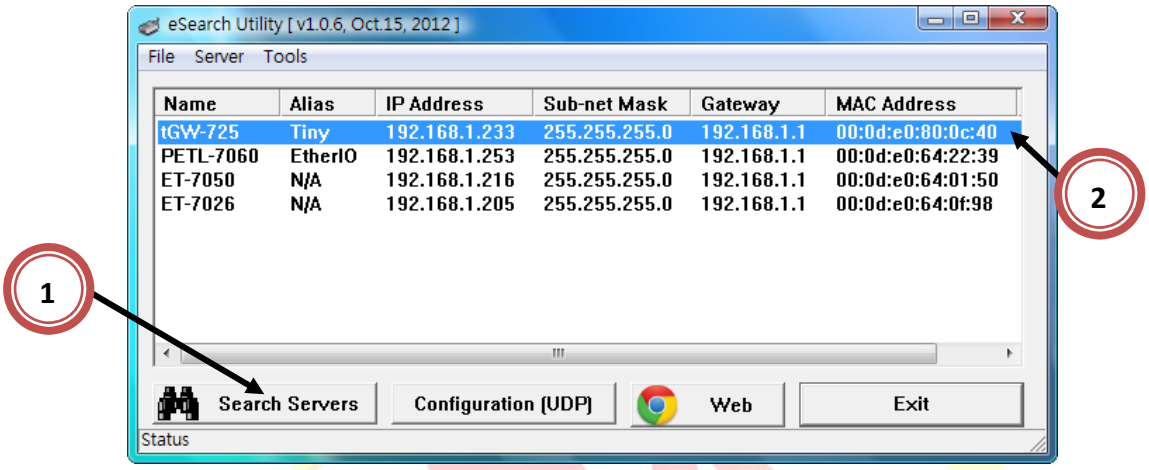
■ Installing the “eSearch.exe” to your PC

1. Download the eSearch Utility “eseach.exe” at:
   http://www.icpdas.com/en/product/guide+Software+Utility_Driver+eSearch__Utility

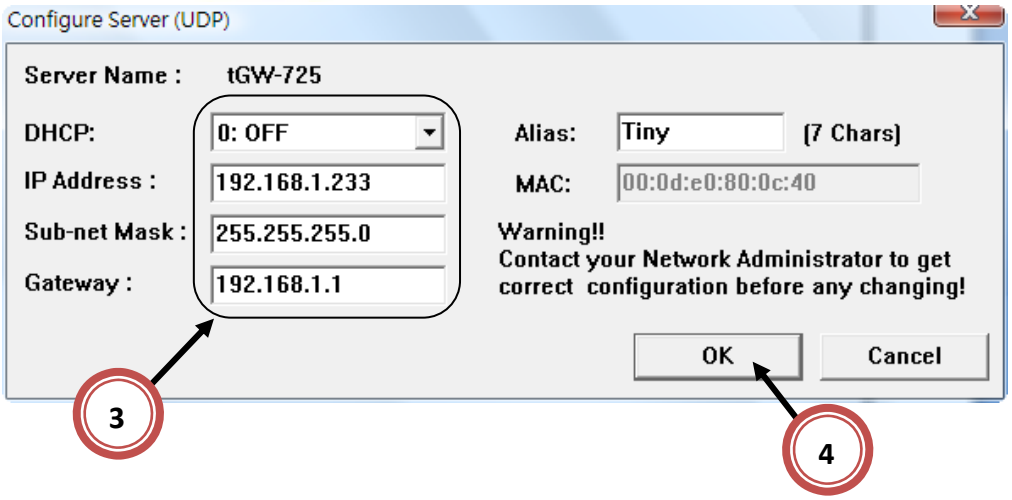
2. Run esearch.exe

■ Setting the network

1. Click the “Search Servers” button to search for your tGW-700.
2. Double click the name of your tGW-700 to open the configuration window.



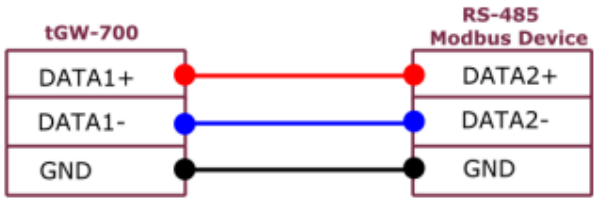
3. Contact your Network Administrator to obtain the correct network configuration information (i.e. IP/ Mask/ Gateway) for your tGW-700.
4. Enter the network settings and then click “OK”, the tGW-700 will use the new settings after reboot.



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- Testing the tGW-700

1. Wiring to the Modbus RTU device (i.e. LC-103, DL-100TM485, PM-2133, IR-210…) with your tGW-700. As below:



2. Use the Modbus Utility to test the tGW-700. If the return data is correct, then the installation has succeeded.

- **More Related Information**
  - tGW-700 Series Product website:
    http://www.icpdas.com/en/download/show.php?num=2374&nation=US&kind1=6&kind2=15&model=&kw=tGW
  - LC-103 Product website:
    http://www.icpdas.com/en/product/LC-103H
  - DL-100 Product website:
    http://www.icpdas.com/en/product/DL-100T485
  - IR-210 Product website:
    http://www.icpdas.com/en/product/IR-210
  - PM-213x Series Product website:
    http://www.icpdas.com/en/download/show.php?num=709&nation=US&kind1=6&kind2=15&model=&kw=pm

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3. How to test the faq159_1 Demo Example

3.1. Hardware Preparation

- **The Hardware for this demo**

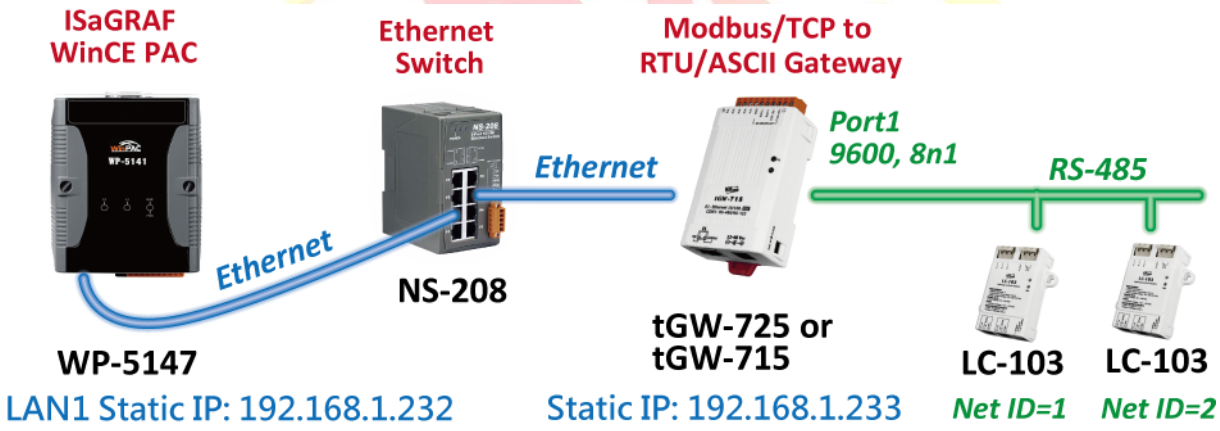
1. ISaGRAF PAC (CE based) x 1 (i.e. WP-5147)
2. tGW-715 or tGW-725 x 1
3. LC-103 x 2

Note: The driver version of the ISaGRAF PAC must support to send Modbus TCP commands of different NET-ID to the same Modbus TCP Slave device. (Refer to the first page of this paper for the version information.) If not, please download the latest driver version.

