

Routing with FL SWITCH GHS

Startup of GHS Layer 3 functions

AUTOMATION

Application note

8146_en_01

© PHOENIX CONTACT 2012-11-19



1 Description

Before you can use a gigabit modular switch in the Layer 3 environment, the following conditions must be met:

- a) the switch must be equipped with version 2.0 of the firmware (or higher),
- b) the Layer 3 license (FL SD Flash/L3/MRM (2700607)) must be installed

or the device concerned must have Layer 3 functionality pre-installed (FL SWITCH GHS 4G/12-L3, Order No. 2700786 or FL SWITCH GHS 12G/8-L3, Order No. 2700787).

The flash card referred to above can be used to

- a) save the switch configuration,
- b) operate the switch as a master in the MRP ring (according to IEC 62439),
- c) and use the Layer 3 functions of static routing and VRRP.

Before you can operate the switch in the Layer 3 environment, you first need to install the valid FW (FW update) and insert the flash card referred to above.



Figure 1 GHS with Layer 3 SD card



Make sure you always use the latest documentation.
It can be downloaded at www.phoenixcontact.net/catalog.



2 Startup of the layer 3 functions on the GHS

The sections below demonstrate various routing scenarios. In addition to port- and VLAN-based routing, an example of router redundancy is also provided. The relevant configuration settings are shown in the screenshots.

2.1 Scenario 1: Port-specific routing

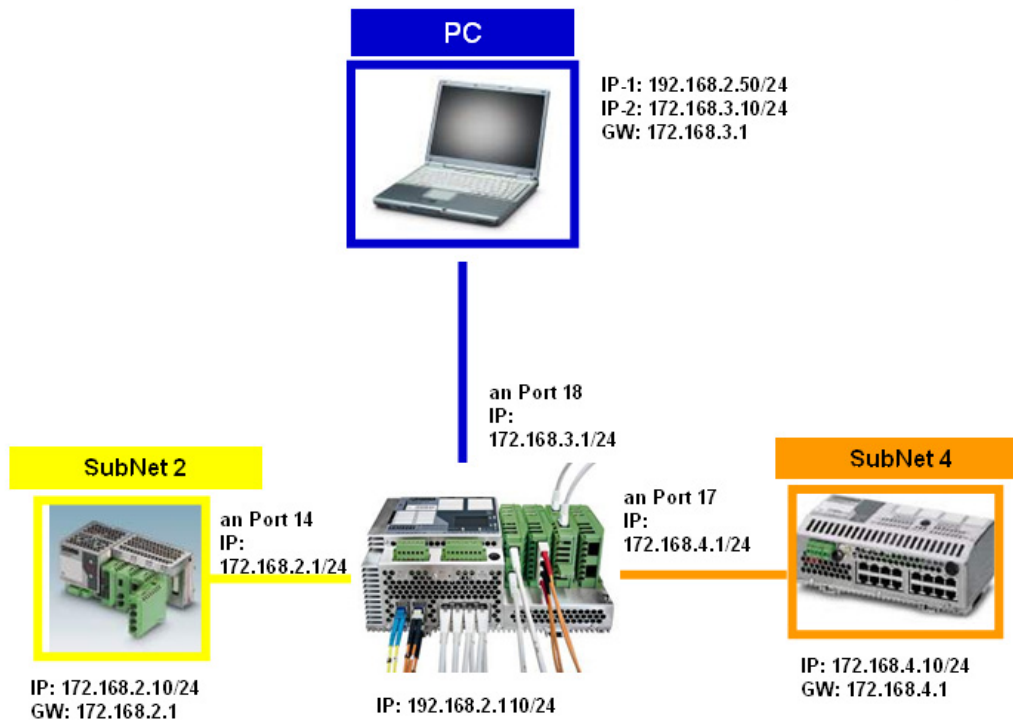


Figure 2 Scenario 1: Port-specific routing

Step 1:

The network contains a preconfigured network device (example: MMS including relevant settings, see Figure 3); the device is connected to port 14 of the GHS.

Name of Device	FL SWITCH MM HS
System Description	Modular Managed Switch (MMS)
Physical Location	Unknown
Contact	Unknown
IP Address	172.168.2.10
Subnet Mask	255.255.255.0
Default Gateway	172.168.2.1

Figure 3 MMS IP settings

Step 2:

The PC is located in the same subnetwork as the GHS; in the example, it is connected to port 18.

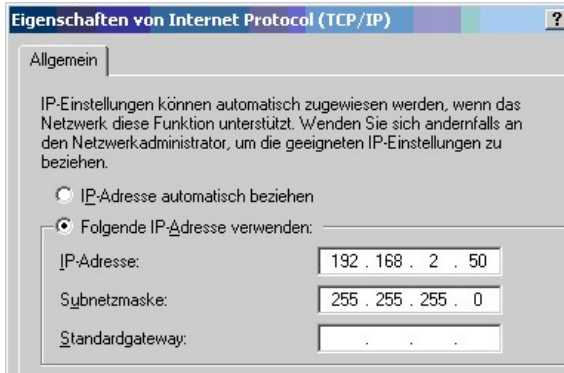


Figure 4 PC IP settings

The IP address of the GHS is 192.168.2.110/24 and it can be reached using WBM.

