

Classification	ISaGRAF FAQ-161						
Author	Chun Tsai	Version	1.2	Date	Feb.2013	Page	1 / 7

## Using many Modbus function blocks Mbus\_AR and Mbus\_AW in a “for” loop in the ISaGRAF PAC

This paper show the way to call Mbus\_AW and Mbus\_AR function block many times in a “for .. end\_for ;” loop to write data to or read data from some Modbus devices.

User can download this paper and example projects from the following web site.  
<http://www.icpdas.com/faq/isagraf.htm> > FAQ-161 . The ISaGRAF driver version listed below support the Mbus\_AR and Mbus\_AW block. If your PAC 's driver is older than it, please visit <http://www.icpdas.com/products/PAC/i-8000/isagraf-link.htm> to download the newest driver.

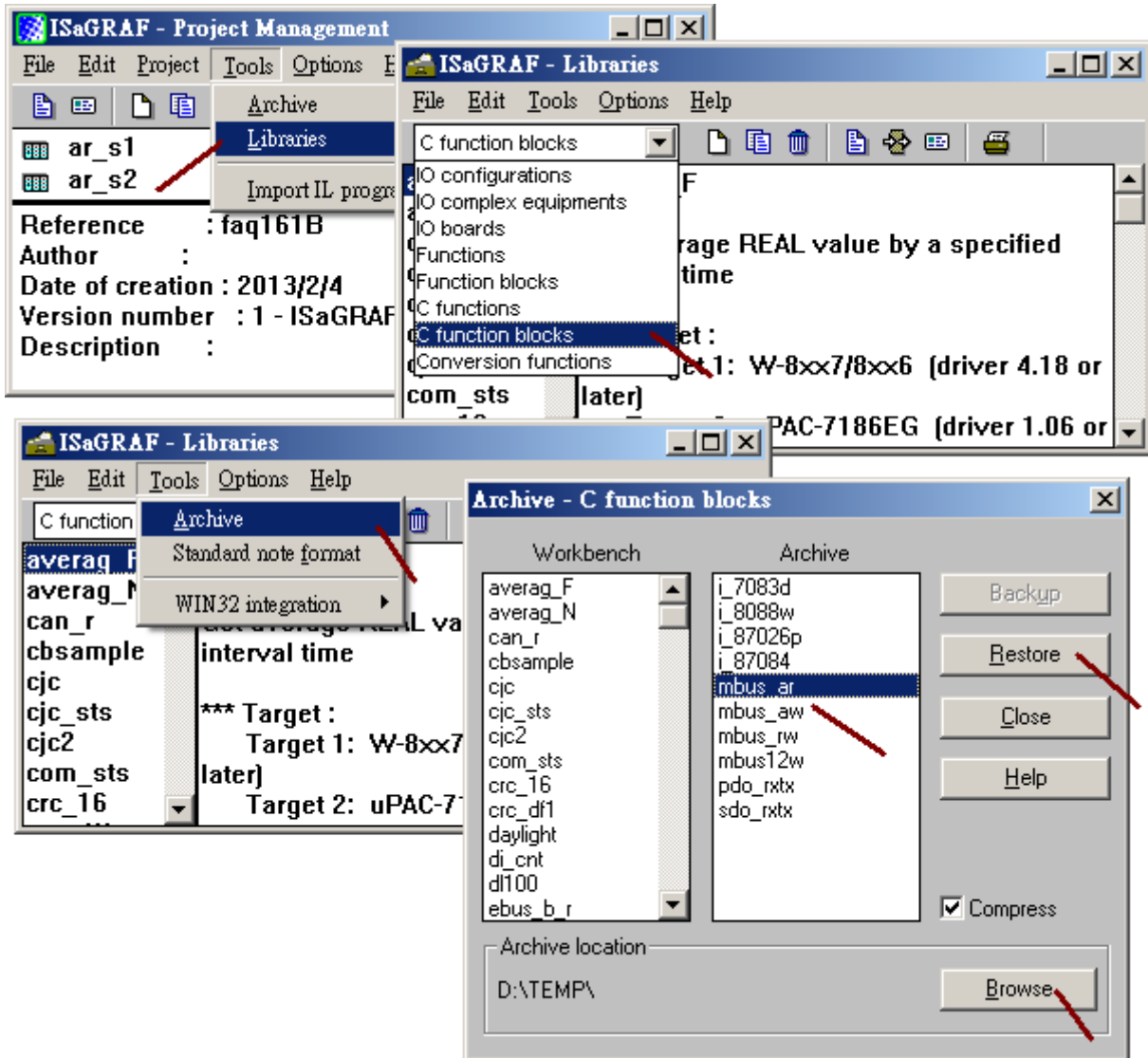
- WP-8xx7: version 1.57 or later
- XP-8xx7-CE6: version 1.37 or later
- XP-8xx7-ATOM-CE6: version 1.02 or later
- VP-25W7/23W7: version 1.49 or later
- WP-5147 : version 1.04 or later