- **Pre-setting for the Hardware**

1. The ISaGRAF PAC : Set IP as "192.168.1.232".
2. The tGW-725 : Set IP as "192.168.1.233", port as "Port1" and Baud rate as "9600".
   For configuring the tGW-700, please refer to 2. tGW-700 Series Modules.
3. One LC-103 : Set Rotary Switch as "1", Modus device NET-ID as "1";
   The other LC-103 : Set Rotary Switch as "2", Modus device NET-ID as "2".
4. Cable Wiring : Wire the Port1 of tGW-725 to the RS-485 of two LC-103 modules

- **Hardware Wiring Picture**



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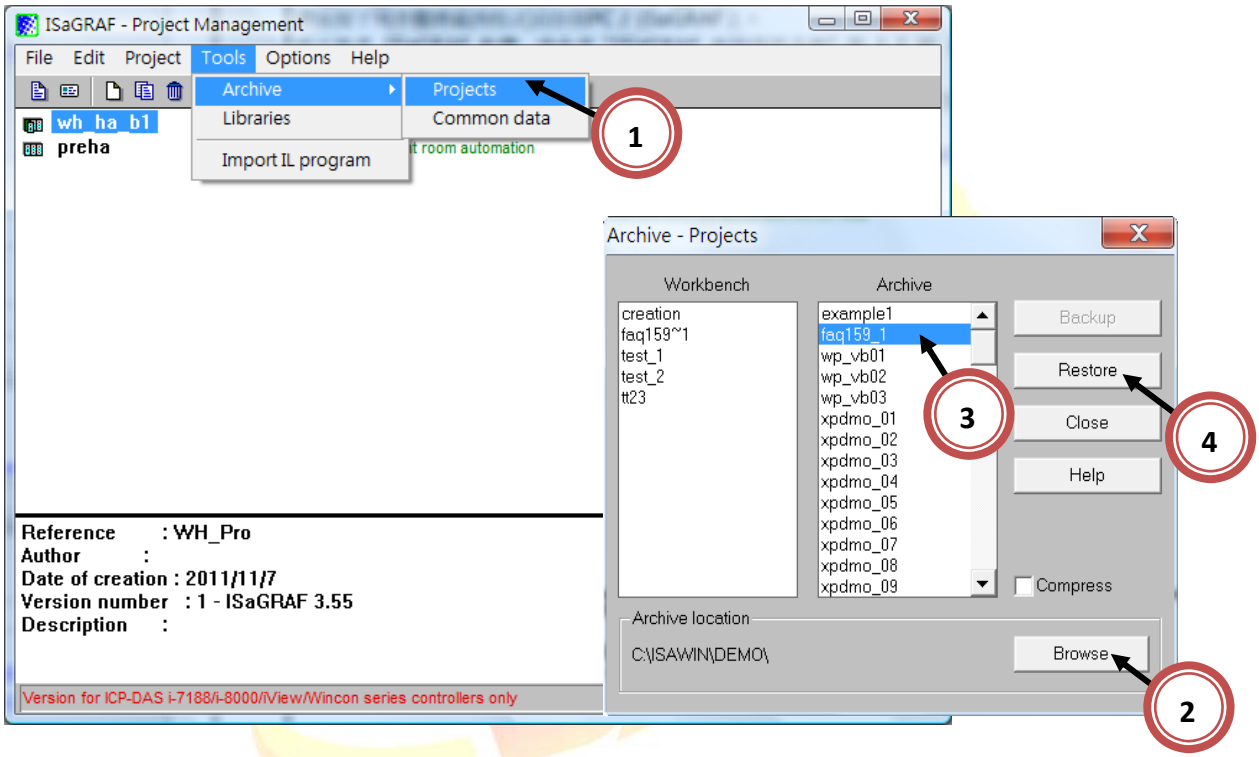
3.2. How to Operate the Demo faq159_1

- **Download faq159_1.pia**

Please download the "faq159_demo.zip" that includes this PDF paper and the demo program "faq159_1.pia" from https://www.icpdas.com/en/faq/index.php?kind=280#751 > 159 .

- **Restore faq159_1.pia to PC/ISaGRAF**

Follow the steps in the below picture to restore the demo program into your PC/ISaGRAF.



- **Compile**

Click the menu bar [Make > Make application] to re-compile this ISaGRAF demo project.

Note:
If user is not familiar with the ISaGRAF, recommend to study the Section 1.1 and 1.2 and Section 2.1 of the ISaGRAF User's manual. You may find them in the web site http://www.icpdas.com/en/download/show.php?num=333&nation=US&kind1=&model=&kw=isagraf .

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- **Download Project to the PAC**

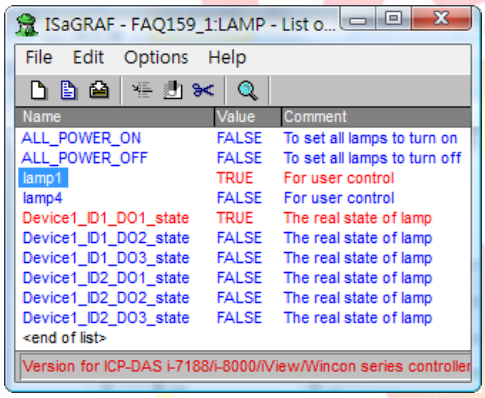
After compiling, download the ISaGRAF project into the ISaGRAF PAC.

- **Test the Demo**

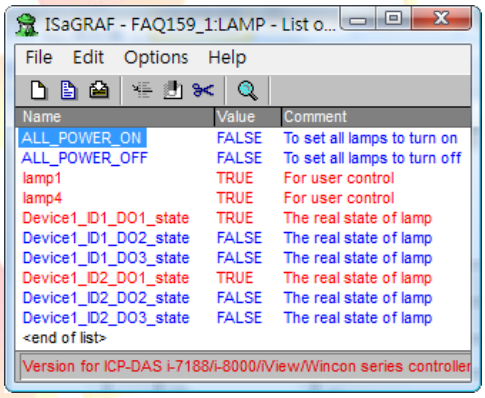
When the PC/ISaGRAF connects the ISaGRAF PAC which is running the “faq159_1” project, the below Spy Lists window will pop up.

