XP-8xx7-CE6 And iDCS-8000 (Or ET-7000 Or Modbus TCP Slave device) Redundant System

Two XP-8xx7-CE6 can connect one or more iDCS-8000 I/O (or connect one or more ET-7000 series I/O modules or others) to become one of the following redundant system.

Note : 1.The ISaGRAF driver of the XP-8xx7-CE6 must use the Ver. 1.03 or later version. Please visit http://www.icpdas.com/en/download/show.php?num=368&nation=US&kind1=&model=&kw=isagraf to download the newest driver version.
2. Visit https://www.icpdas.com/en/faq/index.php?kind=280#751 > FAQ-125 to download this paper and sample programs.

The redundant system of two XP-8xx7-CE6 plus one or two iDCS-8000 I/O (Figure 1)
(Refer to the figure 2 for connecting more redundant stations.)
(Refer to the figure 3 for connecting more iDCS-8000 and the figure 4 for connecting ET-7000 or others)

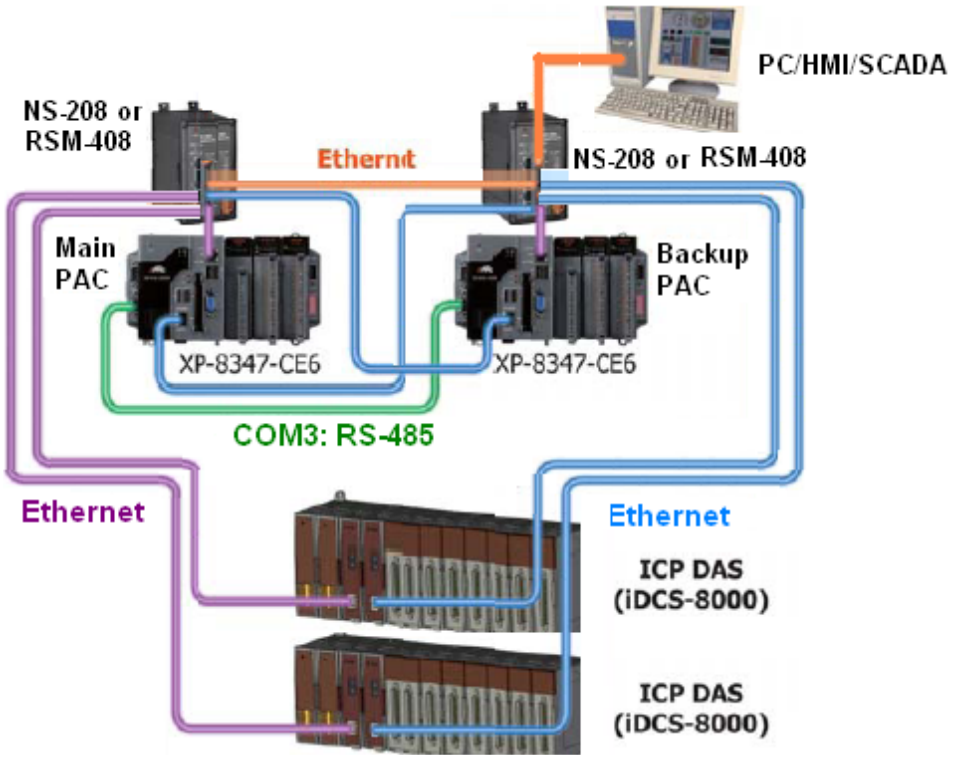


Figure 1

Features :
1. Redundant PAC and redundant ethernet ports : Two PACs, each has two Etrhernet ports.
2. The PC/HMI/SCADA can just connect one IP address (the“Active_IP1”) to access to the XP-8xx7-CE6 redundant system. When the active PAC is damaged for some reasons, the control right will auto-switch to the other PAC and this“Active_IP1”will also auto-switch to belong to the new active PAC.
3. The PAC switching time is about 0.5 second.
4. The iDCS-8000 can have two redundant CPU cards (each with one ethernet port) and two redundant power cards . All I/O cards can also be redundant (two cards for one group I/O). If one is damaged, the other one will take over the work. (or I/O cards can be just a single card for one group I/O)
5. The power cards, CPU cards and I/O cards of the iDCS-8000 can be hot-swapped.

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PC / HMI connecting two or more XP-8xx7-CE6 redundant stations (Figure 2)

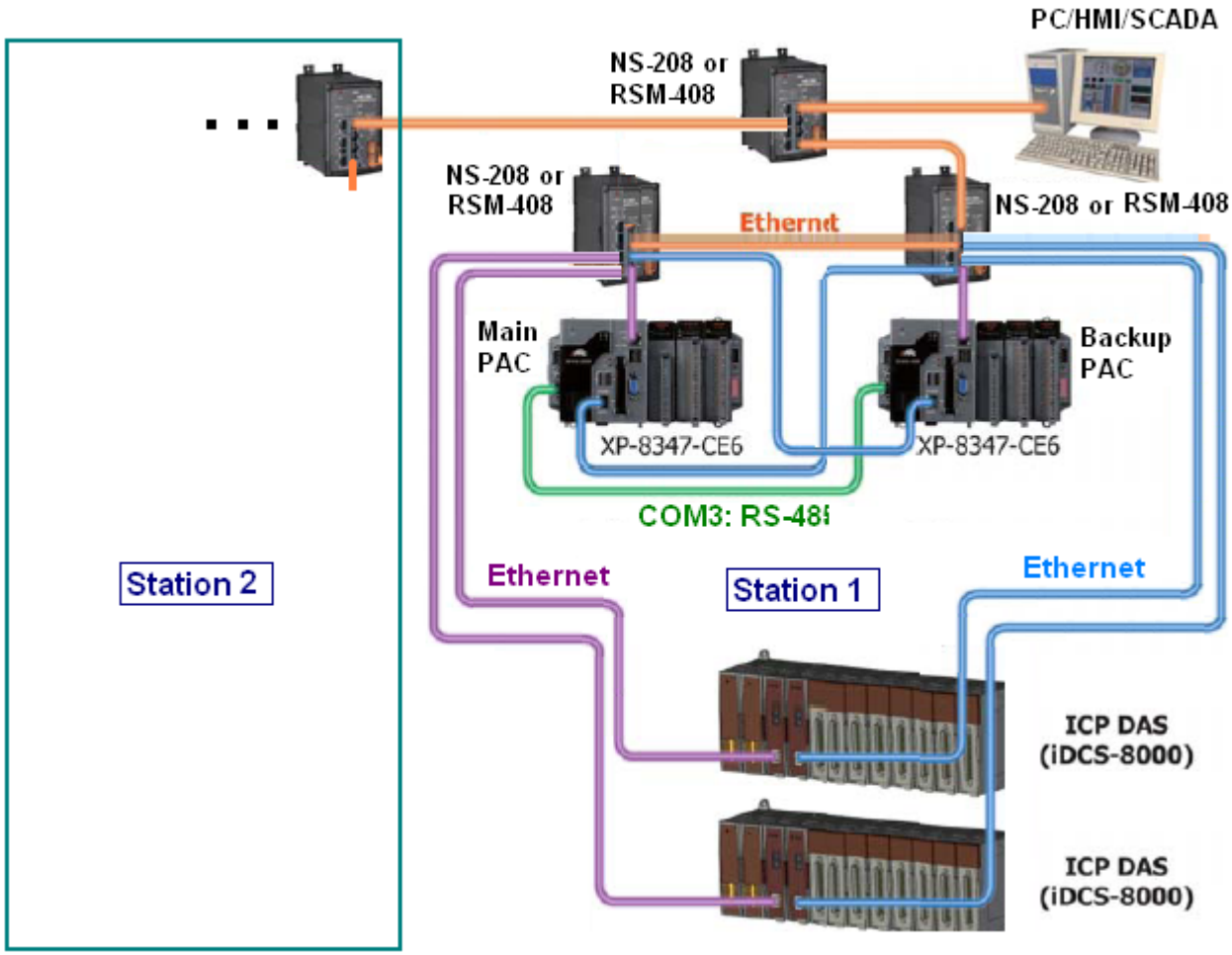


Figure 2

Note: All I/O of this redundant system must use the iDCS-8000 I/O or ET-7000 I/O or other Modbus TCP slave device. The XP-8xx7-CE6 PAC 's slot 1 thru. 7 can plug only the multi-serial port cards (i-8112iW / 8114iW / 8142iW / 8144iW) to connect other communication devices (like the M-7000 or Modbus RTU / ASCII slave devices or other communication devices).

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The redundant system of two XP-8xx7-CE6 plus three or more iDCS-8000 I/O (Figure 3)

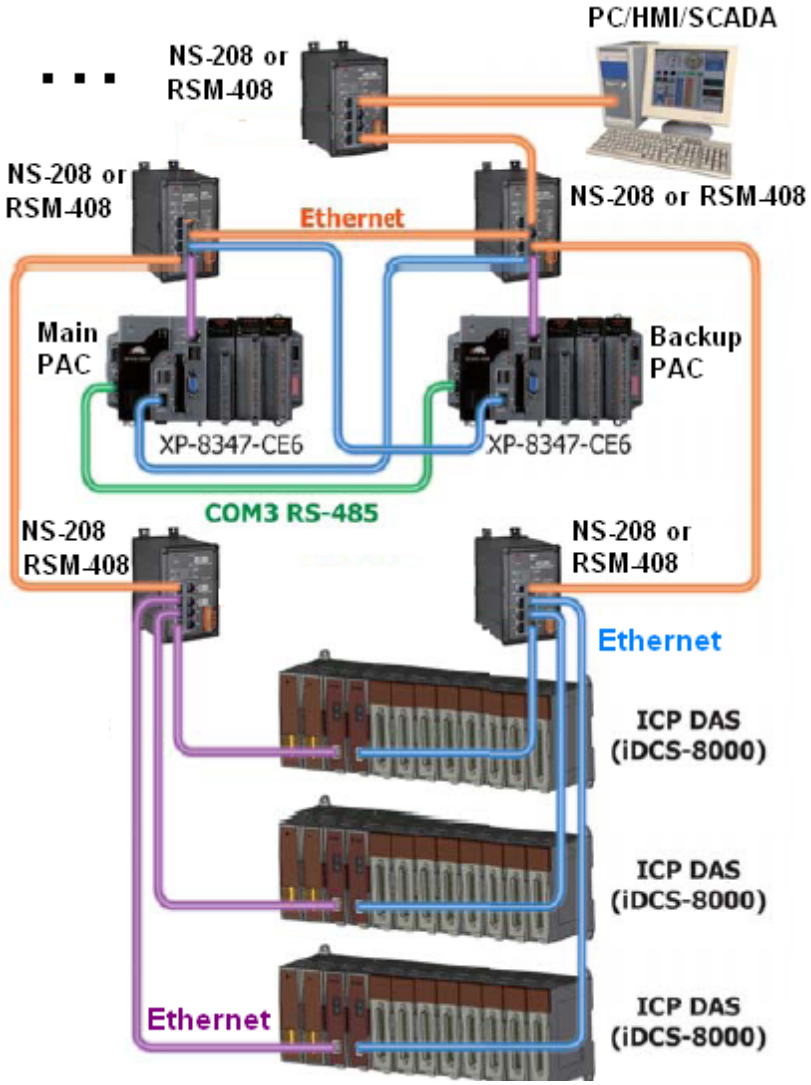


Figure 3

Note: All I/O of this redundant system must use the iDCS-8000 I/O or ET-7000 I/O or other Modbus TCP slave device. The XP-8xx7-CE6 PAC 's slot 1 thru. 7 can plug only the multi-serial port cards (i-8112iW / 8114iW / 8142iW / 8144iW) to connect other communication devices (like the M-7000 or Modbus RTU / ASCII slave devices or other communication devices).

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The redundant system of two XP-8xx7-CE6 plus ET-7000 series I/O or other Modbus TCP slave devices (Figure 4) .

Note : User can connect only ET-7000 series I/O or connect only other Modbus TCP slave devices or connect both or connect No I/O module.

