Chapter 20: Controller Redundancy

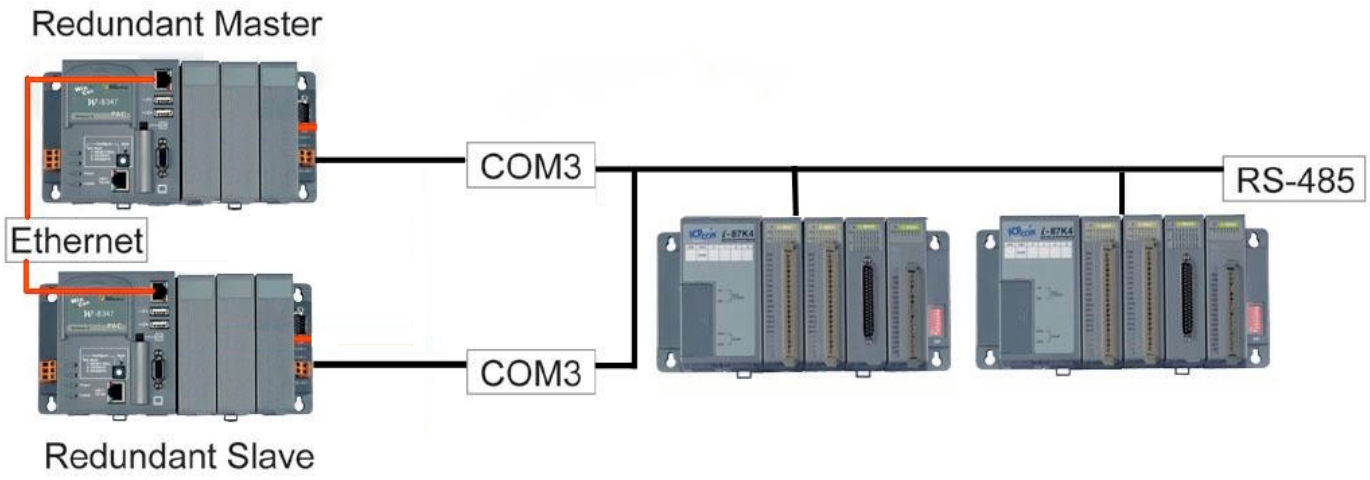
20.1: Wincon-8xx7 CPU Redundancy Plus I-87K I/O

Note:

1. When using this function in controller of W-8x47/8x46, you may connect a cross ethernet cable between these two W-8x47/8x46's "LAN2" port. Then you don't need a Ethernet switch between them. (refer to Appendix F to Enable LAN2)

2. One or more PC/HMI can connect to the Modbus RTU slave RS485 port of these two redundancy controllers at the same time (please refer to section 20.4). If setting Modbus RTU slave ports in COM5 to COM14 of the W-8x47/8x46(Appendix G of the "Wincon Getting Start: ISaGRAF PAC" manual), these Modbus RTU slave ports will reply to the PC/SCADA or HMI's request only when the controller is "redundancy active". This means only one controller will response to the PC/HMI via Modbus RTU RS485 protocol at any time.

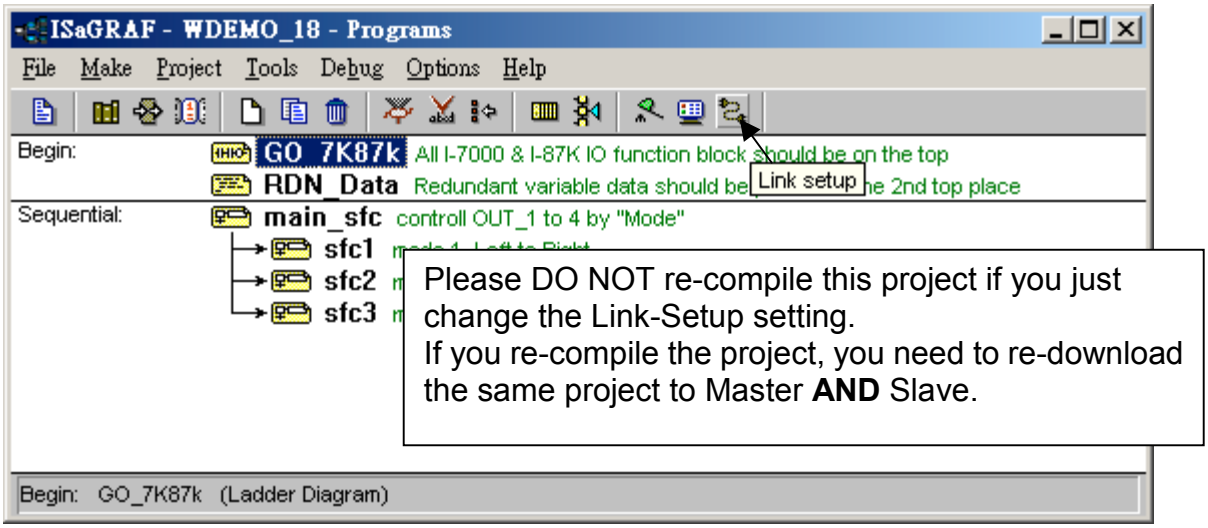
W-8x47/8x37 supports Redundant CPU solution as below figure since driver version of 3.24.