Test the demo in the Spy Lists window:

1). If set “ALL_POWER_ON” to “true”, the DO1 of all LC-103 will turn on.
2). If set “ALL_POWER_OFF” to “true”, the DO1 of all LC-103 will turn off.
3). If set “lamp1” to “true”, the DO1 of LC-103 ID 1 will turn on.
4). If set “lamp1” to “false”, the DO1 of LC-103 ID 1 will turn off.



If set “lamp1” to “true”



If set “ALL_POWER_ON” to “true”

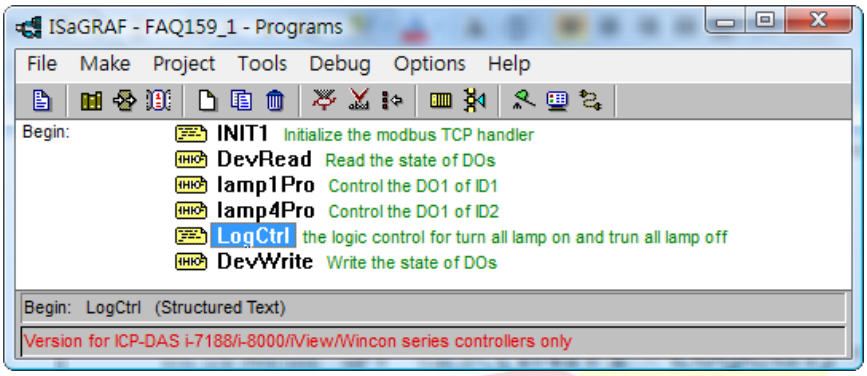
Note:
If user is not familiar with the ISaGRAF, recommend to study the Section 1.1 and 1.2 and Section 2.1 of the ISaGRAF User's manual. You may find them in the web site
http://www.icpdas.com/en/download/show.php?num=333&nation=US&kind1=&model=&kw=isagraf

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3.3. Description of faq159_1

- **ISaGRAF Project Architecture**

There are two ST programs (INIT1, LogCtrl) and four LD programs (DevRead, Lamp1Pro, Lamp4Pro, DevWrite).

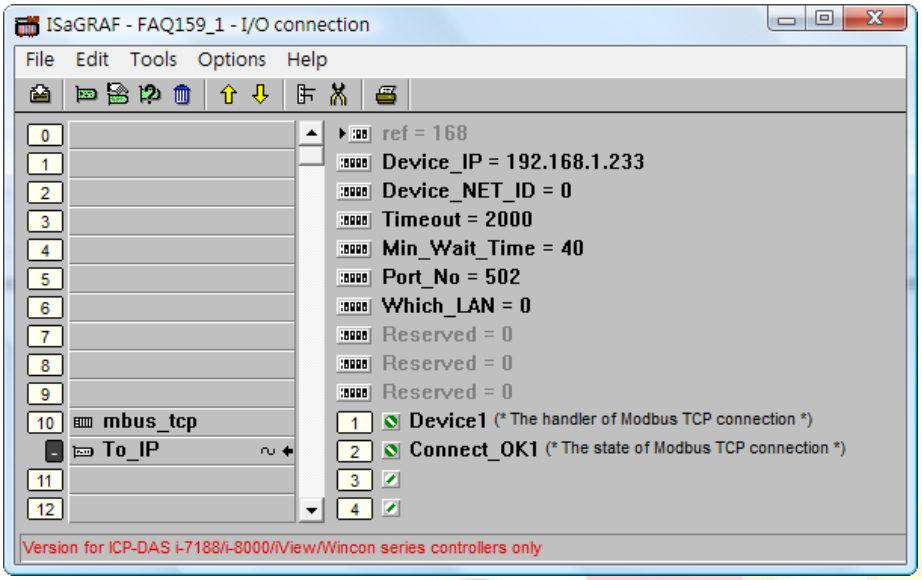


- **ISaGRAF Variables**

Name	Type	Attribute	Description
initialized	Boolean	Internal	Used to run the first scan cycle. Set initial value to “False”.
Dev1_ID1_s	Boolean	Internal	The connection state of the Modbus device ID 1
Dev1_ID2_s	Boolean	Internal	The connection state of the Modbus device ID 2
SetDev1ID1_DO1	Boolean	Internal	If true, set the DO1 state of the LC-103 ID1
SetDev1ID2_DO1	Boolean	Internal	If true, set the DO1 state of the LC-103 ID2
Dev1_ID1_DO1	Boolean	Internal	For Internal used to store the lamp state
Dev1_ID2_DO1	Boolean	Internal	For Internal used to store the lamp state
Dev1_ID1_DO1_s	Boolean	Internal	The DO1 real state of the LC-103 ID1
Dev1_ID1_DO2_s	Boolean	Internal	The DO2 real state of the LC-103 ID1
Dev1_ID1_DO3_s	Boolean	Internal	The DO3 real state of the LC-103 ID1
Dev1_ID2_DO1_s	Boolean	Internal	The DO1 real state of the LC-103 ID2
Dev1_ID2_DO2_s	Boolean	Internal	The DO2 real state of the LC-103 ID2
Dev1_ID2_DO3_s	Boolean	Internal	The DO3 real state of the LC-103 ID2
lamp1	Boolean	Internal	If true, enable the DO1 of the LC-103 ID1
lamp4	Boolean	Internal	If true, enable the DO1 of the LC-103 ID2
ALL_POWER_ON	Boolean	Internal	If true, set lamp1, lamp4 to turn on
ALL_POWER_OFF	Boolean	Internal	If true, set lamp1, lamp4 to turn off
Device1	Integer	Input	Get the Modbus TCP handler of the device
Connect_OK1	Integer	Input	The state of Modbus TCP connection. 1: connection OK
Device1_ID1	Integer	Internal	The Modbus TCP handler of device ID1
Device1_ID2	Integer	Internal	The Modbus TCP handler of device ID2
temp_state1	Integer	Internal	Temporarily store the DO state of device ID1
temp_state2	Integer	Internal	Temporarily store the DO state of device ID2

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- **I/O Connection**



Mbus_tcp Parameter Description	
Device_IP	Enter the tGW-725 IP address. Ex: 192.168.1.233
Device_NET_ID	Assign “0”, if want to send Modbus TCP commands of different NET-ID to the same Modbus TCP Slave device.
Timeout	Unit: ms (0.001 second), range: 500 ~ 15,000
Min_Wait_Time	Unit: ms (0.001 second), the waiting time before send the next Modbus TCP commend. Range: 10 ~ 60,000
Port_No	Enter “502“ if use Port1 of the tGW-725; Enter “503“ if use Port2.
Which_LAN	1 or 2: the LAN number used 0: auto switch the LAN
Device1	Get the Modbus TCP handler
Connect_OK1	Get the connection state with the device 1: connection is ok. 2: not connected.