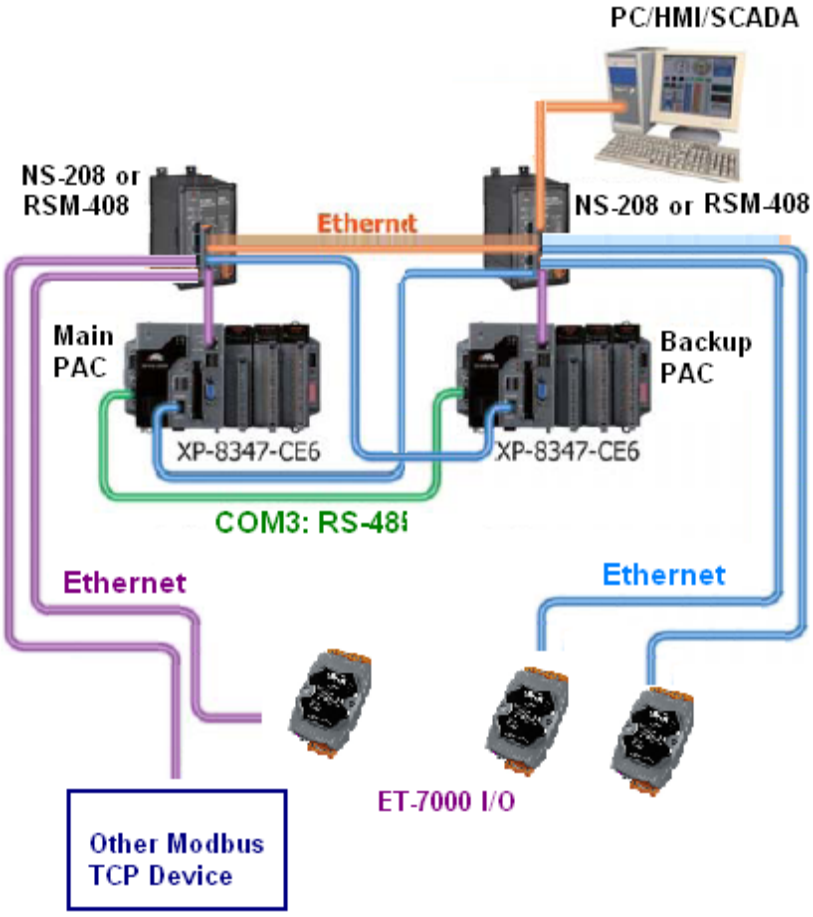


圖 4

Note: All I/O of this redundant system must use the iDCS-8000 I/O or ET-7000 I/O or other Modbus TCP slave device. The XP-8xx7-CE6 PAC 's slot 1 thru. 7 can plug only the multi-serial port cards (i-8112iW / 8114iW / 8142iW / 8144iW) to connect other communication devices (like the M-7000 or Modbus RTU / ASCII slave devices or other communication devices).

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1.1: Install the XP-8xx7-CE6 plus iDCS-8000 redundant system

User may refer to the ISaGRAF example program “xpdmo81a.pia” for designning the XP-8xx7-CE6 redundant system. Please visit https://www.icpdas.com/en/faq/index.php?kind=280#751 > FAQ-125 to download it.

The ”xpdmo81a.pia” is for the two XP-8xx7-CE6 to connect one iDCS-8000. This iDCS-8000 is installed with the following I/O cards (from left to right). The iDCS-8000 manual and utility is listed as following.

iDCS-8000 utility:
https://www.icpdas.com/en/download/show.php?num=1753&nation=US&kind1=&model=&kw=iDCS-8000 > v1.00beta > utility

iDCS-8000 manual:
https://www.icpdas.com/en/download/show.php?num=1678&nation=US&kind1=&model=&kw=iDCS-8000 > v1.00beta > Manual

MiniOS7 Utility:
https://www.icpdas.com/en/download/show.php?num=1053&nation=US&kind1=&model=&kw=MiniOS7 (V.321 or new)

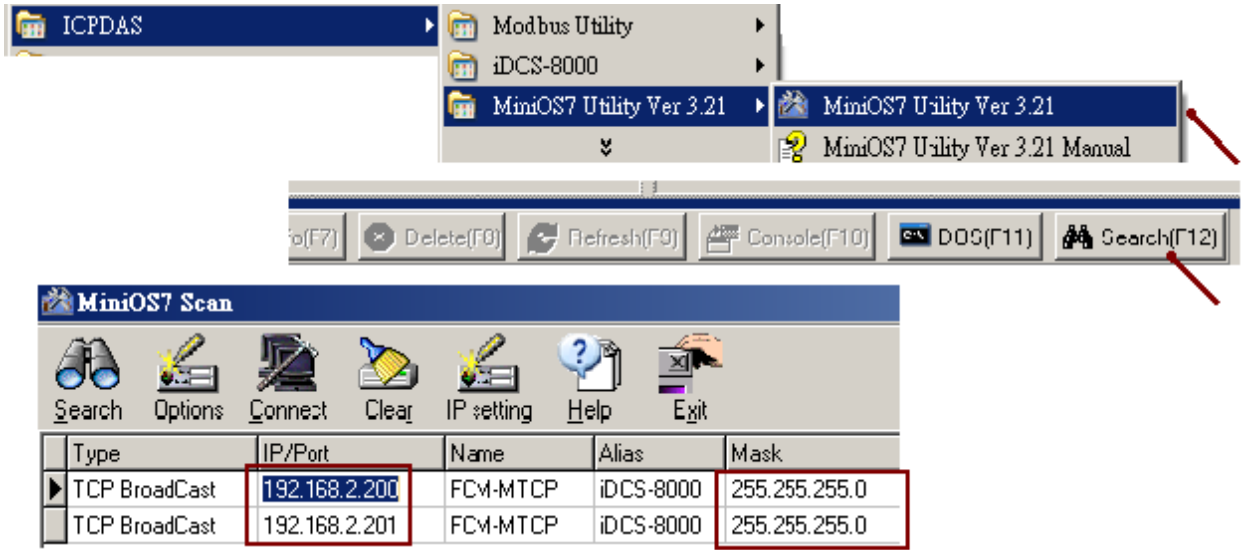
The following configuration is for the “xpdmo81a” example program.

FPM-D2440 : Power card 1 (for power input, 24V)
FPM-D2440 : Power card 2 (for power input, 24V)
FCM-MTCP : MCU 1, SW2 at 'C', SW1 at '8'. (must run the“MiniOS7 utility”to set IP as 192.168.2.200)
FCM-MTCP : MCU 2, SW2 at 'C', SW1 at '9'. (must run the“MiniOS7 utility”to set IP as 192.168.2.201)
F-8040 : I/O slot 0, 32-Ch. D/I (must run the“iDCS-8000 Utility”to set Slot 0 and 1 as Duplex mode)
F-8040 : I/O slot 1, 32-Ch. D/I (must run the“iDCS-8000 Utility”to set Slot 0 and 1 as Duplex mode)
Both 37-Pin-DSUB connectors of the slot 0: F-8040 and slot 1: F-8040 must link to one DN-37 .
F-8041 : I/O slot 2, 32-Ch. D/O (must run the“iDCS-8000 Utility”to set Slot 2 and 3 as Duplex mode)
F-8041 : I/O slot 3, 32-Ch. D/O (must run the“iDCS-8000 Utility”to set Slot 2 and 3 as Duplex mode)
Both 37-Pin-DSUB connectors of the slot 2: F-8041 and slot 3: F-8041 must link to one another DN-37 .

Please refer to the iDCS-8000 manuals for the Modbus address definition. Manuals can be download at https://www.icpdas.com/en/download/show.php?num=1678&nation=US&kind1=&model=&kw=iDCS-8000 > v1.00beta > Manual.

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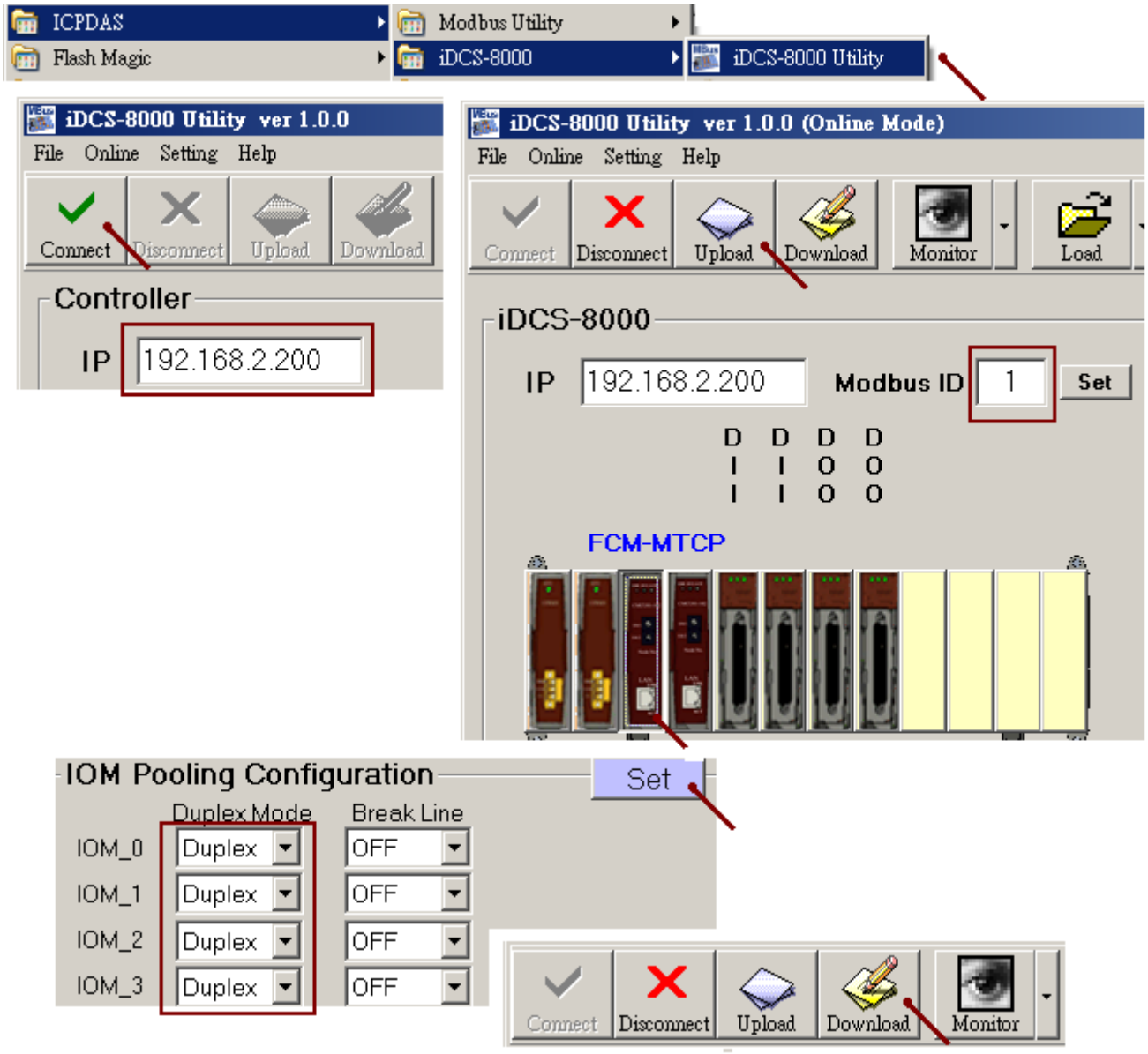
To setup the proper IP for both of the iDCS-8000 CPU cards (FCM-MTCP), run the“MiniOS7 Utility”. Then click“search”on the bottom-right to search the current IP of the iDCS-8000. Click ”Stop”when found. Then click it to modify these two found IP address as 192.168.2.200 and 192.168.2.201. Then modify the Mask address as 255.255.255.0. Remember to set the SW2 of the first“FCM-MTCP”to 'C' and SW1 to '8' (0xC8=200) and set SW2 of the second“FCM-MTCP”to 'C' and SW1 to '9' (0xC9=201).



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Then close the “MiniOS7 utilty”. Run the “iDCS-8000 Utility”to connect the iDCS-8000.
(**Note** : To connect the iDCS-8000 well by your PC, must set your PC 's IP address to the same domain as the iDCS-8000. For instance, PC with IP = **192.168.2**.115 can connect the **192.168.2.**200 well).

