How do I use the “Mbus_RW” function block in the ISaGRAF PAC to easily monitor the Modbus device?

- **Introduction**

  The “Mbus_RW” function block provides a more flexible, easier and efficient way for users to monitor the Modbus device.

  The “Mbus_RW” function block is supported by the following ISaGRAF driver versions:

ISaGRAF PAC	MiniOS7 based	Driver Version
uPAC	I-7188EG	V. 3.22 or later
	I-7188XG	V. 3.20 or later
	uPAC-7186EG	V. 1.22 or later
	uPAC-5xx7	V. 1.02 or later
iPAC	I-8xx7-80/I-8xx7	V. 4.24 or later
	iP-8xx7	V. 1.20 or later
ISaGRAF PAC	**WinCE based**	**Driver Version**
XPAC	XP-8xx7-Atom-CE6	Available Soon
	XP-8xx7-CE6	
WinPAC	WP-8xx7	
	WP-5147/ WP-5146	
ViewPAC	VP-2xW7/2xW6, VP-4137	

This document and demo projects:
https://www.icpdas.com/en/faq/index.php?kind=280#751 > FAQ-171.

ISaGRAF Driver:
http://www.icpdas.com/en/download/show.php?num=368&nation=US&kind1=&model=&kw=isagraf

Data Sheet:
http://www.icpdas.com/en/download/index.php?nation=US&kind1=6&kind2=15&model=&kw=isagraf

ISaGRAF Webpage:
http://www.icpdas.com/en/product/guide+Software+Development__Tools+ISaGRAF

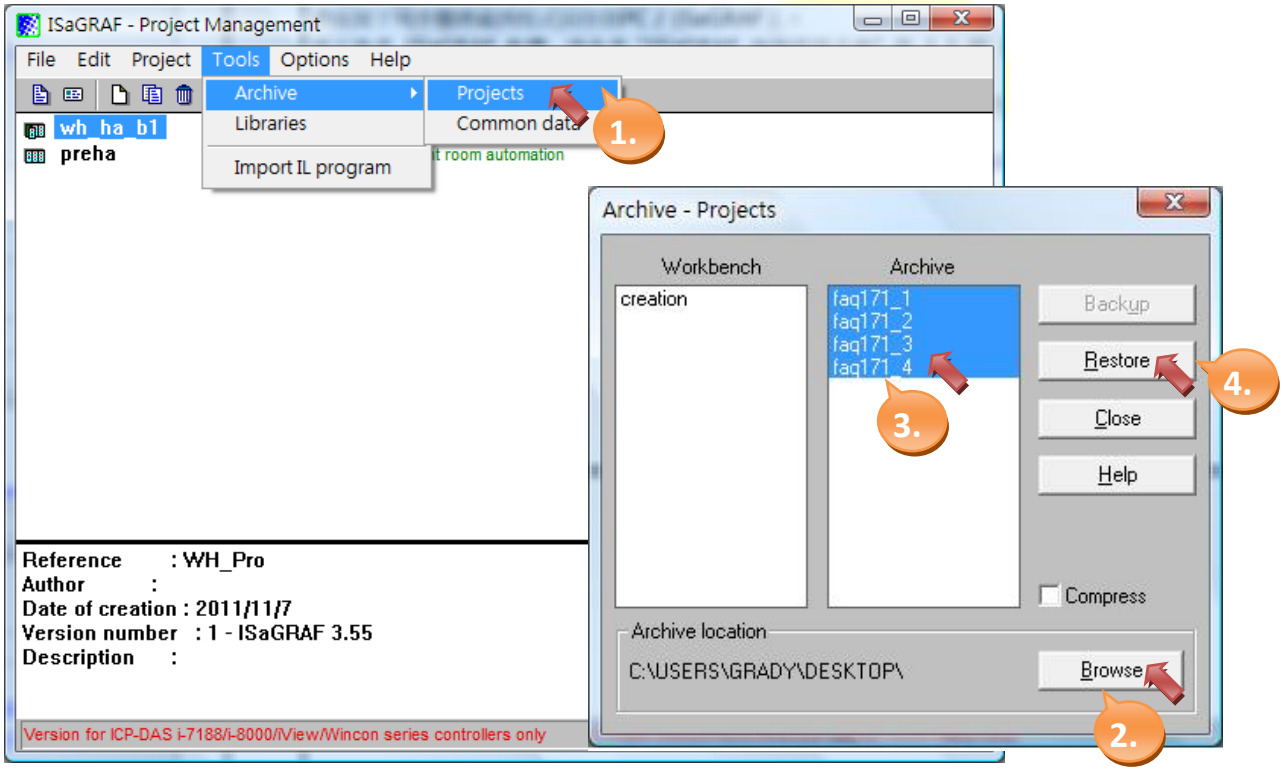
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1.1. Restore the demo projects to the PC / ISaGRAF

Go to the website https://www.icpdas.com/en/faq/index.php?kind=280#751 > FAQ-171 to download the "faq_171.zip" file that includes this PDF file and demo projects (faq171_1.pia to faq171_4.pia).