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- **"INIT1" ST Program**

```
(* For operating correction, this ST program must run first, then can execute Mbus**** block *)
(* This ST only run once in the 1st scan cycle *)
(* Set all NET-ID that Device1 will use in the demo. Set ID 1 and ID 2 devices for this demo *)

if Not (initialized) then

  initialized := true;

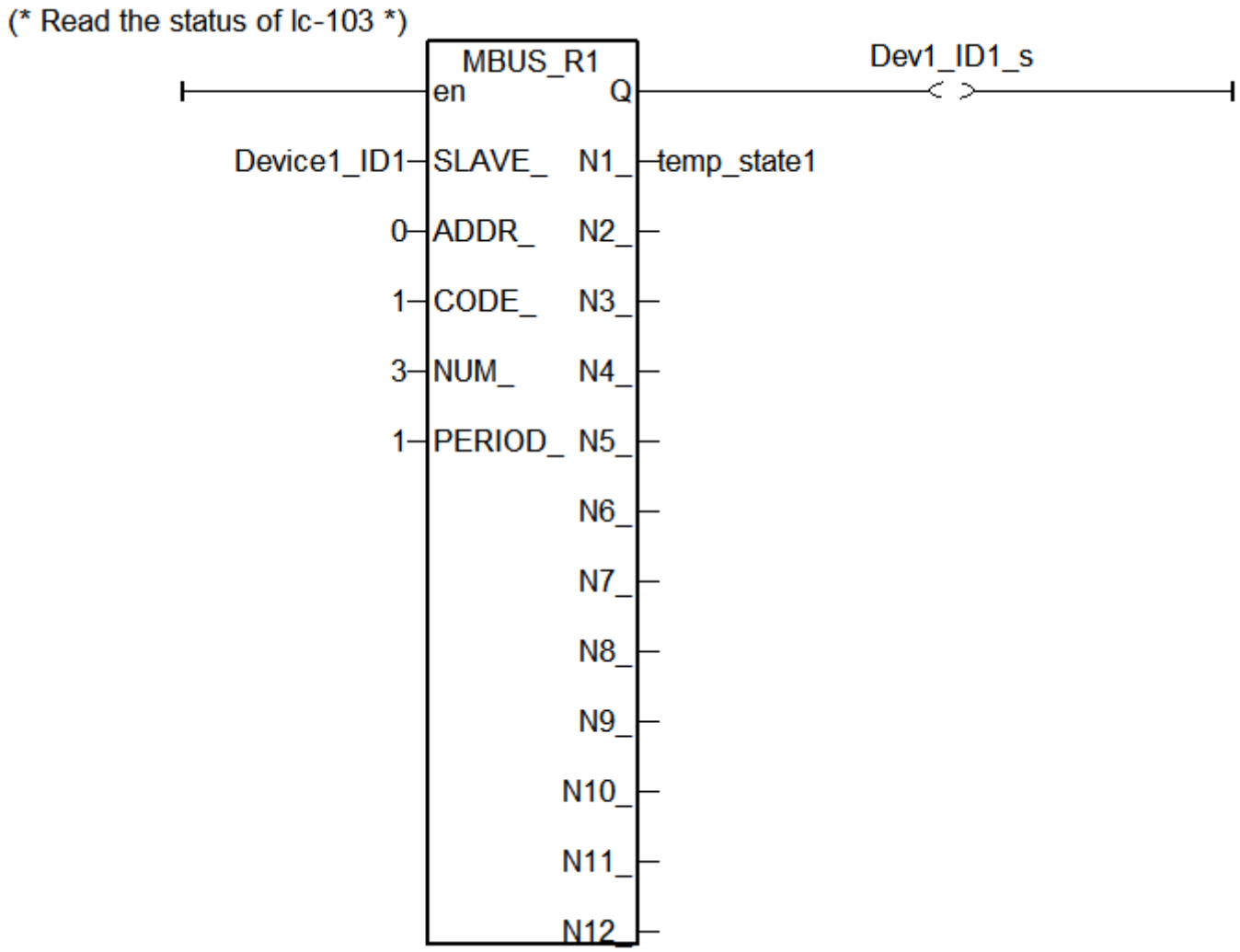
  (* Light controllers, Two LC-103 *)
  (* Get the device handler from the mbus_tcp handler plus the device's Slave ID *)
   Device1_ID1 := Device1 + 1 ;
   Device1_ID2 := Device1 + 2 ;

end_if;
```


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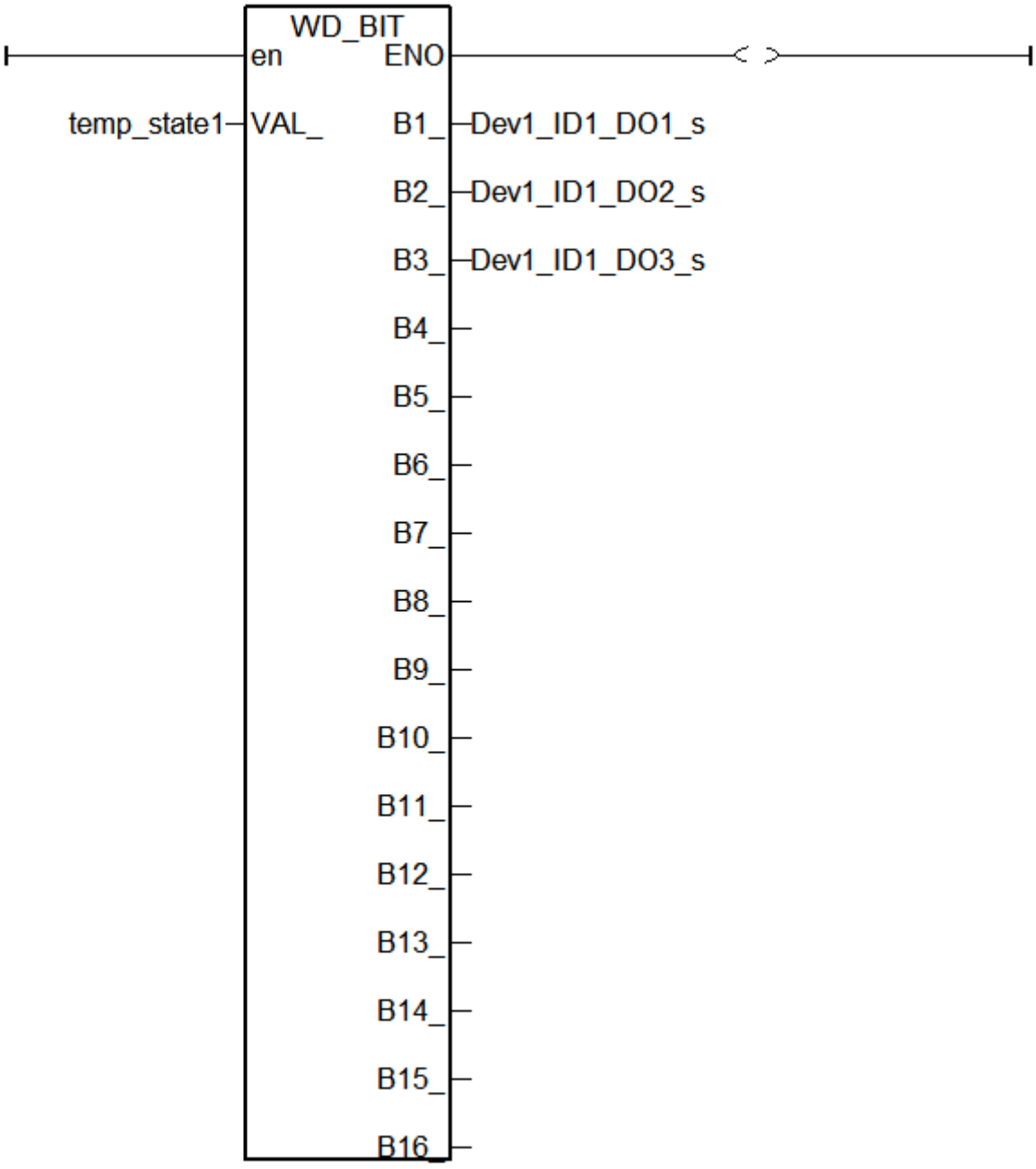
- **"DevRead" LD Program**