Enter the IP address (192.168.2.200) of the iDCS-8000 as the below figure, then click“Connect”. If the iDCS-8000 is connected, the“Modbus ID”will show up (default is 1, please DO NOT modify it). Then click“Upload”to search the current I/O cards. When found, then click the first“FCM-MTCP”(MCU 1) to set the slot 0 and slot 1 as“Duplex” mode, and also set the slot 2 and slot 3 as “Duplex” mode. Then click “Set”and then click “Download”to realize the setting to the iDCS-8000. Then close the“iDCS-8000 Utility”.



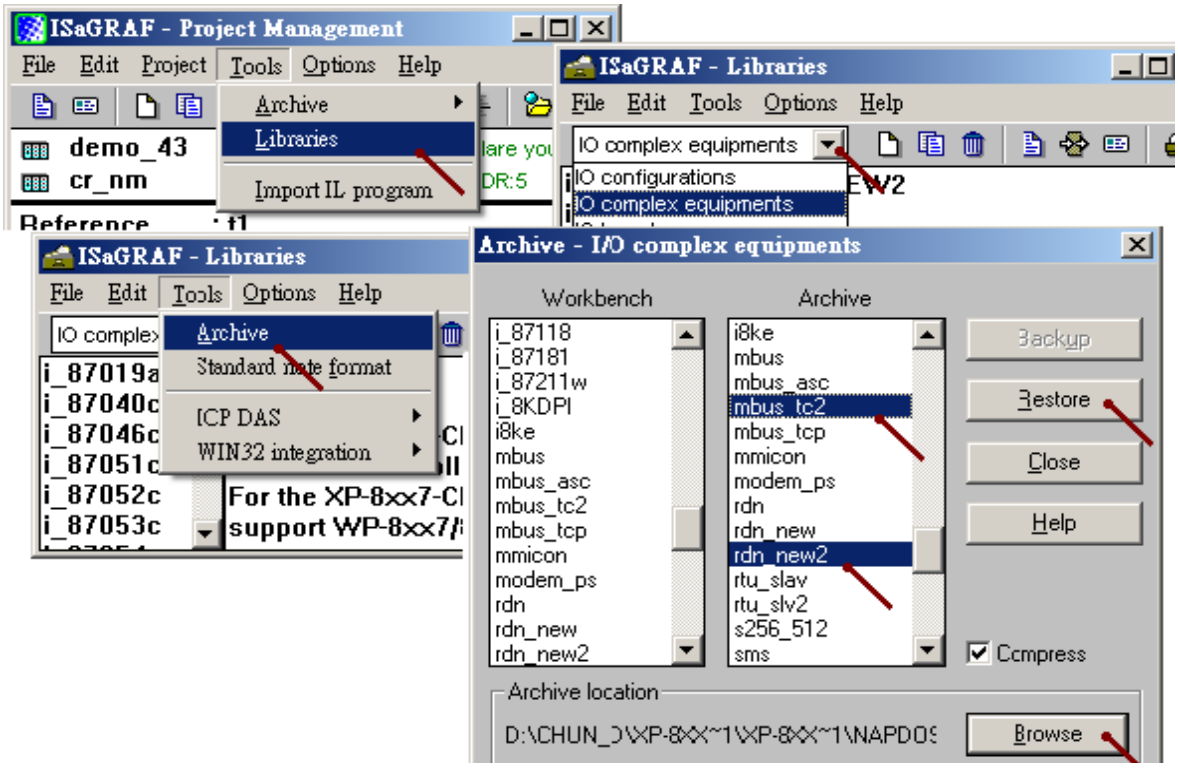
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To download the ISaGRAF program ”xpdmo81a”to the two XP-8xx7-CE6, make sure both of your XP-8xx7-CE6 's ISaGRAF driver are version 1.03 (released at May.2010) or later version. The older driver version doesn't support the“rdn_new2”and the“mtcp_tc2”. User may download the newest driver at http://www.icpdas.com/en/download/show.php?num=368&nation=US&kind1=&model=&kw=isagraf , then follow steps listed in a PDF file inside the downloaded ZIP file to update the XP-8xx7-CE6 's ISaGRAF driver.

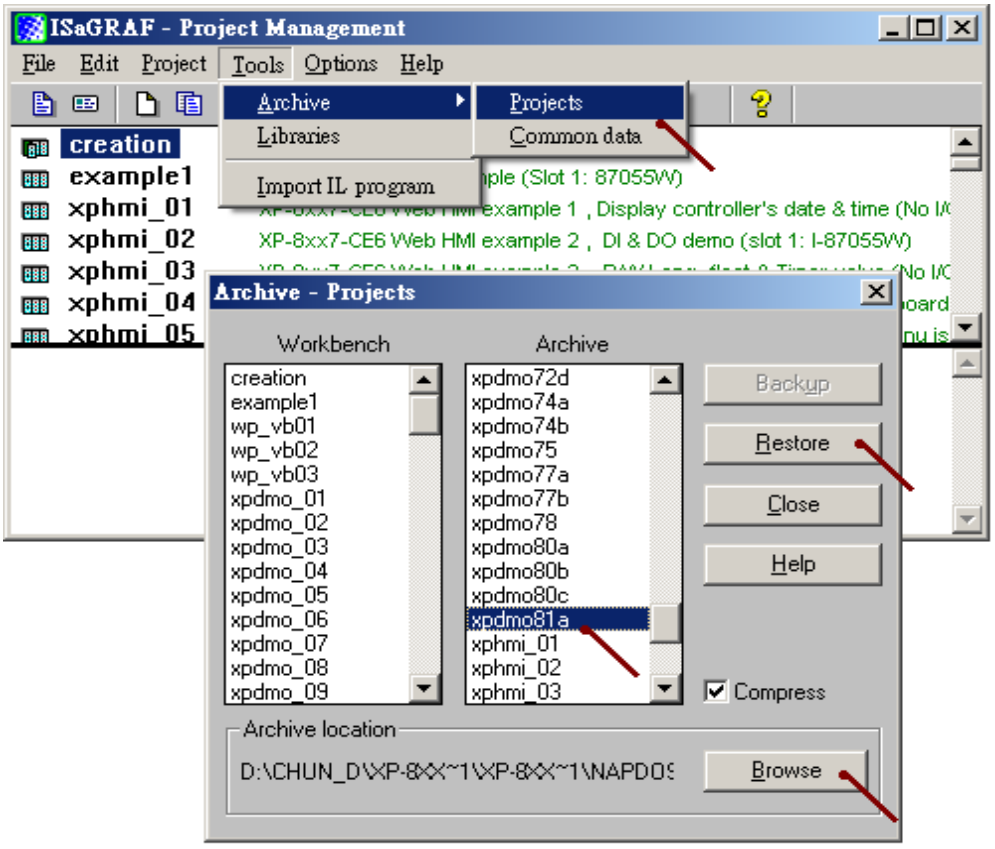
Note : 1. The Rotary switch of the XP-8xx7-CE6 must set to “0” position and recycle its power once for downloading the ISaGRAF program. And also must use “RS-232” communication to download the ISaGRAF redundant program (refer to the description of the next two pages). DO NOT use the “Ethernet” communication to download the redundant program. The XP-8xx7-CE6 with its Rotary switch at “7” (The Main PAC) or “9” (The Backup PAC) position means it is in the redundant working state (can not download the program in the redundant working state).
2. When one PAC of the redundant system is damaged, please must only turn off the power of that damage XP-8xx7-CE6 (swich the“PWR”button on its front panel to“OFF”). Then take off the damaged XP-8xx7-CE6 for repairing. When it is well repaired, set its rotary switch to“0”position to download the exact same ISaGRAF redundant program to it via RS-232. Then switch the“PWR”button to OFF first and then switch its rotary switch to the working state (“7” for the Main PAC,“ 9” for the Backup PAC). Then install this XP-8xx7-CE6 back to the working field and make sure the power cable and all communication cables (includes all its Ethernet cables and its COM3: RS-485 cable) and others are well plugged. Then switch its “PWR”button to“ON” postion.
3. These two redundant XP-8xx7-CE6 must run the same ISaGRAF program to work well. If the program has been modified and re-compiled again, then must download the new program to both XP-8xx7-CE6 again
4. Please DO NOT re-compile the program if modify only the ISaGRAF“Link setup”setting (only re-compile it when program, variables, I/O connection, ... are modified).

When download the example program from https://www.icpdas.com/en/faq/index.php?kind=280#751 > FAQ-125 . User can find“rdn_new2.xia”and“mtcp_tc2.xia”inside the ZIP file. Please restore them to your PC / ISaGRAF as the following figure.

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Then also restore the “xpdmo81a.pia” program to the PC/ISaGRAF .



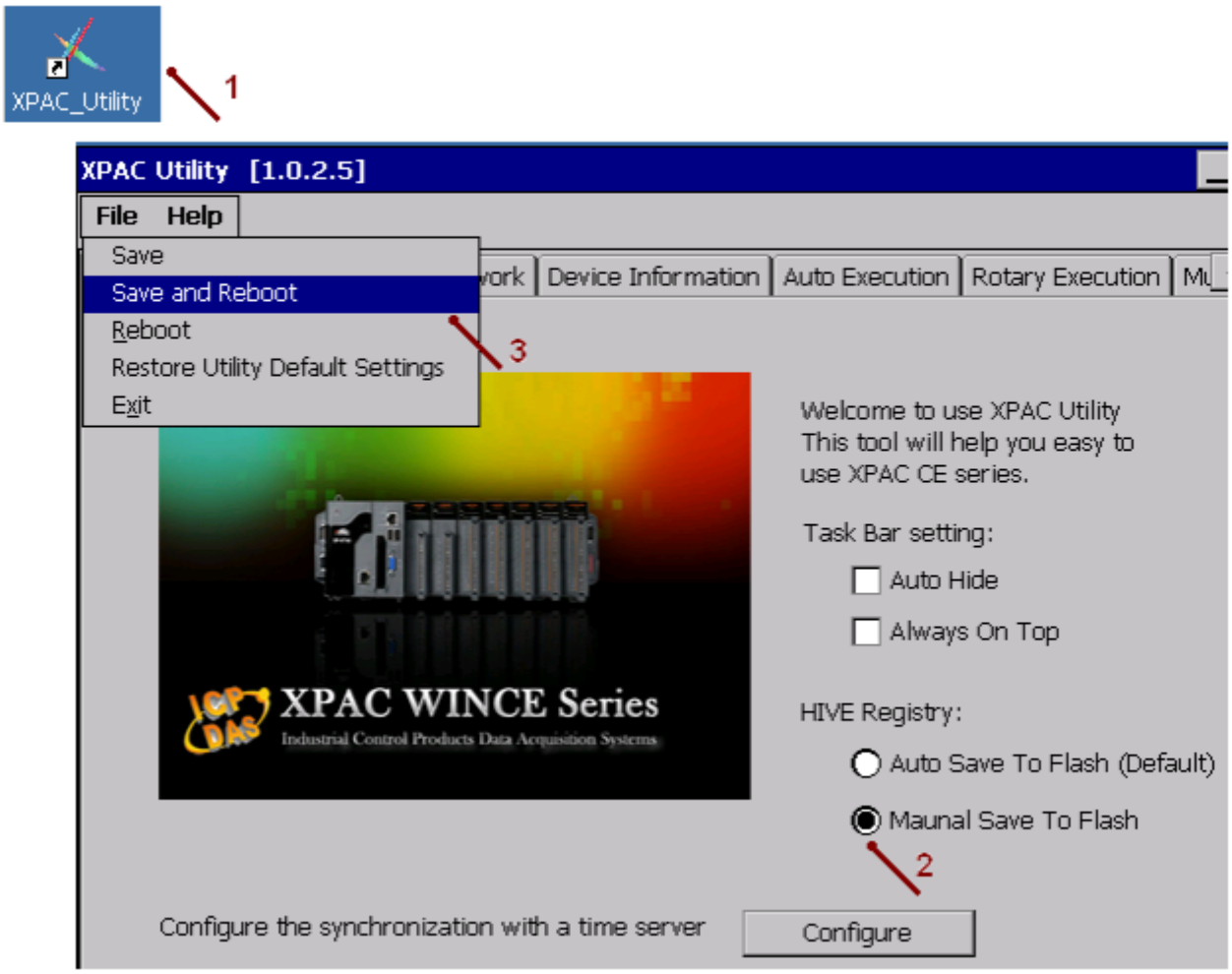
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Important Note : Please must do the following two settings to prevent the XP-8xx7- CE6 redundant system to generate the IP conflict problem. (The XP-8xx7-CE6 redundant system may fail if the IP conflict problem happens)

1. Setting the hardware LAN1 and LAN2 's IP address (at rotary switch 0) to be different as the software IP settings in the ”RDN_New2” of the ISaGRAF program.