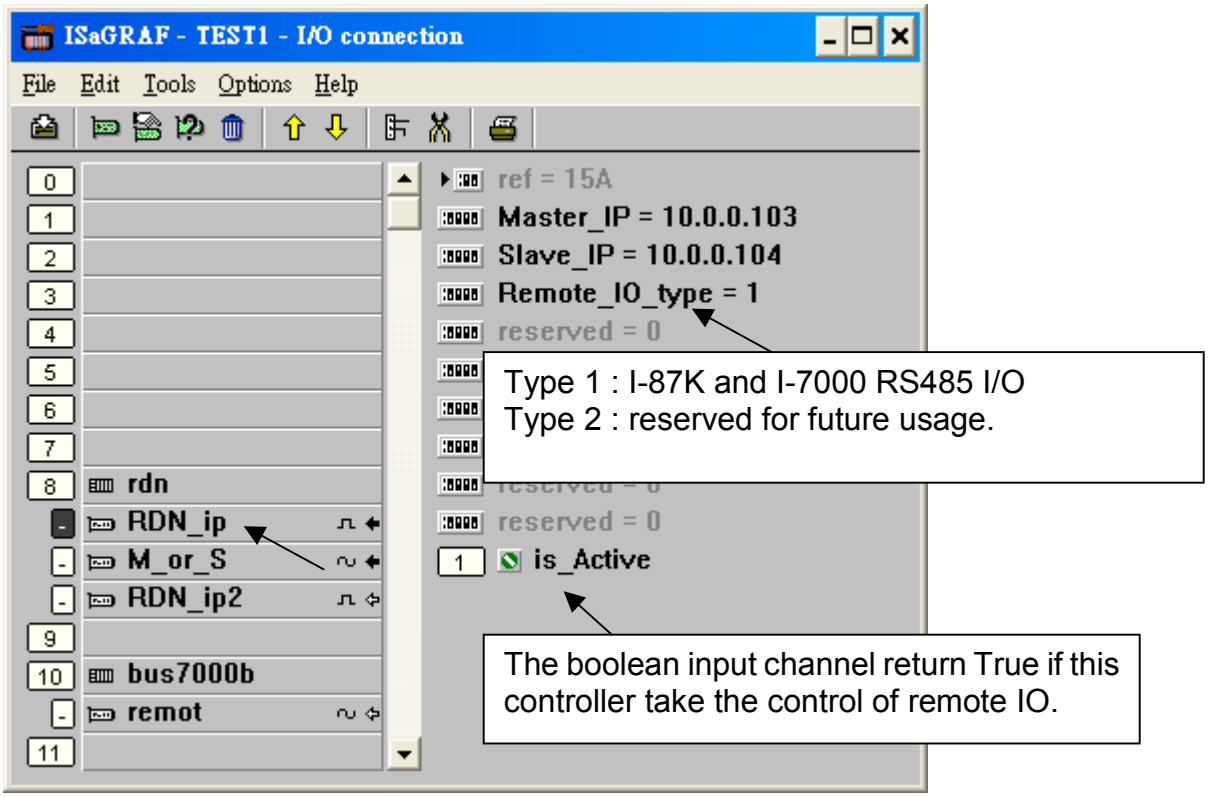
Operations principle:

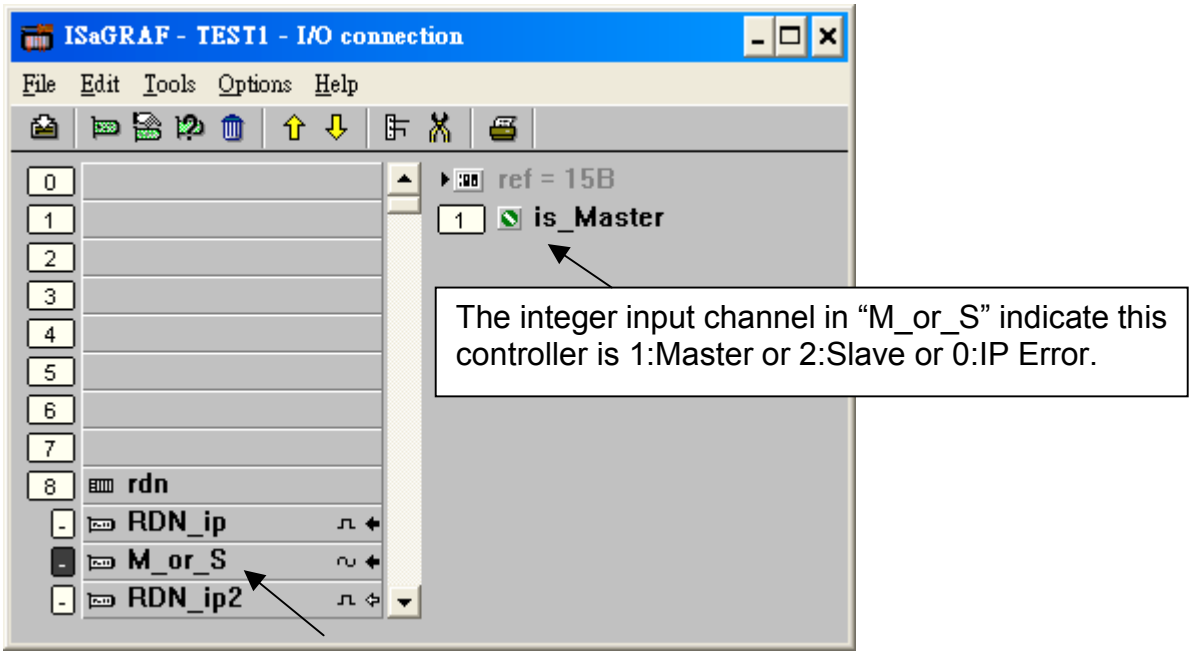
1. Two Wincons can use its COM3:RS485 to connect to one group of RS-485 remote IOs. The IO can be the I-87K4/5/8/9 extension base plus many I-87K IO modules or the I-7000 series remote IO. (Please refer to Chapter 6 for description of remote I/O)
2. **All outputs should be configured as RS-485 remote outputs**, while inputs can locate at slot 1 through slot 7 (I-8K or I-87K IO modules) or configured as RS-485 remote inputs.
3. **At least one I-7000 or I-87K Remote IO should be connected in COM3:RS485**.
4. At run time, only the Redundant Msater controller handles the RS485 command of the remote I/O. The slave controller just standby.
5. When Master controller is dead, the slave controller will take over the control to remote IO.
6. If Master is alive again, it will take back the control of remote IO .
7. The synchronous data is exchanged via the ethernet cable between the Master & slave controller. If you are using Wincon-8x47 (Wincon that has two ethernet ports), it is better to use one cross cable to link from Master controller's LAN2 port to Slave controller's LAN2 port.
8. Redundant change over time <= 500ms , Data sychronization time <= 75ms.