(* Use C function-Block "Mbus_R1" to read the DO state of Slave device ID 1 per second *)



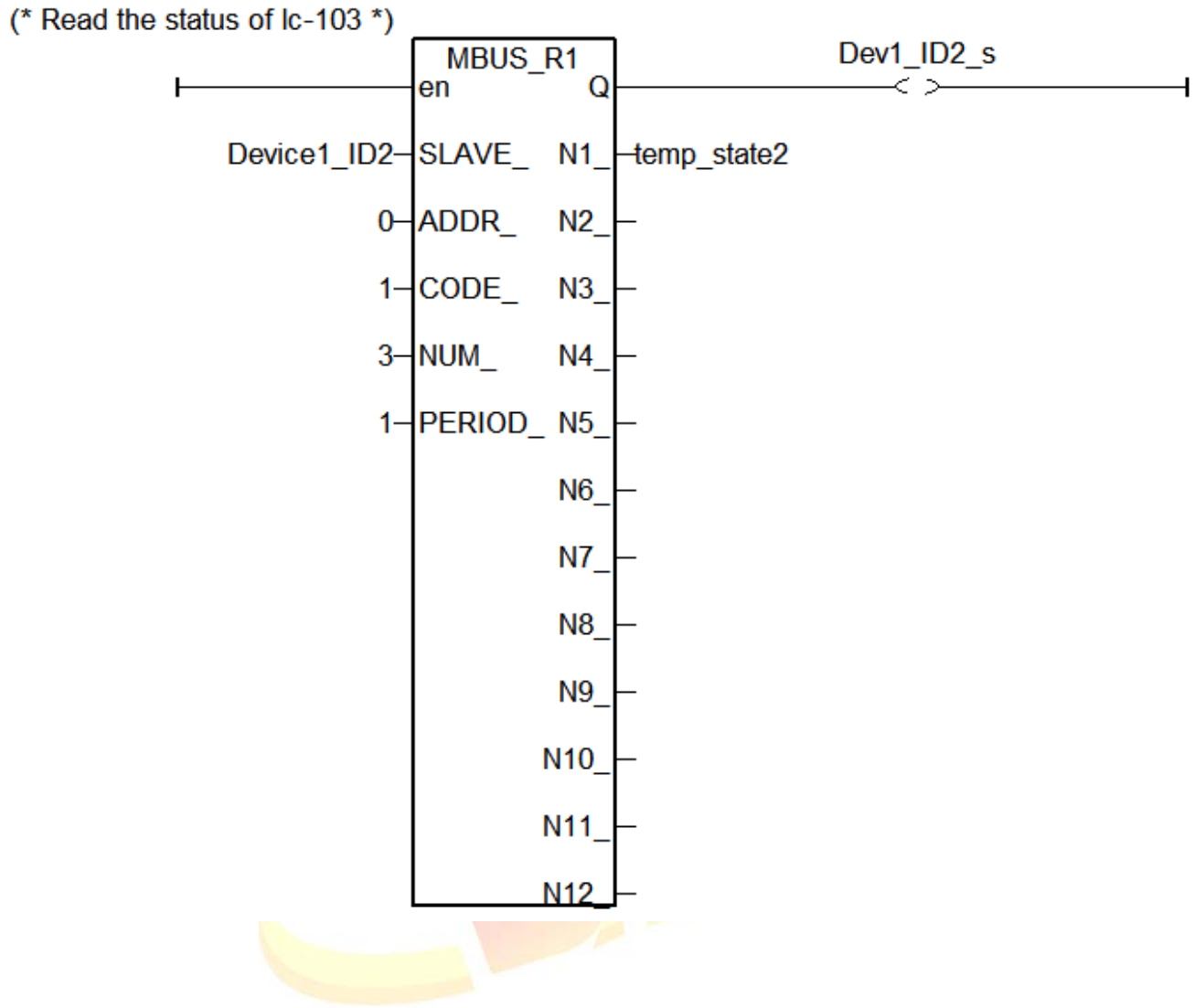
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(* Use C function-block “WD_Bit” to divide the return state into each DO state *)



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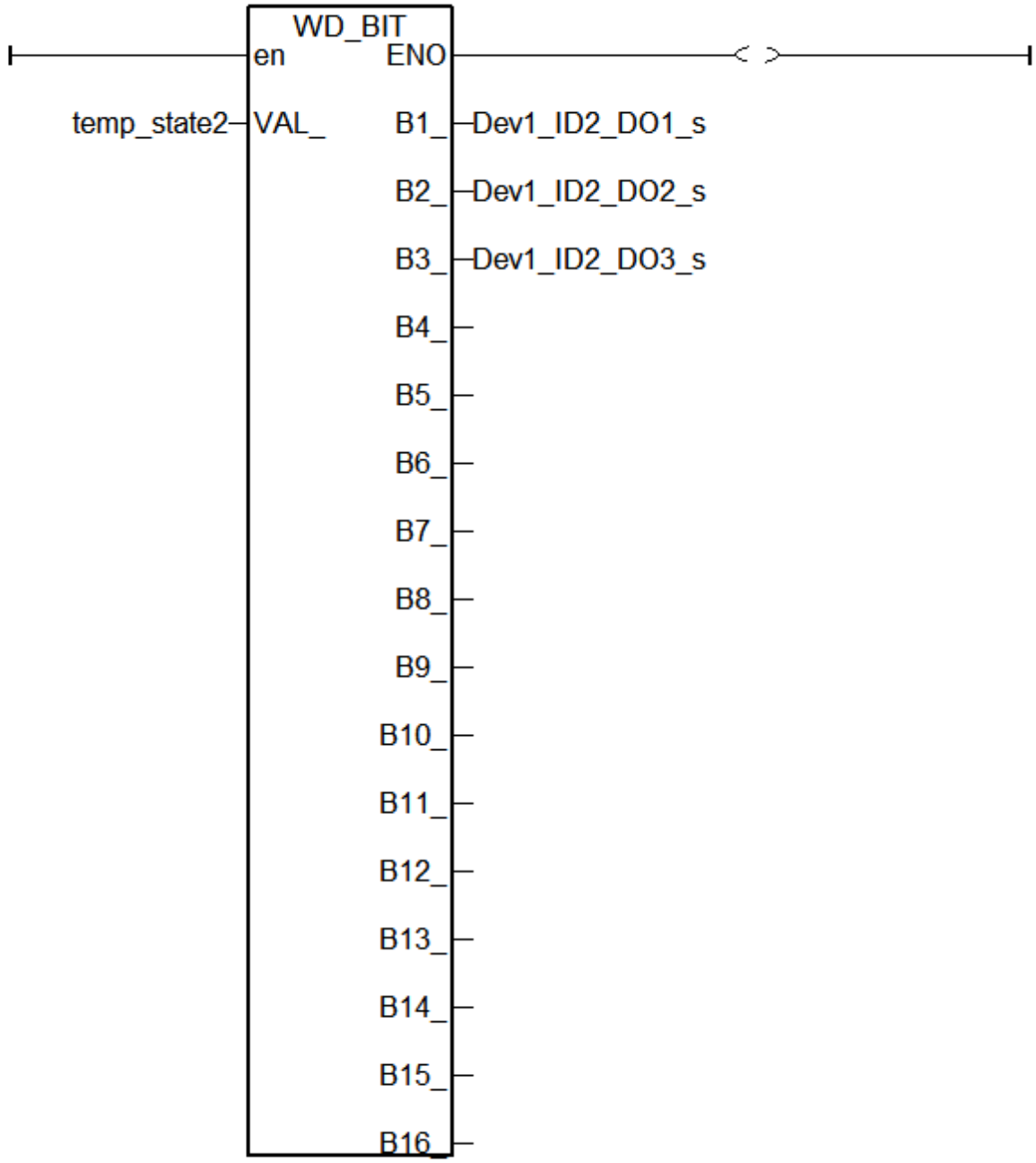
(* Use C function-Block “Mbus_R1” to read the DO state of Slave device ID 2 per second *)



