ProScada Siemens IO Driver

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1 Installation

1.1 Install the Driver

Install the Siemens Ethernet Driver by running the setup.exe provided.

The default install location is the **Program Files\ProScada\SiemensIE** Directory. The directory choice is not crucial. For iFix installations install in the iFix root directory, typically \Program Files\Proficy\Proficy iFix

1.2 Install “Siemens H1 ISO transport” (***Not used for TCP/IP)

*This step is **optional**, depending on the protocols used to talk to the PLC’s, if you are using TCP/IP you DO NOT Require the ISO transport – Please go to Setting up the driver.

To Install the ProScada Siemens ISO Transport

Read More

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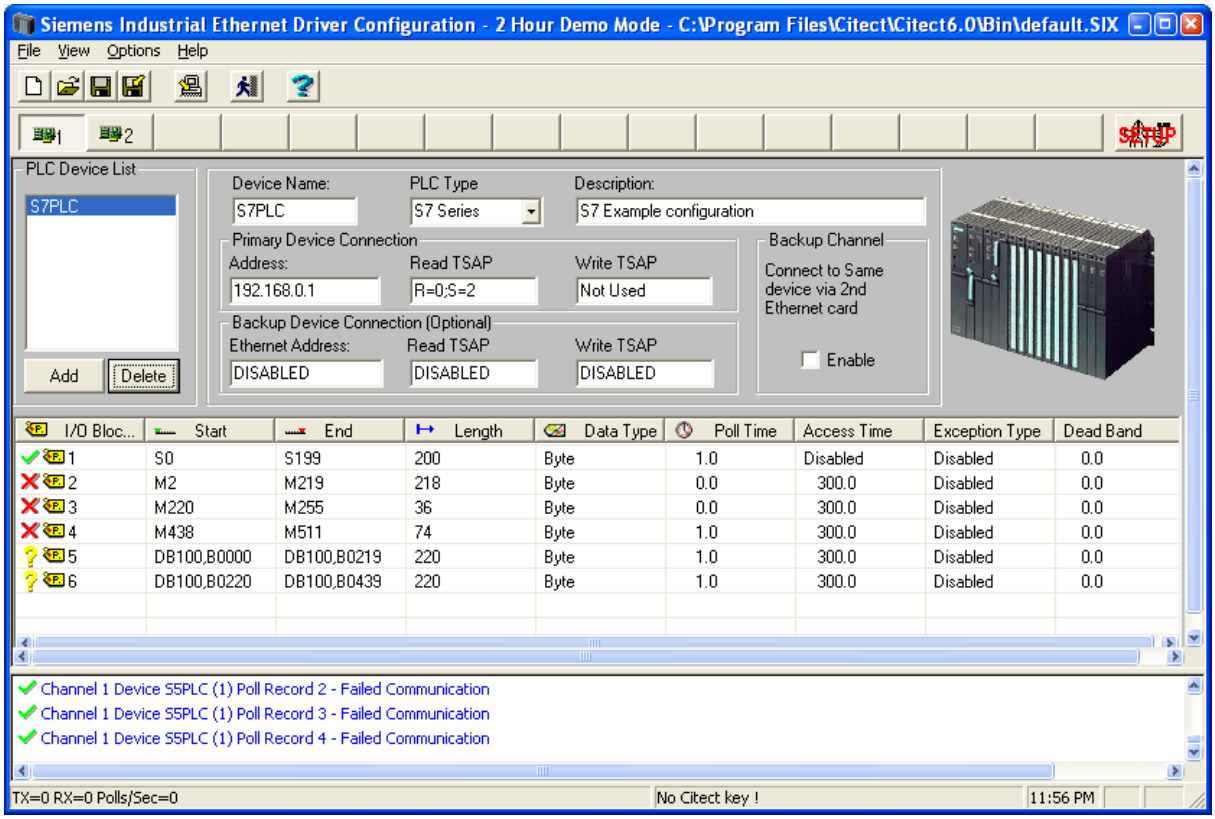
2 Setting Up the driver

Run the “Siemens Industrial Ethernet Driver Configurator”



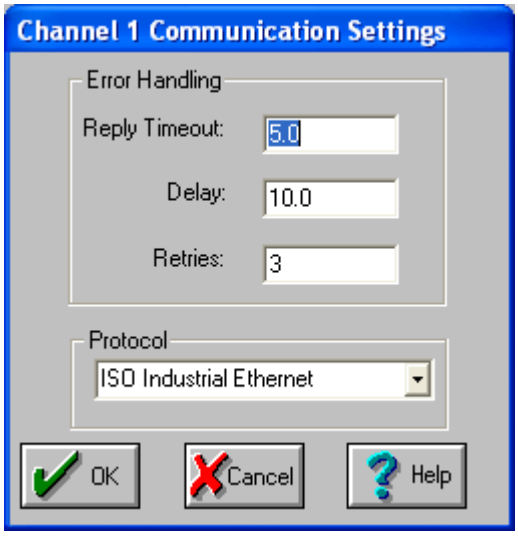
The Default configuration file will open, this includes 3 PLC’s an S5, S7 & TI.

Since you will probably be using an S7 select the S5 PLC & press delete, do the same for the TI PLC

The S7 example configuration is setup to poll M0-M99; this address exists in all S7 PLC’s so it should poll correctly without setting up a Step 7 program on the PLC.

Before setting addresses etc. please set the protocol type in the channel settings

- Open the channel settings to set the protocol – press the  button



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You have a choice between TCP/IP and ISO. If ISO is chosen, then the ISO transport must be installed (supplied with the driver).

- Set the PLC's address, for ISO this is a 12 digit Hexadecimal MAC address, for TCP/IP this is of the form 0.0.0.0
- Now press ok to go back to the main device settings

The read TSAP setting defaults to "R=0;S=2" which means read the CPU in Rack 0 Slot 2. This is Correct for an S7-300. On a S7-400 with 2 slot power supply, meaning the CPU is in Slot 3, this should be R=0;S=3. **Note the Slot is the slot number of the CPU, NOT the CP 443 card!

***For the S7-200 PLC Set the read TSAP to "CP243" because the S7-200 does not comply with the rack & slot system.

Now "Reload" the configuration by pressing the  button. This is IMPORTANT; always reload any configuration change changes. The configurator works on the configuration file on disk, the reload command loads that into memory, briefly interrupting the polling as it does so

Now check that you have communications. The transmit and receive counters at the bottom of the window should increment

The Status of the M0 block should change to a ✔

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3 Quick Start

3.1 Configuration in a nutshell

3.1.1 Channel settings

- The driver will install with a default configuration file that must be changed to suit your configuration.
- The default channel settings should be acceptable in most situations read more

3.1.2 Device Settings

- Change the “Device name” to something descriptive for your PLC *note for the rest of this text, our example will be “PLC1”.
- Set the Ethernet Address of the PLC
- In the Read TSAP set the S7 Rack Number & Slot number **Note the slot number is the slot number of the CPU, example: an S7 400 has a 2 slot power supply so the CPU is in Slot 3. Example “R=0;S=2” means the CPU is in Rack Zero Slot 2
- The S7-200 requires that the READ TSAP be set to “CP243”
- The driver has provision for several redundancy modes, you can leave the backup addresses disabled by typing “DIS”

3.1.3 Poll Block List Settings

- Add poll blocks to the configuration, mostly you will poll Datablocks and Merker Words. In this example since all PLC’s have Merker memory, we configure m0-m100.
- NOTE at the pollblock configuration the only data type available is “byte” you select variable data types later in the database or OPC level.
- Maximum length of poll block is 220 bytes for S7-300 or 440 bytes for S7-400
- Example 400 byte Datablock 15 will require 2 poll blocks (make sure that no variable crosses the B219 boundary)
    - DB15,B0 -> DB15,B219 len=220
    - DB15,B220 -> DB15,B399 len=180

Important !! After Saving the configuration, Reload it into memory with the File|Reload Menu or the reload Toolbar Button

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3.2 Connecting to The Fix SCADA Database (S7 example)

- Set the IO device to “SIX”
- Set the IO address field as below

3.2.1 IO address field

For Analog addresses in Data blocks, use the following format:

<device>:DB<block num>,<format><byte addr>

For Digital addresses in Data blocks, use the following format:

<device>:DB<block num>,X<byte addr>.<bit>

For Analog addresses in other memory areas, use the following format:

<device>:<memory area><format><byte addr>

For Digital addresses in other memory areas, use the following format:

<device>:<memory area><byte addr>.<bit>

Block I/O Address fields accepts a maximum of 128 characters. For examples of valid I/O addresses, refer to Supported Mnemonics table below. The following are descriptions of the parts of the I/O Address:

Device — indicates the name you assigned in the Device Name field of the Device Definition in the I/O Driver Configuration program. It is an alphanumeric tag that the Database Builder uses to differentiate poll records collected from different field devices.

memory area — specifies the block type in the PLC e.g. DB,M,I,Q

byte addr — specifies the address of the I/O point within the section. It has the same style as the Start Address and Length fields on the Poll Record Edit dialog box of the I/O Driver Configuration program, that is AREA:ADDRESS.

Format --- specifies the data length of the variable eg
X or none for digital
B for byte (8 bit integer)
W for word (16 bit integer)
S for swapped word (16 bit integer, bytes swapped)
D for Double word (32 bit integer or float)

bit — specifies a particular digital point in a byte. The bit entry is used for Digital blocks and ranges from 0 – 7 (on S5 & TI WORDS are 0-15).

Signal Conditioning is discussed here: Signal Conditioning
Lo & Hi Egu - Low & High Engineering units range
HW options - Hardware Options is discussed here Hardware Options
Exception based scanning is NOT supported

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3.3 Connecting Via OPC

3.3.1 Installing the OPC Server

1. Install the Siemens IE OPC Server
2. Install your desired OPC client on this or another computer
3. If no other OPC software is installed on the machine then you may need to install the OPC foundation common components from here Download

3.3.2 From Your OPC Client Software

- First Configure the required data in the configurator & reload it into memory
- Browse to the OPC Server "ProScada.SiemensIE" (Also known as the Server Classname or CLSID)
- Browse down to a PLC Device
- The Browser (client dependant) then lists all the poll blocks configured on that device
- Add a OPC Group (some clients hide this from the user)
- then add an Item browsed above

3.3.3 OPC Item ID Format (IO Address format)

<IO Address>[[|$]<Signal Conditioning>[,<Lo Egu>,<Hi Egu>,<HW opt>,<units>]]

where :
IO Address (** thes examples are for S7, S5 & TI slightly different)

For Analog addresses in Data blocks, use the following format:

<device>:DB<block num>,<format><byte addr>

For Digital addresses in Data blocks, use the following format:

<device>:DB<block num>,X<byte addr>.<bit>

For Analog addresses in other memory areas, use the following format:

<device>:<memory area><format><byte addr>

For Digital addresses in other memory areas, use the following format:

<device>:<memory area><byte addr>.<bit>

For String addresses in Data blocks, use the following format:

<device>:DB<block num>,B<byte addr>$<max string len>

| or $ This is a separator indicating what follows is signal conditioning options
Signal Conditioning is discussed here: Signal Conditioning
Lo & Hi Egu - Low & High Engineering units range
HW opt - Hardware Options is discussed here Hardware Options
Units - are optional, only used when the requested datatype is "BSTR" (string)

Examples

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Digital inputs : “PLC1:I2.0”
Digital outputs : “PLC1:Q2.0”
Digital setpoints : “PLC1:M2.0”
S7 Real numbers : “PLC1:MD80|FLT” “PLC1:DB15,D80|FLT”
S7 Analog inputs : “PLC1:IW2|S7A1,0,100.0,,%”
S5 Timer Setpoint : “PLC1:MW2|TIMR” (value is read / written in seconds.xx)
Array of 20 characters: “PLC1:M2$20” “PLC1:DB15,B80$20”
S7 String structure : “PLC1:M2$,,,S7STRING”
Analog Input with user instrument range e.g. 12 bit value with 4ma offset, scaled 0-100%
: “PLC1:MW2|PROP,0.0,100.0,819:4095,%”

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3.4 Connecting to Wonderware Intouch & Archestra via OPC

WW has 2 options for OPC client connection. AN OPC-DDE Iodriver and the FS Gateway which is the newer recomended route. The following procedure is to be followed after Installing FS on the machine running the ProScada IO driver.

