Weidmüller

Industrial Ethernet Training 14

Network Ping Diagnosis

Abstract:
A ping (Packet Internet or Inter-Network Groper) is a basic Internet program that allows a user to test and verify if a particular destination IP address exists within or if it is reachable in the existing network and can accept requests in computer network administration. This application note explains IP addresses and how to use them for troubleshooting the network with the Ping command.

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

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Warning
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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 IP addresses

An IP address is an identifier for devices in a network. It might be compared to a postal address. Almost every device that participates as a member of a network has an IP address. However, there are devices, like unmanaged switches that do not have an IP address as they are working with MAC addresses. IPs are used for identifying the sender and to specify the destination of a packet or telegram.

3.1 Types of IP addresses

- Unicast addresses
  It identifies a unique node on a network and usually refers to a single sender or a single receiver.

- Multicast addresses
  It represents a group of IP devices and can only be used as the destination of a datagram.

- Broadcast addresses
  It is used to target all system on a specific network instead of every single device.

4 Internet Protocol version 4 (IPv4)

IP stands for **Internet Protocol** and **v4** stands for **Version Four** (IPv4). IPv4 was the primary version brought into action for production within the ARPANET in 1983.
IP version four addresses are 32-bit integers which will be expressed in decimal notation like our 8-port switch's IP for example: "192.168.1.20".

4.1 Parts of IPv4

- **Network part:**
  The network part indicates the distinctive variety that is appointed to the network. The network part conjointly identifies the category of the network that is assigned. In our case, our switch's network part (written in bold numbers) would be: "**192.168.1**.20"

- **Host Part:**
  The host part uniquely identifies the element on your network. This unique part of the IPv4 address is assigned to every host.
  For each host on the network, the network part is the same, however, the host part must vary. The switch's host part (written in bold numbers) is: "192.168.1.**20**." and the router's host part would be: "192.168.1.**10**"
  Note: if a device has multiple physical network interfaces, like our router having a WAN and LAN network interface, the network part may vary

- **Subnet mask:**
  The subnet mask divides the IP address into the network part and the host part. Local networks that have massive numbers of hosts are divided into subnets and subnet numbers are appointed to that. For example, a subnet mask of 255.255.255.0 allows to have 253 different devices assigned to your network, excluding the broadcast IP address "192.168.1.255" and the network's own IP of "192.168.1.0".

4.2 Characteristics of IPv4

- IPv4 is a 32-bit IP Address.
- IPv4 is typically a numeric address, and its bits are separated by a dot.
- It has Unicast, broadcast, and multicast style of addresses.

5 Internet protocol version 6 (IPv6)

IPv6 is the most recent version of the Internet Protocol (IP), which can solve the problem of IPv4 address exhaustion and allow the growth of the Internet (particularly in the era of the Internet of Things).

5.1 Advantages of IPv6

- Reliability
- Faster Speeds: IPv6 supports multicast rather than broadcast in IPv4. This feature allows bandwidth-intensive packet flows (like multimedia streams) to be sent to multiple destinations all at once.
- Stronger Security: IP Security, which provides confidentiality, and data integrity, is embedded into IPv6.
- Routing efficiency
- Most importantly it is a solution for growing nodes in global network.

5.2 Disadvantages of IPv6

- Due to the IPv6 addresses having numbers and letters, the complexity in the network topology increases
- Lack of backward compatibility causes confusion during the transition as every device and the network itself must be adapted to the new IP
- As of now, only one third of the internet supports IPv6 meaning it can cause accessibility, connectivity and compatibility issues

6 Ping IPv4

Ping is a network utility command line that is based on Internet control message protocol (ICMP) used in Windows command prompt (cmd) and OS X (Terminal). Ping in its basic form is a packet of data sent from a requester to a host, then the host sends a packet of data back to the requester, acknowledging the transaction. During this process the ping measures two aspects: packet-loss and latency

To ping an IPv4 address of a switch while another switch is connected to the computer, the following connections must be made initially:

Figure 1: Topology of the network

Operating PC

IE-SW-AL08M-8TX
http://192.168.1.20/

IE-SW-AL05LM-5TX
http://192.168.1.30/

6.1 Ping over Web front end

1. Connect your computer via ethernet cable to the switch's Ethernet interface port.

2. For the *"IE-SW-AL08M-8TX"* switch open a web browser and type in *http://192.168.1.20*. Navigate to *"Monitoring/Diagnosis"* and check into "*Ping*".

