Industrial Ethernet Training 05

Setting up an O-Chain network structure with Weidmueller switches

Abstract:

Setting up a communication redundancy such as an O-Chain in your network helps to protect critical links against network failures and keeps network downtimes at a minimum. This redundancy in your network allows you to set up redundant loops resulting in a network with backup data transmission routes in the event of an abrupt failure such as a disconnected or damaged cable. This application note provides an example configuration of an O-Chain redundancy in a network.

Hardware reference

No.	Component name	Article No.	Hardware / Firmware version
1	IE-Training Kit-01	2881730000	1.1.2 (Build 125086)
2			
3			

IE-Training Kit Content

No.	Component name	Article No.	Hardware / Firmware version
1	IE-SR-4TX	2751270000	1.4.7
2	IE-SW-AL08M-8TX	2682280000	1.08
3	IE-SW-AL05M-5TX	2682250000	1.14
4	IE-CS-MBGW-2TX-1COM	2682600000	3.11

Software reference

No.	Software name	Article No.	Software version
1			
2			
3			

File reference

No.	Name	Description	Version
1			
2			

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Content

1 Warning and Disclaimer

Warning
Controls may fail in unsafe operating conditions, causing uncontrolled operation of the controlled devices. Such hazardous events can result in death and / or serious injury and / or property damage. Therefore, there must be safety equipment provided / electrical safety design or other redundant safety features that are independent from the automation system.

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In order to protect equipment, systems, machines and networks against cyber threats, it is necessary to implement (and maintain) a complete state-of-the-art industrial security concept. The customer is responsible for preventing unauthorized access to his equipment, systems, machines and networks. Systems, machines and components should only be connected to the corporate network or the Internet if necessary and appropriate safeguards (such as firewalls and network segmentation) have been taken.

2 Prerequisites for doing

You need to have the following hard- and software and documentation

- Industrial Ethernet Training Kit
- Application Note Industrial Ethernet Training 01 “Setting up default configuration of IE Training Kit” for applying default IP address configuration

3 Why O-Chain?

O-Chain is a feature used to connect Weidmüller switches in a redundant way to any existing Ethernet network/topology. When using O-Chain, the user just has to connect the Weidmüller switches in a daisy chain and then simply link the two ends of the chain (edge switches) to the existing Ethernet network in order to provide the redundancy. In the event of a failure, the downtime using O-Chain can be as short as only 40 ms dependent on our complete network configuration. The basic setup for this feature is very similar to a Daisy Chain network, where we connect all the devices in a chain, but in this case, we also define so called *Edge Ports* that are the ones connected to the existing network. This existing network can be a simple Daisy Chain or an O-Ring network or even a third-party network using Rapid Spanning Tree Protocol (RSTP) or any other redundancy protocol. Possible scenarios can look like the following depicted networks.