*Note although you can run OPC remotely via DCOM, it is generally faster & easier to install FS Gateway on the machine running the IO driver (OPC server).

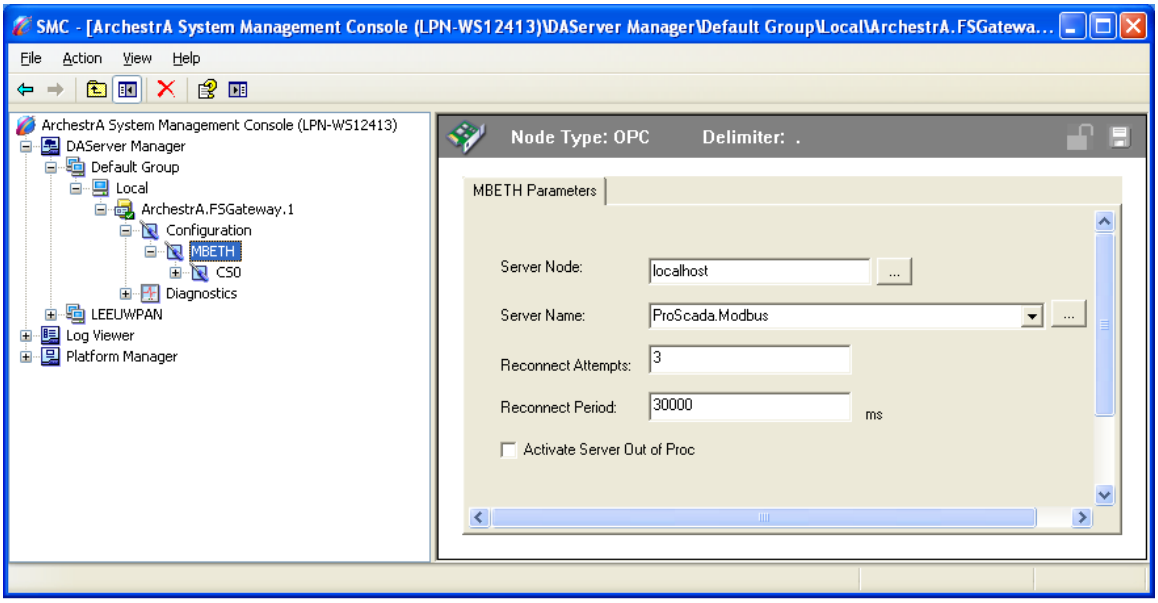
**Note you can install FS Gateway on another vendors SCADA machine & connect OPC directly to the IO driver bypassing any SCADA. The advantage is Only IO driver polling the PLC's sharing the same data – faster.

3.4.1 Configuring an OPC Data Source Object

To add an OPC data source object to your FS Gateway hierarchy

1. Right-click **Configuration** in the hierarchy, and select **Add OPC Object** from the shortcut menu. The following rules apply:
    - A new object is created in the hierarchy tree and is named **New_OPC_000** by default (in "edit mode"). Rename it to something representing the ProSCada IO Driver like S7OPC, or MBETH

The **MBETH** configuration view (right pane) is displayed.



2. Configure the new OPC object according to the following option definitions:
    - **Server Node** – The computer node on which the specified data source can be found. Default value is localhost. Use the browse button to select from a list of all nodes on your network.
    - **Server Name** – ProgID or ClassID of the OPC server (example of a ProgID: ProScada.Modbus, ClassIDs are GUIDs). Use the browse button to select from a list of OPC server ProgIDs on your network. Default value is blank. If the ProScada ProgID includes a version number please delete the version part

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Note Use ClassID when referencing a server that does not use OPC enum to enumerate a ProgID.

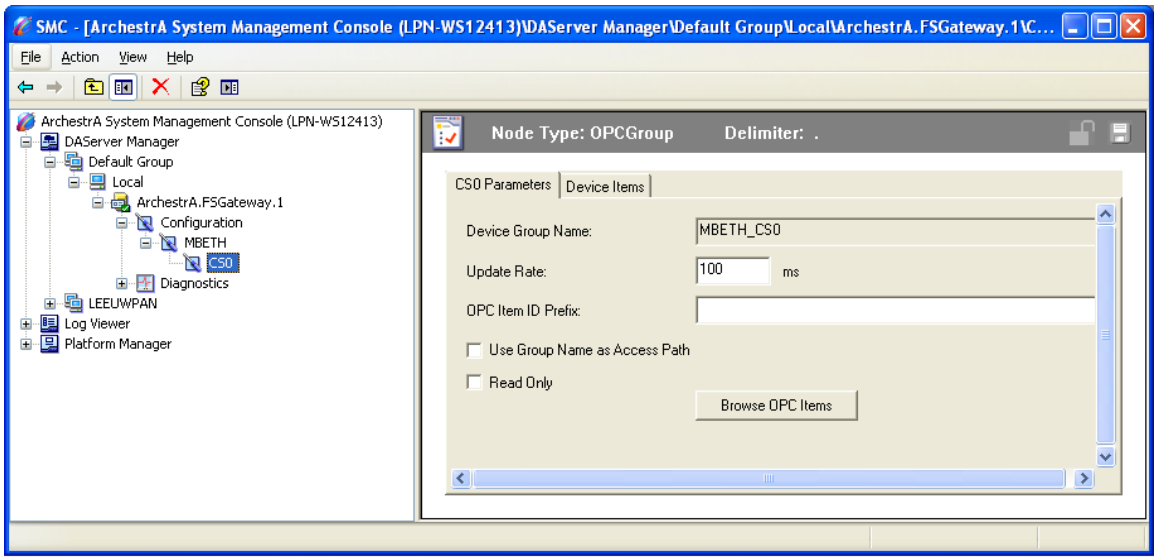
- **Reconnect Attempts** – Number of times FS Gateway attempts to reconnect to the specified data source if a connection fails. Zero (0) means no limit to the number of reconnect attempts. Minimum/maximum range is 0 to 3. Default value is 3.
- **Reconnect Period** – Delay (in ms) between reconnect attempts if a connection fails. Minimum/maximum range is 10,000 to 300,000 ms (corresponding to the range of 10 sec to 5 min). Default value is 30000 ms.
- **Activate Server Out of Proc** – for ProScada we Recomend you Uncheck this

3.4.2 Configuring an OPC Group Object

To add a group object to your OPC data source hierarchy

**Note you May add all tags for multiple PLC's under one (1) Group, OR make a group for each PLC your choice. If making a Group for each PLC Set the Group Name the same as the IO driver device name.

1. Select the new data source object, right-click it, and then click **Add OPCGroup Object** on the shortcut menu.
   - A new object is created in the hierarchy tree and is named **New_OPCGroup_000** by default (in "edit mode"). Rename it, if desired to the IO driver name of the PLC. You are allowed to add up to 100 new group objects.



2. Configure the new group object according to the following option definitions:
   - **Device Group Name** – Name of the topic that DDE or SuiteLink clients of FS Gateway connect to in order to access items at the OPC group. Default value is the concatenation of the OPC data source object's name and the group object's name (this cannot be edited).
   - **Update Rate** – Value (in ms) used by FS Gateway to update the OPC group. Minimum/maximum range is 0 to 10,000 ms. If the OPC server supports it, zero (0) update rate means the data source sends data changes immediately. If the server does not support zero update rate, it typically returns a message including information about its fastest possible update rate. Default value is 1000 ms. **Note for ProScada IO drivers recommend 100ms. The

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rate does NOT affect the PLC polling rate, but the rate the data is read from the IO driver cache.

- **OPC Item ID Prefix** – String prefixed to all item names added to the OPC group. Default value is blank. **Example:** Item Prefix=40, Item=001, Item requested from data source=40001. ** If the Group name is the <PLC name> then you can set this to "<PLC name>**:**" then you can omit that part from the Client Item addresses.
- **Use Group Name as Access Path** – **Note for ProScada recomend Unchecked – not used
- **Read Only** – Check this box to make all items connected through the OPC group read only. This qualification is in addition to any read-only condition that the OPC server imposes. Unchecking this box only removes FS Gateway-imposed read-only qualifications. In other words, items inherently read-only in the data source remain so. Default value is checked.
- **Browse OPC Items button** – Opens the OPC browser, in which you can select items directly from the OPC server. **NB when browsing ProScada OPC servers you only browse the raw address of the first address in the block. This address must be manually edited/created for other addresses & options

**Note you are now done with the FS gateway, now tags need to be created on the Client side Intouch, Archestra, Historian etc.

3.4.3 OPC Item Names (Suitelink Client side application)

This section describes how a connected client requests access to items (or attributes) of a particular OPC data source.

The following is an example of a client/data source connection via FS Gateway, and its associated item name syntax:

- To access an item in an OPC Server via FS Gateway through a SuiteLink client, use the following syntax:

Establish connection: specify Server where FS Gateway is loaded, be sure to setup Access rights

Application = FSGateway

Topic = MBETH_CS0

**Note this is fixed, a concatenation of <Server name>_<Group name>

Reference item:

Example "CS0:40001"

**ProScada Item names as specified in the previous section. These are normally of the form:

"<PLC name>:<address>[|<options>]"

If you set the "**<PLCname>:**" as a Prefix in the group this can be omitted.