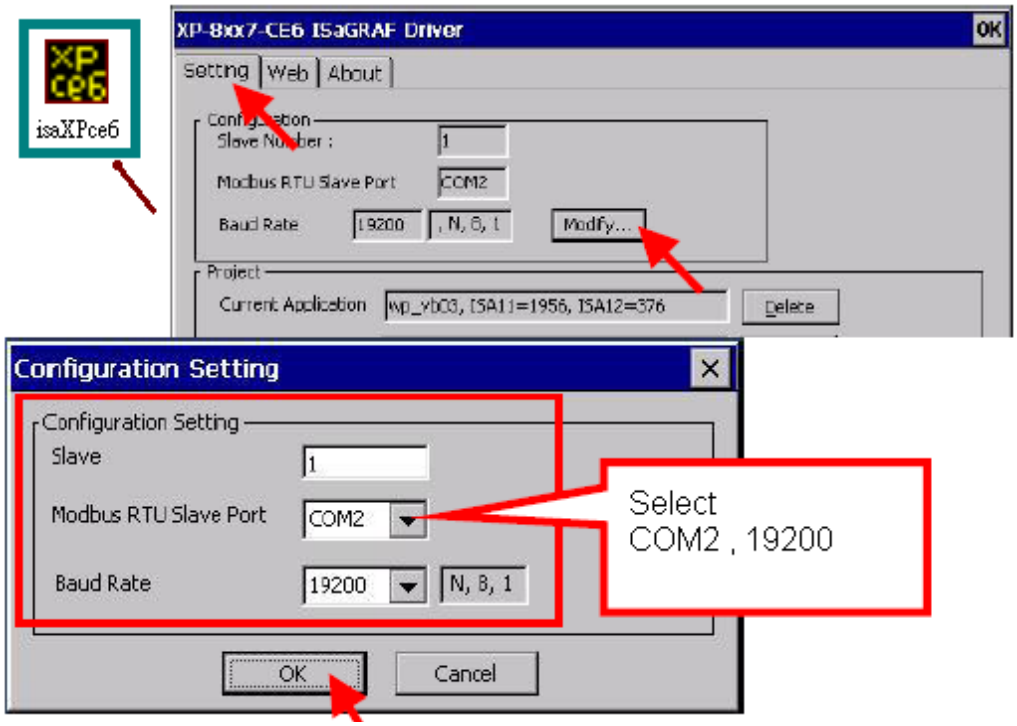
For ex., if the IP setting in the “RDN_New2” is as the following. Active_IP1 = 192.168.2.100 , Active_IP2 = 192.168.2.101 InActive_IP1 = 192.168.2.102 , InActive_IP2 = 192.168.2.103 .

Then user may set the hardware IP address (at rotary switch 0) to the following. Main PAC 's LAN1 = 200.168.2.100 , Main PAC 's LAN2 = 200.168.2.101 Backup PAC 's LAN1 = 200.168.2.102 , Backup PAC 's LAN2 = 200.168.2.103 2. Then must run the XPAC Utility (Version 1.0.2.5 or later) to check the “Manual Save To Flash“ option and run File > Save and Reboot once. (DO NOT check the “Auto Save To Flash”)

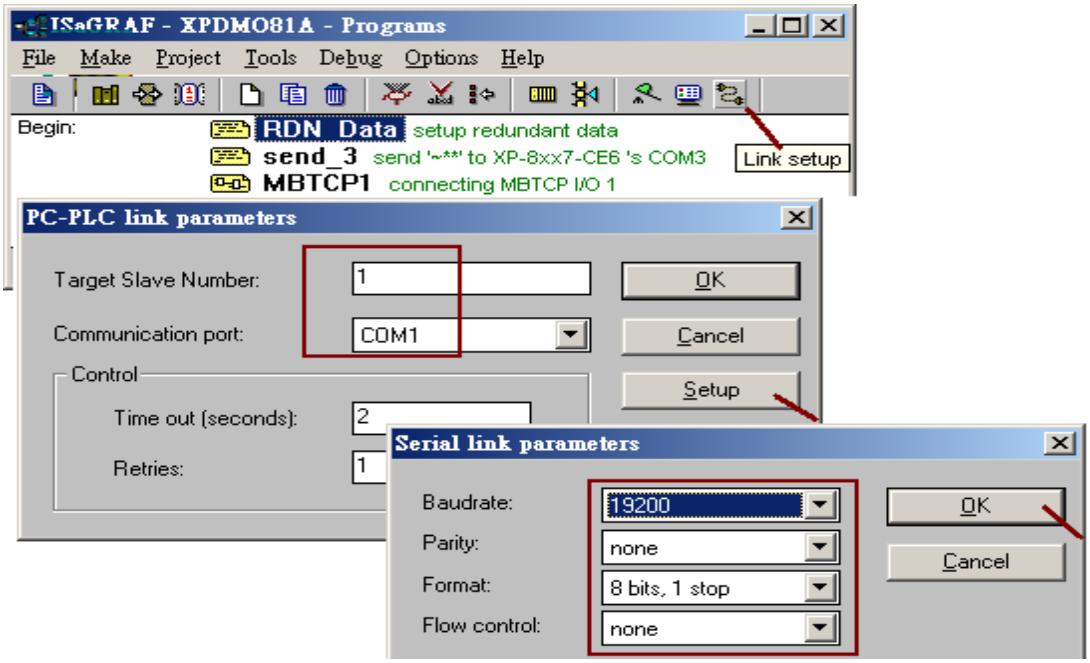


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Power OFF these two XP-8xx7-CE6 and connect a VGA monitor to one of them and then power ON them. Set their“COM2”as Modbus RTU slave Port (baud=19200), then click ok. Then Power OFF them .
This“COM2: Modbus RTU slave” setting is for downloading the IsaGRAF program to them.



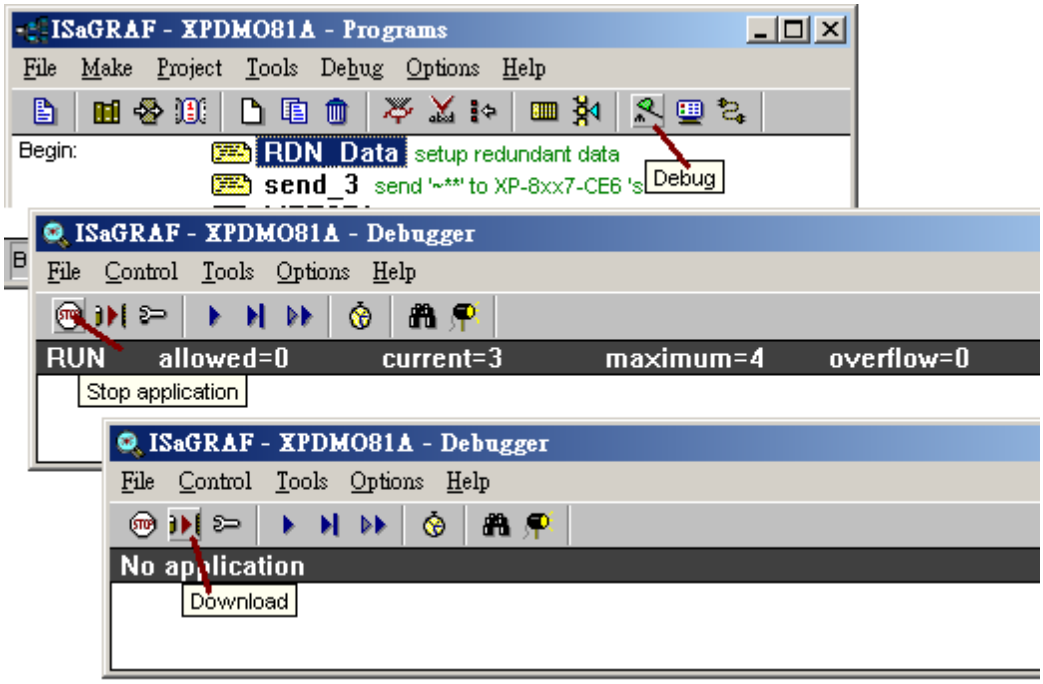
Then set the rotary switch to“0”position, power ON the XP-8xx7-CE6 PAC (**only position“0” can download the ISaGRAF program, position “7” and “9” is not for downloading , they are in the redundant working state**). Then connecting one RS-232 cable between the COM2 of XP-8xx7-CE6 and one RS-232 COM port of your PC. Run PC/ISaGRAF, set the“Link setup" as the RS-232 COM port number of your PC (19200, none, 8, 1, none-flow-control) .



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Note : DO NOT re-compile the program if modify only the ISaGRAF“Link setup”setting (only re-compile it when program, variables, I/O connection, ... are modified).

Then you can download the “xpdmo81a” program to the PAC via RS-232 communication. **Both XP-8xx7-CE6 of the redundant system must download the same program**. (If has modified any program, any variable, any I/O connection, ..., please muste re-compile it and then download to both PACs again).



Then power OFF the XP-8xx7-CE6, Setting the rotary switch of the Main PAC to“7”, while set to“9” for the Backup PAC. Make sure all power cables, all communication cables are well installed like the figure 1 (this demo apply only one iDCS-8000). Then if all are done, power ON the whole redundant system.

Note: All power cables and all Ethernet cables (LAN1 and LAN2) and the COM3: RS-485 cable (D+ --- D+ , D- --- D-) of the Main PAC and Backup PAC and iDCS-8000 and Ethernet switch must be installed well before power ON them (The XP-8xx7-CE6 will take about 75 to 120 seconds to boot up).

1. Each Ethernet cable in the redundant system must be plugged in a fixed port. The Ethernet communication may have problem if plug an Ethernet cable to different ports. Recommend to stamp a label on every Ethernet cable and specify ID something like“Main, LAN1”, “Main, LAN2” , “Backup, LAN1” , “Backup, LAN2”, “iDCS, LAN1”, “iDCS, LAN2” to make sure all of them are plgged in the correct ports.

2. If there is no remote I-7000 (or remote RU-87Pn + I-87KW cards) connected in the redundant system, the COM3: RS-485 of both XP-8xx7-CE6 must connect to each other (D+ --- D+ , D- --- D-) . And must write ISaGRAF program to let COM3 send“~**”to both PAC in about every 50 ms.
If the application need to connect some RS-485 remote I-7000 (or remote RU-87Pn + I-87KW cards), then please link both COM3 ports of the XP-8xx7-CE6 to these remote I/O modules. And do not write ISaGRAF program to let COM3 send “~**”to both PAC.

3. The“Active_IP1”of this demo is 192.168.2.100. It will auto-switch to one working Ethernet port of the active PAC. When the active PAC is dead or damaged, the active PAC will switch to the other PAC and also the“Active_IP”will auto-swich to one working port of the new active PAC . So the PC / HMI / SCADA

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just need to connect this“Active_IP1”(not necessary to connect the“Active_IP2”).The PAC switching time is about 0.5 second.

4. The new active PAC will not give up its control right to the other PAC until it is dead or damaged or its ethernet cable which has the“Active_IP1”is broken.