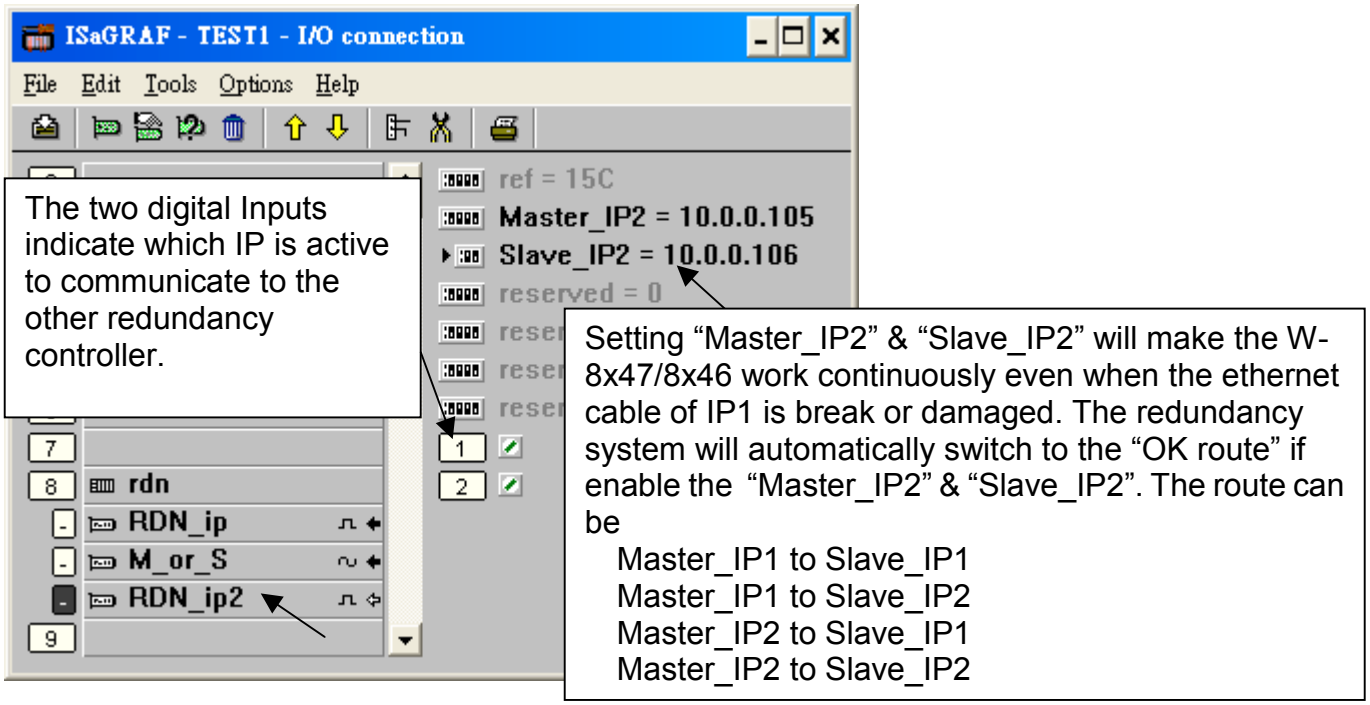
Example program:
Wdemo_18 for both Master (IP=10.0.0.103) & Slave (IP=10.0.0.104) controller.
The program in the Master and Slave controllers are identical (wdemo_18). Please DO NOT re-compile this project if you just change the Link-Setup setting, or the project's CRC value in Master and Slave may be different (Master & Slave 's project must be the same one)



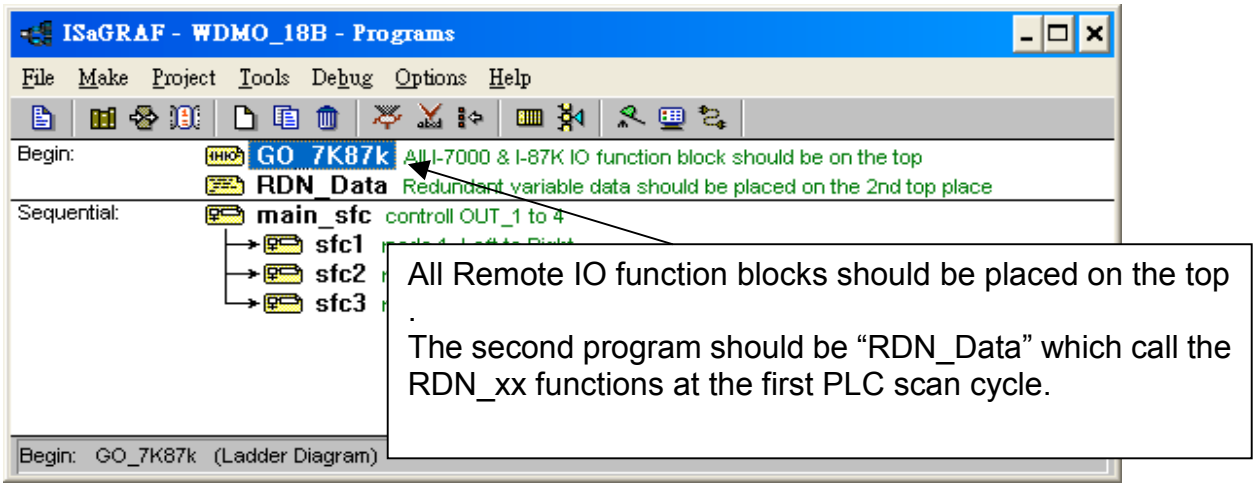
Please connect "rdn" in the IO connection window first as below. Please set the correct Master IP address and Slave IP address. For W-8x47, it is better to use IP address of the "LAN2" port. Please set "Remote_IO_type" to 1 if the remote IO is I-87K and I-7000 RS485 IO (**At least one Remote IO should be connected in COM3:RS485 when type=1**). (type 2 is reserved for future Modbus TCP/IP IO, not available before June.30,2006)


ISaGRAF - TEST1 - I/O connection
File Edit Tools Options Help
ref = 15A
Master_IP = 10.0.0.103
Slave_IP = 10.0.0.104
Remote_IO_type = 1
reserved = 0
reserved = 0
is_Active
rdn
RDN_ip
M_or_S
RDN_ip2
bus7000b
remot
Type 1 : I-87K and I-7000 RS485 I/O
Type 2 : reserved for future usage.
The boolean input channel return True if this controller take the control of remote IO.