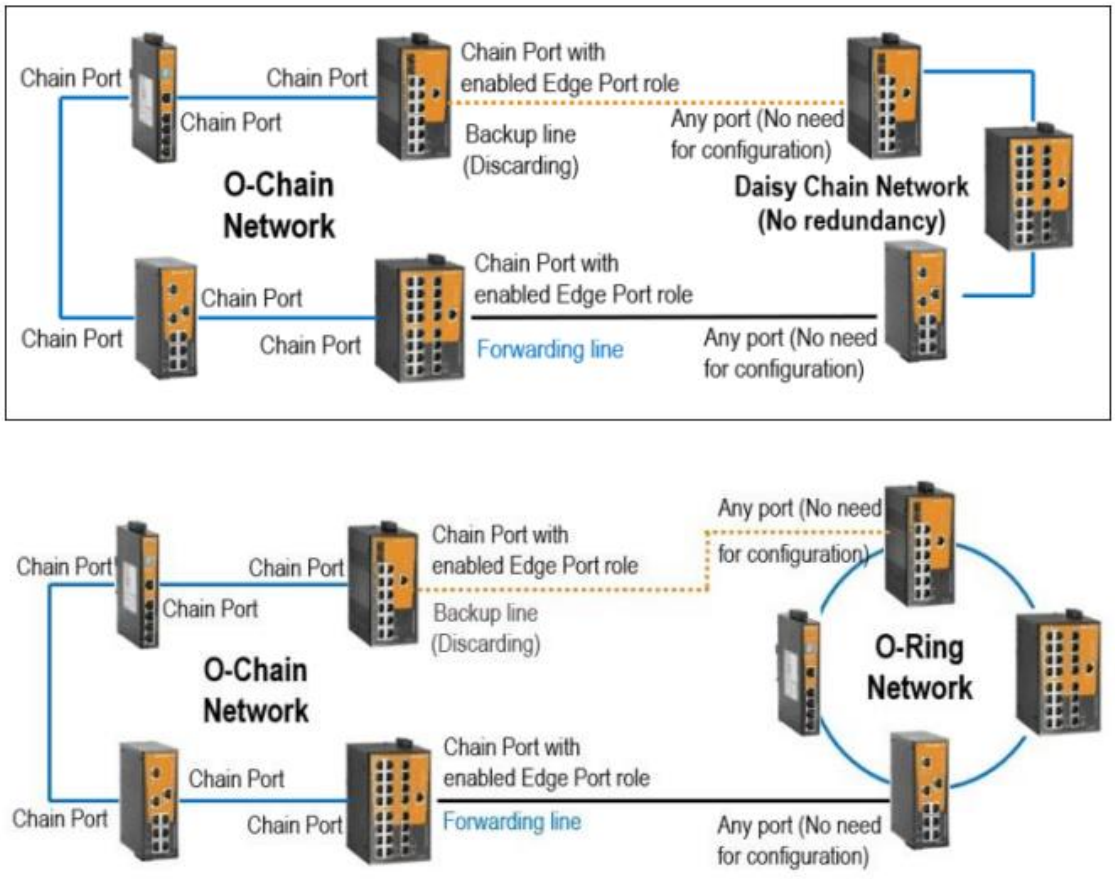

Figure 1: Example setup of O-Chain redundancy

Further terminology and an example configuration will be explained in the following Application Note.

4 O-Chain configuration

Since our Training Kit provides three switches, we will use these as an example for a configuration of O-Chain without the existing Ethernet network that we should have when configuring O-Chain as shown in the pictures above. First of all, please disconnect all cables and **only** connect your computer via Ethernet cable to your 8-port managed switch or connect to any of your router's LAN port and the router must be connected to the switch. Furthermore, connect the two 5-port switches on the Training Kit in a chain topology to the 8-port switch, one by one. By that, we do not have any interference when configuring our O-Chain topology.

1. Now, as we have everything disconnected, we connect to the 8-port managed switch. Make sure your setup, including computer and possibly router, are in the same network and then connect to the web interface with the IP *192.168.1.20* by typing it into the browser's URL field and logging in with the default credentials.

Figure 2: Entering switch IP for web interface

2. For the configuration settings, we navigate the menu tree to "*Redundancy*" and then select the option "*O-Chain*". First of all, enable the chain redundancy protocol by selecting "*Enabled*" in the drop-down menu "*Chain Redundancy*". Then, we select the port in which the left 5-port switch is connected to by selecting in in the drop-down menu (in our case: Port 02). Moreover, select an unused port which will be our edge port, but we will configure this later on. You should now see the status saying "*Broken*".