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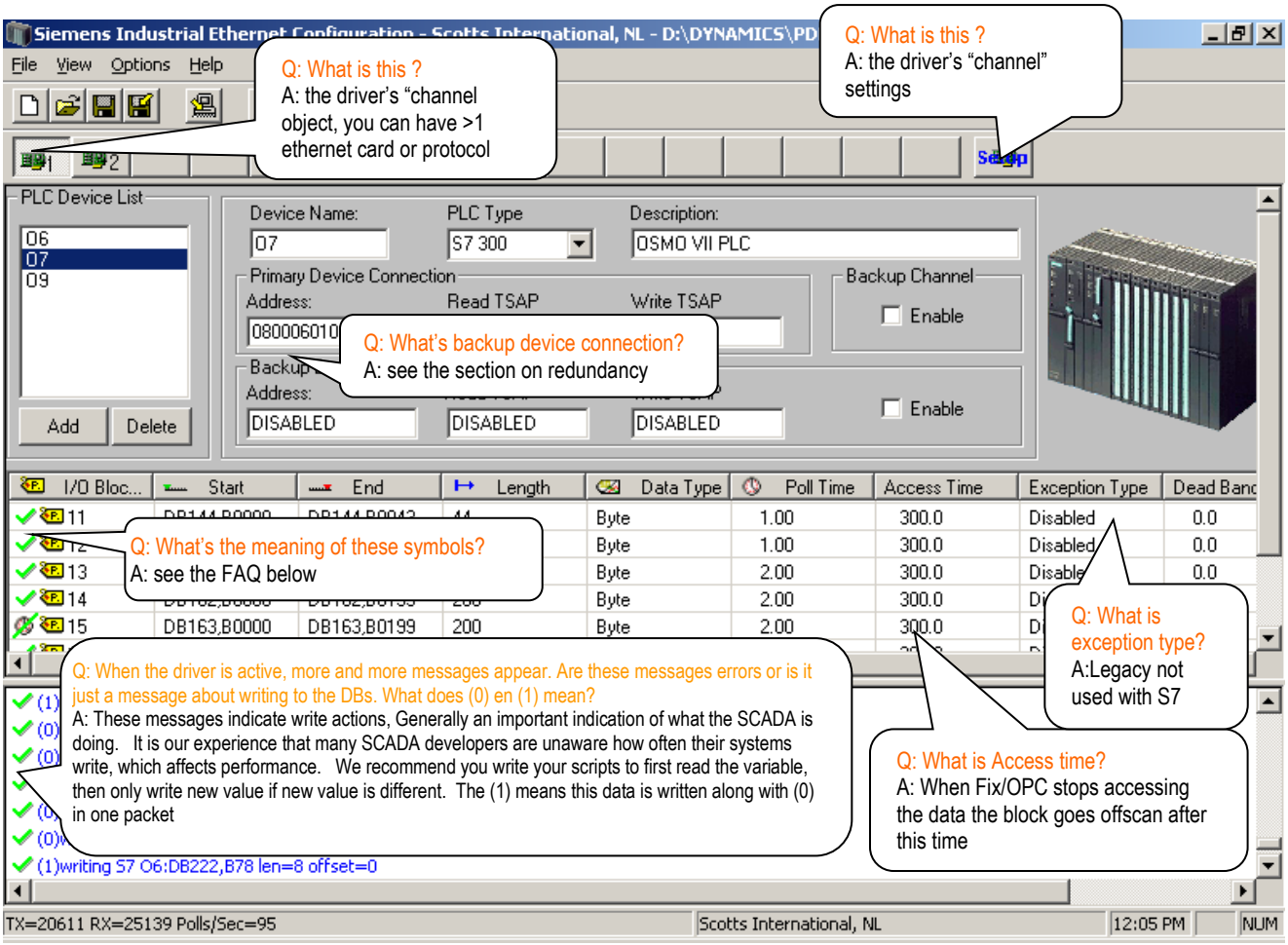
Frequently asked questions & troubleshooting

3.5 The configurator



Q: The latest version 7.9.52 has PLC options for S7-300 & S7-400, what has changed since I note that my old configurations still work & have defaulted to S7-300

A: The protocol is indentical, the S7-400 can handle larger block sizes than the S7-300 and is therefore faster – so it is a performance optimisation.

Q: What do the Icons in the configurator mean ?

A:

- ✓ The block is healthy & contains current data
- ✗ Communications failure
- The block is currently not in use, it is off poll, all the blocks on a standby server should be in this state
- ? This block is newly configured & is not currently being polled. You need to reload the configuration

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Q: The driver configurator us using all my PC's CPU time and the whole machine is slow, what is wrong ?

A: You have many error messages flooding the bottom window of the configurator, this is caused by all the scrolling. This happens if the database or OPC client contains references to not in the poll configuration

- Pull the horizontal splitter down to close the bottom window, this reduces CPU time
- Use "Menu>Options>Learn addresses" to solve the NIO-*Address… errors, then driver reload

Q: Why do I see messages like "Nio-*Address Error DB15,W248" in the bottom window of the configurator ?

A: This means that Fix or the OPC client is reading that address however this address is not configured for polling in the backend.

- **It is Crucial to resolve this issue**, before doing any other testing
- You only see these errors when the client tries to access the data, so seldom used addresses may not be noticed.
- There is a Semi-automatic method of solving this
    - By selecting Menu>Options>Learn addreses, the configurator uses those error messages to stretch existing blocks or add new ones.
    - Reload the iFix Database, it will cause the errors, the configurator will use these to stretch & add blocks
    - Reload the Driver config & Reload the iFix database again

***Note this only changes the edited file in disk you need to "reload"  to make it active in the Background polling program. Then you should see fewer address errors, you then need to Learn addresses again. Read more

Q: I am unable to get communication, what are the most common problems?

A: If using ISO protocol Check that the siemens ISO transport is installed, if you see the message in the bottom window "failed to open ISO channel 1" then the ISO transport is not correctly installed OR there may be a problem in the registry and the driver is not using the correct Ethernet card.

The read TSAP setting defaults to "R=0;S=2" which means read the CPU in Rack 0 Slot 2. This is Correct for an S7-300. On a S7-400 with 2 slot power supply, meaning the CPU is in Slot 3, this should be R=0;S=3. **Note the Slot is the slot number of the CPU, NOT the CP 443 card!

If you have 2 SCADA's communicating to a S7-300 the third SCADA connection will fail. By default the S7-300 has 8 communication channels – 2 for step 7, 2 for SCADA, 4 for PLC-PLC, This configuration can be changed in later model CPU's read more

OR

One PLC does not communicate until I shut down the other SCADA's read more

Q: How do I update the configuration after making changes ? Or Why do newly added blocks show a ? status

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A: Remember the configurator is not actually polling the PLC's The background polling program sixspoll.exe is doing that. Save the file then Select "File|Reload" off the menu, or press  . This saves the configuration and tells the background polling program to stop & reload it's configuration into memory. During this process you may see ????? in FIX or OPC quality bad.

Q: I have problems reading Direct S7 IO (I,Q,PI etc.) what do I do ?

A: You need to make sure that the poll blocks exactly match the configuration in the PLC. The PLC WILL NOT allow you to poll across an address for which no IO cards exist. You need to break this up into smaller blocks. **Note we Do not recommend writing directly to outputs for safety reasons.

Q: My communications are Slow, WHY ?

A: Please Note the following, typical performance achievable

- This driver polls as fast as the PLC allows, the PLC is the bottleneck(slow side), the figures below are per PLC, the driver performance scales linearly per PLC.
- S7-315 CPU typically achieves 15-20 polls per second (We believe it is crippled)
- S7-416 CPU typically achieves upto 150 polls per second (10 x faster). This is with 2 IO Devices talking to the same PLC.
- A Vipa PLC typically achieves upto 40 polls per second with default settings, if communications resources are increased this can reach 100+
- From version 7.9.52 performance has been increased substantially over the above the difference is more noticeable for configurations of lots of small blocks

Q: The communications are Slow, how do I make it faster ?

A: read the section about optimisation of the driver & try some of the following modifications at the PLC side.

- Try to increase the PLC scan cycle by moving code to the Idle processing OB's OR process half the code each scan & thereby doubling the scan cycle.
- Try Increasing the PLC process time dedicated to communications this is in the CPU Properties seen below

Q: How do I configure communications to an S5 PLC ?

A: This is far more complicated than an S7 PLC. Please read the Driver help file (SIXHLP.DOC) section "Setting up the hardware" for Full instructions. In addition there are example S5 PLC programs & CP card setup files in the backend distribution in the "PLC" directory.

Q Does the driver support the S7-400H hotstandby PLC ?

A: Yes simply configure the second IP addresses & rack & slot in the Backup fields, read more in Configuring for Redundancy

Q: How do I debug the operation of the low level backend redundancy

A: read the section on Using the Special Debug addresses

Q: Can the driver communicate with ProfInet ?

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A: Technically NO, however all ProfInet capable CPU's communicate S7 Functions thru the same Ethernet port so it does not matter ! The driver will work, remember the driver communicates with the PLC program NOT IO.

The PSDIRECT driver uses a protocol called "S7 Function" or GET/SEND of Object oriented large chunks of data (Instance DB's) and is processed in the PLC asynchronously in 10+(variable) millsecond rates, this is more appropriate between a SCADA & PLC. ProfInet is more about remote IO and processing that in sub millisecond interrupt driven processing.

In this sense your ProfInet remote IO is more appropriately handled by the PLC program. It is dangerous to use the PLC as a gateway to directly access the IO.

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4 Communication Optimisation

4.1 *note on performance in new version 7.9.52

This version can reads multiple block simultaneously, and when upgrading you should notice an improvement in the backend driver poll rate. This new version requires no additional changes, it will open existing configuration files. To take full advantage of this the only change to the configuration required is to set the PLC type to “S7-400” in the PLC type. The greatest performance improvement will be seen with configurations with large numbers of small poll blocks.

4.2 How to Measure Driver Performance

- Create a minimal backend configuration with 1 poll block, 1 variable and a poll time of 0.0 seconds
- Note how many polls per sec you get in the configurator status at the bottom
- After measuring the speed, you can calculate the update time of your full configuration. e.g. If you get 10 pps (Pollblocks per second), you can have
  - 1 pollblock updating 10 times a second or
  - 10 pollblocks updating at 1.0 seconds
  - 5 pollblocks updating at 1.0 seconds + 10 pollblocks updating at 2 seconds

If you configure more pollblocks, no errors will occur but you are not actually achieving your configuration update time. In this case the driver just processes each block in turn. This is not a problem most of the time but as you add more blocks your system will slow down & if you need faster update on a specific block, changing its polltime will achieve little.

4.3 Optimisation Techniques

To make a limited bandwidth system appear faster, you have to **slow down** the updating of less critical data to give more bandwidth to the critical data. (Increasing the pollrate of a block when the system is already at full stretch will have no effect) The basic principle is - poll only the data that the operator needs for a given picture & at the minimum rate he is prepared to accept. It is usually better to set slow polltimes at the start of a project which leaves plenty of room to expand, this sets a lower expectation and if you need more speed later you have spare bandwidth resources.

- Setpoints, Outputs, controls or any value that never changes in the PLC (only changes when modified from the SCADA) can be setup so that they hardly use any channel bandwidth at all. Set the polltime to a large value like 60 seconds. If a value is written the driver automatically forces the block to update so the user does not notice the slow poll times.
- Configure iFix to stop reading data not in use, to do this change all AI/DI blocks that are NOT alarmed to AR/DR blocks.
- Prioritize your data; find out how fast the data changes in the PLC. Do not poll faster than necessary especially while you are constructing your system. You can always speed up certain blocks later once your system is fully configured. Generally analog values can be polled slower e.g. 5 sec but Digital Inputs may need 1 sec.

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4.4 PLC Optimisation

*4.4.1 *notes on PLC Performance*

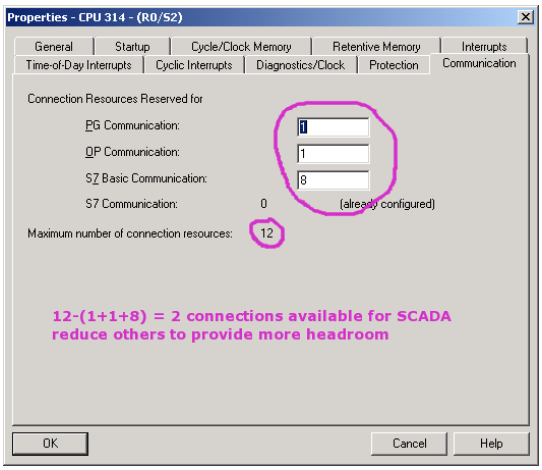
Siemens seem to cripple the performance of the S7-300. It is not unusual to get 10x performance improvement with the S7-400 versus the S7-300

Try to increase the PLC scan cycle by moving code to the Idle processing OB's OR process half the code each scan & thereby doubling the scan cycle.