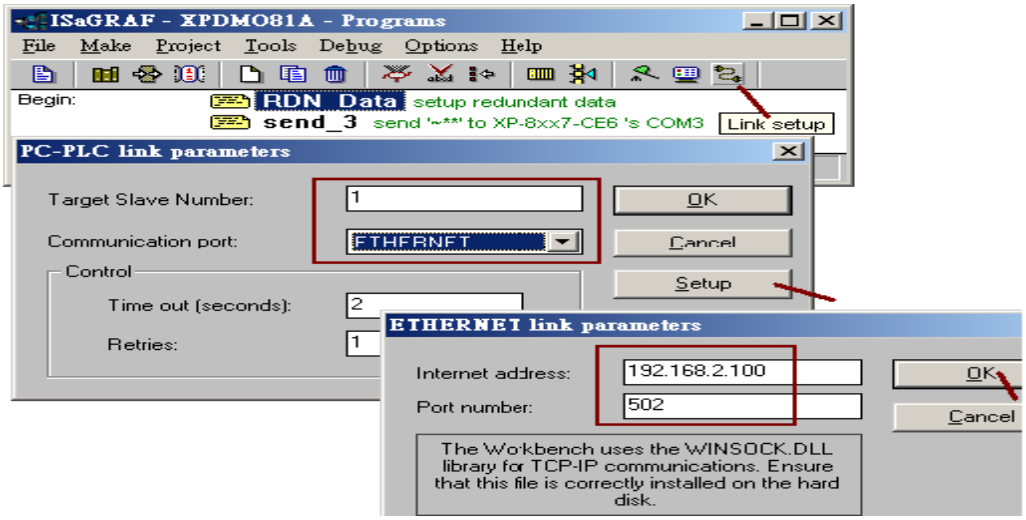
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1.2: Test the XP-8xx7-CE6 plus iDCS-8000 redundant system

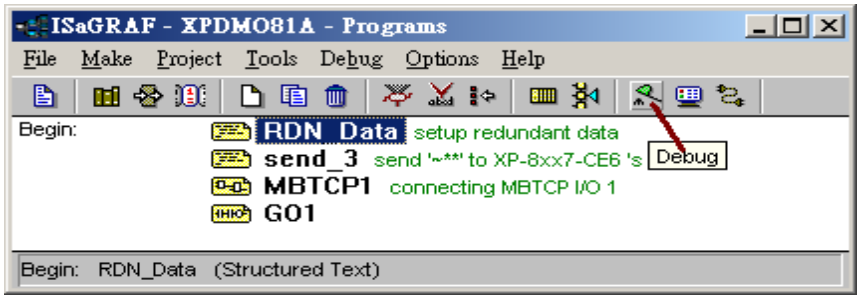
If there is no HMI / SCADA available for connecting the redundant system, user may use one PC running ISaGRAF to connect the redundant system via Ethernet communication to test and debug. If there is one HMI / SCADA available , then please program this HMI / SCADA to access to those Modbus network address of variables of the“xpdmo81a” program. Refer to the section 4.1 and 4.2 of the ISaGRAF User's manual for more information about the Modbus network address definition. (The file size is about 22MB in the following web site - http://www.icpdas.com/en/download/show.php?num=333&nation=US&kind1=&model=&kw=isagraf

Run PC / ISaGRAF to open the“xpdmo81a”and set its“Link setup" as“ETHERNET”. Then entering “192.168.2.100” (The“Active_IP1” of this demo program)

Note : DO NOT re-compile the program if modify only the ISaGRAF“Link setup”setting .



Then click“Debug”to connect the active PAC (Might be the Main PAC or the Backup PAC. It will be the Main PAC when power up the redundant system normally).

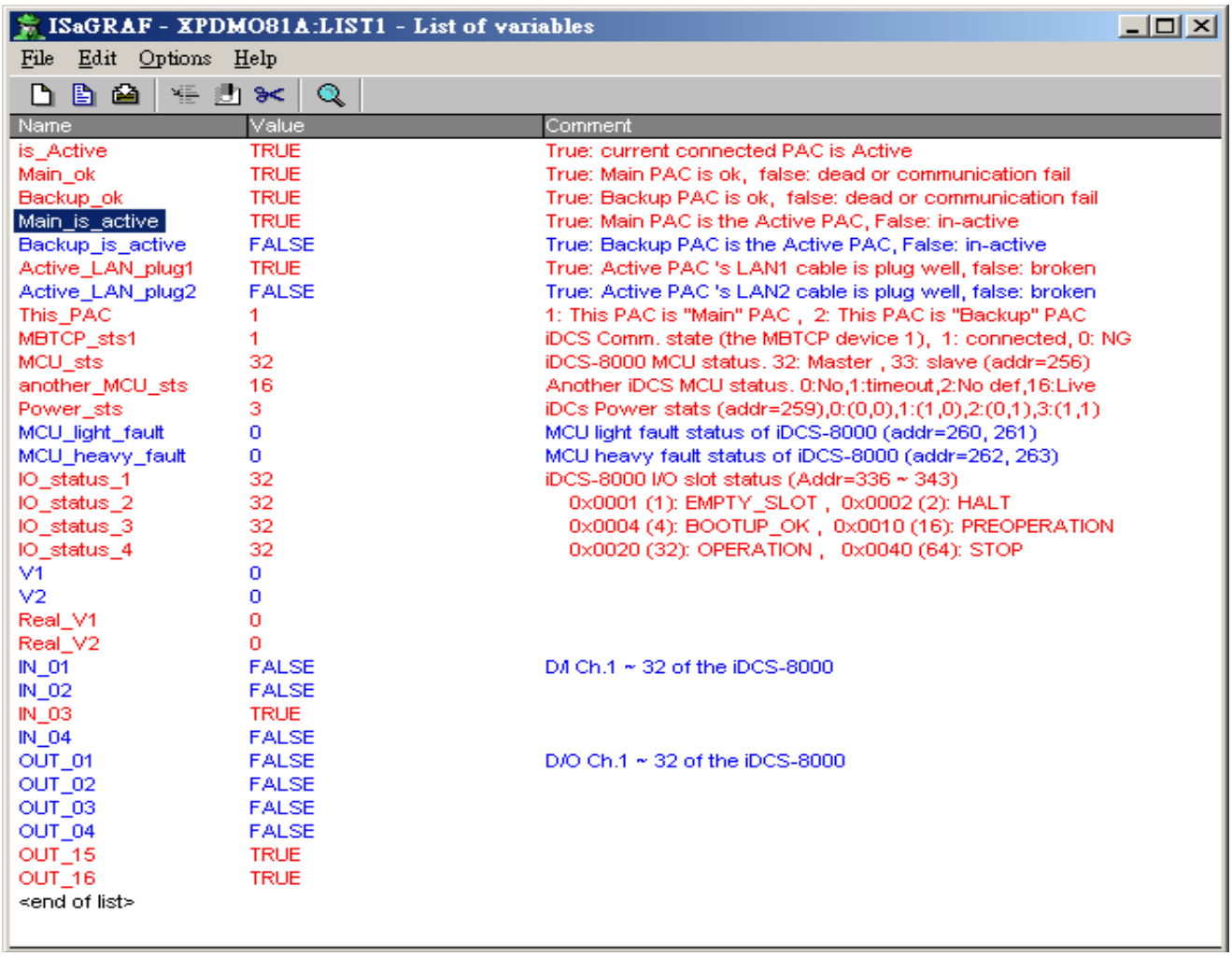


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The below window will pop-up if connecting the “Active_IP1” well. The following is the description of some important variables of this demo.

is_Active: True: current connected PAC is active . False : in-active.
Main_ok : Main PAC (with rotay switch at “7”) is working ok or not, True: ok , False: NG.
Backup_ok : Backup PAC (with rotay switch at “9”) is working ok or not, True: ok , False: NG.
Main_is_active : True: Main PAC is active currently (take the control), False: in-active.
Backup_is_active : True: Backup PAC is active currently (take the control), False: in-active
Active_LAN_plug1: True: the LAN1 cable of the active PAC is plugged ok. False: broken.
Active_LAN_plug2: True: the LAN2 cable of the active PAC is plugged ok. False: broken.

MBTCP_sts1: Is the iDCS-8000 connected well ? 1: connected, 0:disconnected
MCU_sts: The connected MCU card of the iDCS-8000 is master or slave ?
another_MCU_sts: The working staus of the other MCU card of the iDCS-8000.
Power_sts: The working status of the two power cards of the iDCS-8000.
IO_status_1 ~ 4 : I/O card status of the iDCS-8000.
V1 , V2: Two redundant ineter variables in this demo.
Real_V1 , Real_V2: Two redundant REAL variables in this demo.



Name	Value	Comment
is_Active	TRUE	True: current connected PAC is Active
Main_ok	TRUE	True: Main PAC is ok, false: dead or communication fail
Backup_ok	TRUE	True: Backup PAC is ok, false: dead or communication fail
Main_is_active	TRUE	True: Main PAC is the Active PAC, False: in-active
Backup_is_active	FALSE	True: Backup PAC is the Active PAC, False: in-active
Active_LAN_plug1	TRUE	True: Active PAC 's LAN1 cable is plug well, false: broken
Active_LAN_plug2	FALSE	True: Active PAC 's LAN2 cable is plug well, false: broken
This_PAC	1	1: This PAC is "Main" PAC , 2: This PAC is "Backup" PAC
MBTCP_sts1	1	iDCS Comm. state (the MBTCP device 1), 1: connected, 0: NG
MCU_sts	32	iDCS-8000 MCU status. 32: Master , 33: slave (addr=256)
another_MCU_sts	16	Another iDCS MCU status. 0:No,1:timeout,2:No def,16:Live
Power_sts	3	iDCs Power stats (addr=259),0:(0,0),1:(1,0),2:(0,1),3:(1,1)
MCU_light_fault	0	MCU light fault status of iDCS-8000 (addr=260, 261)
MCU_heavy_fault	0	MCU heavy fault status of iDCS-8000 (addr=262, 263)
IO_status_1	32	iDCS-8000 I/O slot status (Addr=336 ~ 343)
IO_status_2	32	0x0001 (1): EMPTY_SLOT , 0x0002 (2): HALT
IO_status_3	32	0x0004 (4): BOOTUP_OK , 0x0010 (16): PREOPERATION
IO_status_4	32	0x0020 (32): OPERATION , 0x0040 (64): STOP
V1	0	
V2	0	
Real_V1	0	
Real_V2	0	
IN_01	FALSE	D/I Ch.1 ~ 32 of the iDCS-8000
IN_02	FALSE	
IN_03	TRUE	
IN_04	FALSE	
OUT_01	FALSE	D/O Ch.1 ~ 32 of the iDCS-8000
OUT_02	FALSE	
OUT_03	FALSE	
OUT_04	FALSE	
OUT_15	TRUE	
OUT_16	TRUE	
<end of list>		

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Connecting the PC/ISaGRAF to the redundant system and try the following steps to test it.

1. On the PC / ISaGRAF, double click the “OUT_02” and “OUT_03” and modify their current value to TRUE, then user may find the Led of the iDCS-8000 's slot 2 or 3 's F-8041 card will turn ON . Then input a power-GND signal to the Pin4 of the DN-37 which is connected by the slot 0 and 1 's F-8040 cards (This Pin19 of the DN-37 connected by the two F-8040 must input the power-24V signal and short its Pin1 and Pin37 by a small cable together), Then will find the “IN_03” will become True on the PC/ISaGRAF. If input the power-GND signal to Pin3, then the “IN_02” will become True. Then double click the V1 , V2, Real_V1, Real_V2 to modify them as different value. For instance, entering value as 11, 22, 1.01, 22.022 , These 4 value and all D/O Output value(the “OUT_01” ~ “OUT_32”) will keep on its last value whatever the PAC control right is switched to the other PAC or not.

2. Power OFF the Main PAC (the one with rotary switch at “7”), then will find the “Main_ok” on the PC/ISaGRAF become False. The control right will switch to the Backup PAC (the one with rotary switch at “9”). Will find the “Backup_is_active” become True.

3. Power ON the Main PAC after step (2), wait about 75 to 120 seconds. The “Main_ok” will become True.The control right is still belong to the Bacup PAC(“Backup_is_active” is True).

4. Power OFF the Backup PAC after step (3), will find the “Backup_ok” become False. The “Main_is_active” become True (means the control right is belong to the Main PAC).

5. Power ON the Backup PAC after step (4),wait about 75 to 120 seconds. The “Backup_ok” will become True. The control right is still belong to the Main PAC (“Main_is_active” is True).