Follow the process indicated below to restore these demo projects to the PC/ISaGRAF. If you are not familiar with the ISaGRAF, see the section 1.1 and 1.2 and chapter 2 of the "ISaGRAF User's Manual" from the visit to the website http://www.icpdas.com/en/download/show.php?num=333&nation=US&kind1=&model=&kw=isagraf to download the manual.

- **Restore the faq171_1.pia to faq171_4.pia :**



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1.2. Description of the "Mbus_RW" C-function Block

Description of parameters:

Parameters	Type	Description
Port_	Integer	The COM port number to communicate with the Modbus slave device.
SLAVE_	Integer	The Modbus device ID (1 ~ 255)
ADDR_	Integer	The starting Modbus address (0 ~ 65535)
CODE_	Integer	Modbus Function Code 1: Read coil status (DO) 2: Read input status (DI) 3: Read holding register (AO) 4: Read input register (AI) 5: Write single coil status (DO) 6: Write single holding register (AO) 15: Write multiple coils (DO) 16: Write multiple registers (AO)
NUM_	Integer	The amount of Read/Write data CODE 5, 6 : The value must be 1. CODE 1, 2, 15: The value must be between 1 and 255. CODE 3, 4, 16: The value must be between 1 and 255.
TYPE_	Integer	The data type 0 : Boolean 1 : DWORD 2 : REAL 3 : WORD
NETW_	Integer	The starting address to Read/Write the variable. For example, 1. If "NETW_" is set to "21", "NUM_" is set to "10" and "CODE_" is set to "**1**" that means to **read** 10 **DO** statuses from the Modbus device then put them to the ISaGRAF Boolean variables with the network address 21 to 30. 2. If "NETW_" is set to "10", "NUM_" is set to "5" and "CODE_" is set to "**3**" that means to **read** 5 **AO** values from the Modbus device then put them to the ISaGRAF integer variables with the network address 10 to 15.

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Parameters	Type	Description
NETW_	Integer	3. If "NETW_" is set to "8", "NUM_" is set to "3" and "CODE_" is set to "**16**" that means to **write** 3 **AO** values to the Modbus device from the ISaGRAF integer variables with the network address 8 to 10.
PERIOD_	Integer	The cycle time of sending the Modbus command (unit: ms); the value must be between 0 and 600000. "0" means to send a real-time command.
RUN_	Boolean	TRUE: Sending Modbus commands depends on the "PERIOD_" settings. FALSE: Without sending commands Pulse TRUE: Sending command only once.

Return value:

Parameters	Type	Description
Q	Boolean	TRUE: the communication status is "OK". FALSE: the communication status is "Failed".
Err_Code_	Integer	1: Send commands successfully 2: The parameters are correct 3: Get the respond 4: Wait for the cycle time to send command 5: Wait for commands be added to the queue 6: Wait to send commands -10: Communication error -1: "PORT_" parameter error -2: "Slave_" parameter error -3 : "Addr_" parameter error -4 : "Code_" parameter error -5 : "Num_" parameter error -6 : "Type_" parameter error -7 : "NetAddr_" parameter error -8 : "Period_" parameter error -11 : Communication timeout -12 : CRC check error -13 : The data length of the response is not correct.

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1.3. How to test the demo projects?

1.3.1. Testing the "faq171_1" Project

■ **Description**

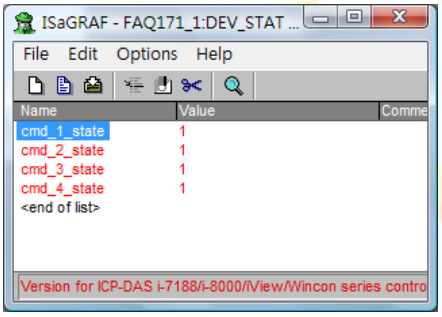
How do I use the "Mbus_RW" C-function Block to read the status of devices?

■ **Device Requirements for Testing**

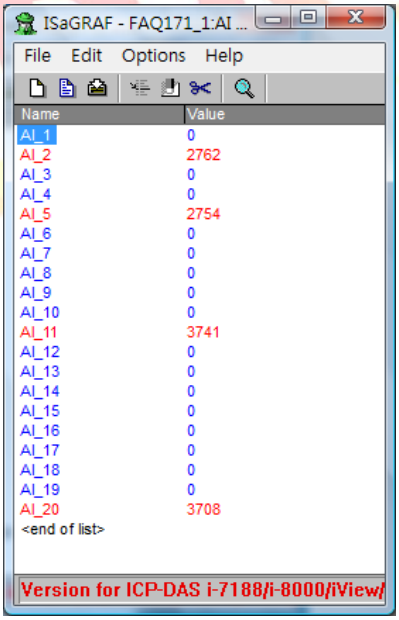
1. ISaGRAF PAC x 1 (e.g., uPAC-7186EG)
   Make sure the driver version of ISaGRAF PAC supports the "Mbus_RW" C-function Block.
2. Modbus device x 2:
   Device 1 setting: Slave ID = 1, use 10 DI and 10 AI, connect with the COM2 of PAC.
   Device 2 setting: Slave ID = 2, use 10 DI and 10 AI, connect with the COM2 of PAC.

