

Network Topology

Revision	Date	Comment	Initials
4	12.06.2017	Added local WiFi router to "B"	MOJO
3	03.01.2017	New OPC UA module. Assigned 201- to OPC UA devices. Assigned 151-199 to IO devices. Changed HiSF to HVL.	MOJO
2	06.07.2016	New PROFINET and PROFIBUS IO modules. New CX. Rearranged addresses.	MOJO
1	05.01.2016	Updated with ring topology. New figures. ++	MOJO
0	15.08.2015	First	MOJO

This document describes the network topology for the PLCs and distributed IO located in Hammer, a lab room at HVL. It is written for any student or employee at HVL who will be using the equipment.

There are two local networks, with different topologies; the "A" network with ring topology (Siemens Media Redundancy Protocol) and local static IP addresses only, and the "B" network with star topology (simple switch) where DHCP is also allowed.

The intent of this setup is to:

- Make all the PLCs available to each of the 5 desktop PCs on the "B" network.
- In turn put this LAN on a school LAN, access PLCs from anywhere on campus
- Share data between PLCs on the "A" network.
- Teach topology

Addressing

192.168.XX.YYY

All local IP addresses at the Lab are on the following form: 192.168.xx.yyy. The xx numbers shall be 10 or 11 depending on network "A" or "B", the yyy numbers 101-199 are reserved for PLCs and distributed IO, 80-99 are reserved for PCs.

The "A" network uses xx = 10, the "B" network uses xx=11. The PLC's are numbered from left to right, with the six S7-1500 PLC's numbered from 101 to 106, the Beckhoff PLCs from 107 to 108, the TP-700 panel is 109, the profinet IO is 151 and the ET200S PLC for the conveyor is 110.

Name	Type	"A" address (node)	"B" address (node)	Profibus available	Note
A101	S7-1500	192.168.10.101 (A101)	192.168.11.101 (B101)	Yes	
A102	S7-1500	192.168.10.102 (A102)	192.168.11.102 (B102)	Yes	

A103	S7-1500	192.168.10.103 (A103)	192.168.11.103 (B103)	Yes	
A104	S7-1500	192.168.10.104 (A104)	192.168.11.104 (B104)	Yes	
A105	S7-1500	192.168.10.105 (A105)	192.168.11.105 (B105)	Yes	
A106	S7-1500	192.168.10.106 (A106)	192.168.11.106 (B106)	Yes	
CX-16A464	CX5020	192.168.10.107 or DHCP (A107)	192.168.11.107 or DHCP (B107)	No	"A" port is not double, not part of Siemens MRP.
CX-?	CX5140	192.168.10.108 or DHCP (A108)	192.168.11.108 or DHCP (B108)	Yes	"A" port is not double, not part of Siemens MRP.
TP700	TP-700	192.168.10.109 (A109)	192.168.11.109 (B109)	Yes	Only one double port available.
ProfinetIO	IM	192.168.10.151 (A151)	Not used	No	Only one double port available.
Conveyor	ET200S	192.168.10.110 (A110)	Not used	No	Used for Conveyor.
ProfibusIO	IM	Not used	Not used	Yes	See Profibus Network for addressing
IBH Link UA	OPC UA Server/Client		192.168.11.201 (ports 2-4)	No	Port 1 is DHCP (to external network)

On the S7-1500 PLC's there are two Profinet connections, X1 and X2, where X1 has two ports. X1 is reserved for the "A" network, X2 is reserved for the "B" network.

Note! The TP-700 has only one profinet connection, X1, with two ports. This can be configured for either the "A" or the "B" network, but not both at the same time.

The Beckhoff PLCs have two ports. X000 is reserved for EtherCAT communication with the distributed IO EtherCAT coupler. The X001 connection is reserved for the "B" network with DHCP.

Note! The Beckhoff CX5020 PLC is mostly not included at all in the "A" network.

Warning! Do not operate equipment remotely. Minimize danger, and maximize safety, by always being present at Hammer when operating machinery there.

The "B" Network

On this network, PLCs are connected to a hub (including WiFi), which in turn can be reached from a PC through this hub. The IBH OPC UA Link is also connected to the hub.