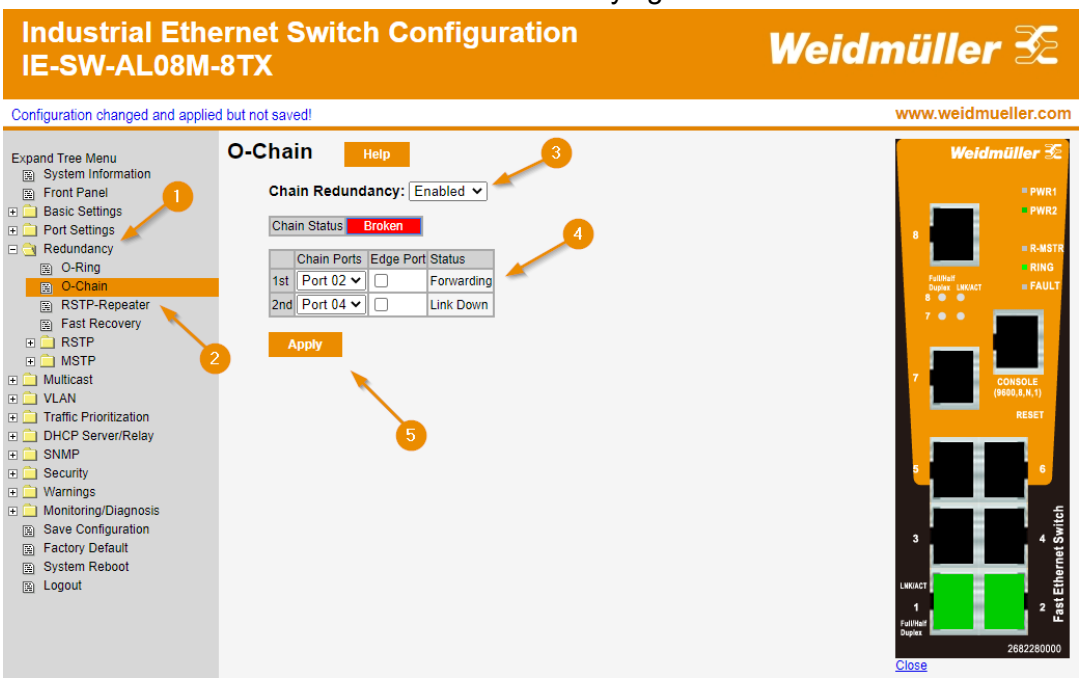

Figure 3: 8-port switch O-Chain redundancy settings

4.1 O-Chain configuration 5-port switch

1. The next devices in the topology are the 5-port switches next to our 8-port managed switch. We repeat the procedure explained beforehand by typing in *192.168.1.30* or *192.168.1.40* in the URL field.

2. Next, we once again navigate the menu tree as we did in the 8-port switch to "*Redundancy*" and then "*O-Chain*". Subsequently, we repeat once again the steps from before. First, activate the chain redundancy and then choose the two ports where the device is connected to the 8-port and to the 5-port switch (in our case: Ports 01 and 02) and hit *Apply*. Note that the status still remains "*Broken*".

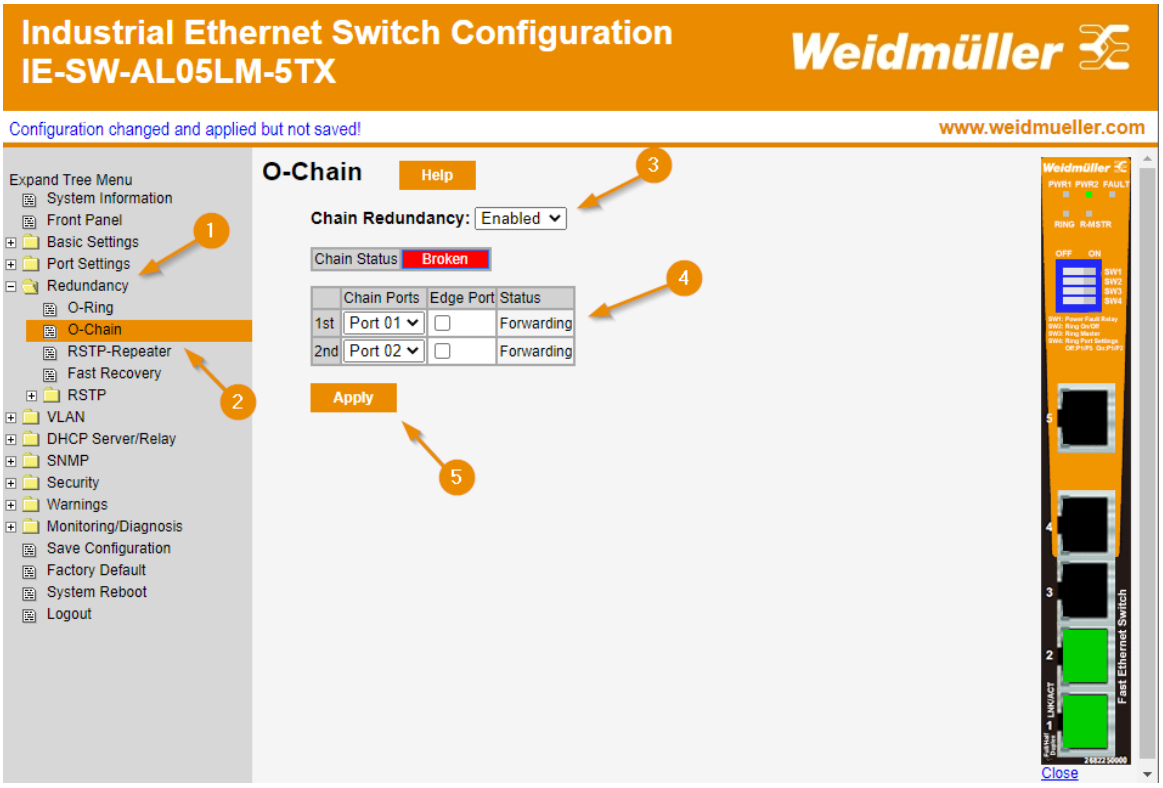

Figure 4: O-Chain configuration for 5-port switch

*Repeat this procedure step by step for **both 5-port** switches on the Training Kit.*