6. When the control right (means active) is belong to the Main PAC (or belong to the Backup PAC), will find the “Active_LAN_plug1” and the “Active_LAN_plug2” are True. Then plug-out the LAN2 cable of the active PAC, will find the “Active_LAN_plug2” become False. Then plug-in it back, will find it return to True again. If plug-out the LAN1 cable of the active PAC (keep it un-plugged), the control right and “Active_IP1” will switch to the other PAC. User can find the “Main_is_active” or the “Backup_is_active” is changed. User may also find the “Main_ok” (or “Backup_ok”) of the PAC which release the control right become False first and about 10 seconds later return to True again.

7. Please plug-in all the Ethernet cables back to their correct port.

8. If you have plug-in two Ethernet cables in the two MCU cards of the iDCS-8000, you will find the “MBTCP_sts1” value is 1. Then the “MBTCP_sts1” value will be 1 still if you plug out one of these two Ethernet cables. However the “MBTCP_sts1” value will become False if you plug out both cables. It means the XP-8xx7-CE6 PAC can not control the iDCS-8000 anymore (lose the ethernet communication). So please plug-in one Ethernet cable back to the iDCS-8000 at least (the ”MBTCP_sts1” will become 1) .

9. Remove the power supply of one of the two FPM-D2440 (Power card), must keep at least one FPM-D2440 alive. Then will find the “Power_sts” value become 1 (means only the first FPM-D2440 is powered up) or 2 (means only the second FPM-D2440 is powered up). The value is 3 when both FPM-D2440 are powered up.

10. Plug-out (Hot-plug-out) one of the two FCM-MTCP (MCU card), will find the “another_MCU_sts” value changed from 16 (means alive, working) to 1(Timeout of no-found) or 0 (no-found) . Then please plug-in it back (Hot plug-in) to the iDCS-8000 (The “another_MCU_sts” value will return back to 16).

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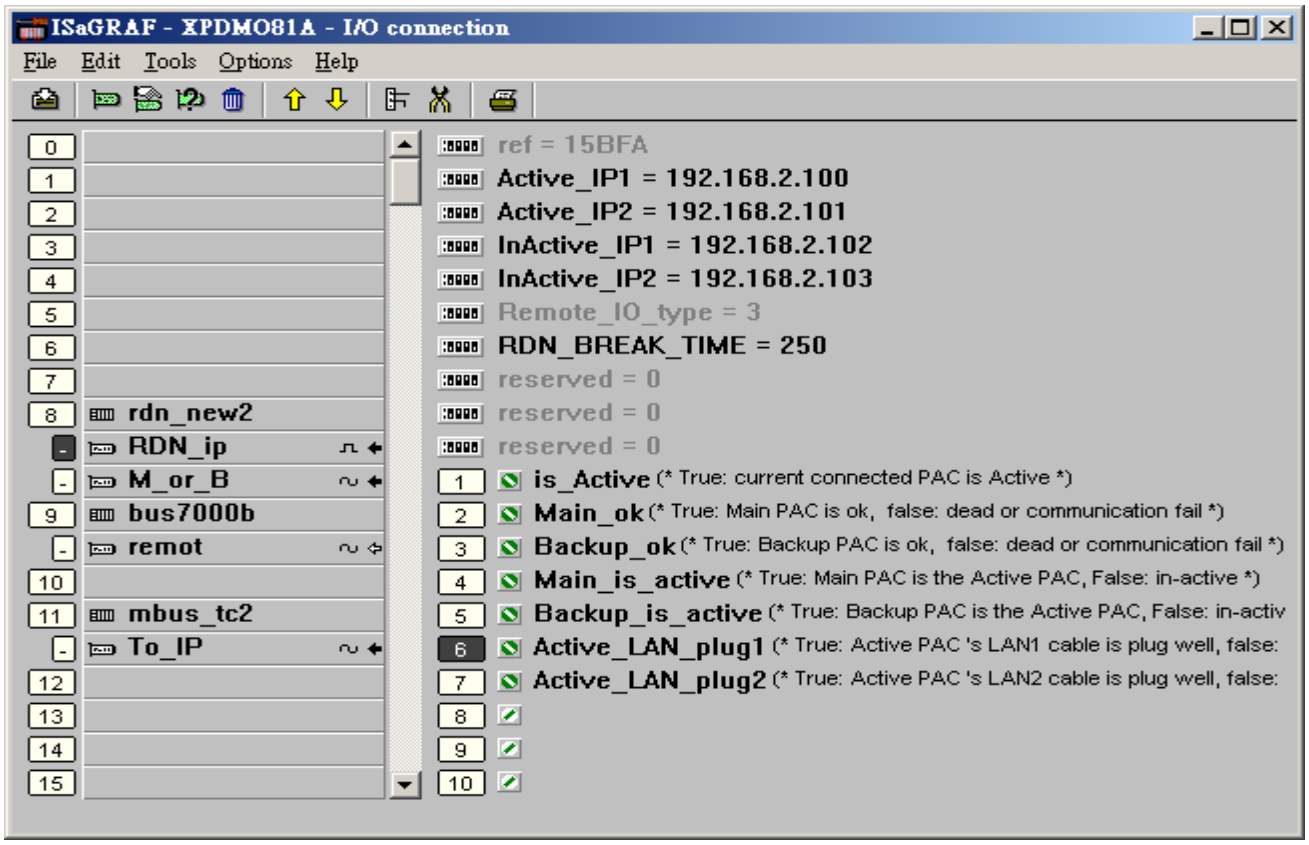
11. Plug-out (Hot plug-out) one of the two F-8040 cards or one of the two F-8041 cards, then will find the related “IO_status_1” ~ “IO_status_4” value changed from 32 (means working) to 2 (means HALT). Plug-in it back (Hot plug-in), the value will become 32 again. You may also find the other I/O card is still working if one is plugged-out.

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1.3 : The description of program of the XP-8xx7-CE6 redundant system

This section is for the “xpdmo81a.pia” example program. User can download it at https://www.icpdas.com/en/faq/index.php?kind=280#751 > FAQ-125

The “rdn_new2” and “bus7000b” and “mbus_tc2” are used in the I/O connection windows. The “mbus_tc2” is for connecting the iDCS-8000 because it has two IP address. The “mbus_tc2” will try to connect the second IP address if the first one is disconnected (there is one another “mbus_tcp” which is for connecting the Modbus TCP slave device with one IP address only).

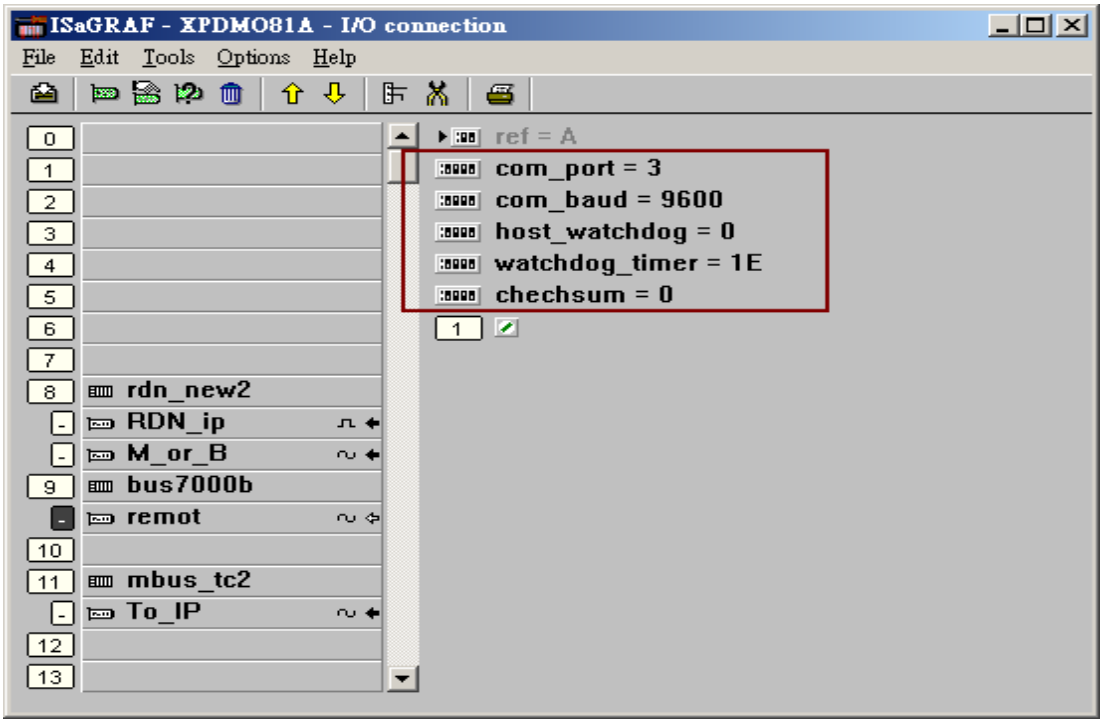


There are 10 channel boolean inputs in the “rdn_new2” > “RDN_ip” .
Ch-01: This PAC is Active (take the control right) or not , True : active , False : in-active.
Ch-02: Main PAC working state, True : working ok , False : no working, failed or damaged.
Ch-03: Backup PAC working state, True : working ok , False : no working, failed or damaged.
Ch-04: Main PAC is currently active ? True : yes , False : no.
Ch-05: Backup PAC is currently active ? True : yes , False : no
Ch-06: The LAN1 cable state of the active PAC, True : ok , False : broken.
Ch-07: The LAN2 cable state of the active PAC, True : ok , False : broken.
Ch-08 ~ Ch-10 : reserved for future usage.

There are 6 channel integer inputs in the “rdn_new2” > “M_or_B” .
Ch-01: The PAC is 1: Main PAC or 2: Backup PAC .
Ch-02 ~ Ch-06: reserved for future usage..

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Please must use the “Bus7000b” in the XP-8xx7-CE6 redundant system (even there is no RS-485 remote I-7000 or remote RU-87Pn + I-87KW cards connected by COM3: RS-485 port). Set “com_port” as 3, “com_baud” as 9600, “host_watchdog” as 0 and checksum as 0 in this demo.



The program must send “~**” from COM3 to the other XP-8xx7-CE6 (for application without RS-485 remote I-7000 and without RU-87Pn + I-87KW cards connected).
Refer to the ”RDN_DATA” program of the “xpdmo81a” project.

```
(* RDN_init should be decalred with an initaial value "True" *)
if   RDN_init   then
   RDN_init := FALSE ;   (* No more 1st PLC scan *)
   ...
   ...
   TMR_2 := T#0s;   (* reset as 0 , TMR_2 is declared as a Timer variable*)
   Tstart(TMR_2) ;   (* start ticking TMR_2 *)
end_if ;
```

And refer to the “send_3” program.

```
(* Send '~**' to XP-8xx7-CE6 's COM3 every 50 ms if this PAC is active *)
if   is_Active   then
   if   TMR_2 > T#50ms   then
      TMP := COMSTR_W( 3 , '~**' ) ;
      TMR_2 := T#0s ;   (* reset as 0 *)
   end_if ;
end_if ;
```


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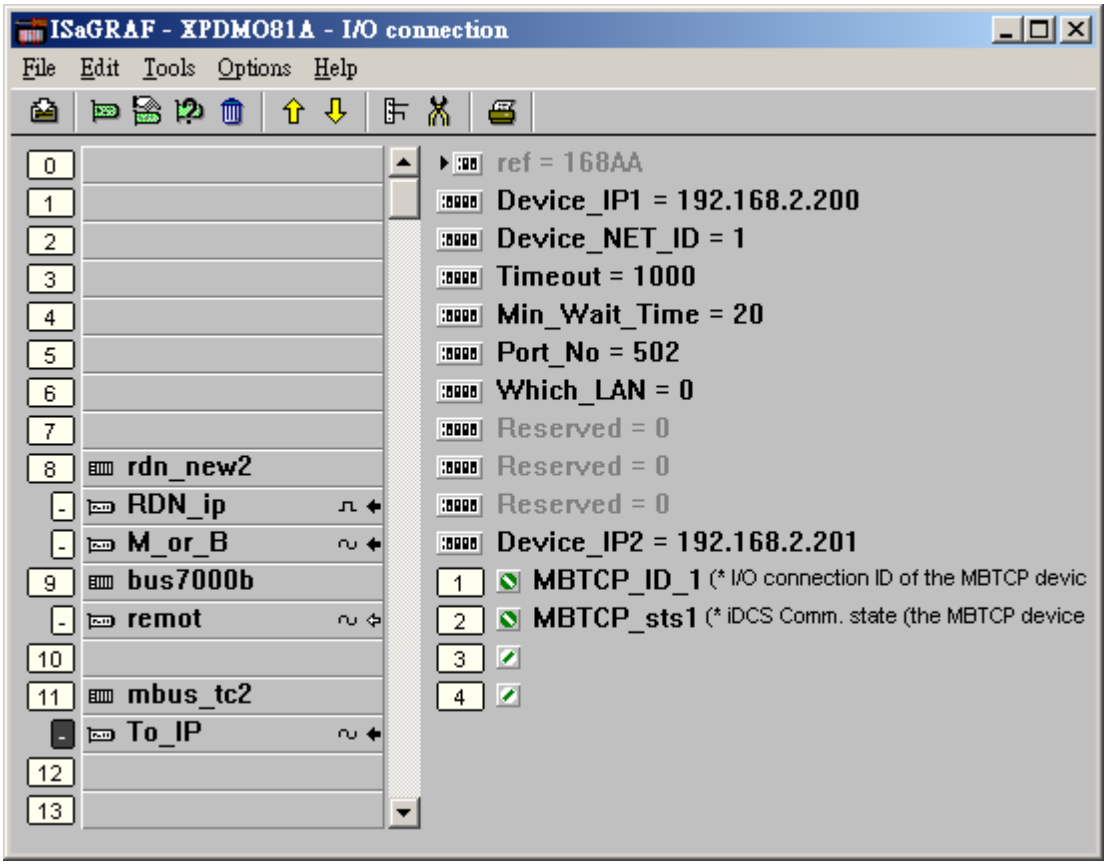
There are 4 channel Integer inputs in the “Mbus_tc2” > “To_IP”.