ISaGRAF PAC supports Modbus master function to connect other Modbus slave devices to read or write data. For example, the Mbus24R is to read max. 24 words (16-bit signed) or max. 12 REAL (32-bit floating point) or max. 12 long integer (32-bit long). User may refer to the Chapter 8 of the “ISaGRAF User's manual” for more information or visit the following web site .  
<http://www.icpdas.com/faq/isagraf.htm> > FAQ-75, 46, 47, 96, 101, 113, 129, 144 ,159 .

When using many Modbus function blocks in a PAC (for instance, using 50 or may be 100 to 2000 Modbus blocks), the ISaGRAF project become huge. This make the program complicated and difficult to maintain. The major reason is the input parameters of those Modbus blocks like Mbus24R, Mobus12W, Mobus\_N\_R, ... must be a constant. So they can not apply in a ST program 's “for .. end\_for ;” loop. Then the program becomes huge. While if using the Mbus\_AR and Mbus\_AW blocks, all of their input parameters can be a variable value. Then if apply them in a “for .. end\_for ;” loop, the program is much smaller and easy to maintain. The other advantage is the Mbus\_AR and Mbus\_AW blocks consume less CPU time .

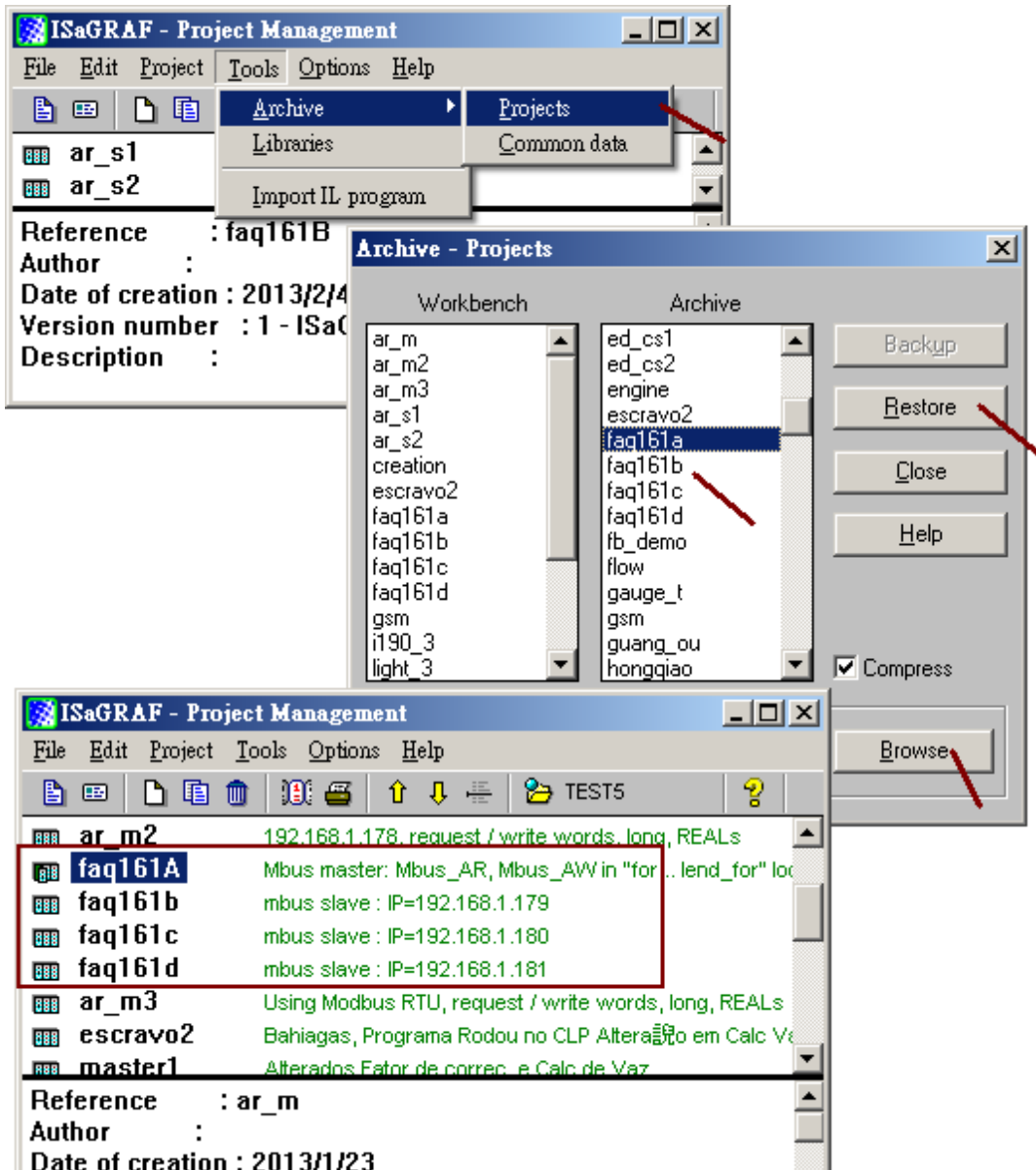
Classification	ISaGRAF FAQ-161						
Author	Chun Tsai	Version	1.2	Date	Feb.2013	Page	2 / 7