4.4.2 Number of Network connection resources (CPU properties)

Resources available for the driver on the S7-300 is Two (2) by default, which can be changed this means 2 IO servers can connect but the third will fail, unless you change this configuration in Step 7. The S7-400 allows 4-8 connections by default.

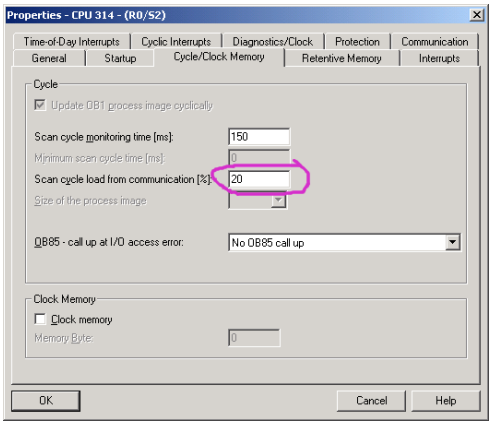
*note it is recommended that you increase this to leave plenty spare because sometimes the PLC holds onto old connections – blocking the driver's reconnection attempts.



**Note - by default the driver uses SCADA connections, which are the missing/unlisted connections in the picture above. The S7 Basic connections are PLC-PLC connections normally you can reduce this number. Ideally you want the SCADA connections free to be at least 2+the number of SCADA's. To force the driver to use an OP or PG connection set the local TSAP to "R=0;S=2;OP" or "R=0;S=2;PG"

CPU communication load priority (CPU properties)

You can try increasing communication priority



4.4.3 Block size (CP card properties)

Some CP cards (not all) have an option in the options tab for large PDU block size (>240) – set this option if available.

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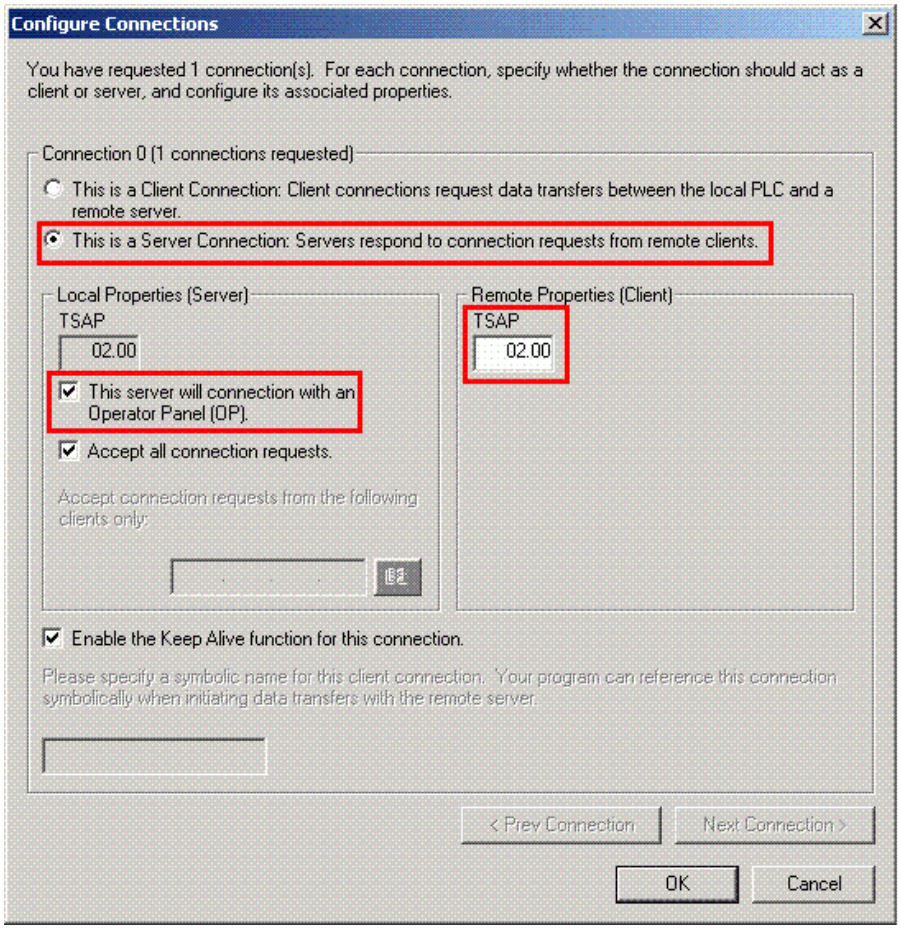
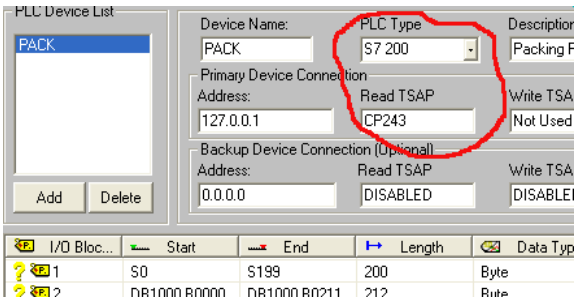
5 S7 200 Setup

1/ Run the Micro Win Ethernet Wizard
2/ We recommend that the CP243 be installed in position 0
3/ Set the CP243's Ethernet address
4/ Configure a New connection & set it as follows



In the Driver polling configuration set the Read TSAP field to "CP243"



You can poll the following data from an S7-200

M0-M32 (S7-200 has very small M area)
DB1,0->x is equivalent to the "V" mem area e.g. VW8 == Citect block type INT address DB1,8
I0 len 2 (Built in I inputs)
Q1 len 1 (Built in Q outputs)

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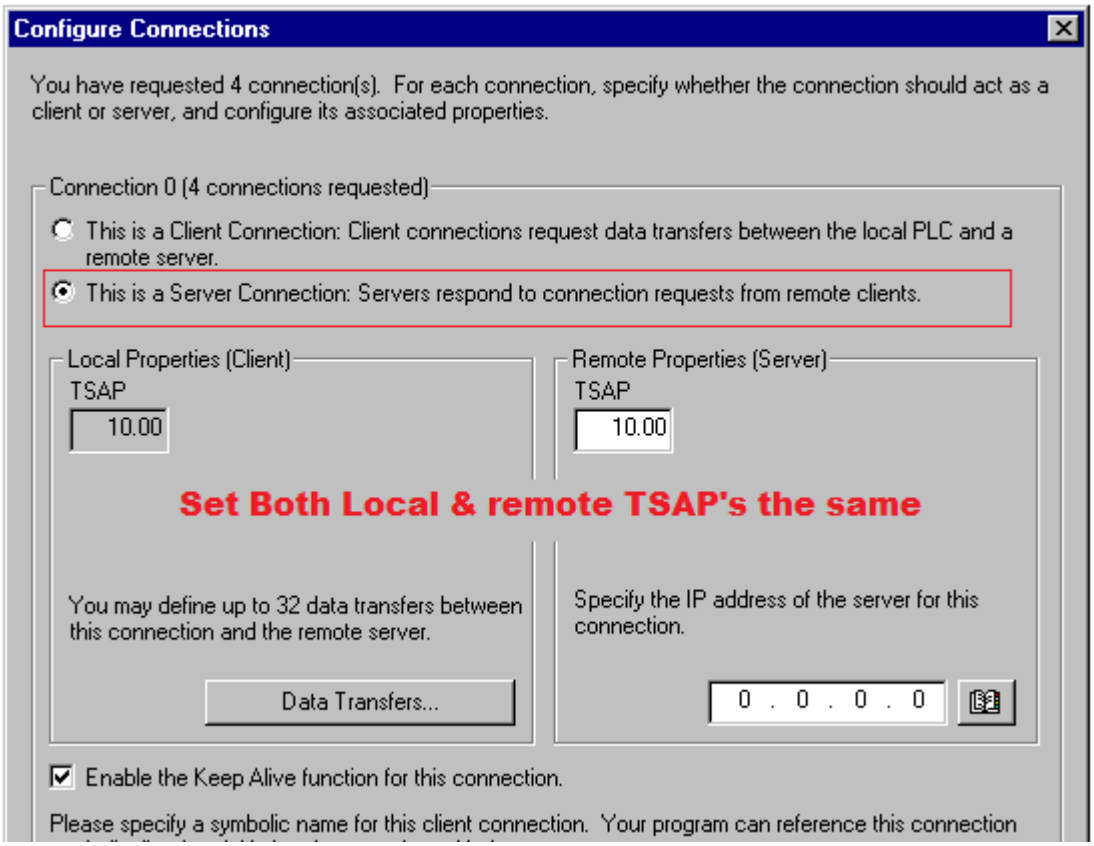
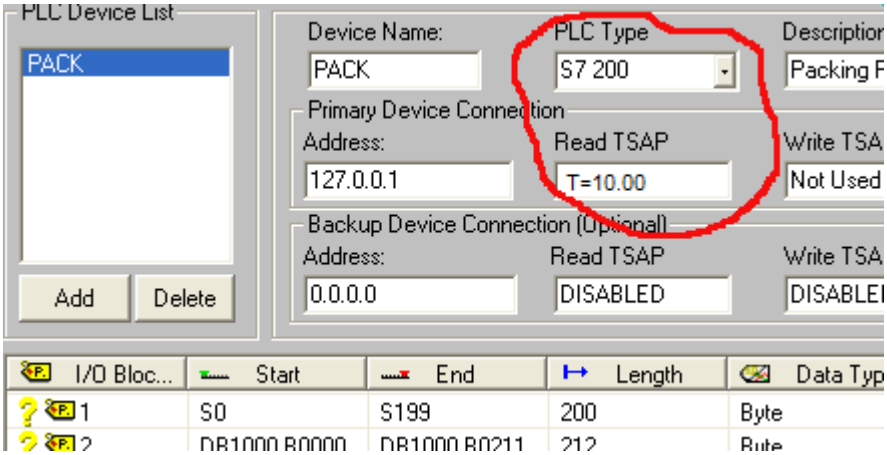
5.1 Alternative S7-200 configuration