Ch-01: The ID value returned for that modbus TCP slave.
(This ID will apply in the “Mbus_xxx” function block).

Ch-02: The communication state of the Modbus TCP slave, 1: connected, 0: disconnected.

Ch-03 ~ Ch-04: Reserved for future usage.

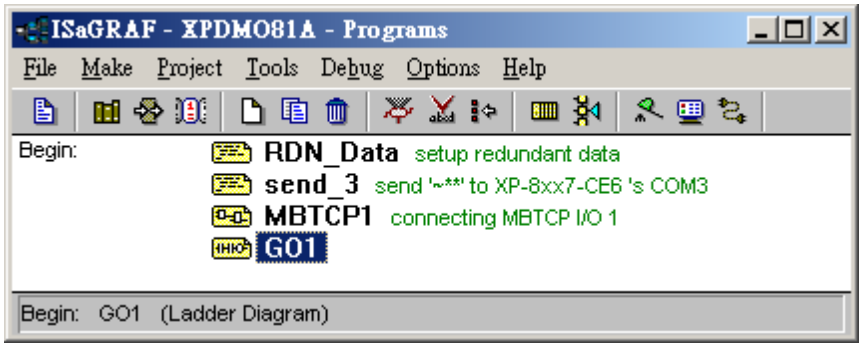
“Device_IP1” and “Device_IP2” : the two IP address of the Modbus TCP slave device.
“Device_NET_ID” : the NET-ID number of the device, it is 1 normally
“Timeout” : unit is ms (0.001 second), value can be 500 to 5000. The Modbus TCP command will be drop-out if waiting more than this time period and receive no answer from the device. And then will send the next Modbus TCP command (or try to connect the other IP address).
Recommend to set it as 1000 ms for this demo project to scan all iDCS-8000 value fast (or try to connect the other IP fast when disconnected). If setting larger than 2000, it will become slow when swithcing IP address.
“Min_Wait_Time”: unit is ms (0.001 second),value can be 10 to 60000. It means the time period to wait before sending each Modbus TCP command.
“Port_No”: The Modbus TCP port number of the device. It is 502 normally.
“Which_LAN” : Can be 0: auto-switch between the LAN1 and LAN2 of the XP-8xx7-CE6 PAC, 1: Only use the LAN1 to connect the Modbus TCP device, 2: Only use the LAN2 to connect the Modbus TCP device.
Recommend to set as 0 in this demo.



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This “xpdmo81a” project contains four programs.

The most upper one should place the “RDN_Data” program. The second one is “Send_3”, The third one is the program to Read / Write the data in the Modbus TCP device. The programs starting from the fourth are the programs of user's logic.



The “**RDN_Data**” program is for setting up the redundant data between these 2 XP-8xx7-CE6. All D/I and A/I data of the Modbus TCP slave device are not necessary to be setup as redundant data (They are auto-updated by these 2 PAC). All D/O and A/O of the Modbus TCP slave device and other output data and other control data (internal) must setup as redundant data.

```
(* Operations in the 1st PLC scan *)
(* RDN_init should be decalred with an initaial value "True" *)
if   RDN_init   then

   RDN_init := FALSE ;   (* No more 1st PLC scan *)

   TMP := RDN_T(T1);              (* Timer *)

   TMP := RDN_N(V1);              (* Integer *)
   TMP := RDN_N(V2);

   TMP := RDN_F(Real_V1);       (* Real *)
   TMP := RDN_F(Real_V2);

   TMP := RDN_B(OUT_01);        (* Boolean Output *)
   TMP := RDN_B(OUT_02);
   TMP := RDN_B(OUT_03);
   TMP := RDN_B(OUT_04);
   TMP := RDN_B(OUT_05);
   TMP := RDN_B(OUT_06);
   TMP := RDN_B(OUT_07);
   TMP := RDN_B(OUT_08);
   TMP := RDN_B(OUT_09);
   TMP := RDN_B(OUT_10);
   TMP := RDN_B(OUT_11);
```


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```
   TMP := RDN_B(OUT_12);
   TMP := RDN_B(OUT_13);
   TMP := RDN_B(OUT_14);
   TMP := RDN_B(OUT_15);
   TMP := RDN_B(OUT_16);
   TMP := RDN_B(OUT_17);
   TMP := RDN_B(OUT_18);
   TMP := RDN_B(OUT_19);
   TMP := RDN_B(OUT_20);
   TMP := RDN_B(OUT_21);
   TMP := RDN_B(OUT_22);
   TMP := RDN_B(OUT_23);
   TMP := RDN_B(OUT_24);
   TMP := RDN_B(OUT_25);
   TMP := RDN_B(OUT_26);
   TMP := RDN_B(OUT_27);
   TMP := RDN_B(OUT_28);
   TMP := RDN_B(OUT_29);
   TMP := RDN_B(OUT_30);
   TMP := RDN_B(OUT_31);
   TMP := RDN_B(OUT_32);

   TMR_2 := T#0s;    (* reset as 0 *)
   Tstart(TMR_2) ;    (* start ticking TMR_2 *)

end_if ;
```

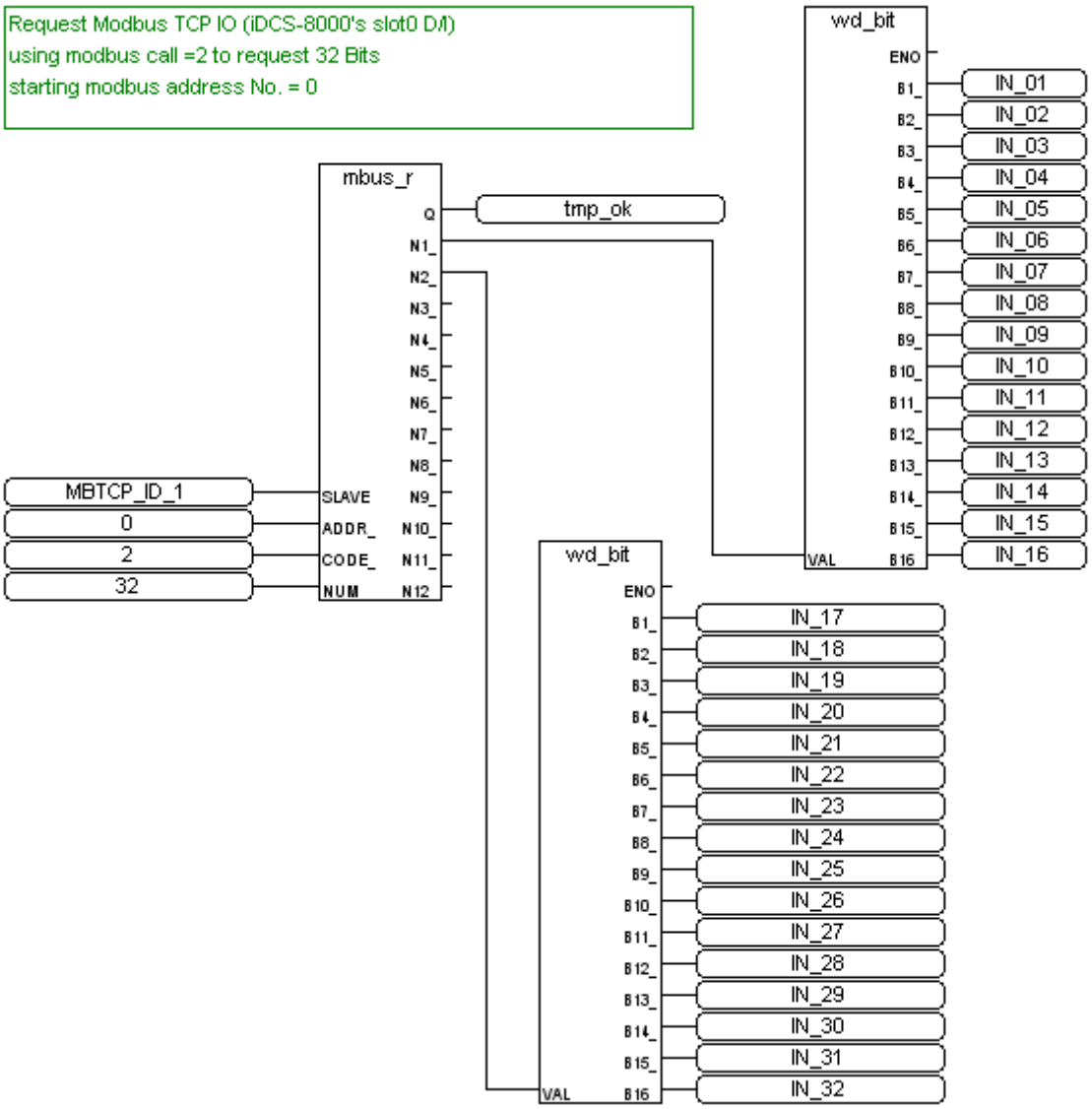
The "**send_3**" is the program to send "~**" from COM3 to the other PAC 's COM3.