First restore the “mbus\_aw.fia” and “mbus\_ar.fia” c-function blocks to your PC / ISaGRAF. These two block's files are included in the “faq161\_demo.zip” which you download from the FAQ-161.



Classification	ISaGRAF FAQ-161						
Author	Chun Tsai	Version	1.2	Date	Feb.2013	Page	3 / 7

This "faq161\_demo.zip" also includes four example projects - faq161a, faq161b, faq161c and faq161d. Please restore them to the PC / ISaGRAF as the below figure. The major example project is the "faq161a" which enables an ISaGRAF WinCE PAC (WP-8xx7, WP-5147, VP-25w7 / 23W7, XP-8xx7-CE6, CP-8xx7-ATOM-CE6) as a Modbus TCP master to connect three Modbus TCP slave devices ( IP address are 192.168.1.179 , 192.168.1.180 and 192.168.1.181 respectively, NET-ID are all 1) .



Classification	ISaGRAF FAQ-161						
Author	Chun Tsai	Version	1.2	Date	Feb.2013	Page	4 / 7

The Mbus\_AR block is to enable the PAC to read max. 24 words (16-bit signed) or max. 12 long integers (32-bit long) or max. 12 REAL (32-bit floating point) or max. 200 Booleans from a Modbus slave device. It can apply only in the first scan cycle. Applying it in the 2nd, 3rd and later scan cycles has no meaning. One PAC can apply (call) this Mbus\_AR block max. 2000 times in the 1st scan cycle. Each calling Mbus\_AR means enable one block to read data from the specified slave device.