■ **How to use the "faq171_1" Project?**

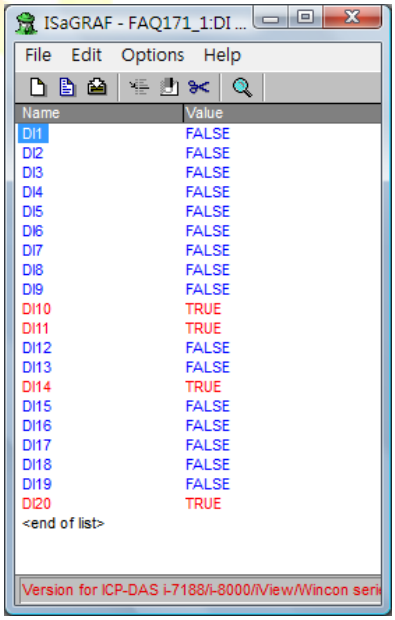
1. Connect the COM2 of ISaGRAF PAC with the Modbus device.
2. After compiling the ISaGRAF project, download it to the ISaGRAF PAC. If you are not familiar with the ISaGRAF, see the section 1.1 and 1.2 and chapter 2 of the "ISaGRAF User's Manual" from the visit to the website http://www.icpdas.com/en/download/show.php?num=333&nation=US&kind1=&model=&kw=isagraf to download the manual.
3. Users can view the current status of Modbus devices in the ISaGRAF – "Spy lists".



(Figure1.
Current communication status)



(Figure2. Current status of AI)



(Figure3. Current status of DI)

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1.3.2. Testing the "faq171_2" Project

■ **Description**

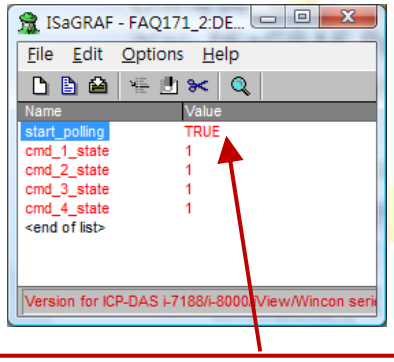
How do I use the "Mbus_RW" C-function Block to read the status of devices and stop polling the status anytime?

■ **Device Requirements for Testing**

1. ISaGRAF PAC x 1 (e.g., uPAC-7186EG)
   Make sure the driver version of ISaGRAF PAC supports the "Mbus_RW" C-function Block.
2. Modbus device x 2:
   Device 1 setting: Slave ID = 1, use 10 DI and 10 AI, connect with the COM2 of PAC.
   Device 2 setting: Slave ID = 2, use 10 DI and 10 AI, connect with the COM2 of PAC.

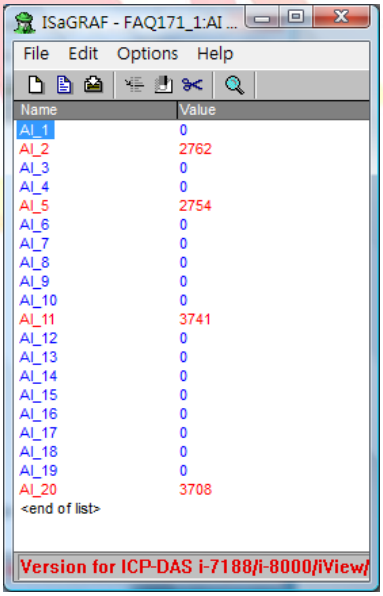
■ **How to use the "faq171_2" Project?**

1. Connect the COM2 of ISaGRAF PAC with the Modbus device.
2. After compiling the ISaGRAF project, download it to the ISaGRAF PAC. If you are not familiar with the ISaGRAF, see the section 1.1 and 1.2 and chapter 2 of the "ISaGRAF User's Manual" from the visit to the website http://www.icpdas.com/en/download/show.php?num=333&nation=US&kind1=&model=&kw=isagraf to download the manual.
3. Users can view the current status of Modbus devices in the ISaGRAF – "Spy lists".

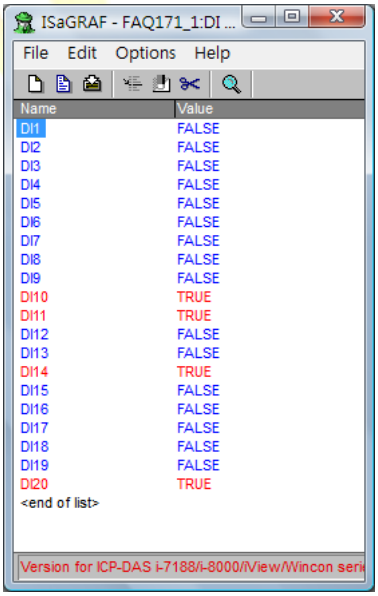


For testing, users can set the "start_polling" variable to "FALSE" to stop polling the status.