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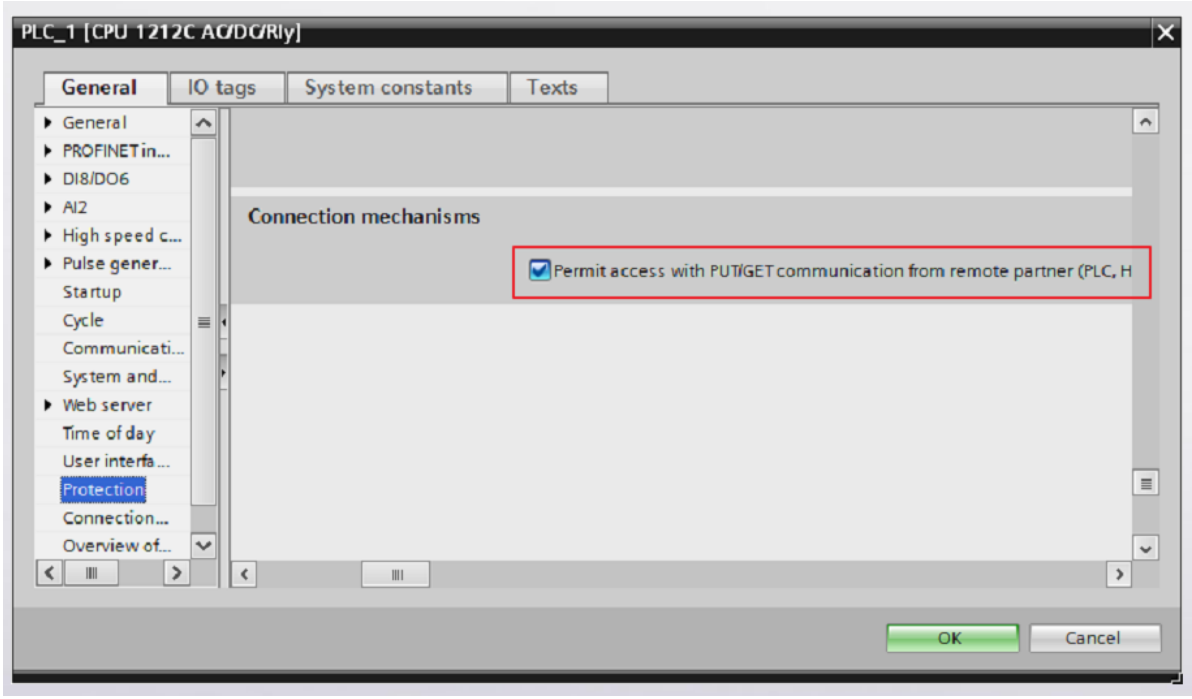
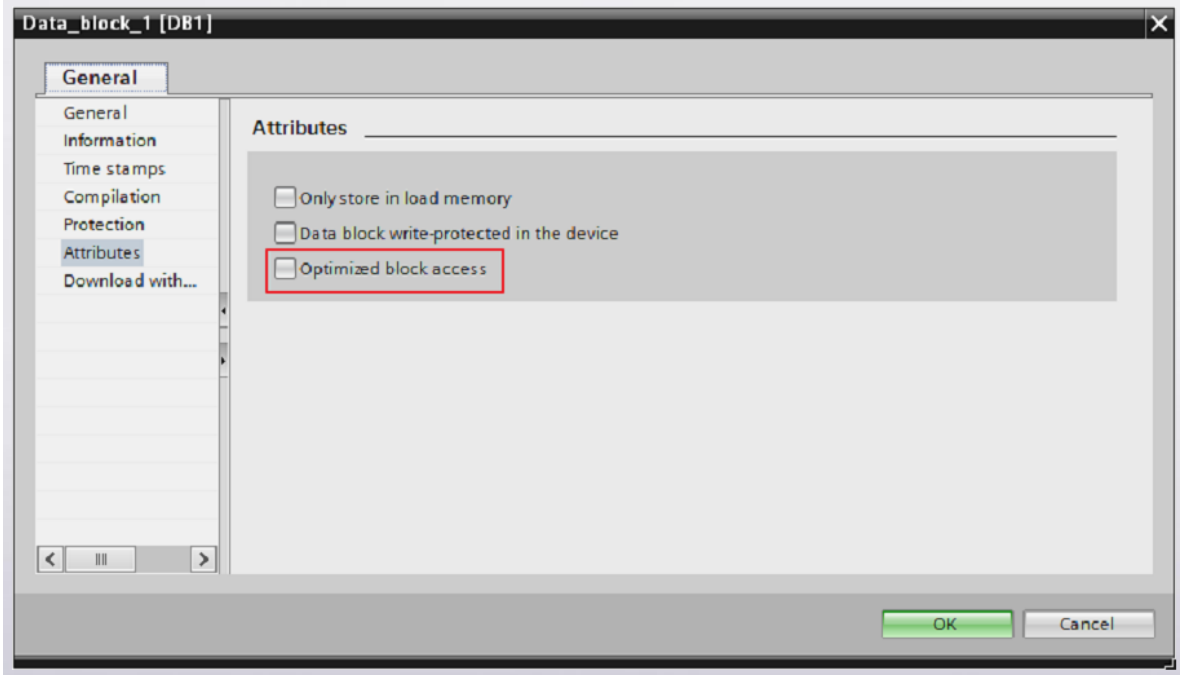
6 S7 1200 & 1500 Setup

TIA-Portal PLC Setup check the following:

- CPU -> Properties -> Protection; make sure you TICK the "Permit access with PUT/GET communication from remote partner" and the protection itself must be set to "full access"



- UN-TICK the property "optimized block access" attribute on the DB's you want to read in SCADA



On the driver side:

- Set TSAP to R=0;S=1

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7 Configuring for Redundancy

7.1 Standard Fix redundancy

- Normally this is simply twin SCADA servers with the same database & driver config

7.2 Using driver redundancy with S7-400H systems OR >1 CP card in the PLC

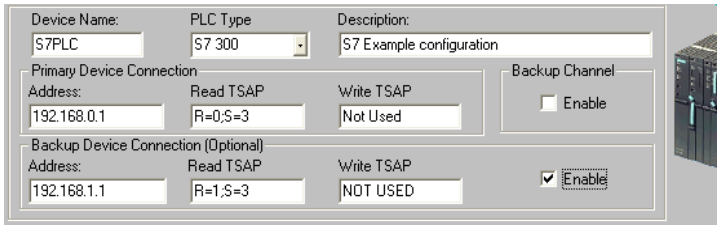
The driver level has a backup address per IO Device, typically on a S7-400H system you setup as follows:

Primary address:

IP 192.168.0.1 Read TSAP = "R=0;S=3"

Backup address:

IP 192.168.1.1 Read TSAP = "R=1;S=3" (check enable backup address)



*Note** the Rack number of the backup CPU is "1", note I specifically gave the IP addresses different subnets (Ethernet cards in the IO server) you probably have twin Ethernet networks.*

7.2.1 Notes

- A potential issue is that the device takes 2x longer to show communication. The timers that affect this are the settings in the channel setup (backend) We recommend settings (do not set any lower)
    - timeout time = 3 sec
    - Delay = 30 sec
    - Retries = 1
- You can monitor which connection the driver is using via the debug addresses
- Unfortunately you cannot at present force the backend to switch over manually
- Read more about monitoring the status in Using the Special Debug addresses

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8 Using the Special Debug addresses

This driver is a cached Front End / Back End driver, so the standard CitectSCADA driver statistics are not very useful. This section describes the Special Tag addresses available for debugging purposes. All datatypes are INT

<PLC NAME>:SW0	Connection	current connection number an Internal value, this is normally static, is only meaning full when backup addresses are used. Connection number of connection inuse, stays the same if backup feature not used.
<PLC NAME>:SW2	State	means trying to connect to PLC, =2 means Connected. Use this address to alarm communication failure
<PLC NAME>:SW24	Reconnections	Increments every time the driver attempts to reconnect after the connection failure. If this is going up, you have a bad network
<PLC NAME>:SW26	Poll blocks per sec	Poll rate for this PLC - useful for checking optimisation. The rate shown at the bottom block of the configurator should be the sum of these per channel.
<PLC NAME>:SW28	Disconnect Req's	Increments when PLC sends Disconnect Request. This Means that your Network is OK but the PLC is refusing connection requests.
<PLC name>:SW32	PDU size	PLC request block size, 240 or 480 bytes
<PLC name>:SW40	Primary connection	Connection number
<PLC name>:SW42	Primary connection state	=2 means connected
<PLC name>:SW80	Backup connection	Connection number of backup connection

When using the Backup IP address, the following logic may be used to indicate which connection is active.

<PLC name>:SW0= =<PLC name>:SW40 means that the Primary IP address is being polled

<PLC name>:SW0= =<PLC name>:SW80 means that the Backup IP address is being polled

Writing 1 to <PLC name>:SW0 causes the driver to connect to the Backup connection

Writing 2 to <PLC name>:SW0 causes the driver to connect to the Primary connection

**NB the above are S7 addresses. S5 example: (note addresses / 2)

<PLC name>:S:0= =<PLC name>:S:20 means that the Primary IP address is being polled

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9 Using the S7 Simulator application

9.1 What is it ?

The small console application “S7simulator.exe” may be downloaded from a link on

http://www.proscada.com/Siemens_Ethernet.htm

9.2 Introduction - why a PLC simulator ?

We originally wrote this as a simple application to regression test the driver particularly to test hard to find PLC’s like old S5 models. We soon realised that others would also find it useful for quick test & setup without having to have to setup a *real* PLC. As such it lowers the barriers to using the PSDIRECT Driver. We would not want to pretend that it is a “Full” emulation in particular it has not been tested against Siemens software like the OPC server or WinCC. It certainly does not emulate the protocol fully but is sufficient for the ProScada Siemens Driver. It is a low priority project for us, with minimal support.

9.3 Capabilities

- Emmulates Both S5 & S7 PLC’s (TI sort of…)
- Only Supports TCP/IP
- Automatically emulates any datablock you poll with the DB’s initialised to []0, any data written is stored, like a PLC with no program running. Emulates 4kb DB’s upto DB 1999. M,I,Q memory areas are emulated as DB0
- Supports 2 incoming connections so you can setup a redundant pair of SCADA IO Servers.
- Only Supports Rack 0 Slot 2 (deliberate for training purposes)
- DB 1 & DB15 contain some forced values

9.4 Installation

run from the command line or explorer there are no parameters.

The program simply listens for Incoming connections. Being a TCP/IP server you need to unblock any firewall systems. *Note it is receiving connections on TCP port 102.

When run on the same PC as the IO Server you can use the IP address 127.0.0.1(local loop back) in the driver

9.5 Forced variables

DB15 is in S5 format
DB15:0 increments up infinitely every 10msec
DB15:1 increments to pi * 1000
DB15:2 is sin(DB15:1)

DB1 is in S7 format
DB1,2 increments upto 100 every 10msec
DB1,0 increments everytime DB1,2 gets to 100 aprox every second

STRING SDB1,128[32] contains "Hello there"

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Pseudo code for S7

```
IF DB1,4.0=1 THEN
    DB1,5.6 =1
ELSE
    DB1,5.6 =0
END

IF DB1,4.1 AND DB1,4.2 THEN
    DB1,5.7 =1
ELSE
    DB1,5.7 =0
END
```

DB1,4.3 blink every 1 sec.

Pseudo Code for S5

```
IF DB15,4.0=1 THEN
    DB15,4.14 =1
ELSE
    DB15,4.14 =0
END

IF DB15,4.1 AND DB1,4.2 THEN
    DB15,4.15 =1
ELSE
    DB15,4.15 =0
END
```

DB15,4.3 blink every 1 sec.

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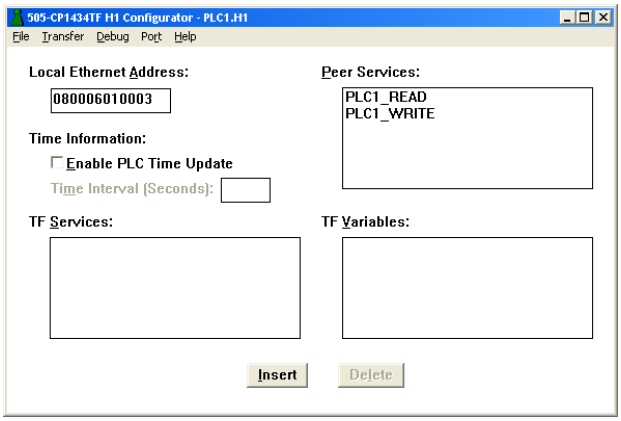
10 Setting up the Simatic TI

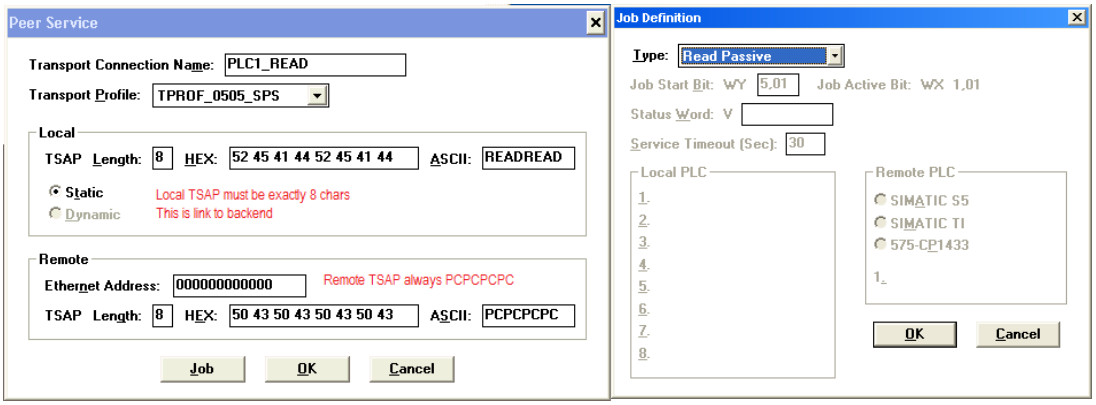
The steps to migrating an existing system are as follows:

10.1.1 Step 1: Adding peer-peer jobs to the PLC CP card setup. You can leave the old TF Jobs in place simply add these new ones.