3. Type in the IP Address of the other switch (according to the image above, 192.168.1.30) and you will get the following results:

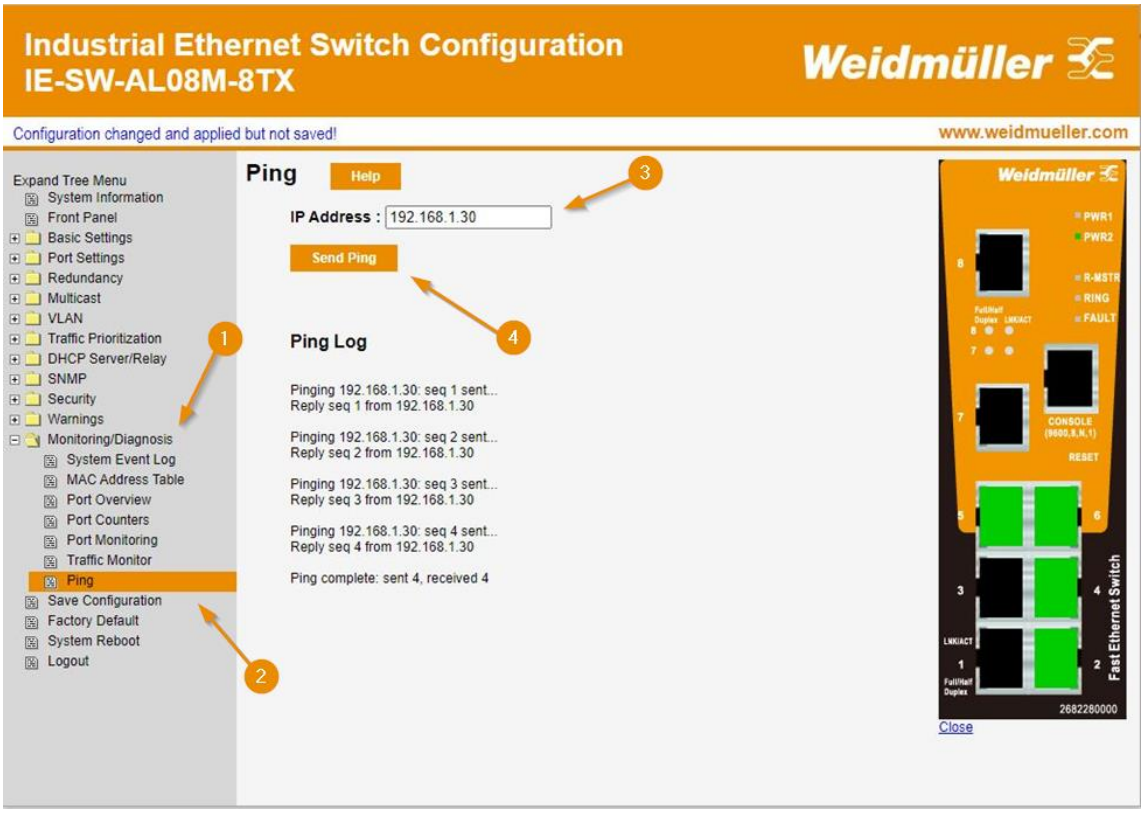

Figure 2: Pinging 5-port switch from 8-port switch web interface

6.2 Ping over Command Prompt

To ping an IP Address from your command prompt, follow these instructions:

1. Press the windows button and enter *“cmd”*. Then, *open* the application.

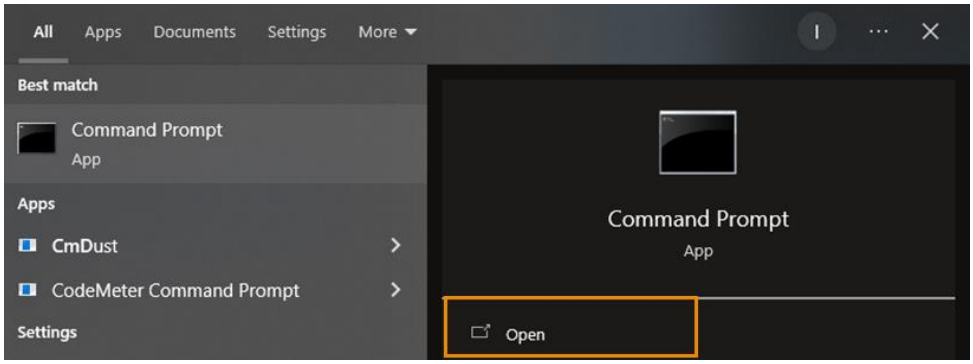

Figure 3: Open the Command Prompt

2. After opening the command prompt enter the command *“ping”* and the *destination IP* address separated by a space.

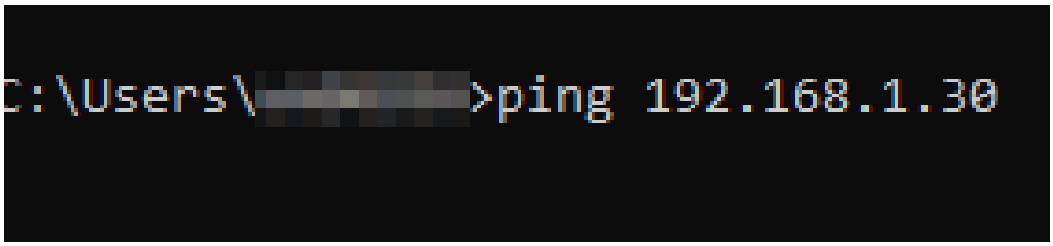

Figure 4: Ping over Command Prompt

3. As a result, 4 packets will be sent to the destination IP address. Underneath the ping statistics the details are displayed. These include the *numbers of packages sent, received, and lost*.

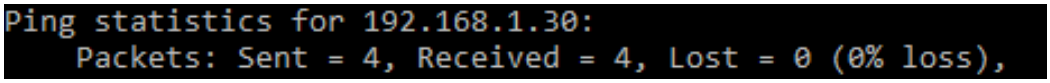

Figure 5: Lost/Received Packets

4. The last information displayed is the *latency* of the pings in ms. They are shown as a *minimum, maximum and an average* time for the packets to travel.

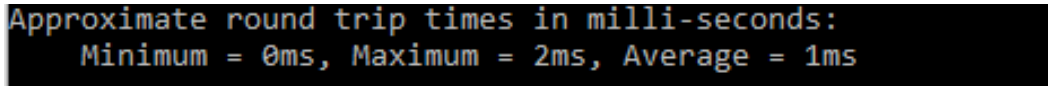

Figure 6: Latency of the Ping

7 Ping IPv6

To ping an IPv6 address, a certain setup needs to be done primarily:

1. Right-click on the icon indicated below and open *Network and Internet settings.*

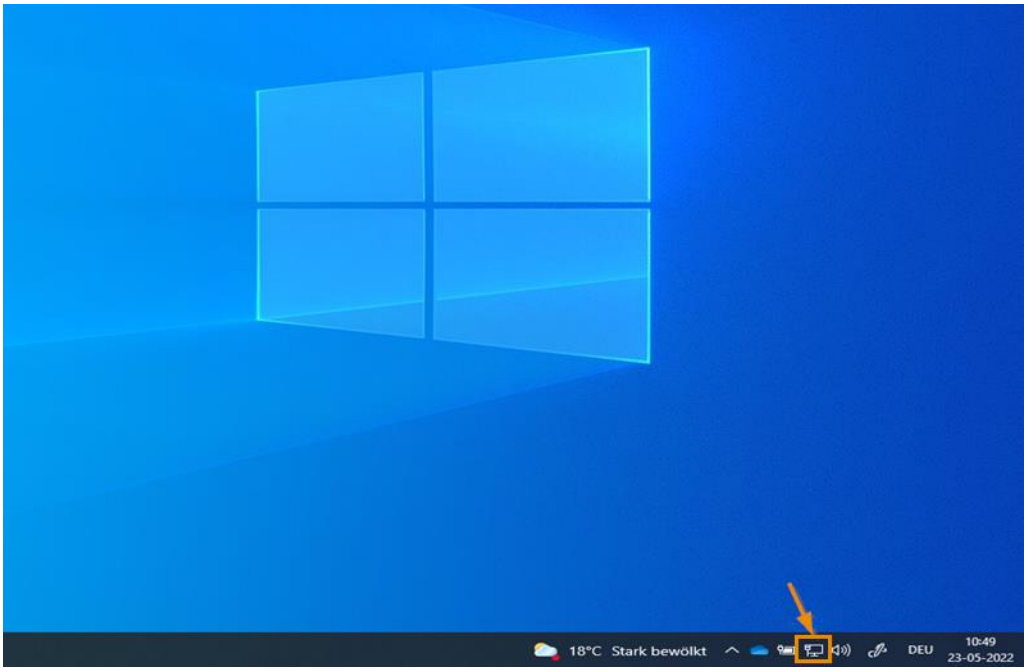

Figure 7: Opening Network Settings

2. Check in to *Change adapter options.*

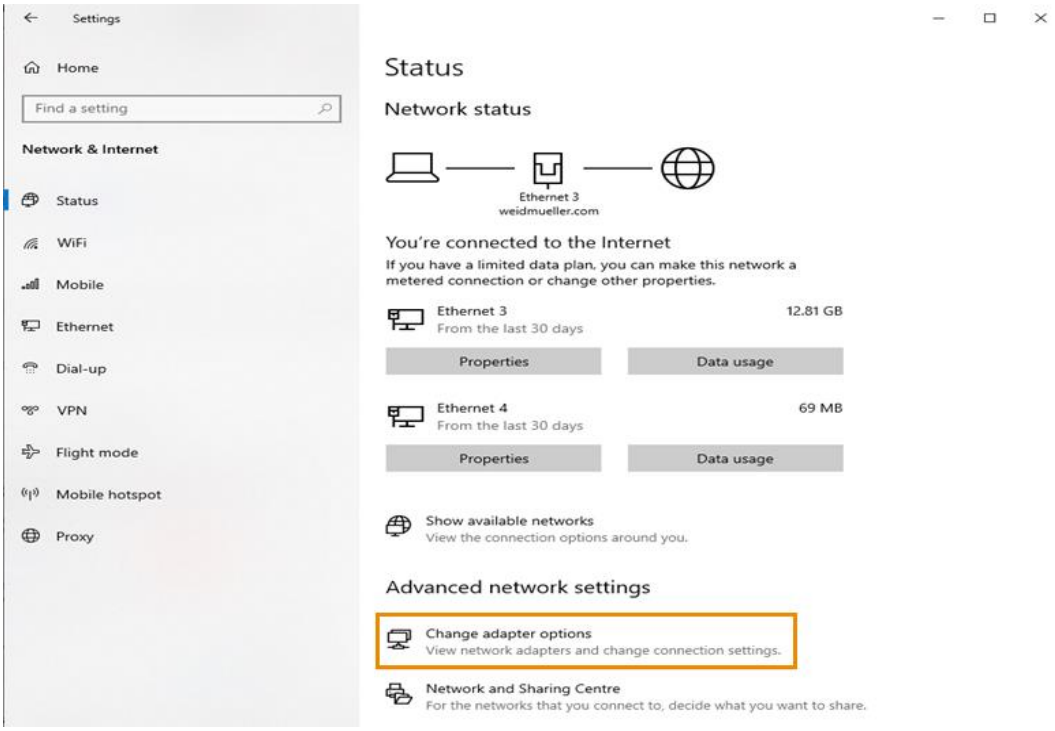

Figure 8: Opening the Change adapter options

3. Here, identify the ethernet that is connected to your switch. In case of multiple ethernets, please disconnect and reconnect the ethernet connected to the switch and you will notice which one is the required ethernet connection.