(Figure1. Current communication status)



(Figure2. Current status of AI)



(Figure3. Current status of DI)

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1.3.3. Testing the "faq171_3" Project

■ **Description**

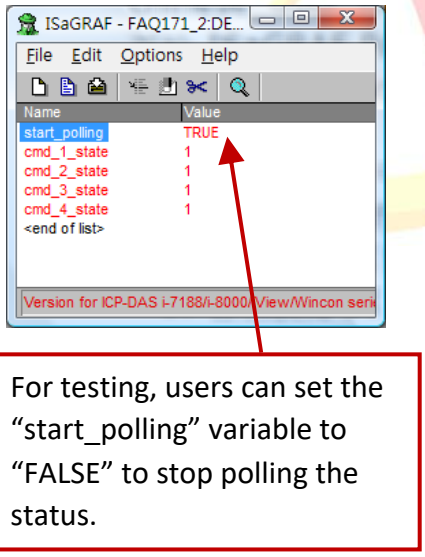
How do I use the "Mbus_RW" C-function Block to read data from the devices, and stop polling the status when users write data to the device to improve the efficiency for command sending?

■ **Device Requirements for Testing**

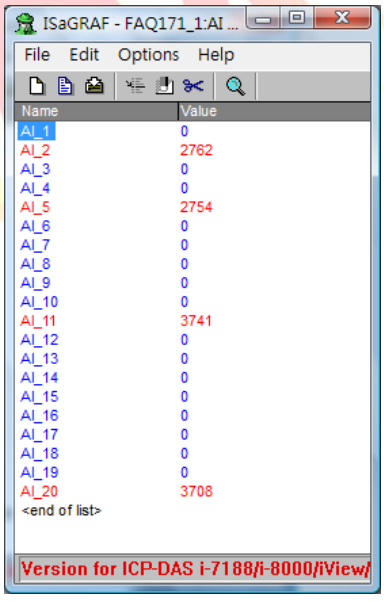
1. ISaGRAF PAC x 1 (e.g., uPAC-7186EG)
   Make sure the driver version of ISaGRAF PAC supports the "Mbus_RW" C-function Block.
2. Modbus device x 2 :
   Device 1 setting: Slave ID = 1, use 10 DI, 10 AI and 3 DO, connect with the COM2 of PAC.
   Device 2 setting: Slave ID = 2, use 10 DI, 10 AI and 3 AO, connect with the COM2 of PAC.

■ **How to use the "faq171_3" Project?**

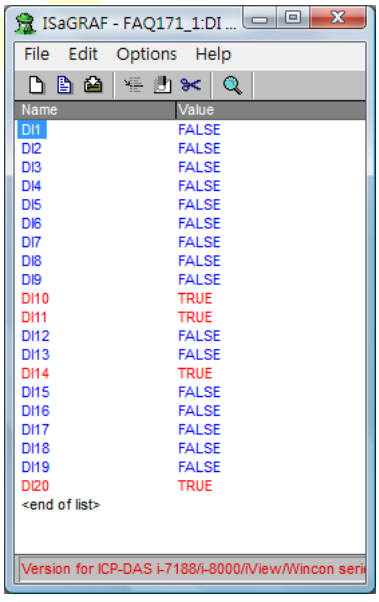
1. Connect the COM2 of ISaGRAF PAC with the Modbus device.
2. After compiling the ISaGRAF project, download it to the ISaGRAF PAC. If you are not familiar with the ISaGRAF, see the section 1.1 and 1.2 and chapter 2 of the "ISaGRAF User's Manual" from the visit to the website http://www.icpdas.com/en/download/show.php?num=333&nation=US&kind1=&model=&kw=isagraf to download the manual.
3. Users can view the current status of Modbus devices in the ISaGRAF – "Spy lists".



(Figure1. Current communication status)



(Figure2. Current status of AI)

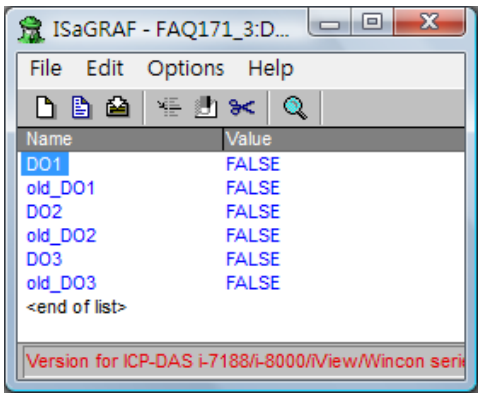


(Figure3. Current status of DI)

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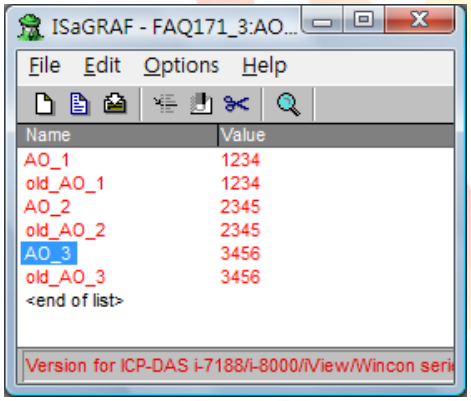
(Figure 4. To write the DO value to the device)

If the value of DO1 to DO3 is changed, the value will be set to the device 1.