You can leave the old TF Jobs in place simply add these new “Peer Services”.



They look like this



- Local TSAP must be exactly 8 chars
- Local TSAP is the link to the backend configuration see below
- Remote Ethernet address should be “0000” – accepts any incoming connection
- This should be a read Passive job
- The Write job should be a Write passive
- All jobs remote TSAP must be “PCPCPCPC”

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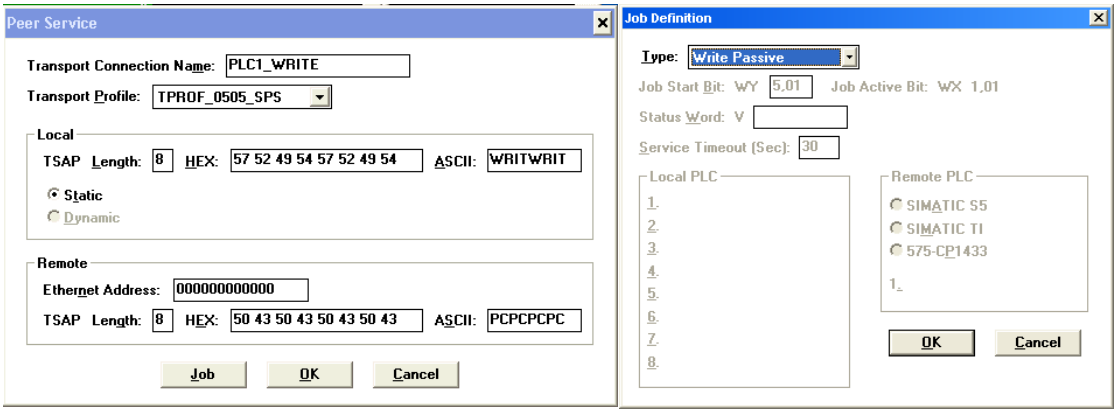

10.1.2 Step 2: Configure the poll configuration

- Setup the Siemens ISO transport in the newtwork settings, this is the same as for the S7 & S5 PLC's described earlier in this document
- Check that you have communications, you should do this before setting up the database. Simply setup 1 block of "V" registers. You should see green ticks & blocks per second at the bottom of the configurator window indicating successful communication

10.1.3 Step 3: Configure the backend blocks

- Open the database file in excel, sort on IO Address. Then manually add equivalent blocks in the backend
- At present there are no Learn address & variable import features for TI.

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11 Install the ISO Transport (** not used for TCP/IP)

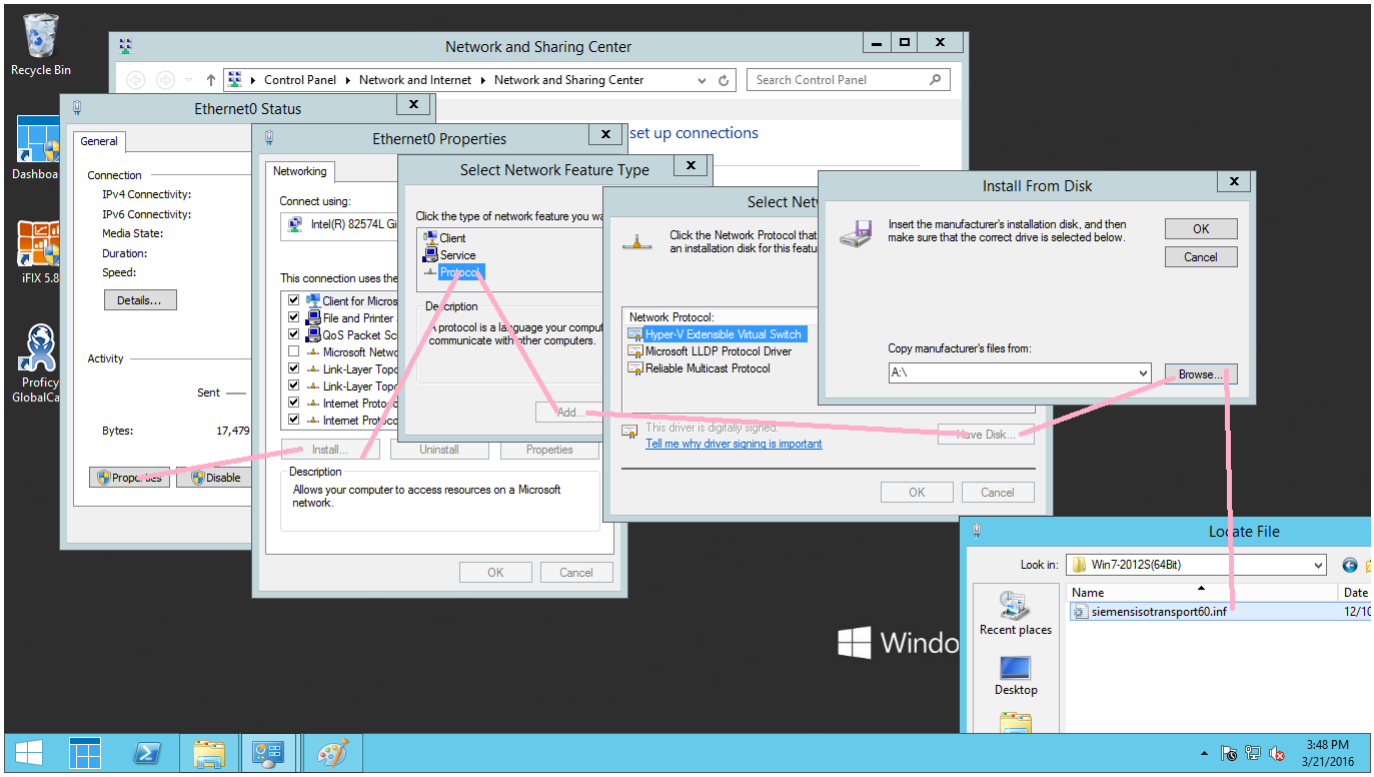
*This step is **optional**, depending on the protocols used to talk to the PLC's, if you are using TCP/IP you DO NOT Require the ISO transport – Please go to Section 4 Setting up the driver.

The ISO transport is an older Siemens protocol that requires a 64bit Kernel mode Windows driver called "ProScada Siemens ISO Transport".

To Install:

11.1 Copy the contents of the zip file directory Win 7 – 2012S (64 bit) to a user directory.

Open Network and Sharing centre > Change Adapter settings > R click properties and click Install



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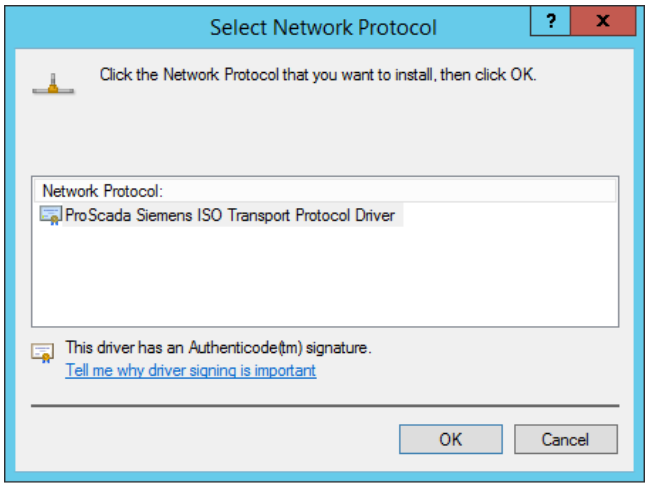
11.2 Select the ProScada Siemens ISO transport



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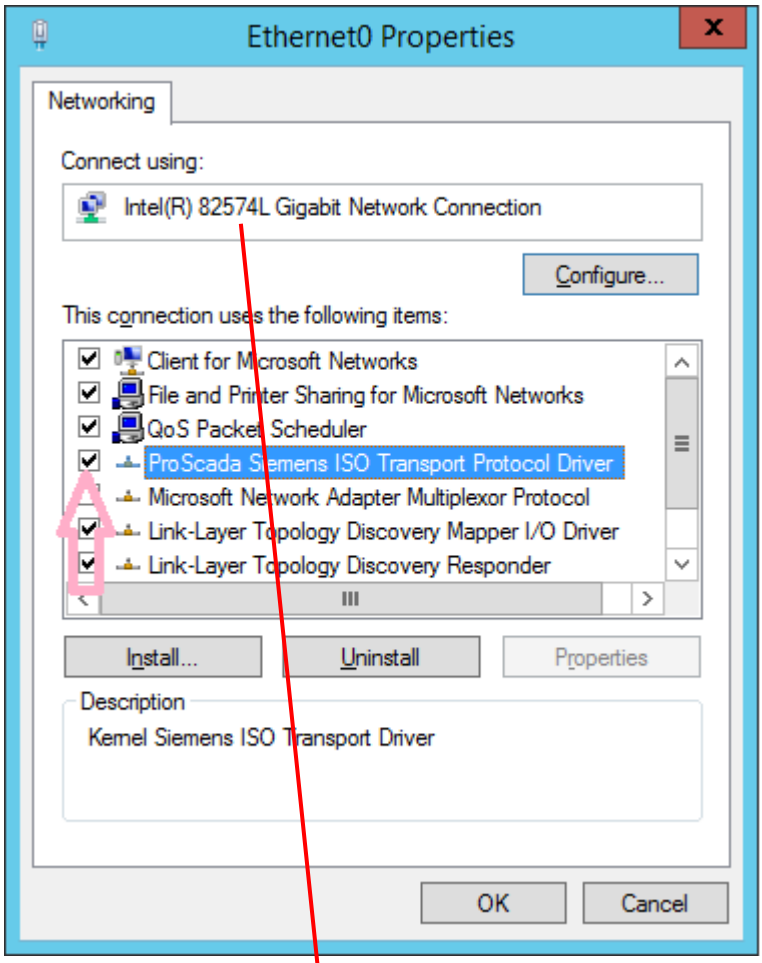
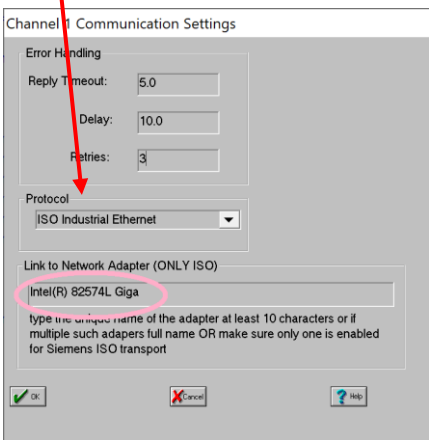
11.3 Now open properties on ALL Other network adapters and unclick the “ProScada Siemens ISO transport”

11.4 Uncheck all Internet Protocol Version x (TCP/IP) & all Microsoft networking leaving only ISO on this ethernet card (*note you will need >1 ethernet adapter)



11.5 Now go to the Front end (SIXDIDW.EXE) driver configurator and press setup button on the channel settings type at least 11 characters of the ethernet card name in “Link to Network adapter”



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11.6 Now reboot the machine, run the driver configurator “AS Administrator” & check that you get the message ISO Channel opened on adapter x address nn:nn:nn….

a. If you get “unable to open SC” it means you are not running as admin
b. It may also fail to connect if the ethernet cable is unplugged
c. The Siemens ISO transport, should run at startup after a reboot but if it does not, you need to shut down the driver and try again (AS Admin)
d. To debug the ISO transport service open a CMD Box with admin rights and type
    i. “NET START SIEMENSISOTRANSPORT<enter>

It should say Already started or successfully started

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12 Setup S5 PLC

The S5 PLC has some complex settings, therefor this driver requires very specific setting of these.