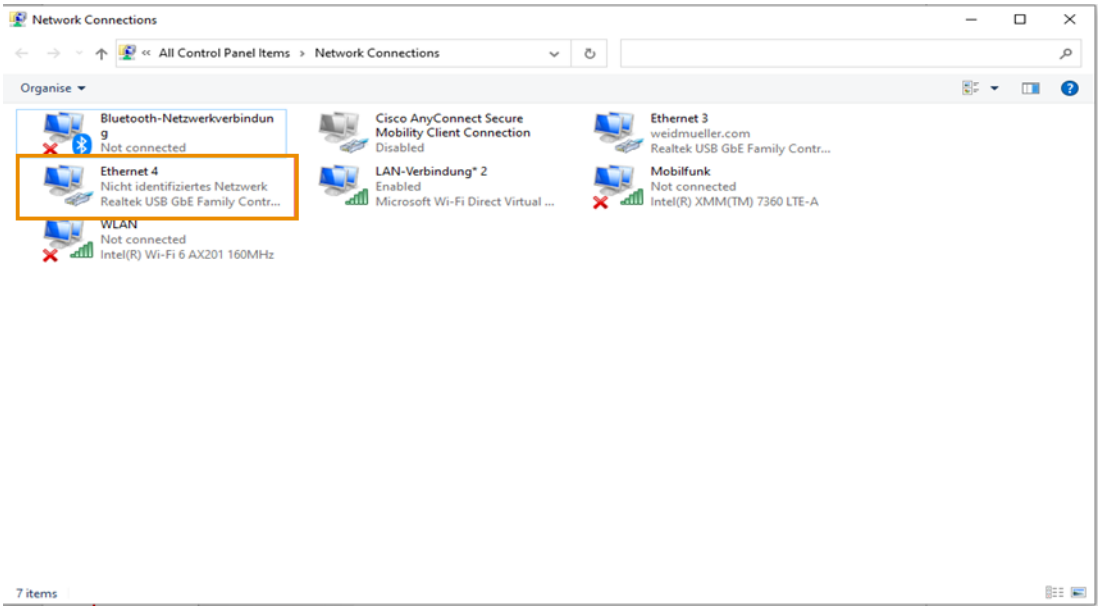

Figure 9: Ethernet connections

After right clicking on the ethernet connection (here, Ethernet 4), please go to "*Properties"*.