(Figure 5. To write the AO value to the device)

If the value of AO1 to AO3 is changed, the value will be set to the device 2.



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1.3.4. Testing the "faq171_4" Project

■ **Description**

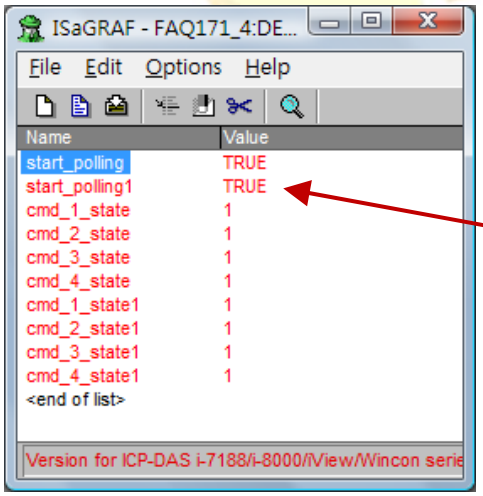
How do I use the "Mbus_RW" C-function Block to read data from the devices that connect to multiple COM port of the PAC, and stop polling the status when users write data to the device to improve the efficiency for command sending?

■ **Device Requirements for Testing**

1. ISaGRAF PAC x 1 (e.g., uPAC-7186EG)
   Make sure the driver version of ISaGRAF PAC supports the "Mbus_RW" C-function Block.
2. Modbus device x 2:
   Device 1 setting: Slave ID = 1, use 10 DI, 10 AI and 3 DO, connect with the COM2 of PAC.
   Device 2 setting: Slave ID = 2, use 10 DI, 10 AI and 3 AO, connect with the COM2 of PAC.
   Device 3 setting: Slave ID = 1, use 10 DI, 10 AI and 2 DO, connect with the COM8 of PAC.
   Device 4 setting: Slave ID = 2, use 10 DI, 10 AI and 2 AO, connect with the COM8 of PAC.

■ **How to use the "faq171_4" Project?**

1. Connect the COM2 of ISaGRAF PAC with the Modbus device 1 and device 2.
   Connect the COM8 of ISaGRAF PAC with the Modbus device 3 and device 4.
2. After compiling the ISaGRAF project, download it to the ISaGRAF PAC. If you are not familiar with the ISaGRAF, see the section 1.1 and 1.2 and chapter 2 of the "ISaGRAF User's Manual" from the visit to the website http://www.icpdas.com/en/download/show.php?num=333&nation=US&kind1=&model=&kw=isagraf to download the manual.
3. Users can view the current status of Modbus devices in the ISaGRAF – "Spy lists".

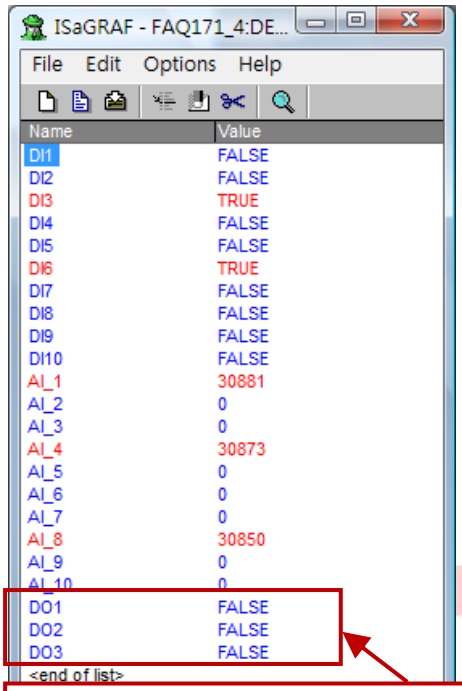


For testing, users can set the "start_polling" or "start_polling1"variables to "FALSE" to stop polling the status.