The screenshot shows the 'ISaGRAF - FAQ161A - Global integers/real' window. The 'Modbus SCADA addressing map' is displayed, showing a table with columns: Name, Attrib., Addr., and Comment. The table lists variables from Mbus\_AR\_VAL\_01 to Mbus\_AR\_VAL\_08. The 'Addr.' column shows hexadecimal values from 0065 to 006C. A red box highlights the 'Addr.' column, and a red arrow points to the value '0065' for 'Mbus\_AR\_VAL\_01'. Another red box highlights the comment 'Value from 1st slave' with the text 'network addr = 101 ~'. A red arrow points to the text 'Here is displayed as Hex value.'

All the following parameters can be a variable value.

PORT	For Mbus_tcp, set it as the value returned from the 1st channel in the IO connection > Mbus_tcp. For Mbus and Mbus_asc, set it as the comm. port number of that RS-232, RS-485 or RS-422 port.
SLAVE	The NET-ID number of Modbus slave device, 1 ~ 255.
ADDR	The starting Modbus addr. number of slave device (0 or 1 ~ 65535)
CODE	Modbus function number, 1 ~ 4 (1, 2 for Booleans, 3, 4 for Word, Long, REAL).
NUM	data amount to read. Word: 1 ~ 24, Long and REAL: 1 ~ 12. Boolean: 1 ~ 200
TYPE	1: data is Word (16-bit signed integer), 2: data is Long (32-bit signed integer) 3: data is Real (32-bit floating point), Note: if CODE is 1 or 2, TYPE is ignored.
NETW	1 ~ 7700. The starting network address of those ISaGRAF variables which will receive the data successfully read from the slave device. For CODE 1 and 2, the related ISaGRAF variables should be declared as Boolean. For CODE 3 and 4, if TYPE is 1 or 2, the related ISaGRAF variables should be declared as integers. If TYPE is 3, should be declared as REAL variables. Note: please set the network address of the related ISaGRAF variable to jump one number for TYPE 2 and 3. For example, set them as 101, 103, 105, ...
Q_NETW	0 or 1 ~ 7700, the network address number of an ISaGRAF Boolean variable which will receive the communication state of the Mbus_AR block. Set as 0 means no need to get this communication state.
PERIOD	0 or 1 ~ 600, unit is second. The interval to send this Modbus command. Set 0 means send it continuously.

Classification	ISaGRAF FAQ-161						
Author	Chun Tsai	Version	1.2	Date	Feb.2013	Page	5 / 7

The Mbus\_AW block is to enable the PAC to write max. 12 words (16-bit signed) or max. 6 long integers (32-bit long) or max. 6 REAL (32-bit floating point) or max. 16 Boolean to a Modbus slave device. It can apply only in the first scan cycle. Applying it in the 2nd, 3rd and later scan cycles has no meaning. One PAC can apply (call) this Mbus\_AW block max. 2000 times in the 1st scan cycle. Each calling Mbus\_AW means enable one block to write data to slave device.

The screenshot shows the ISaGRAF interface with a table of global integers/real variables. The table has columns for Name, Attrib., Addr., and Comment. The 'Addr.' column contains hexadecimal values from 00C9 to 00D1. A red box highlights this column, and a red arrow points from the 'NETW\_' parameter in the 'mbus\_aw' block to the table. A red text box with an arrow pointing to the table says "Here is displayed as Hex value."