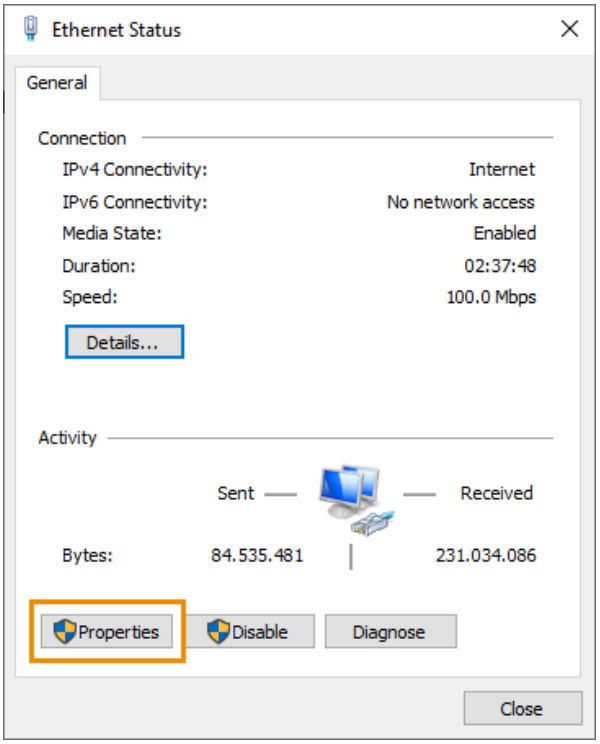

Figure 10: IPv6 properties

4. Now, double click on "*Internet Protocol Version 6 (TCP / IPv6)*".

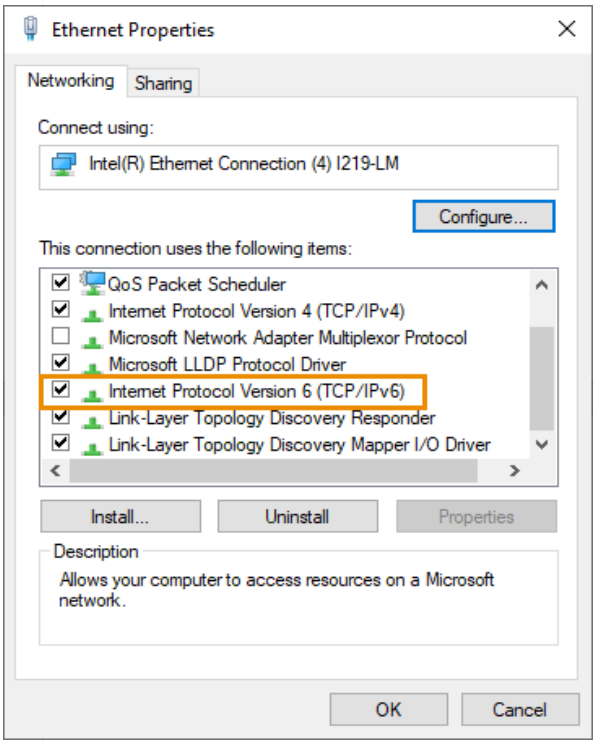

Figure 11: navigating to IPv6

5. Set the IP-address "`fd00::1`" as shown below.

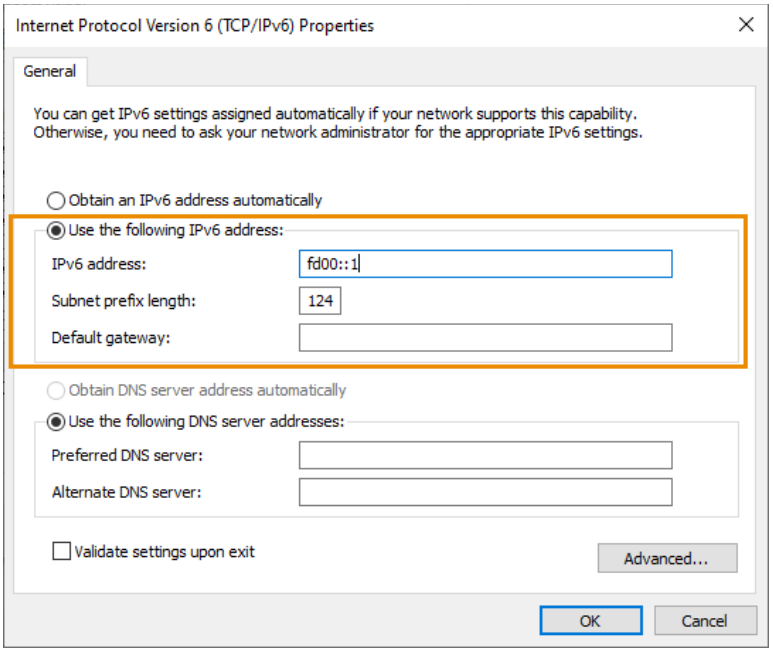

Figure 12: changing IPv6 address

6. To login to the interface of the switch, enter the IP address of the switch *"192.168.1.20"* into the browser's URL field.

7. To configure the IPv6 address, we need to navigate to *"Basic Settings"* and click on the option *"IPv6 Setting"*. Now, we can enter the following IPv6 address into the address field: *"FD00::2"* and "*Apply*" our new settings.