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(* Use C function-block “WD_Bit” to divide the return state into each DO state *)

(* *)

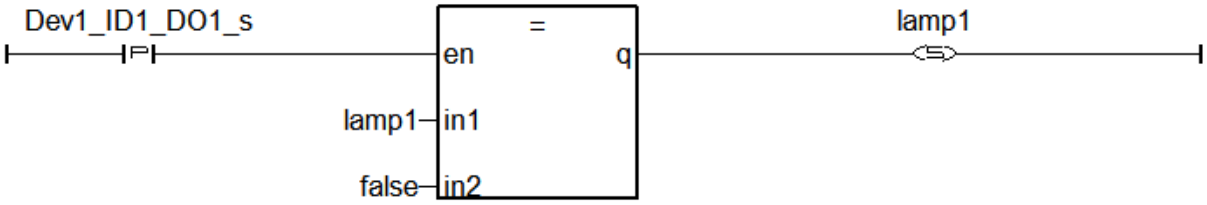


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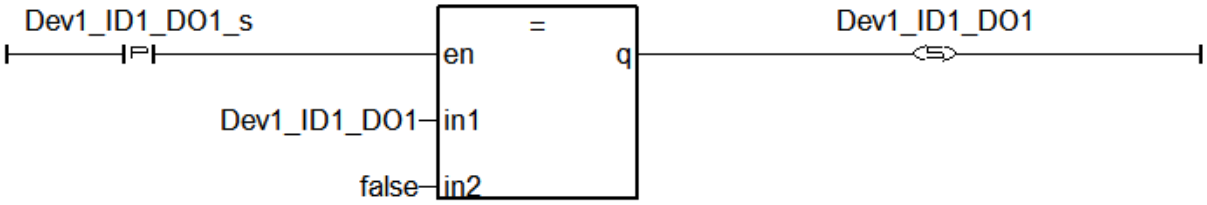
- **"lamp1Pro" LD Program**

(* If DO at rising eage, set external variable "lamp1" and internal variable "Dev1_ID1_DO1" to true *)

(* *)

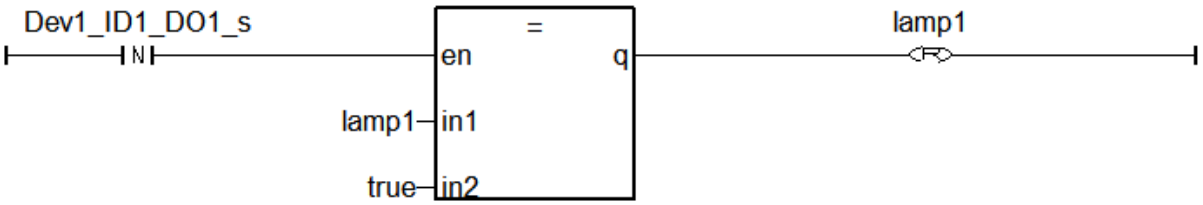


(* *)

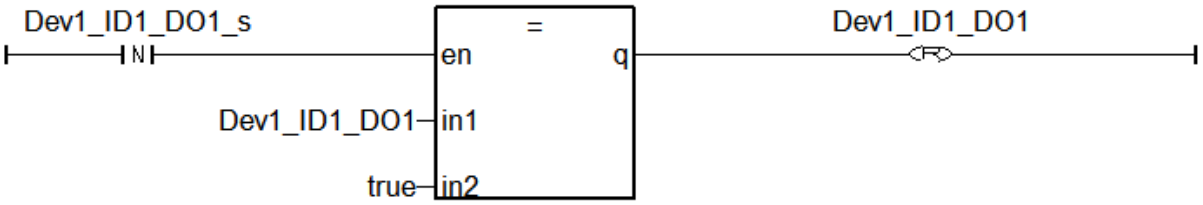


(* If DO at falling eage, set external variable "lamp1" and internal variable "Dev1_ID1_DO1" to false *)

(* *)



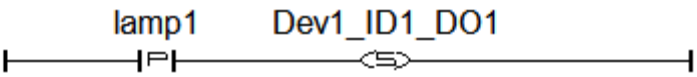
(* *)



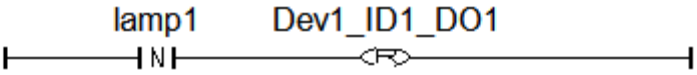
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(* If the state of external variable lamp1 changed, change the state of internal variable Dev1_ID1_DO1 *)

(* *)

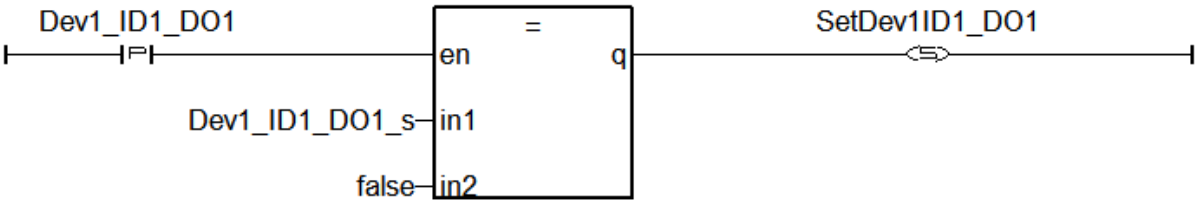


(* *)