4.2 Configuring Edge Ports

As we have mentioned at the beginning, the whole redundancy feature relies on the function of the edge port working as a backup route for our data. This means, that we connect our 8-port switch to our second 5-port, which is on the “edge” of the Training-Kit to create this exact backup route. Before doing so, we must activate the edge port settings of the two switches. To configure this, we must once again go into the O-Chain settings.

1. First, we go to the switch O-Chain settings like we did previously. Now, activate for the unused port from before the “*Edge Port*” checkbox as we are going to connect our second 5-port switch to this port and hit *Apply*.

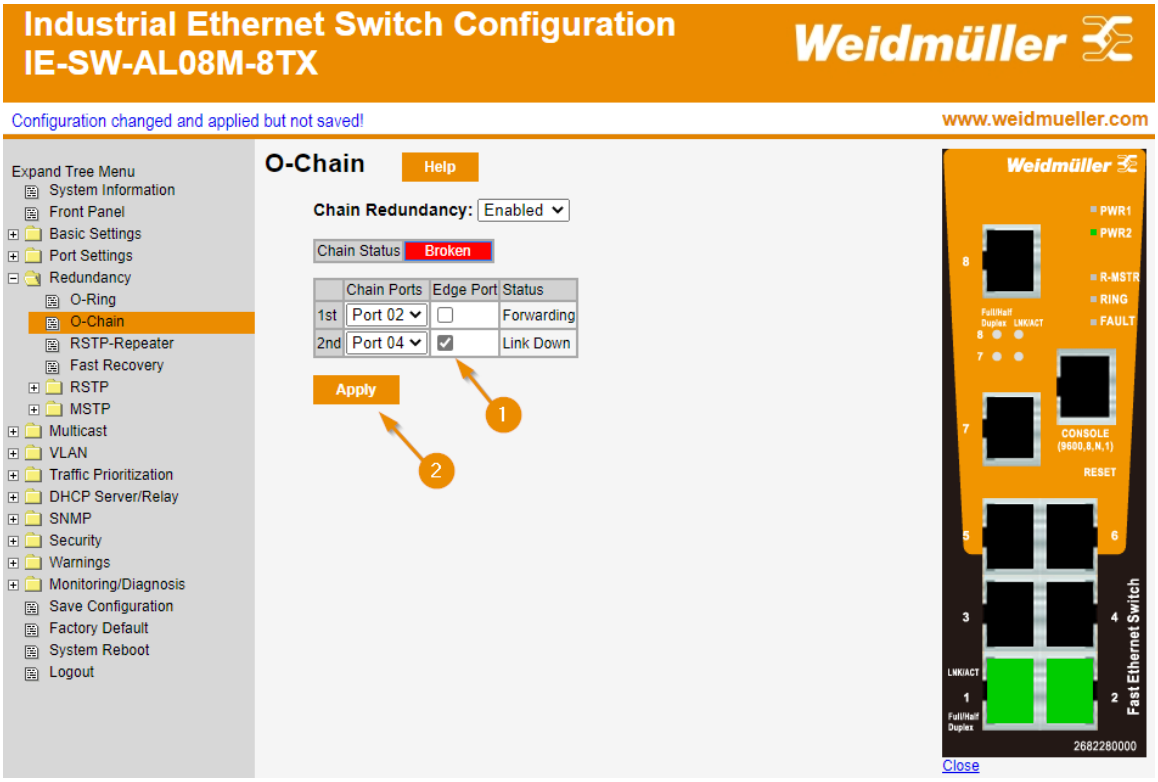

Figure 5: Activating edge port configuration

Once again, repeat this procedure for the second switch that is going to act as the edge switch of the chain (in our case the right 5-Port switch 192.168.1.40).

Now we have successfully configured a redundancy protocol. This is also displayed on the *System Information* menu and in the *O-Chain settings*.