(Figure1. Current communication status)

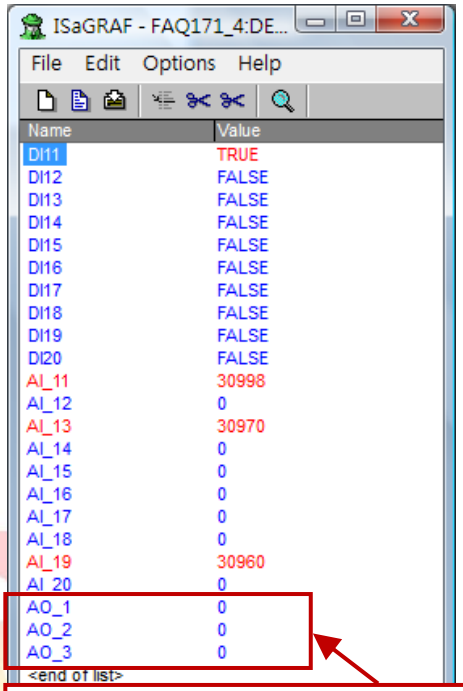
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(Figure2. The DI, AI status of device 1)



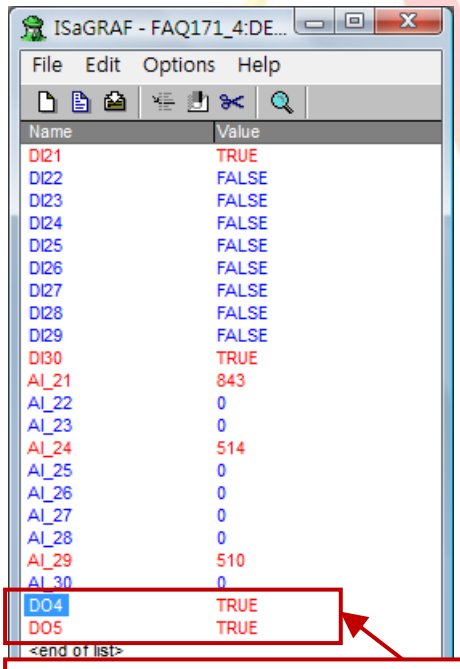
If the value of DO1 to DO3 is changed, the value will be set to the device 1.

(Figure3. The DI, AI status of device 2)



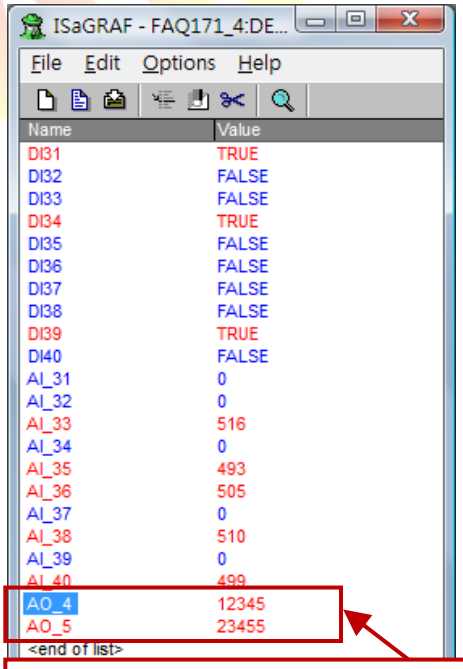
If the value of AO1 to AO3 is changed, the value will be set to the device 2.

(Figure4. The DI, AI status of device 3)



If the value of DO4 to DO5 is changed, the value will be set to the device 3.

(Figure5. The DI, AI status of device 4)



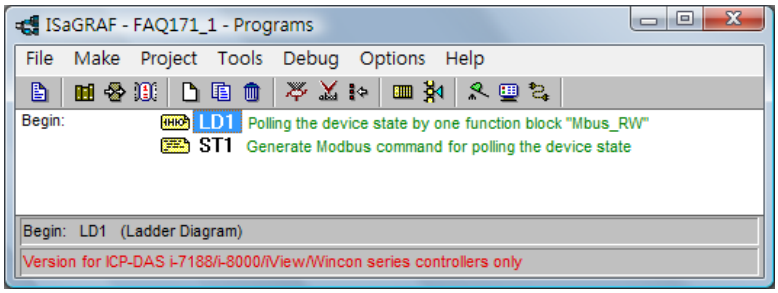
If the value of AO4 to AO5 is changed, the value will be set to the device 4.

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1.4. Description of the "faq171_1" Project

1.4.1. ISaGRAF Project Architecture

This demo project includes one ST program (ST1) and one LD program (LD1).