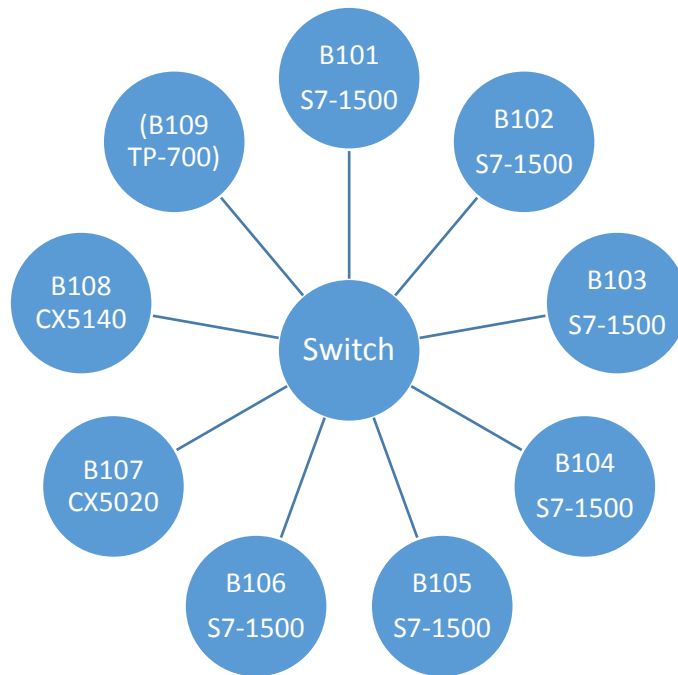


Figure 1 The "B" network with star topology. A simple "office network". Used for connecting PC's to PLC's for download and monitoring.

The hub is a simple switch with a WiFi router, same as in any office or home network. The sole purpose of his "B" network is to make the PLC's available for download and monitoring.

Feel free to disconnect a PLC from the "B" network if you want to connect directly to it instead. The remaining network will still work just fine.

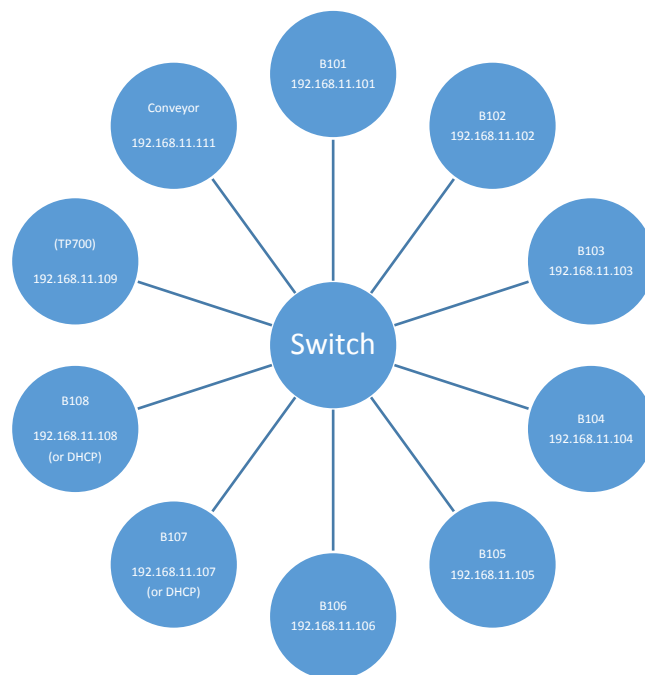


Figure 2 Addresses for the "B" network.

Default username and password for the connected WiFi router is found on its back.

The “A” Network

On this network, the Siemens equipment is connected in a ring using the double X1 ports. Node A101 (the S7-1500 PLC on the far left side of the wall) is the default manager in the MRP setup.

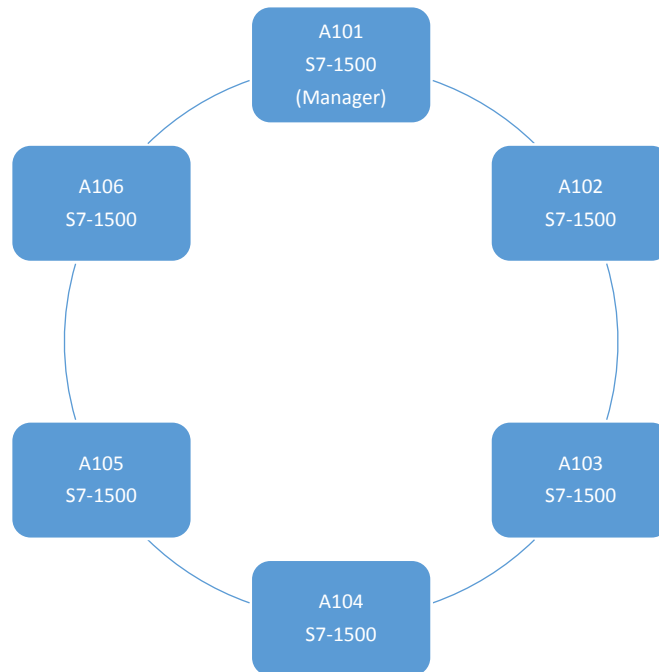


Figure 3 The "A" network with ring topology. Used for teaching topology. To be used for sharing data between PLCs.