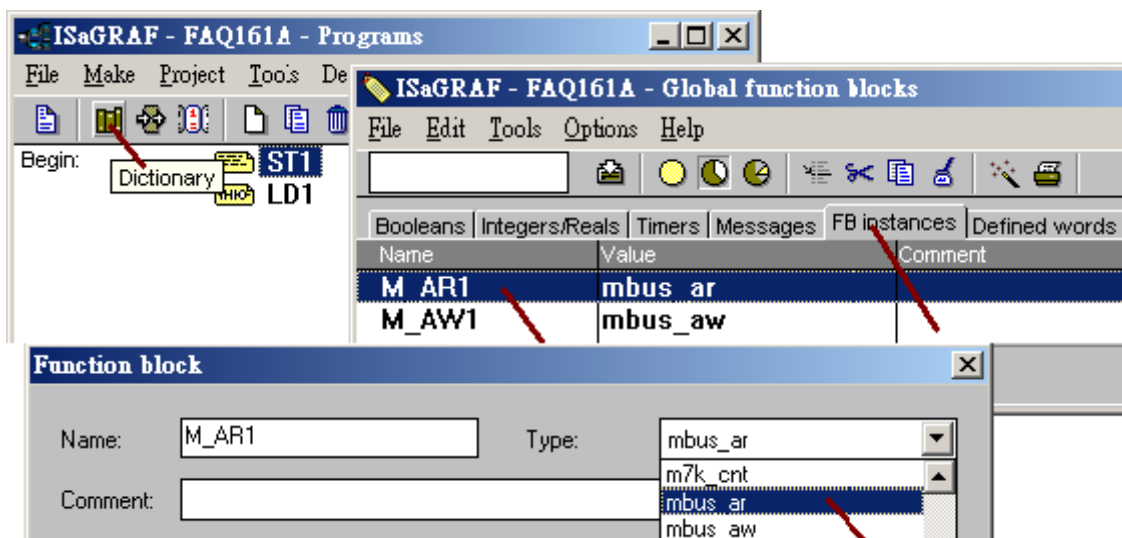
All the following parameters can be a variable value.

PORT	For Mbus_tcp, set it as the value returned from the 1st channel in the IO connection > Mbus_tcp. For Mbus and Mbus_asc, set it as the comm. port number of that RS-232, RS-485 or RS-422 port.
SLAVE	The NET-ID number of Modbus slave device, 1 ~ 255.
ADDR	The starting Modbus addr. number of slave device (0 or 1 ~ 65535)
CODE	Modbus function call number, 6 or 16 (or 5 or 15 for boolean) Note: function call 6 can write only 1 word. While many data for function 16. function call 5 can write only 1 boolean. While 1 to 16 booleans for function 15.
NUM	The data amount to write. Word : 1 ~ 12, Long and REAL : 1 ~ 6 If CODE is 5, NUM is ignored. If CODE is 15, NUM can be 1 to 16.
TYPE	1: data is Word (16-bit signed integer), 2: data is Long (32-bit signed integer) 3: data is Real (32-bit floating point). TYPE is ignored if CODE is 5 or 15.
NETW	1 ~ 7700. The starting network address of those ISaGRAF variables which will hold the data being written to the slave device. If CODE is 5 or 15, the related ISaGRAF variables should be declared as Boolean. However, if CODE is 6 or 16 and TYPE is 1 or 2, the related ISaGRAF variables should be declared as integers with proper network address. If CODE is 6 or 16 and TYPE is 3, should be declared as REAL variables. Note: please set the network address of the related ISaGRAF variable to jump one number for TYPE 2 and 3. For example, set them as 101, 103, 105, ...
Q_NETW	0 or 1 ~ 7700, the network address number of an ISaGRAF Boolean variable which will receive the communication state of the Mbus_AW block. Set as 0 means no need to get this communication state.
Act_NETW	0 or 1 ~ 7700, the network address number of an ISaGRAF Boolean variable

Classification	ISaGRAF FAQ-161						
Author	Chun Tsai	Version	1.2	Date	Feb.2013	Page	6 / 7

which controls the Mbus\_AW block to write or stop writing.  
Set as 0 means write it continuously.

To use Mbus\_AR and Mbus\_AW , first declare FB instance “M\_AR1” and “M\_AW1” as the following figure.