The Driver use the CP 535/143/1430 in the following mode:

- Data reading is done via Passive FETCH Jobs, Writing is done via Passive READ Jobs
- The CP cards Ethernet address

Note : It is recommended that you configure the Ethernet address of the remote node as 00-00-00-00-00-00. This allows any SCADA node to connect(one at a time) and allows you to change Ethernet cards etc. without having to reconfigure the CP. If you want to configure the SCADA nodes address into the CP143 you will need the Ethernet Address of the Ethernet card in the SCADA node.

The setup of the PLC & CP card is beyond the scope of this manual, however an example CP 143 configuration and PLC program is supplied in the directory ><ZIP file>\PLC

Observe the following:

Configure the CP's Ethernet address and take note of it (you must use this address in the SIX config

The Remote TSAP name of the SCADA node is always "PCPCPCPC" (for all connections)

You must configure Two connections per SCADA node
1.A passive FETCH connection local TSAP = (whatever you configure in SIX driver config - read TSAP) Remote TSAP = "PCPCPCPC" Ethernet address = 00-00-00-00-00-00 or SCADA node's Ethernet address

2.A passive RECEIVE connection local TSAP = (whatever you configure in SIX driver config - write TSAP) Remote TSAP = "PCPCPCPC" Ethernet address = 00-00-00-00-00-00 or SCADA node's Ethernet address

In the PLC program you must call a Send/Receive ALL function block every cycle or 1 SEND block & 1 RECEIVE block with all parameters set to 0 and QZTYP = "NN

If you are upgrading the system from the DOS version 5.5 driver using the PCLINK2 card then the only mod you need to make is to change the Remote Ethernet address from the PCLINK2 's address to the address of the Ethernet card in the new SCADA node.

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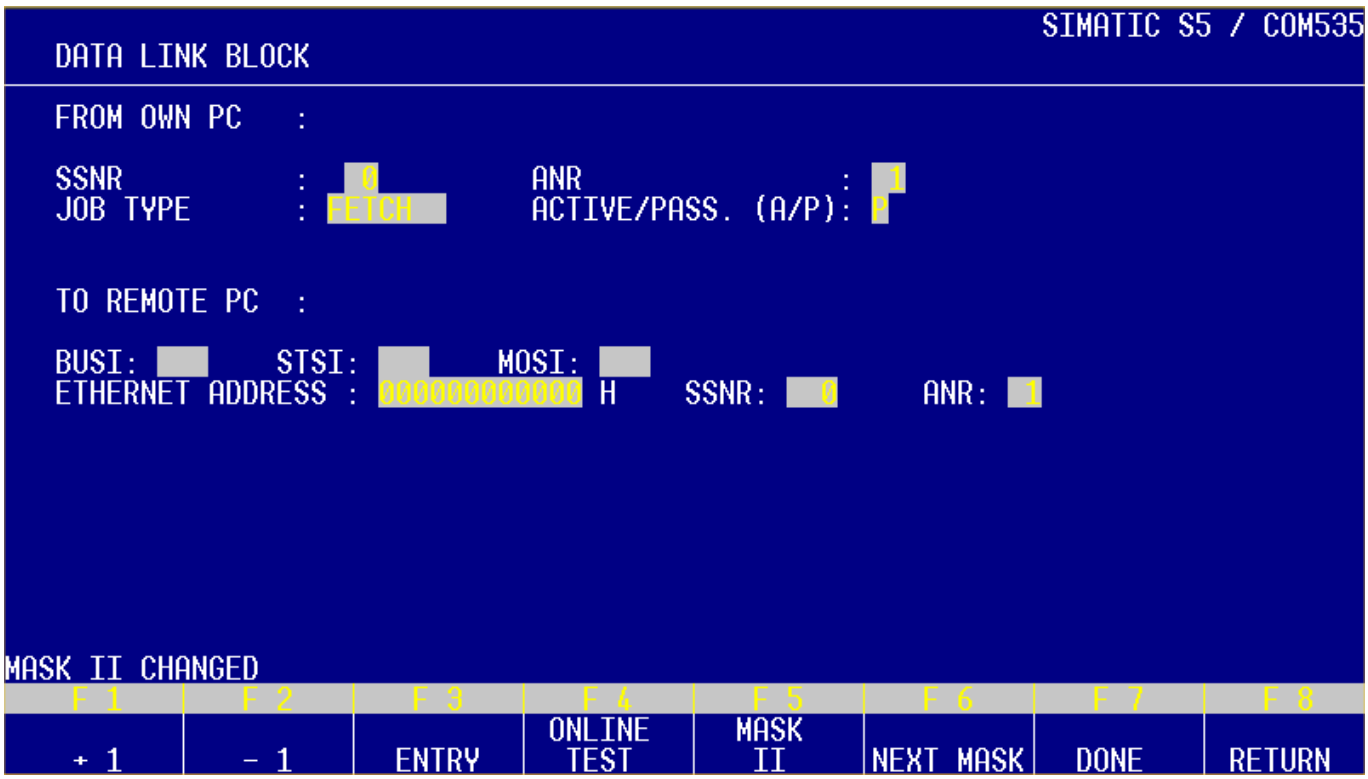
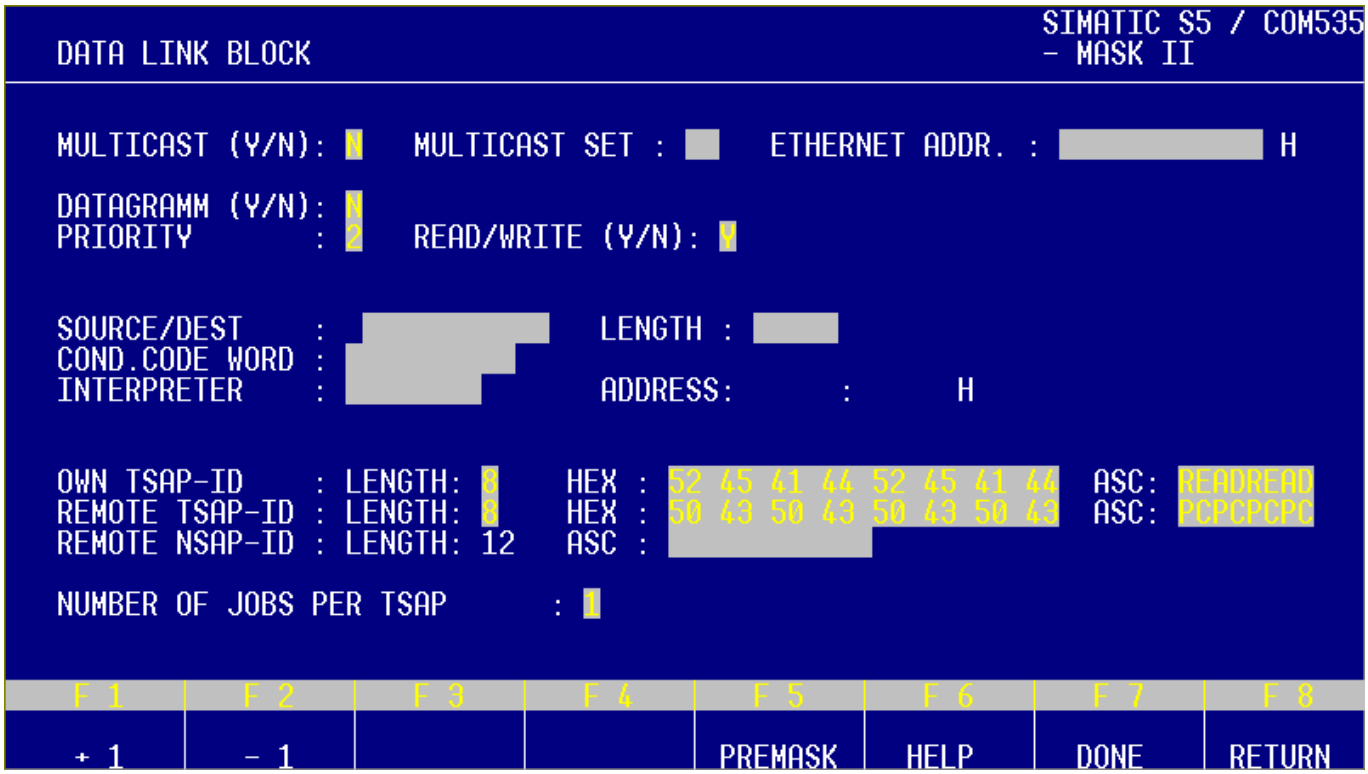
The first page of the FETCH job *NB your Ethernet address will be 00-00-00-00-00-00 or SCADA node's Ethernet address (not the same as this)