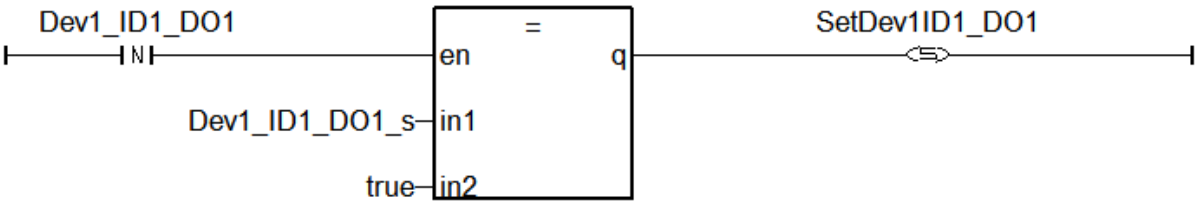


(* If the state of internal variable Dev1_ID1_DO1 changed, judge DO state to send commend or not *)

(* *)



(* *)

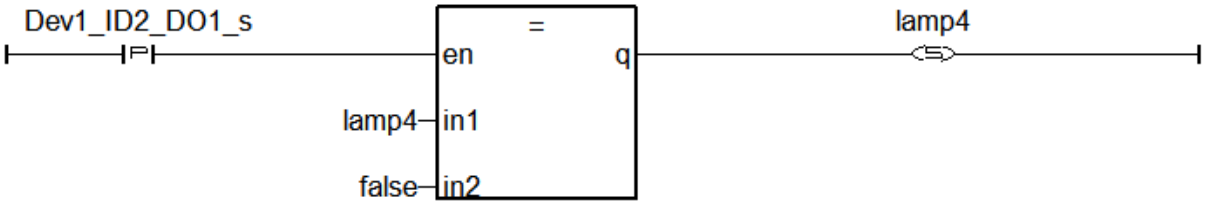


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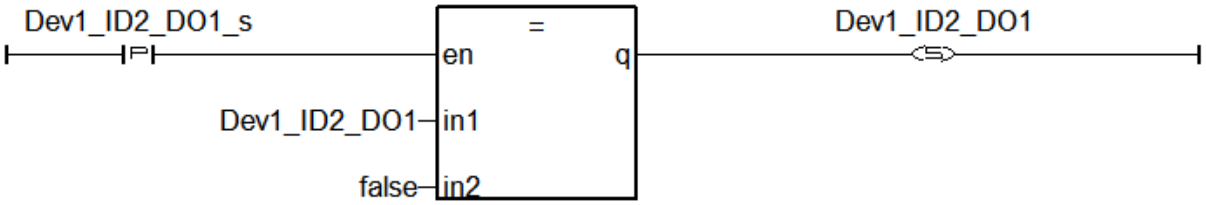
- **"lamp4Pro" LD Program**

(* If DO at rising eage, set external variable "lamp4" and internal variable "Dev1_ID2_DO1" to true *)

(* *)

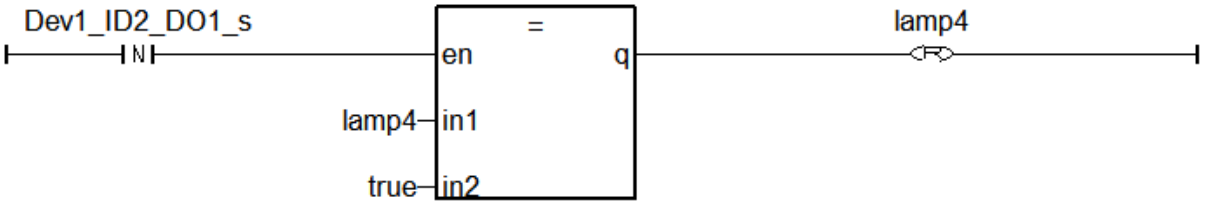


(* *)

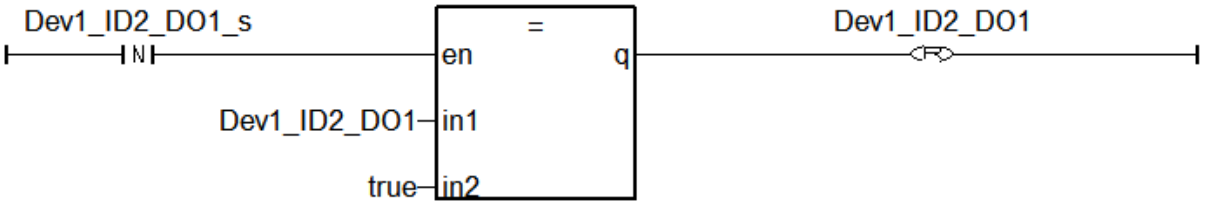


(* If DO at falling eage, set external variable "lamp4" and internal variable "Dev1_ID2_DO1" to false *)

(* *)



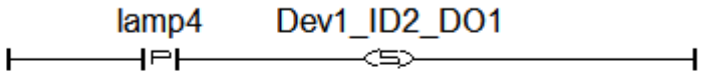
(* *)



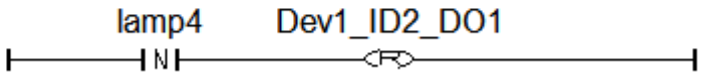
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(* If the state of external variable lamp4 changed, change the state of internal variable Dev1_ID2_DO1 *)

(* *)

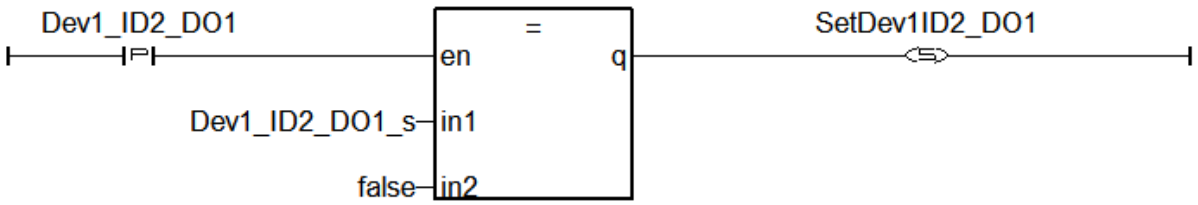


(* *)

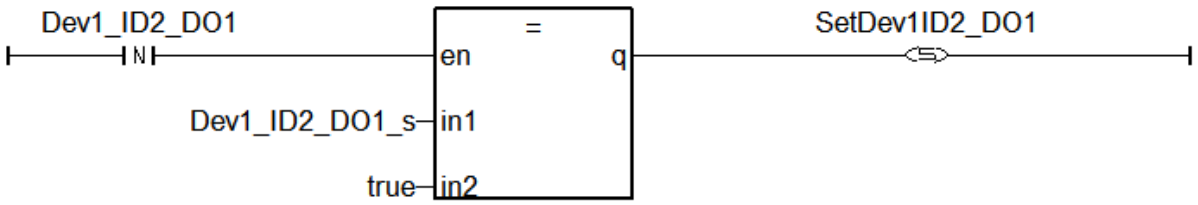


(* If the state of internal variable Dev1_ID2_DO1 changed, judge DO state to send commend or not *)