ISaGRAF - TEST1 - I/O connection
File Edit Tools Options Help
ref = 15B
is_Master
rdn
RDN_ip
M_or_S
RDN_ip2
The integer input channel in “M_or_S” indicate this controller is 1:Master or 2:Slave or 0:IP Error.



In the project , please must place the I-87xxx function blocks and the I-7xxx function blocks on the top. The second program should be “RDN_Data” which call the RDN_xx functions at the first PLC scan cycle.



All redundant synchronous data should be set in the first PLC scan cycle by using the following functions. However not necessary for the digital inputs & analog inputs in slot 1 to 7 or in the RS-485 I-7K & I-87K IO ,they are automatically updated. Only the output and other important internal data should be set as synchronous data.

RDN_B(Boolean_variable_name)
RDN_F(REAL_variable_name)
RDN_N(Integer_variable_name)
RDN_T(Timer_variable_name)

For example,

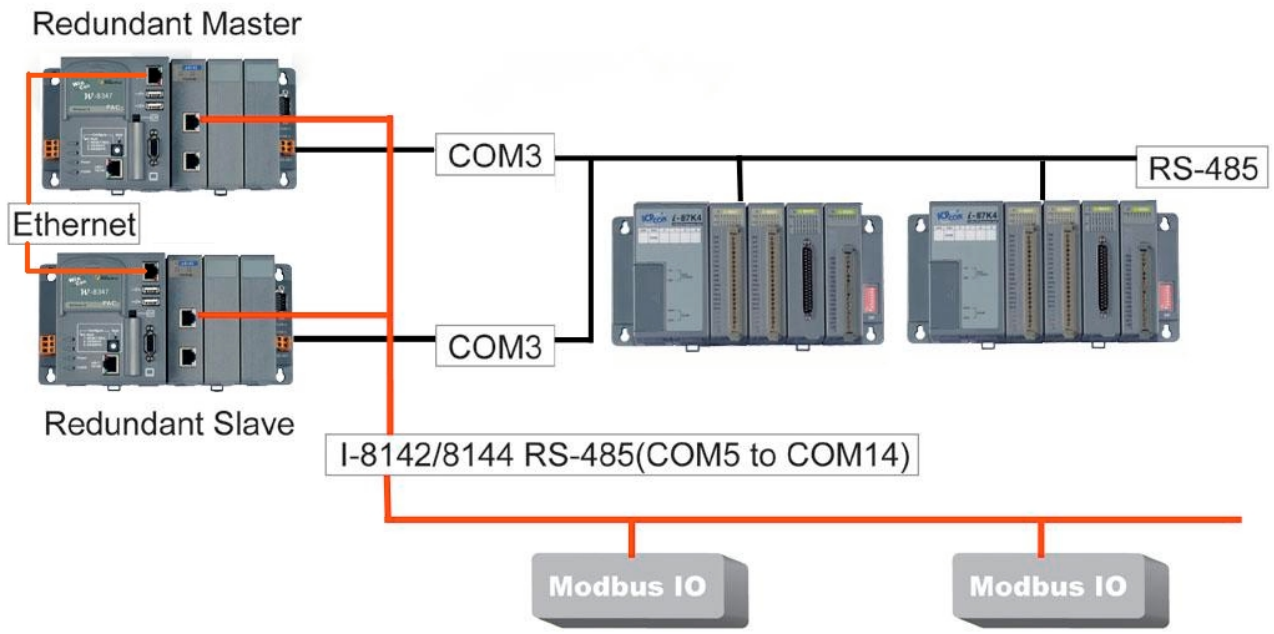
```
if  RDN_init  then   (* RDN_init is decalred with a initial value of "True" *)

   RDN_init   := False  ;  (* only do it once *)

   (* Please set Output channels of I-7000 & I-87K IO as synchronous data *)
   (* Not necessary for Input channels of I-7000 & I-87K IO ,they are automatically updated *)
   TMP  :=  RDN_B(OUT_1)  ;
   TMP  :=  RDN_B(OUT_2)  ;   (* Boolean *)
   TMP  :=  RDN_B(OUT_3)  ;
   TMP  :=  RDN_B(OUT_4)  ;   (* TMP & RND_init is declared as Boolean internal variable *)
   TMP  :=  RDN_B(OUT_5)  ;
   TMP  :=  RDN_B(OUT_6)  ;
   TMP  :=  RDN_B(OUT_7)  ;
   TMP  :=  RDN_B(OUT_8)  ;

(* set other synchronous data by using rdn_b(bool), rdn_n(integer), rdn_f(real), rdn_t (timer) *)
   TMP  :=  RDN_N(Mode)  ;     (* Integer *)
   TMP  :=  RDN_F(Real1)  ;    (* Real *)
   TMP  :=  RDN_T(Timer1)  ;   (* Timer *)
   TMP  :=  RDN_B(B1) ;    (* Boolean *)
end_if ;
```

Please refer to “Wdemo_18” in W-8xx7 CD-ROM:\napdos\isagraf\wincon\demo\ or
ftp://ftp.icpdas.com/pub/cd/winconcd/napdos/isagraf/wincon/demo/ “wdemo_18.pia”