The Second page of the FETCH job



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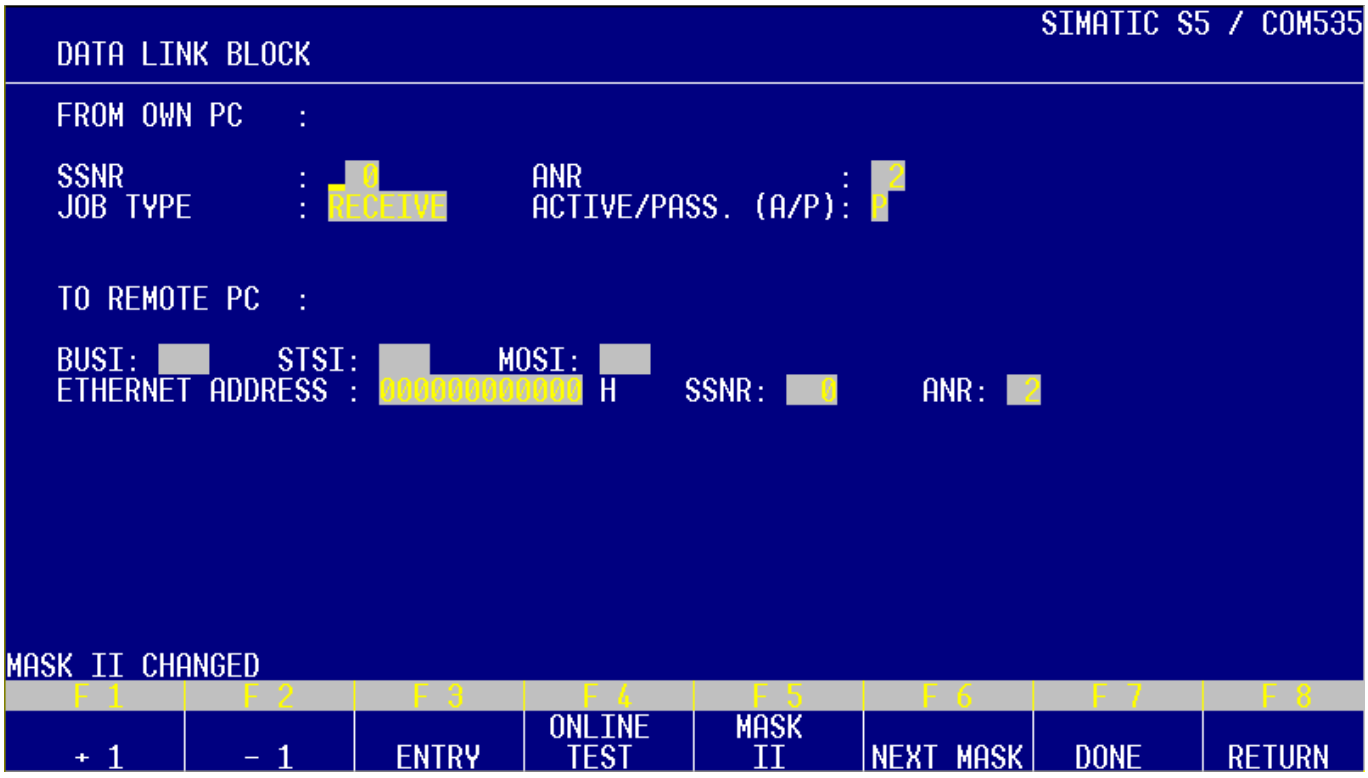
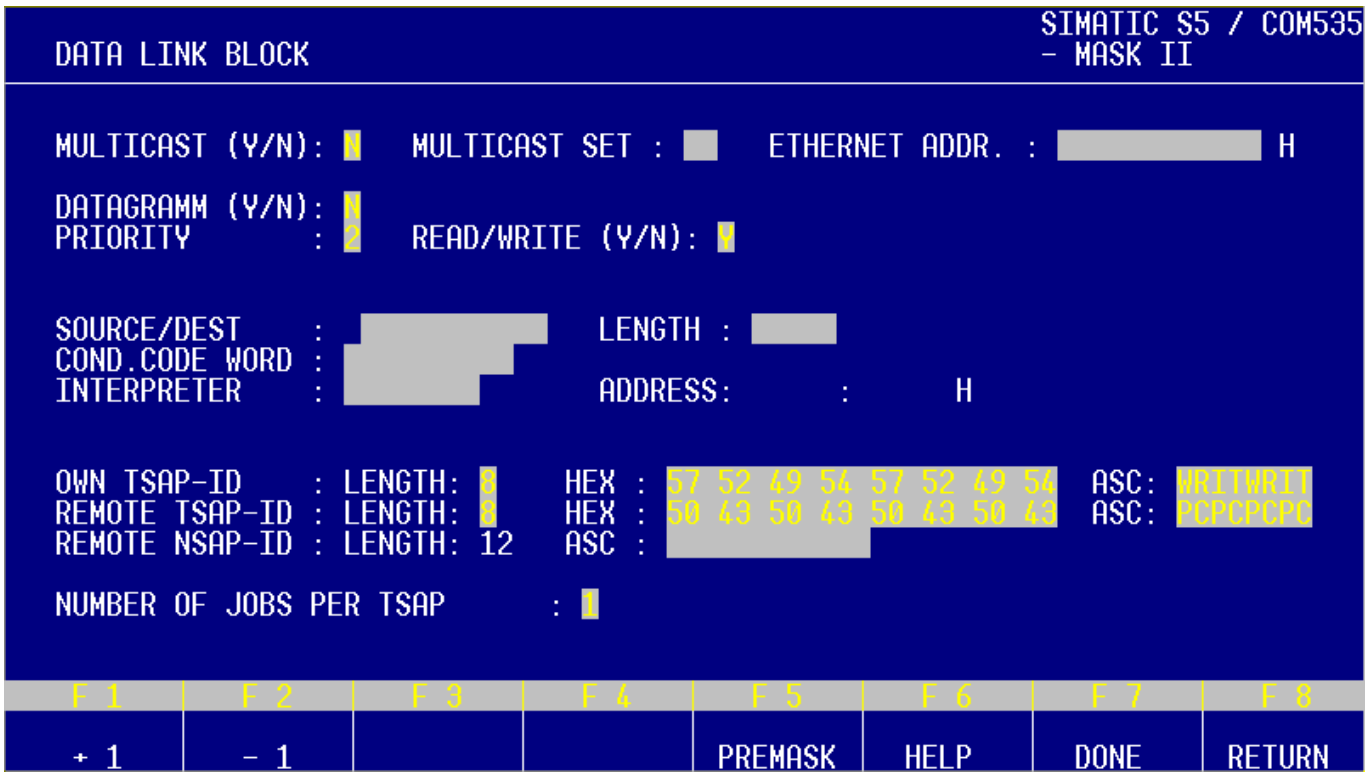
The first page of the RECEIVE job NB your Ethernet address will be 00-00-00-00-00-00 or SCADA node's Ethernet address (not the same as this)



The Second page of the RECEIVE job



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12. Signal conditioning & Hardware Options

**Note Signal conditioning means the scaling/conversion of analog data from raw PLC data. Use the PROP Option for linear scaling. Related to this the HW-Options field is used for 2 options for String handling. HW-Option="S7STRING" for S7 String datatype, OR HW-Option="ZeroTermini" for an array of characters starting at that address.

Signal Conditioning Options

SC Option	Scaling	Notes	PLC
None	No Scaling	Ignores EGU range in the block. No Range checking Alarming.	S5, TI
	0-65535	Interprets the value as "Unsigned" then scales to the EGU range. This SC is used for backward compatibility with older systems where Unsigned pollrecs were used with SC=LIN	S5, S7,TI
PROP	user defined	Scales user defined raw range (rawLo:rawHi) entered in the HW-Options field to EGU range (Linear Scaling) e.g. HW-opt=819:4095 for live zero 12 bit AD converter	S5, S7, TI
PHEX	user defined	Same as PROP except the rawLo:rawHi is in hexadecimal	S5, S7, TI
ROOT	user defined	Scales user defined raw range entered in the HW-Options field to EGU range (Scaled proportional to the square root of the raw range)	S5, S7, TI
SINT	No Scaling	S5 - forces the value to be interpreted as an signed integer regardless of the data type of the poll record (allows you to mix signed & unsigned in one poll record) S7 – Resolution depends on the format len. B, W or D formats	S5, S7
UINT	No Scaling	S5 - forces the value to be interpreted as an unsigned integer regardless of the data type of the poll record (allows you to mix signed & unsigned in one poll record) S7 – Resolution depends on the format len. B, W or D formats **NB by default 32 bit values are converted to float, resulting in loss of accuracy in values > 8.3 million	S5, S7, TI
DWRD	No Scaling	Use with 32 bit LONG variables to avoid the loss of resolution in values >8.3 million. In iFix use "G_CV" field to display.	S5, S7, TI
TIMR	No Scaling	Use this SC for setpoints to timer values. Do not use this for the actual timer value(T pollrec) – use S&M instead eg. You want a timer to have a user configurable time base, create an AR block with addr DB:16:10 & SC=TIMR Then the PLC code is C DB 16 L DW 10 SE T 3	S5, S7
S&M	User configurable	Shift & mask - Shifts the word Right then ANDS the result with the mask. The parameters are stored in the HW-OPTIONS Field in the form SHIFT:MASK S5 - This is useful for the T and C pollrecs where you would use 0:1023 to strip out the lower 10 bits	S5, S7, TI
RS&M	User configurable	Shift & mask - Shifts the word Right then ANDS the result with the mask. The parameters are stored in the HW-OPTIONS Field in the form SHIFT:MASK. Differs from S&M when writing retains 'other' bits S5 - This is useful for the T and C pollrecs where you would use 0:1023 to strip out the lower 10 bits	S5, S7, TI
FLT	No Scaling	S5-Use with word pollrecs to interpret 2 consecutive Words as a float S7- Use with 4 bytes format="D"	S5, S7
LONG	No Scaling	S5 - Use with word pollrecs to interpret 2 consecutive Words as a Double word	S5, TI
TNON	0-32000	TI Analog inputs	TI only
20P	6400-32000	TI Live zero inputs	TI only
8AL	0 - 255	Scaled to EGU range in the block. Range checking Alarming.	S5, S7, TI
8BN	0 - 255	Scaled to EGU range in the block. No Range checking Alarming.	S5, S7, TI
12AL	0 - 4095	Scaled to EGU range in the block. Range checking Alarming.	S5, S7, TI

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SC Option	Scaling	Notes	PLC
12BN	0 - 4095	Scaled to EGU range in the block. No Range checking Alarming. Ignores the most significant 4 bits (nibble).	S5, S7, TI
15AL	0 - 32767	Scaled to EGU range in the block. Range checking Alarming.	S5, S7
15BN	0 - 32767	Scaled to EGU range in the block. No Range checking Alarming. Ignores the most significant bit.	S5, S7, TI
3BCD	0 - 999	Scaled to EGU range in the block. Range checking Alarming. Ignores the most significant 4 bits.	S5, S7, TI
4BCD	0 - 9999	Scaled to EGU range in the block. Range checking Alarming.	S5, S7, TI
LIN (Signed DataType)	-32768 - +32767	Scaled to EGU range in the block. No Range checking Alarming.	S5, S7, TI
DTEN	No Scaling	Divides raw value by 10 e.g. 0-9999 becomes 0-999.9	S5, S7, TI
DHUN	No Scaling	Divides raw value by 100 e.g. 0-9999 becomes 0-99.99	S5, S7, TI
S7A1	0- 27648	S7 Analog inputs in process image (unipolar)	S7
S7A2	-27648- 27648	S7 Analog inputs in process image (signed bipolar)	S7

Example of the use of the PROP signal conditioning field

SC-OPT =" PROP"
HW-OPT = raw analog range in the PLC expressed as RAWLOW:RAWHIGH
this performs a linear scaling of the raw value using a user configurable raw range

example
Siemens 13 bit Analog input module 4-20mA signal
SC-OPT = PROP
HW-OPT = 512:2560

Example of the use of the ROOT signal conditioning field
SC-OPT = ROOT
HW-OPT = raw analog range in the PLC expressed as RAWLOW:RAWHIGH
this performs a scaling proportional to the square root of the raw value using a user configurable raw range

example
12 bit Analog input module 4-20mA signal from the differential pressure across a orifice plate in a water pipeline. The instrument is calibrated to provide 4ma at 0 m^3/h and 20mA at 500 m^3/h.

SC-OPT = ROOT
HW-OPT = 512:2560
EGU HI = 500
EGU LOW = 0

Example of the use of the S&M signal conditioning field

SC-OPT = S&M
HW-OPT = parameters expressed as SHIFT:MASK
this SC shifts the value to the left by SHIFT then ANDS the result with MASK

example
Get the time base of a timer (stored in bits 14,15 of the word)

SC-OPT = S&M
HW-OPT = 13:3

example

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Get the time of a timer (stored in bits 0-9 of the word)

SC-OPT = S&M
HW-OPT = 0:1023

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