The addressing for the “A” network is shown below.

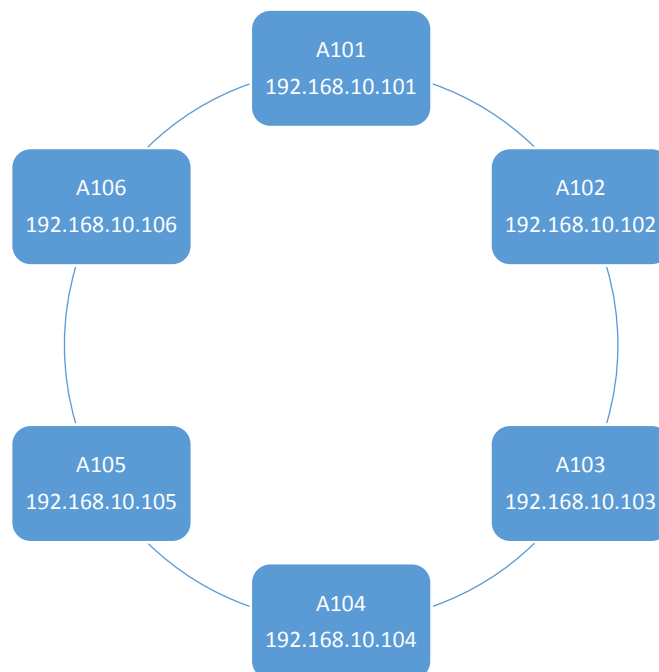


Figure 4 Addresses for the "A" network.

At a later stage, the Beckhoff PLCs are hopefully to be connected to “A” ring using a two-port profinet module EL6631.

Profibus Network

The profibus network is only intended for one-to-one or line communication. No additional hardware for creating other profibus topologies is available at the lab for the time being. Only 2-wire RS485 cable (the purple ones) with possible daisy-chain is available. The master node shall use profibus address 1 and the following nodes on the line shall have increasing numbers from 3 to 125 (0, 2, 126, 127 is reserved for future use).



Figure 5 Addresses for profibus network

EtherCAT Network

The EtherCAT network can be line or ring. For star network, quality switches should be purchased.

HVL LAN

FOR FUTURE USE.

The B network is setup using two simple switches (to get enough ports). One of these ports is connected to a SCALANCE S623 gateway which in turn is connected to local school network at HVL.

Addresses:

This makes the B network available around campus. It does not offer super duper security, but it is expected to avoid any random connection to the lab.

“It is still demanded that machinery is only operated while present at the lab. Disconnect any power cords to machinery before leaving the lab.”

OPC UA

The IBH Link UA is connected to the switches on port 2. Its ports 2-4 are for locale use. These all use the same address 192.168.11.201. Port 1 is DHCP, to be connected to external network. Its function is to add OPC UA functionality to the S7-1500 PLCs, enabling MES and ERP systems (or SCADA).

UaExpert is recommended for debugging.

Using TIA portal, 32 indexes/slots can be configured on the link, hence only one address needed. Index 2 (default) is reserved for IE card. See available documentation online from vendor for more information, manuals, guides and examples.

Notes

Keep in mind.

X1 and X2 ports are separated

On the S7-1500 (S7-1516-3) the X1 and X2 ports are separate, using xx=10 and xx=11. To configure IO connected to a S7-1500 PLC's A network, connect your PC to the A network as well. To do this, disconnect a port on the A network and borrow this port for your PC while you configure the IO device (i.e. IP address and device name). Be sure to re-connect the port you borrowed after configuring the IO device.

Web-Visu

Feel free to mess around with Web-Visu to get your TwinCAT visualization (Beckhoff HMI) available on the "B" WiFi network. Connect any wireless device with a browser, e.g. tablet, phone or PC.