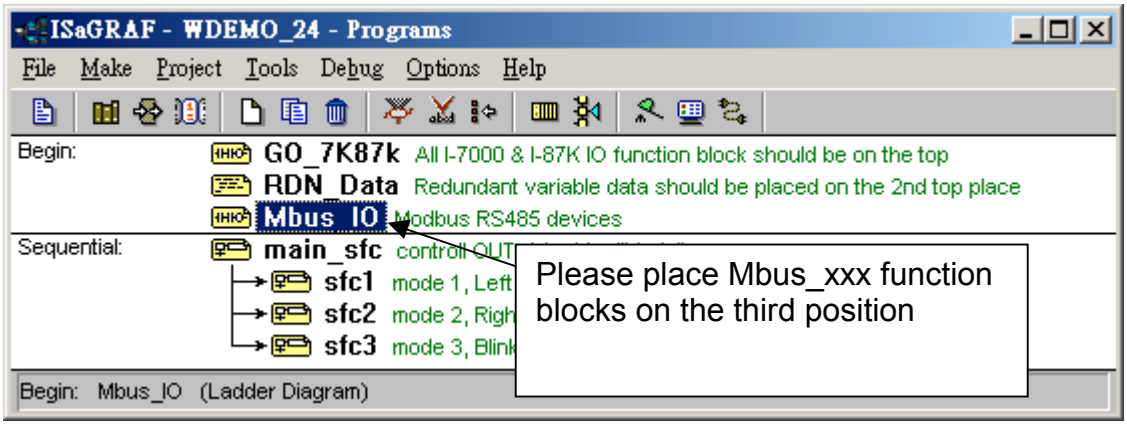
20.2: Wincon-8xx7 CPU Redundant Plus I-87K I/O & Modbus RTU Devices

Note: When using this function in controller of W-8x47/8x46, you may connect a cross ethernet cable between these two W-8x47/8x46's "LAN2" port. Then you don't need a Ethernet switch between them. (refer to Appendix F to Enable LAN2)

The W-8x47/8x37 Redundant CPU solution can also support Modbus IO device as below. **At least one I-7000 or I-87K Remote IO should be connected in COM3:RS485**

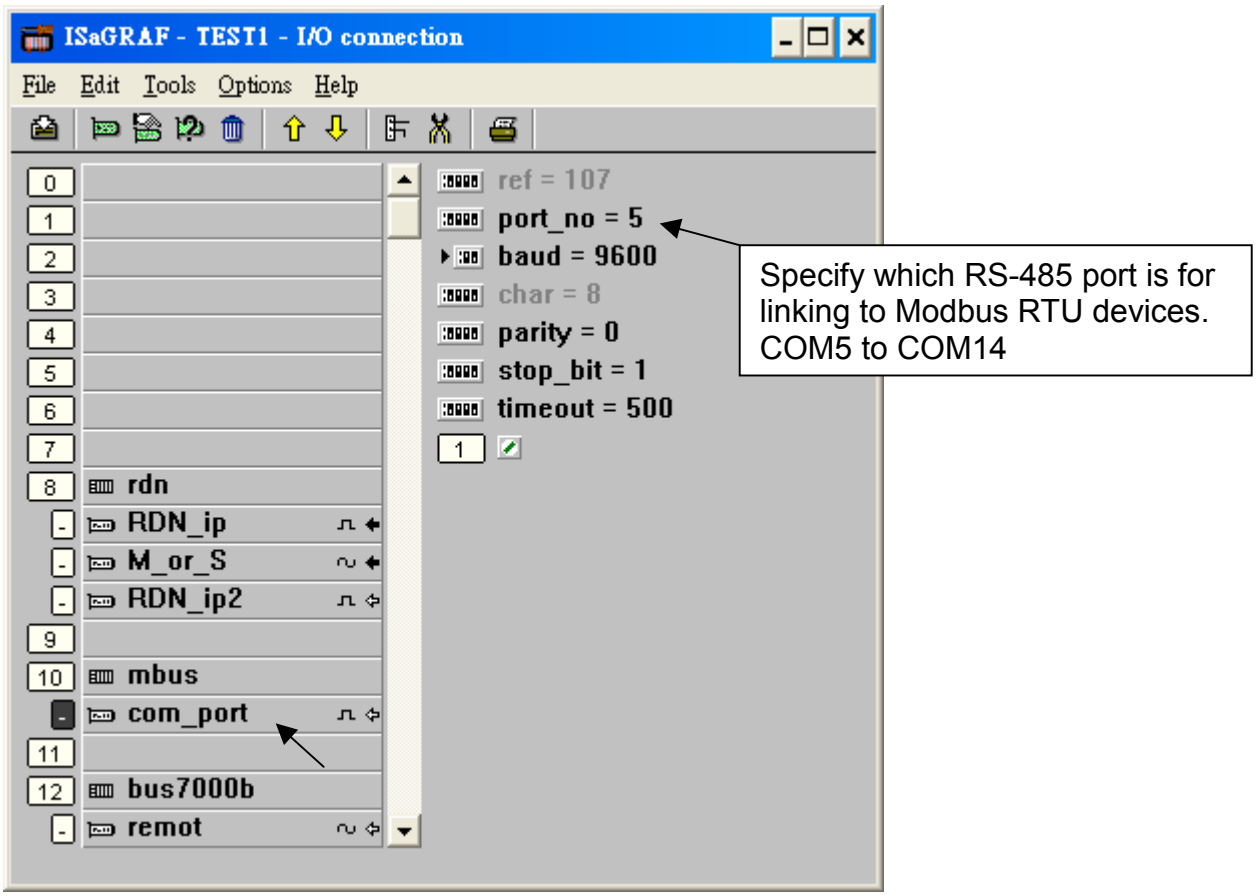


Please place Mbus_xxx function blocks on the third position as below. Please refer to Chapter 8 for using Modbus RTU devices.