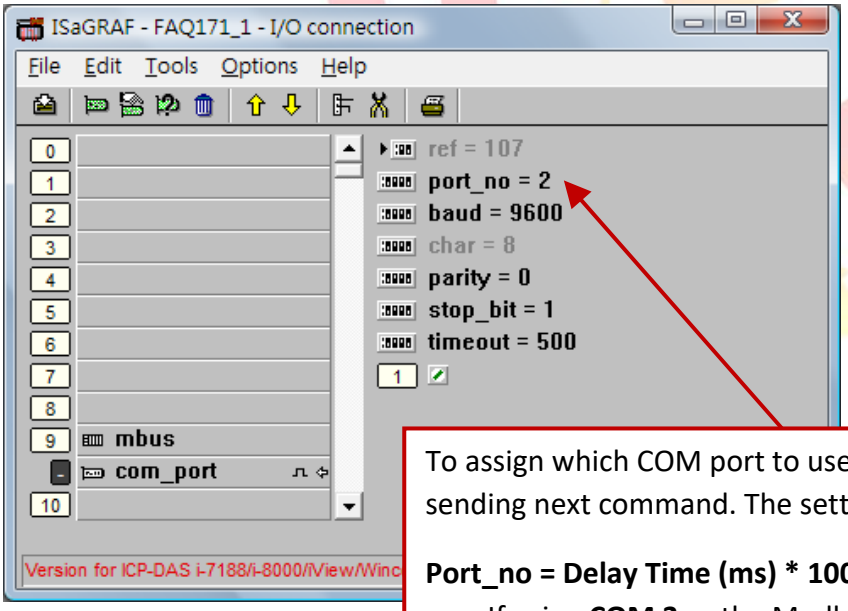
1.4.2. ISaGRAF Project Variables

Name	Type	Attrib.	Description
trigger_to_read	Boolean	Internal	If this value is set to "True", the function block will be triggered to send a "read" command and get the current status from the device.
DI1 ~ DI10	Boolean	Internal	The DI status of device 1. Network Address = 1 ~ 10
DI11 ~ DI20	Boolean	Internal	The DI status of device 2. Network Address = 21 ~ 30
device_status	Boolean	Internal	For internal use
next_cmd	Boolean	Internal	If this value is set to "True", the next command will be assigned to "Mbus_RW" function block
AI_1 ~ AI_10	Integer	Internal	The AI status of device 1. Network Address = 11 to 20
AI_11 ~ AI_20	Integer	Internal	The AI status of device 2. Network Address = 31 to 40
Error_code_1	Integer	Internal	The return value of "Mbus_RW" function block
Port	Integer	Internal	COM Port
slave	Integer	Internal	Slave ID
Addr	Integer	Internal	The starting Modbus address of slave device
Code	Integer	Internal	Modbus Function Code

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Name	Type	Attrib.	Description
Num	Integer	Internal	The amount of data
data_type	Integer	Internal	The data type
NETW	Integer	Internal	The starting “Network Address” for users to access the ISaGRAF variable.
Period	Integer	Internal	The cycle time of sending the Modbus command
cmd_num	Integer	Internal	To switch the command
cmd_1_state~ cmd_4_state	Integer	Internal	To record the communication status for each command.

1.4.3. I/O Connection



To assign which COM port to use and the delay time for sending next command. The setting way as follows:

Port_no = Delay Time (ms) * 100 + COM Port Number

e.g., If using **COM 3** as the Modbus RTU Master port, and the delay time is **50 (ms).**

Port_no = 50 * 100 + 3 = 5003

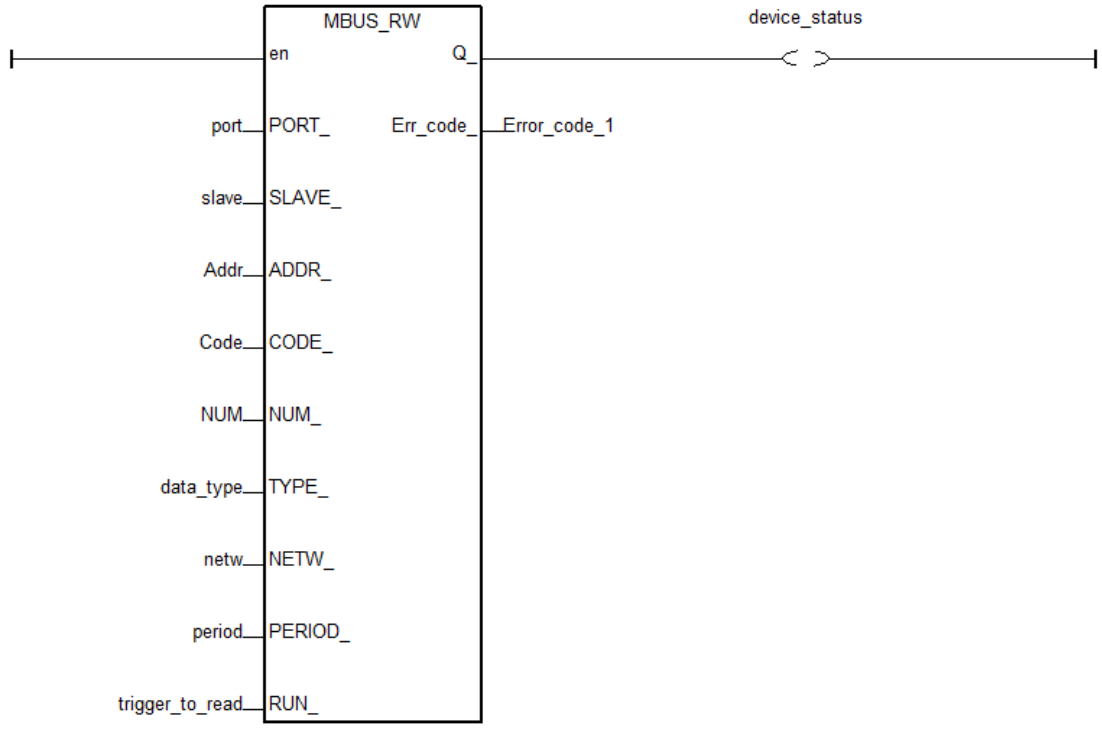
Default "Delay Time" is 100 ms if setting "Port_no" < 100

e.g., Port_no = 2

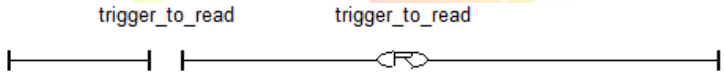
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1.4.4. Description of the "LD1" Program