```
(* Send '~**' to XP-8xx7-CE6 's COM3 every 50 ms if this PAC is active *)
if    is_Active    then
   if    TMR_2 > T#50ms    then
      TMP := COMSTR_W( 3 , '~**' ) ;
      TMR_2 := T#0s ;    (* reset as 0 *)
   end_if ;
end_if ;
```


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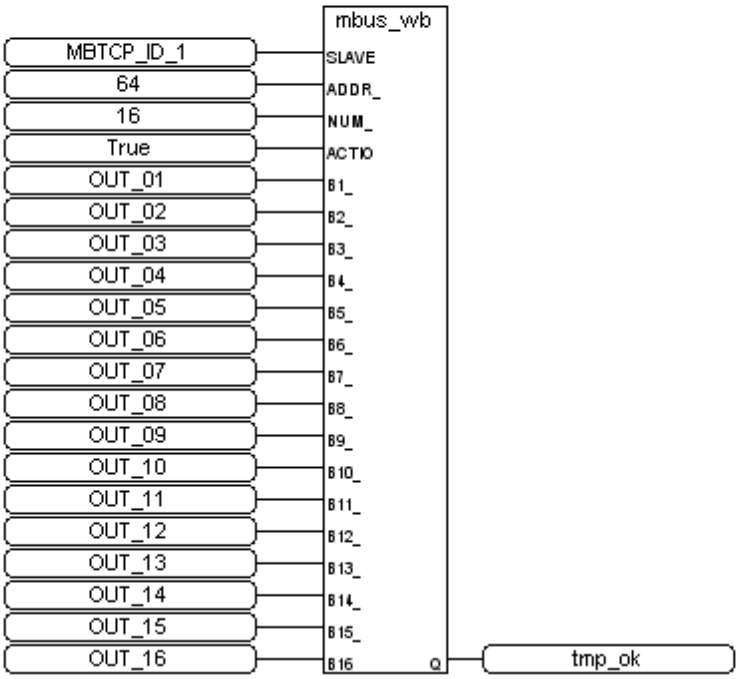
The “**MBTCP1**” program is using some ”Mbus_xxx” function blocks to read / write data in the Modbus TCP slave device.

Please refer to the manuals of the iDCS-8000 for the Modbus address definition.
Visit
https://www.icpdas.com/en/download/show.php?num=1678&nation=US&kind1=&model=&kw=iDCS-8000 > v1.00beta > Manual .

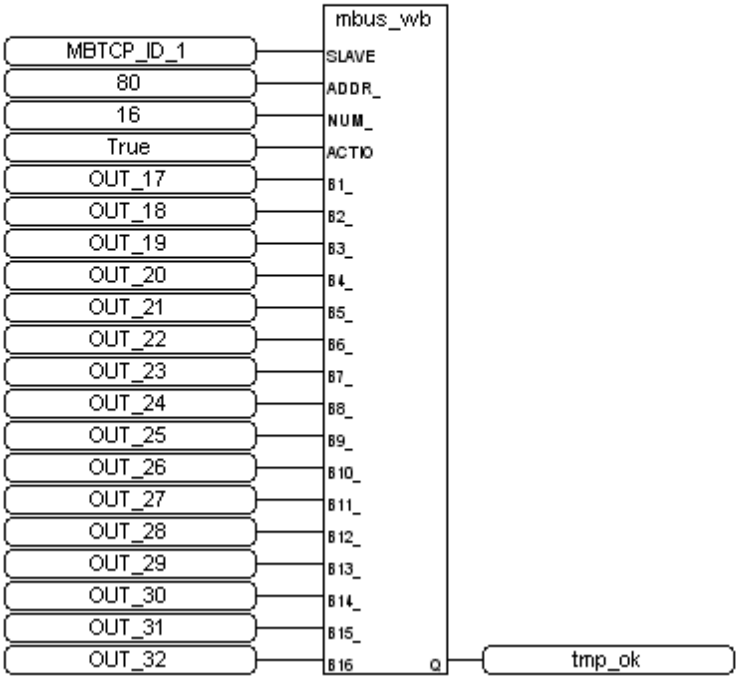


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Write D/O to Modbus TCP device (iDCS-8000 's slot2 D/O)
Using modbus call 15 to write 16 D/O
starting Modbus address No. = 64



Write D/O to Modbus TCP device
Using modbus call 15 to write 16 D/O
starting Modbus address No. = 80



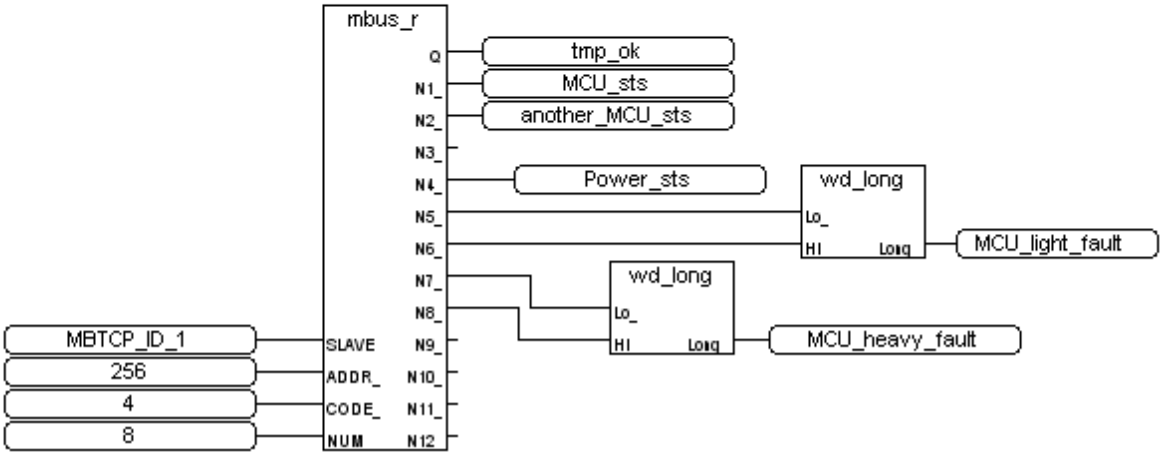
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Request 8 words by modbus command 4
starting address is 256

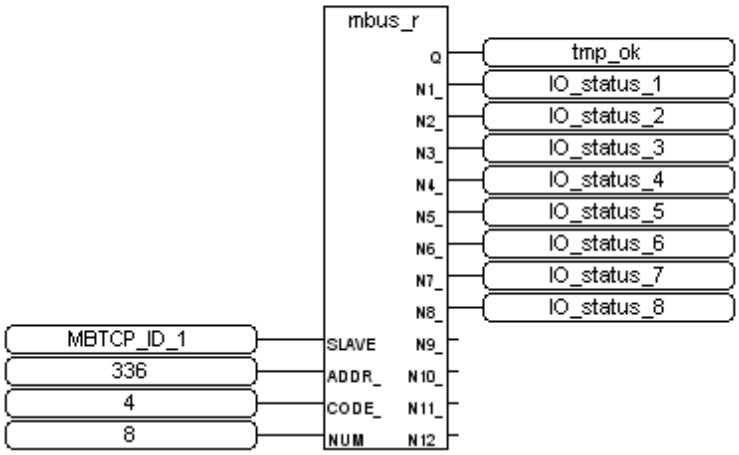
Power ststus: (refer to iDCS-8000 manual)
1: POW1 : OFF , POW2: OFF
2: POW1 : ON , POW2: OFF
3: POW1 : OFF , POW2: ON
4: POW1 : ON , POW2: ON

MCU_sts : (The MCU ststus of iDCS-8000)
32: Master , 33: Slave

another_MCU_sts : (another MCU status of iDCS-8000)
0:No MCU , 1:timeout , 2:No define , 16:Live

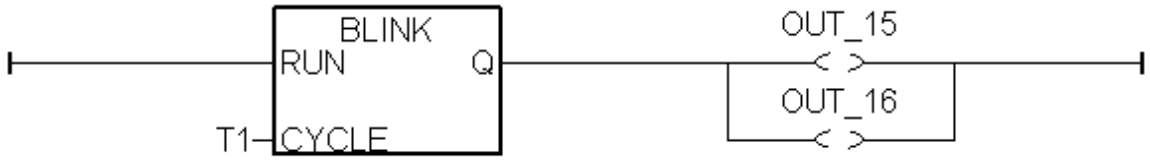


Request 8 words by Modbus command 4
starting addr=336
IO slot status of iDCS-8000 (refer to its manual)
0x0001: EMPTY_SLOT
0x0002: HALT
0x0004: BOOTUP_OK
0x0010: PREOPERATION
0x0020: OPERATION
0x0040: STOP



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The fourth program (or other more programs) of this demo is the user's logic. This “xpdmo81a” 's “GO1” program is only blinking the “OUT_15” and “OUT_16” in period of “T1” .



To program the PC / HMI / SCADA to connect this XP-8xx7-CE6 redundant system (running the “xpdmo81a” project) via modbus TCP, please use the following Network address definition of ISaGRAF variables.

If user want to modify or add the Network address cdefinition, please refer to the section 4.1 and 4.2 of the ISaGRAF User's manual for more information.
http://www.icpdas.com/en/download/show.php?num=333&nation=US&kind1=&model=&kw=isagraf (about 22MB)

Name	Type	Description	NetWork Address
Main_ok	Boolean	Main PAC is working or not	1
Backup_ok	Boolean	Backup PAC is working or not	2
Main_is_active	Boolean	Main PAC is the current Active PAC ?	3
Backup_is_active	Boolean	Backup PAC is the current Active PAC ?	4
Active_LAN_plug1	Boolean	LAN1 cable state of the active PAC	5
Active_LAN_plug2	Boolean	LAN2 cable state of the active PAC	6
MBTCP_sts1	Integer	IDCS-8000 is connected or not, 1: connected, 0: No	21
Power_sts	Integer	Power board state of the iDCS-8000	22
MCU_sts	Integer	Current connected MCU of iDC-8000 is Master or ...	23
another_MCU_sts	Integer	The other one MCU stste of the iDCS-8000	24
MCU_light_fault	Integer	iDCS-8000 MCU light fault	25
MCU_heavy_fault	Integer	iDCS-8000 MCU heavy fault	27
IO_status_1	Integer	IO card state of the IDCS-8000 's slot 0	29
IO_status_2	Integer	IO card state of the IDCS-8000 's slot 1	30
IO_status_3	Integer	IO card state of the IDCS-8000 's slot 2	31

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IO_status_4	Integer	IO card state of the IDCS-8000 's slot 3	32
IO_status_5	Integer	IO card state of the IDCS-8000 's slot 4	33
IO_status_6	Integer	IO card state of the IDCS-8000 's slot 5	34
IO_status_7	Integer	IO card state of the IDCS-8000 's slot 6	35
IO_status_8	Integer	IO card state of the IDCS-8000 's slot 7	36
IN_01 ~ IN_32	Boolean	IDCS-8000 's 32-Ch. D/I value	201 ~ 232
OUT_01 ~ OUT_32	Boolean	IDCS-8000 's 32-Ch. D/O value	233 ~ 264
V1	Integer		301
V2	Integer		303
Real_V1	REAL		305
Real_V2	REAL		307
T1	Timer	The blinking period of the “OUT_15” and the “OUT_16” , unit is ms (0.001 second)	309

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1.4: Description of other programs

User can download other example programs at
https://www.icpdas.com/en/faq/index.php?kind=280#751 > FAQ-125 .

"xpdmo81b" :

The difference between the "xpdmo81b" and "xpdmo81a" is that the "xpdmo81b" has open the COM6 (the first RS-485 port on the i-8144iW or i-8142iW in the XP-8xx7-CE6 's slot 1. The leftmost I/O slot number of the XP-8xx7-CE6 is 1). It will use the "COMOPEN", "COMSTR_W", ... functions to operate this COM6.

To test this "xpdmo81b" , please configure one i-7055D by the DCON utility to be Addr=1 and baudrate=9600, 8,N, 1, No checksum. Then install the redundant system as the figure 1 in the first page of this document (Only one iDCS-8000 connected for this demo), The difference than the "xpdmo81a" is connecting both XP-8xx7-CE6 's slot 1 (8144iW or i-8142iW) 's first RS-485 port to the i-7055D. (D+ --- D+ --- D+ , D- --- D- --- D-).
When the redundant system is working, only the active PAC will communicate with the i-7055D by its COM6.

The expansion serial COM ports of the XP-8000-CE6 are auto setup when plug-in the expansion cards (i-8144iW / i-8142iW) and then power ON the XP-8xx7-CE6 . The relationship of the ISaGRAF COM port number and the XP-8000-CE6 number is listed as the following table. (refer to the Appendix E of the XP-8xx7-CE6 Getting Started manual.
http://www.icpdas.com/en/download/show.php?num=343&nation=US&kind1=&model=&kw=isagraf)

Slot	XPAC	ISaGRAF	Slot	XPAC	ISaGRAF
Slot 1	MSA1	COM6	Slot 5	MSC1	COM22
	MSA2	COM7		MSC2	COM23
	MSA3	COM8		MSC3	COM24
	MSA4	COM9		MSC4	COM25
Slot 2	MSA5	COM10	Slot 6	MSC5	COM26
	MSA6	COM11		MSC6	COM27
	MSA7	COM12		MSC7	COM28
	MSA8	COM13		MSC8	COM29
Slot 3	MSB1	COM14	Slot 7	MSD1	COM30
	MSB2	COM15		MSD2	COM31
	MSB3	COM16		MSD3	COM32
	MSB4	COM17		MSD4	COM33
Slot 4	MSB5	COM18			
	MSB6	COM19			
	MSB7	COM20			
	MSB8	COM21			

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