Note: Please refer to Appendix E of "Wincon Getting Started: ISaGRAF PAC" manual for setting COM5 to COM14 in the I-8142/8144 RS-485 expansion board.

And please connect “mbus” or “mbus_asc” in the IO connection windows.



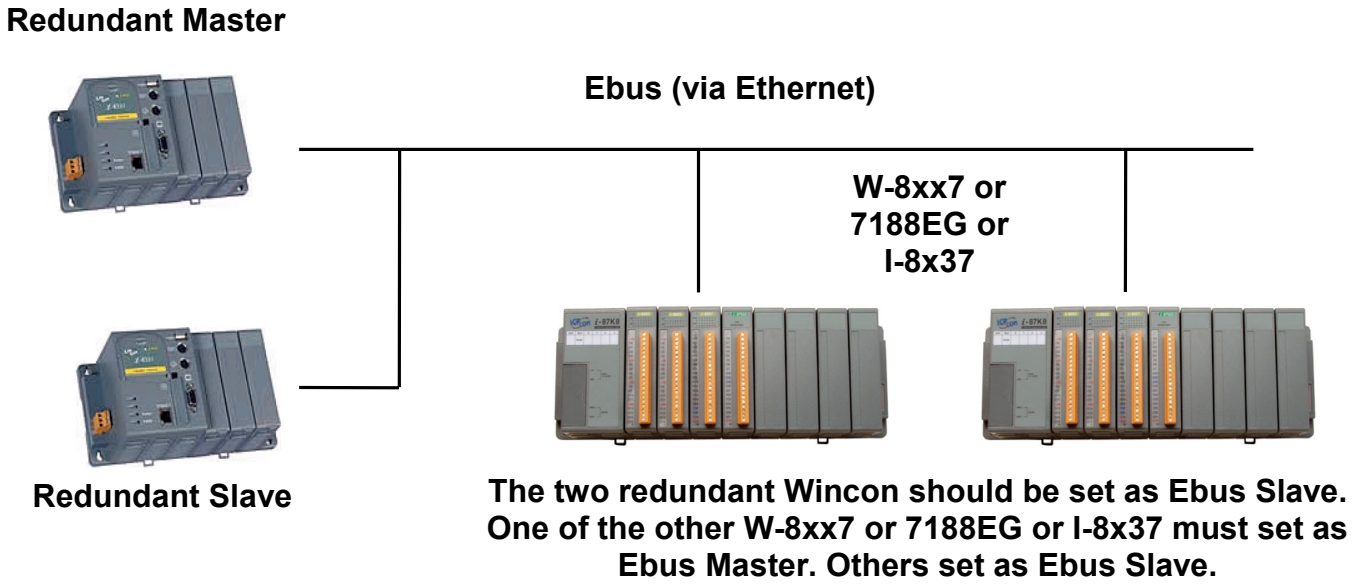
Note:
1. Redundant solution doesn’t support Modbus RTU device in RS-232 ports since RS-232 is one-to-one connection (Two Wincon can not link to one Modbus RTU device by RS-232)
2. The Modbus device can be RTU or ASCII format listed as section 8.3.
3. Multi-ports Modbus IO can also work in redundant solution. Please refer to section 8.4

Example:
Please refer to “Wdemo_25” in W-8xx7 CD-ROM:\napdos\isagraf\wincon\demo\ or ftp://ftp.icpdas.com/pub/cd/winconcd/napdos/isagraf/wincon/demo/ “wdemo_25.pia”

20.3: Wincon-8xx7 CPU Redundant Without I/O

Note: When using this function in controller of W-8x47/8x46, it is better to connect a cross ethernet cable between these two W-8x47/8x46's "LAN2" port. Then you don't need a Ethernet switch between them. (refer to Appendix F to Enable LAN2)

W-8x47/8x37 supports Redundant CPU solution without I/O as below.