(* To assign the related variables to the "Mbus_RW" function block *)



(* To generate a "Pulse True" signal to the "Mbus_RW" function block *)



(* When detected the status of the device is "Communication OK" (Figure 1) or "Communication Error" (Figure 2), set "next_cmd" to "TRUE". *)
(* They are used to import the next Modbus command *)

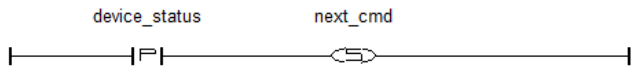


Figure1.

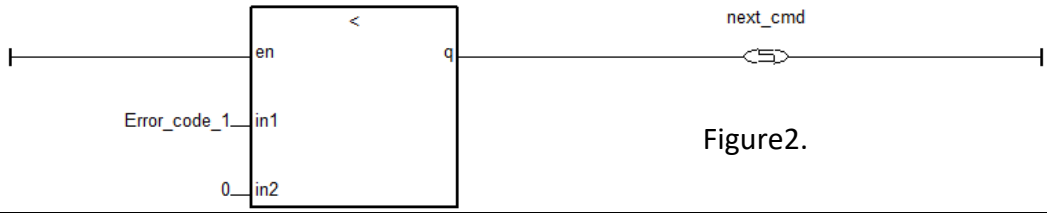
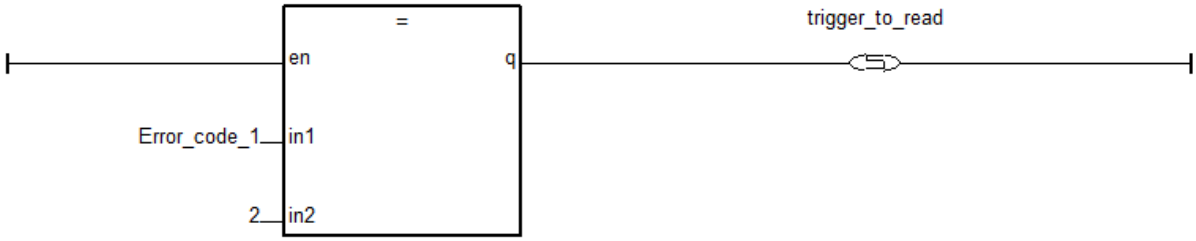


Figure2.

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(* Set “trigger_to_read” to “TRUE” if the “Mbus_RW” notice that all the parameters are correct *)
(* It used to send Modbus command *)



1.4.5. Description of the “ST1” Program

```
(* Using “Switch Case” to generate some Modbus commands *)
if next_cmd then
   next_cmd := false;

   case cmd_num of
   1:
         (* To read 10 AI data from the device 1 (Slave ID=1) with the address 1 to 10 *)
         (* Then, write these data to the variable to the network address 11 to 20 *)
         slave := 1;
         Addr := 0;
         Code := 4;
         num := 10;
         data_type := 3;
         NETW := 11;
         (* To save the last communication status for debug easier *)
         cmd_4_state := Error_code_1;
   2:
         (* To read 10 DI data from the device 1 (Slave ID=1) with the address 1 to 10 *)
         (* Then, write these data to the variable to the network address 1 to 10 *)
         slave := 1;
         Addr := 0;
         Code := 2;
         num := 10;
         data_type := 0;
         NETW := 1;
         (* To save the last communication status for debug easier *)
         cmd_1_state := Error_code_1;
```


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```
    3:
            (* To read 10 DI data from the device 2 (Slave ID=2) with the address 1 to 10 *)
              (* Then, write these data to the variable to the network address 21 to 30 *)
            slave := 2;
            Addr := 0;
            Code := 2;
            num := 10;
            data_type := 0;
            NETW := 21;
            (* To save the last communication status for debug easier *)
            cmd_2_state := Error_code_1;


    4:
            (*To read 10 AI data from the device 2 (Slave ID=2) with the address 1 to 10 *)
              (* Then, write these data to the variable to the network address 31 to 40 *)
            slave := 2;
            Addr := 0;
            Code := 4;
            num := 10;
            data_type := 3;
            NETW := 31;
            (* To save the last communication status for debug easier *)
            cmd_3_state := Error_code_1;
    else
            cmd_num := 0;
    end_case;

    cmd_num := cmd_num + 1;

end_if;
```


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