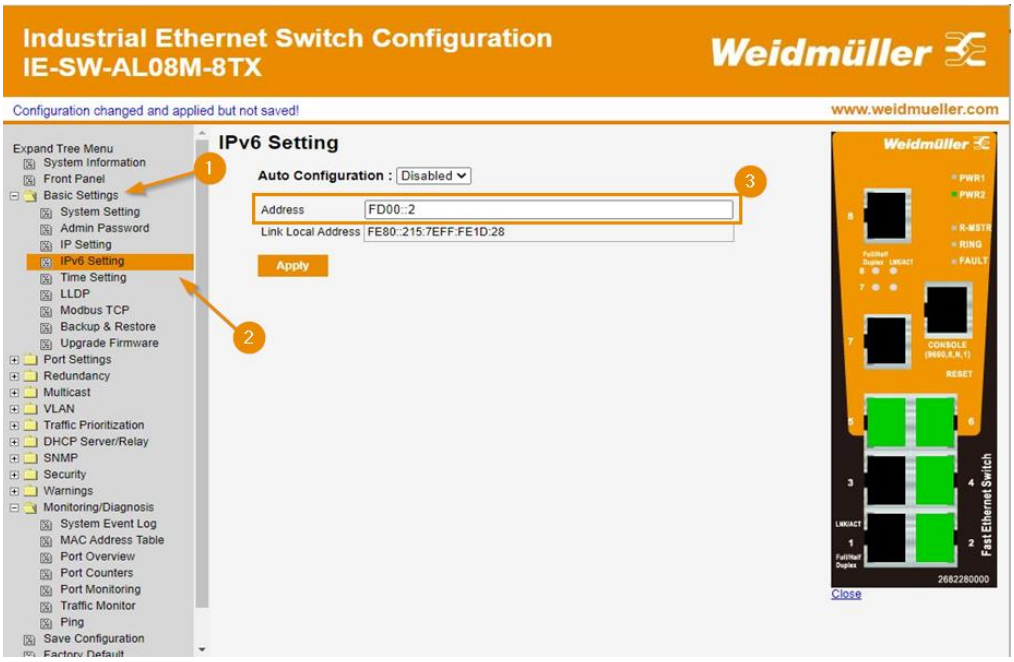

Figure 13: Changing IPv6 on 8TX-Switch

The browser now asks to reconnect to http://[FD00::2]. Hit *"OK"*.

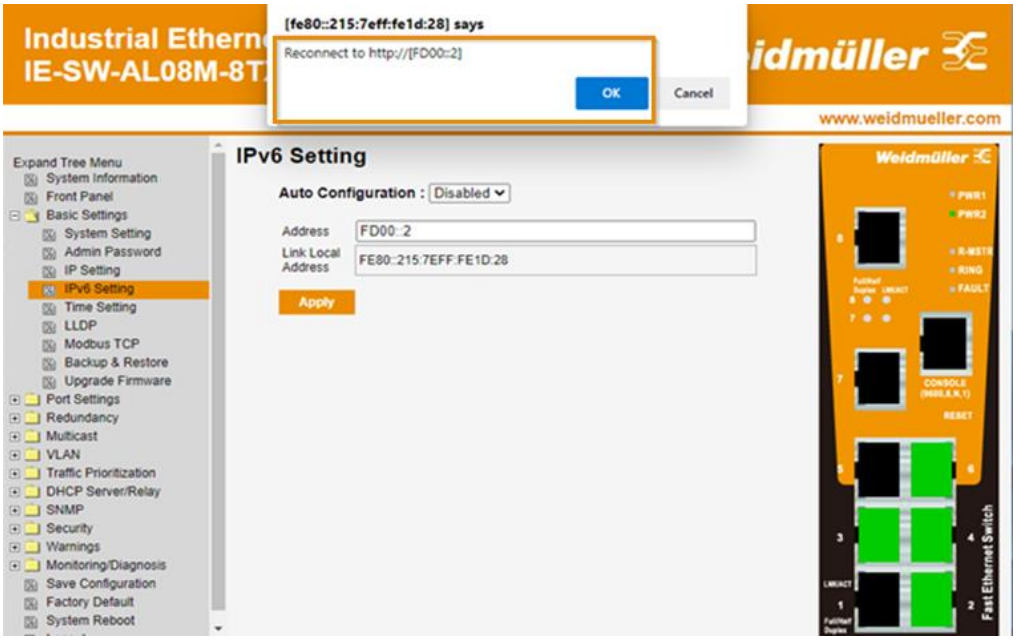

Figure 14: Reconnecting to Web frontend

8 Results

In this Application Note we have achieved the skillset to prepare a network for a Ping Diagnosis. The ping cannot run continuously but can be very helpful as a first step of finding problems in a network. E.g., we can check if there is traffic coming through our devices, meaning that we can detect a misconfigured/broken device in the network. Furthermore, we can generate intended traffic between devices in the network which can be used for various methods of network operations such as checking the traffic between the devices.

9 List of figures