The below ST program is from the example project “faq161a” . It runs only in the first scan cycle to enable three M\_AR1 to read 24 words in each slave device (3 devices). The slave NET-ID are 1. The data address in slave is starting from 0 . Using Modbus function 4 to read 24 words. The data successfully read will be stored in those ISaGRAF integer variables with network address ( 101 ~ 124 ) , ( 125 ~ 148 ) and ( 149 ~ 172 ) respectively . The communication state will be stored in the ISaGRAF Boolean variable with network address 1 , 2 and 3 respectively. The last parameter value 2 means the interval to read data is 2 second.

**Note:** please set the network address of the related ISaGRAF variable to jump one number for TYPE 2 and 3. For example, set them as 211 , 213 , 215 , 217 , ...

```

if INIT then (* This example declare "INIT" with an initial value TRUE *)
  INIT := FALSE ;
  TCP_NO[0] := TCP_ID01 ; (* Ch.1 value in the first mbus_tcp in the IO connection *)
  TCP_NO[1] := TCP_ID02 ; (* Ch.1 value in the 2nd mbus_tcp in the IO connection *)
  TCP_NO[2] := TCP_ID03 ; (* Ch.1 value in the 3rd mbus_tcp in the IO connection *)
  for ii := 0 to 2 do
    (* Mbus_AR(PORT, SLAVE, ADDR, CODE, NUM, TYPE, NETW, Q_NETW, PERIOD);*)
    (* TYPE = 1: data is wrod , 2: data is long, 3: data is REAL *)
    M_AR1( TCP_NO[ii] , 1 , 0 , 4 , 24 , 1 , 24*ii+101 , ii+1 , 2 ) ;
  end_for ;
end_if ;

```

Classification	ISaGRAF FAQ-161						
Author	Chun Tsai	Version	1.2	Date	Feb.2013	Page	7 / 7

The below ST program is from the example project “faq161a” . It runs only in the first scan cycle to enable three M\_AW1 to read 5 REAL value in each slave device (3 devices). The slave NET-ID are 1. The data address in slave is starting from 110 (they are 110, 112, 114, 116 and 118) . Using Modbus function 16 to write 5 REAL. The data being written are stored in those ISaGRAF REAL variables with network address 211 , 213 , 215 , 217 and 219 respectively . No need to get the communication state of the Mbus\_AW block (because the 2nd last parameter is 0) . The network address number of those ISaGRAF Boolean variables which control the Mbus\_AW block to write or stop writing are 14 , 15 and 16.

**Note:** please set the network address of the related ISaGRAF variable to jump one number for TYPE 2 and 3. For example, set them as 211 , 213 , 215 , 217 , ...

```

if INIT then (* This example declare“INIT” with an initial value TRUE *)
  INIT := FALSE ;
  TCP_NO[0] := TCP_ID01 ; (* Ch.1 value in the first mbus_tcp in the IO connection *)
  TCP_NO[1] := TCP_ID02 ; (* Ch.1 value in the 2nd mbus_tcp in the IO connection *)
  TCP_NO[2] := TCP_ID03 ; (* Ch.1 value in the 3rd mbus_tcp in the IO connection *)
  for ii := 0 to 2 do
    (* Mbus_AW( PORT, SLAVE, ADDR, CODE, NUM, TYPE, NETW, Q_NETW, ACT_NETW ); *)
    (* TYPE = 1: data is wrod , 2: data is long, 3: data is REAL *)
    M_AW1( TCP_NO[ii] , 1 , 110 , 16 , 5 , 3 , 211 , 0 , ii+14 ) ;
  end_for ;
end_if ;

```

**Action of the Boolean variable which controls the Mbus\_AW to write or stop writing :**

If the Boolean value is TRUE, it make the Mbus\_AW to write data.

If the Boolean value is FALSE, it make the Mbus\_AW to stop writting data.

If the Boolean value is a pulse TRUE, it make the Mbus\_AW to write data one time.

If set the “ACT\_NETW” parameter as 0 (Network addr = 0 means no related ISaGRAF variable), this Mbus\_AW block will write data continuously .