(* *)



(* *)



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- **"LogCtrl" ST Program**

```
   (* Turn on all lamps *)
if ALL_POWER_ON then

ALL_POWER_ON := false;

lamp1 := true;
lamp4 := true;

end_if;

   (*Turn off all lamps *)
if ALL_POWER_OFF then

ALL_POWER_OFF := false;

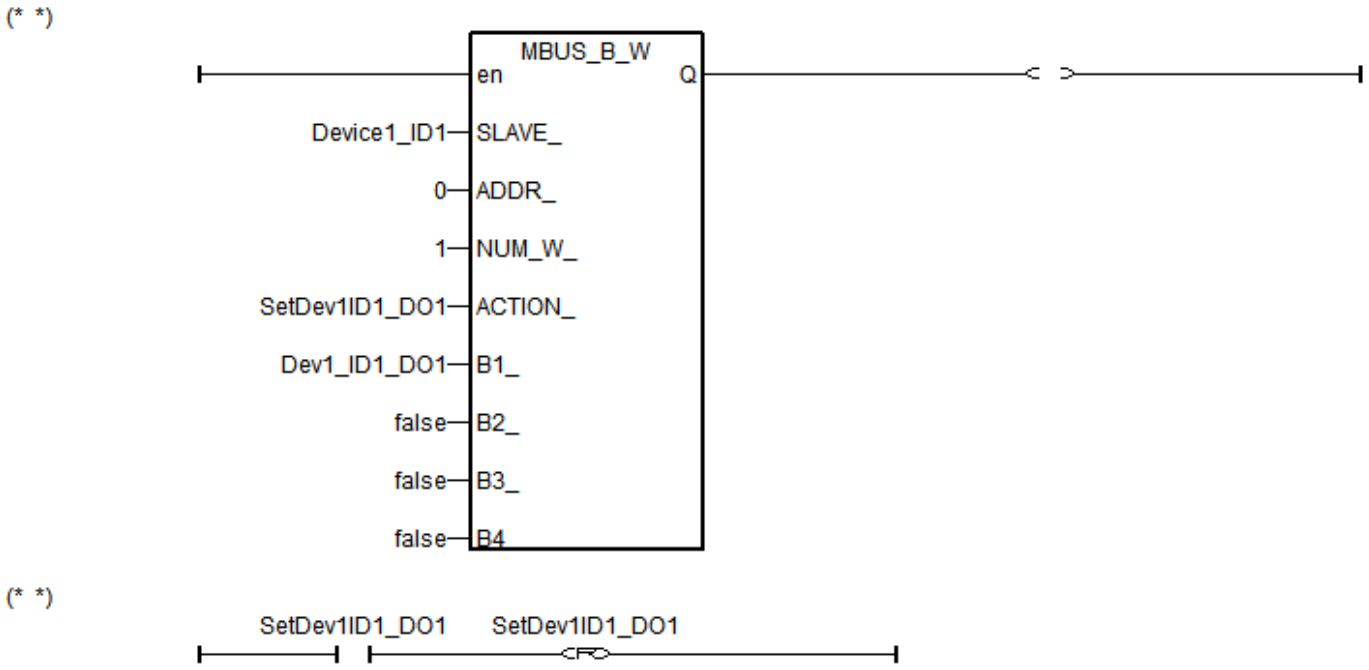
lamp1 := false;
lamp4 := false;

end_if;
```

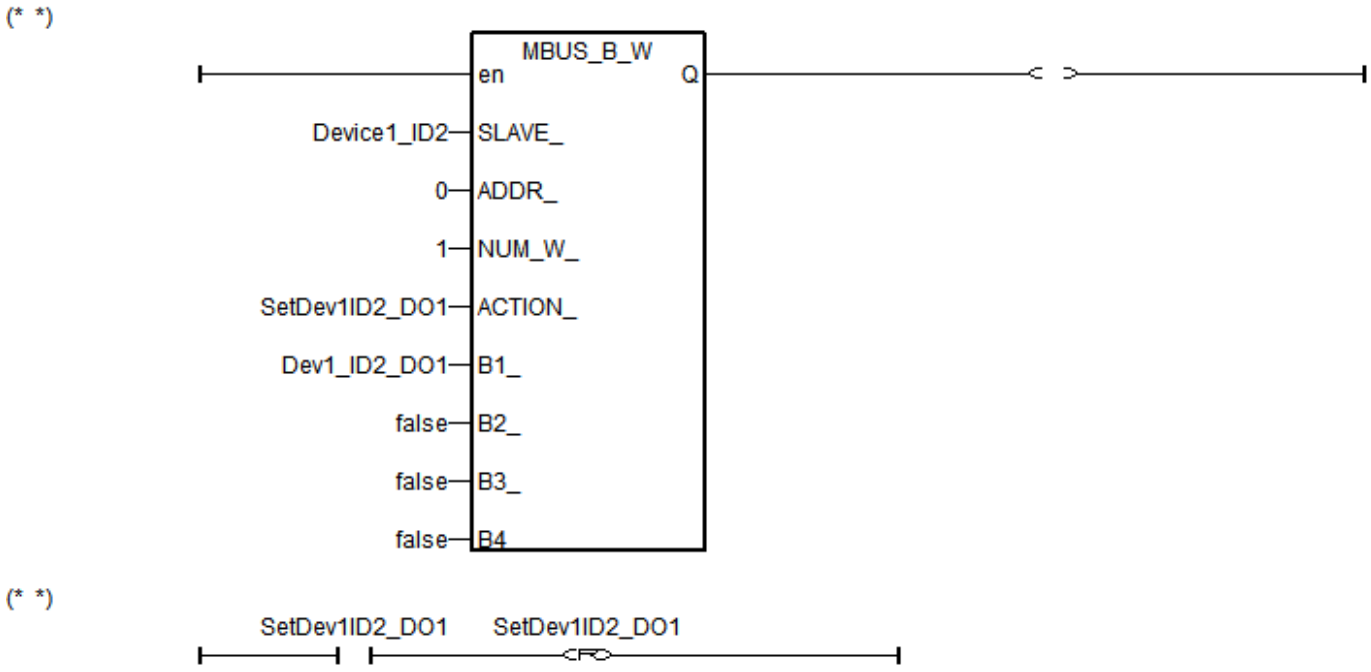

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- **"DevWrite" LD Program**

(* If SetDev1ID1_DO1 is true, write the state of Dev1_ID1_DO1 *)



(* If SetDev1ID2_DO1 is true, write the state of Dev1_ID2_DO1 to DO *)



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