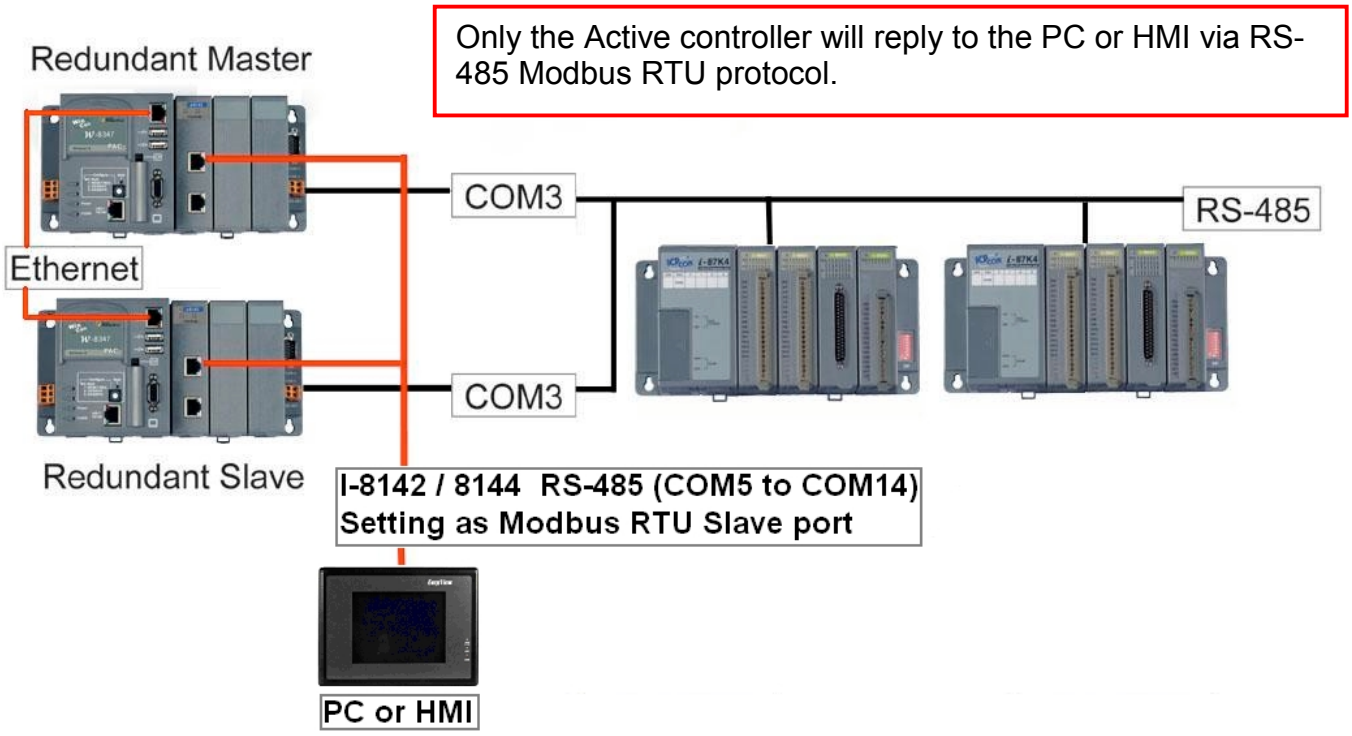


Operations principle:

1. Two redundant Wincons should be set as "Ebus Slave"
2. At run time, only the Redundant Msater controller can handle the command coming from the SCADA system.
3. When Master controller is dead, the slave controller will take over the command handling from the SCADA system.
4. If Master is alive again, it will take back the control .
5. The synchronous data is exchanged via the ethernet cable between the Master & slave controller. If you are using Wincon-8x47 (Wincon that has two ethernet ports), it is better to use one cross cable to link from Master controller's LAN2 port to Slave controller's LAN2 port.
6. Redundant change over time <= 100ms , Data sychronization time <= 75ms.

20.4: Connecting PC/HMI to Modbus RTU RS485 ports

PC or HMI (with RS-485 Modbus RTU Master protocol supported, for example, Touch 506L) can link to the COM5 to COM14 RS-485 Modbus RTU slave port of the two redundancy controllers at the same time as below. **Only the redundancy Active one will reply to the PC/HMI at any time**. Please refer to Appendix E & G of the "Wincon Getting Start: ISaGRAF PAC" manual for setting up the Modbus RTU slave ports at COM5 to COM14.

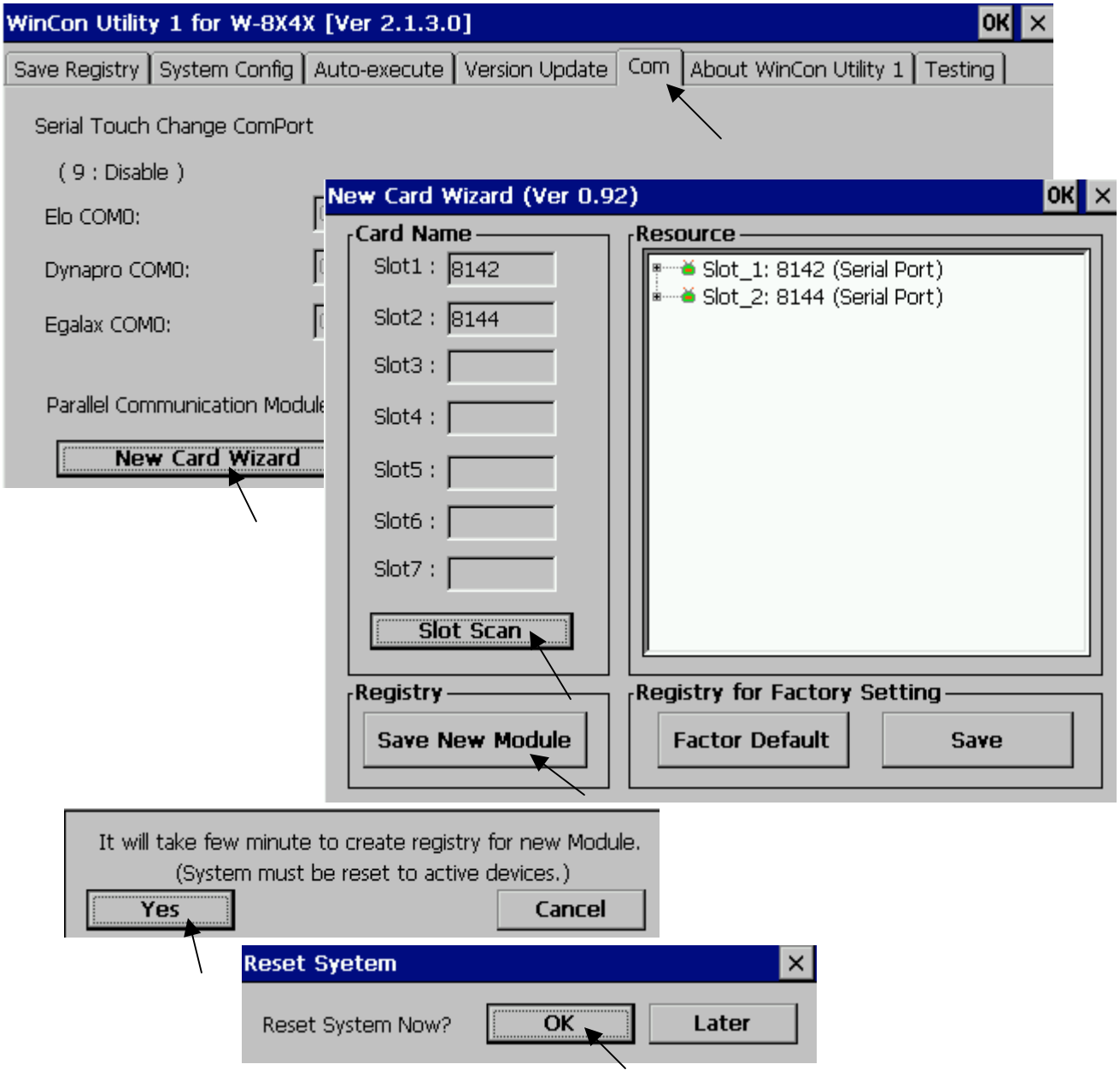


Appendix E: Using Expansion RS-232 or 485 or 422

Wincon can expand 10 more COM ports in its slot 1 to 5 by using below modules:

- i-8112 : 2-channel RS232
- i-8114 : 4-channel RS232
- i-8142 : 2-channel RS422/485
- i-8144 : 4-channel RS422/485
- i-8142i : 2-channel isolated RS422/485

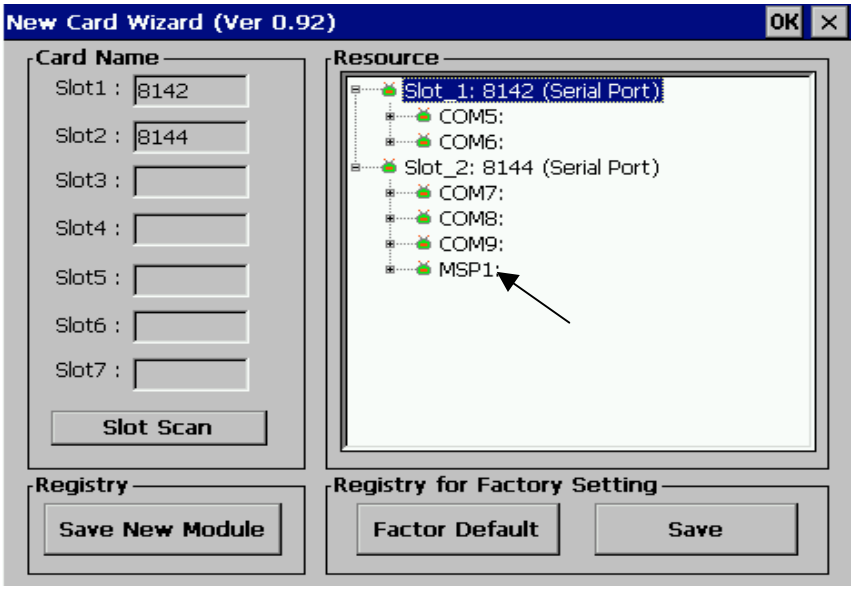
Before user can use them, please configure them By “Wincon utility” first.
Please plug them in slot 1 to 5 and then run “Wincon utility” – “Com” , then click on “New Card Wizard” and then “Slot Scan” and then click on “Save new Module” and Reset the Wincon.



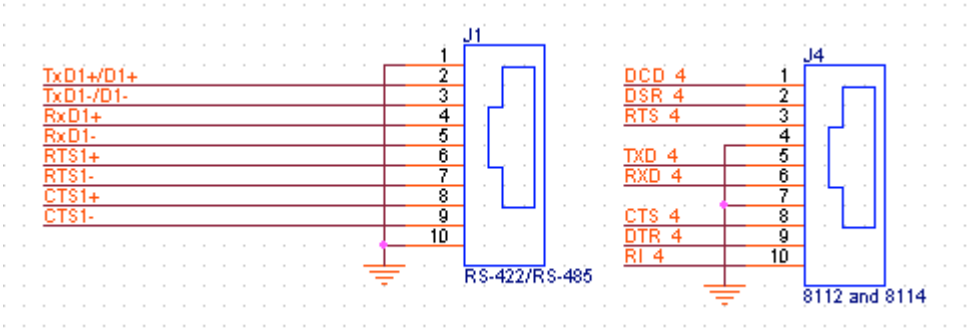
After the configuration succeed. The COM port No. for the expansion board is COM5 to COM14 in the ISaGRAF definition.

The relation between WinCE and ISaGRAF definition for COM10 to COM14 is

WinCE	ISaGRAF
MSP1:	COM10
MSP2:	COM11
MSP3:	COM12
MSP4:	COM13
MSP5:	COM14



Pin assignment of i-8142/8144/8142i i-8112/8114



(D1+ = RS485+ , D1- = RS485-) (RS232's signal GND is Pin 4 or 7)

Note:
1. Please refer to section 8.4 of ISaGRAF User's Manual for multi-ports Modbus Master.
2. Please refer to Appendix A.4 of ISaGRAF User's Manual for COM_OPEN, COM_READ, … functions to read write COM ports.

Appendix G: Setup More Modbus RTU Salve Ports

The Wincon-8xx7/8xx6 can setup up to five Modbus RTU slave ports in COM2 or COM3 or in COM5, COM6, COM7 COM8 (multi-serial ports in slot 1 or 2, refer to appendix E) since the driver version of 3.25.

Note:
1. Modbus RTU slave port 1 can be COM2 or COM3 which can be set on the "Wincon's monitor" by mouse (refer to appendix A.2).
2. User may enable 2nd , 3rd , 4th or 5th Modbus RTU slave port in COM5 , COM6 , COM7 or COM8 only. (No support other COM port number)
3. Before using this function, please make sure COM5 , COM6 (or COM7 , COM8) does exist and well configured. (refer to appendix E)
4. Via 2nd, 3rd, 4th or 5th Modbus RTU slave port, user may use ISaGRAF to Debug/Set_val to the controller, however user can not Stop/Download/Update the ISaGRAF program.
5. To Debug/Set_val/Stop/Download/Update the ISaGRAF program, please use Ethernet port (or Modbus RTU slave port 1, COM2 or COM3 if enabled). COM5 to COM8 is not for ISaGRAF to Stop/Download/Debug.

How to setup ?

Please connect “Rtu_slav” in the ISaGRAF IO connection window as below. Re-compile the project and download to the Wincon via Ethernet (or first Modbus RTU port if it is enabled)