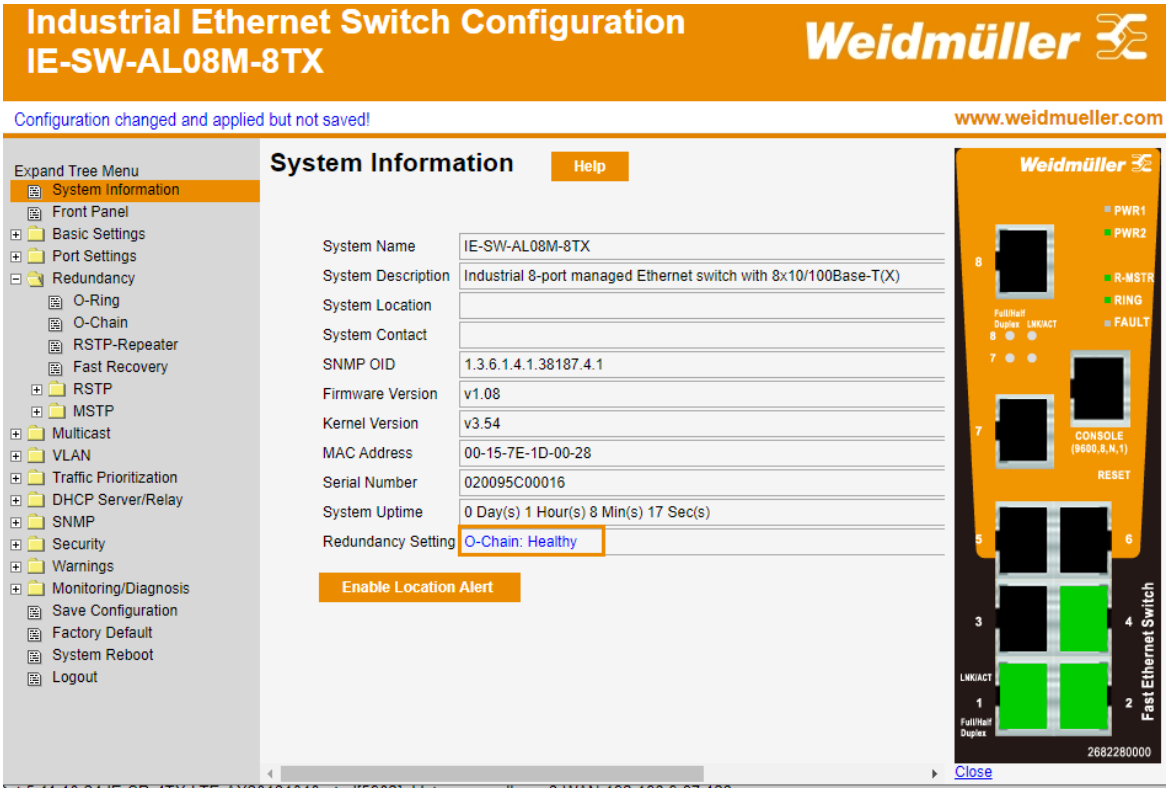

Figure 6: Healthy O-Chain settings

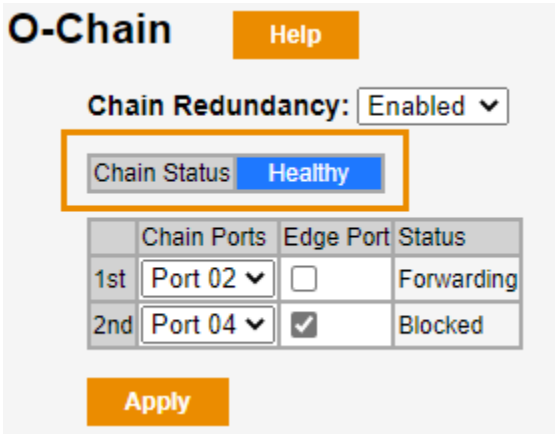

Figure 7: O-Chain status healthy

5 Results

We have now successfully setup the O-Chain redundancy feature of our switches to ensure a steady and stable data transmission with backup routes in case of a failure. Furthermore, we know how to configure our Edge Ports and how to use the O-Chain configuration in combination with non-redundant networks to ensure a secure operation of our devices.
We can send continuous ping messages from the computer to the 5-port “edge” switch (ping 192.168.1.40) and we can check that, even unplugging the connecting cable between the two 5-port switches, the ping messages are still properly received. Under this scenario (cable between 5-port switches unplugged), we can check that both the Chain and Port status of the switches shown in the O-Chain page change to “*chain broken*”. When plugging again the cable between the 5-port switches we can check that the status comes back to its previous conditions “*chain healthy”*.