Hardware Version	01
MAC Address	00:02:BC:00:00:77
Device Name	FL-SWITCH-GHS
System Description	Modular Managed Gigabit Switch - Head Station (GHS)
Location	PHOENIX CONTACT
Contact	Martin Hecker
IP Address	192.168.2.110
Network Mask	255.255.255.0
Default Gateway	0.0.0.0
Temperature	43.0°C

Figure 5 GHS web page

Step 3:

Port 18 must be located in a different subnetwork.

In the context of routing, each port needs to be located in a different subnetwork, including the PC's connection port (port 18 in the example). This means that ports 18 and 14 need to be in different networks. Despite the fact that port 14 is located in network 172.168.2.x-network and the switch with the address 192.168.2.110 is located in a separate network, port 18 needs to be explicitly created in yet another network.

Given that we want to access the switch from the same PC network card, an additional IP address needs to be defined and activated on the card:

Network card -> Properties -> Advanced -> Add

The address of port 18 (172.168.3.1) must be entered for the GW so that the requests for the external subnetwork can be forwarded (see Figure 6).

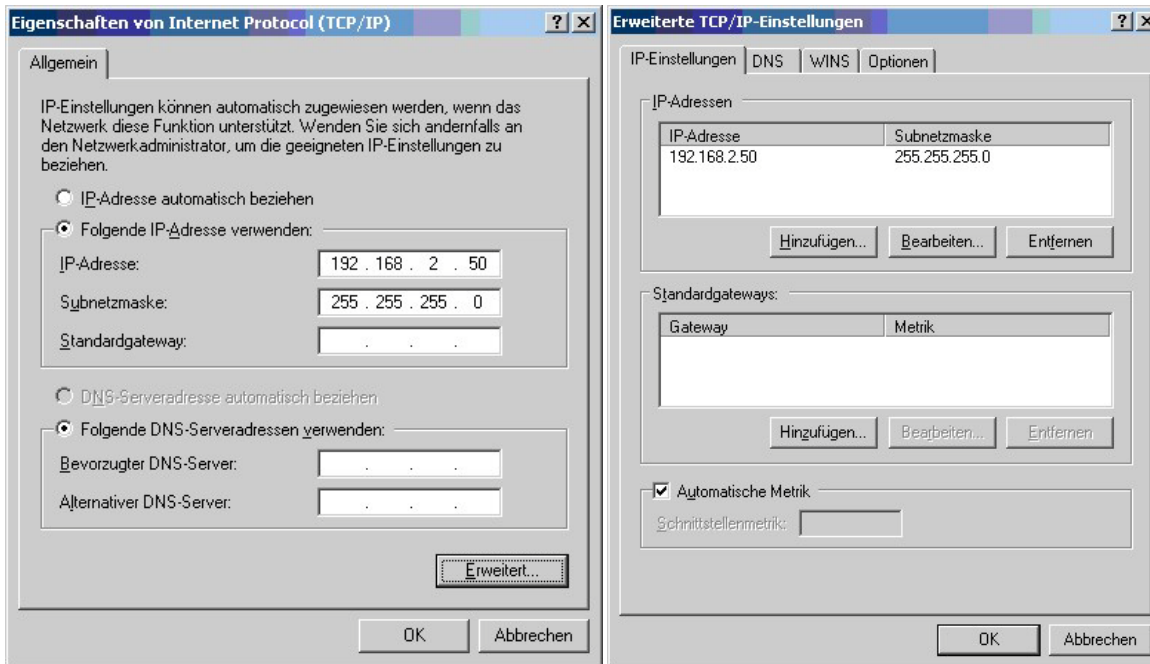


Figure 6 TCP/IP settings on the PC

An additional IP address must be set on the PC.

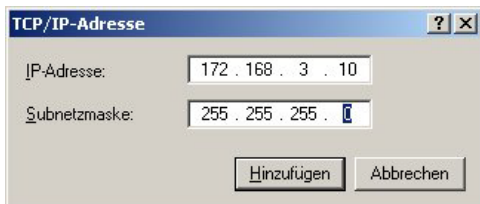


Figure 7 Additional IP address

The gateway address is likewise entered on the PC.



Figure 8 Additional IP for the default gateway

Once everything has been configured correctly, the configuration should look like this:

The first IP address on the network is 172.168.3.10/24 with 172.168.3.1 as the gateway and the second IP on the network card is 192.168.2.50/24

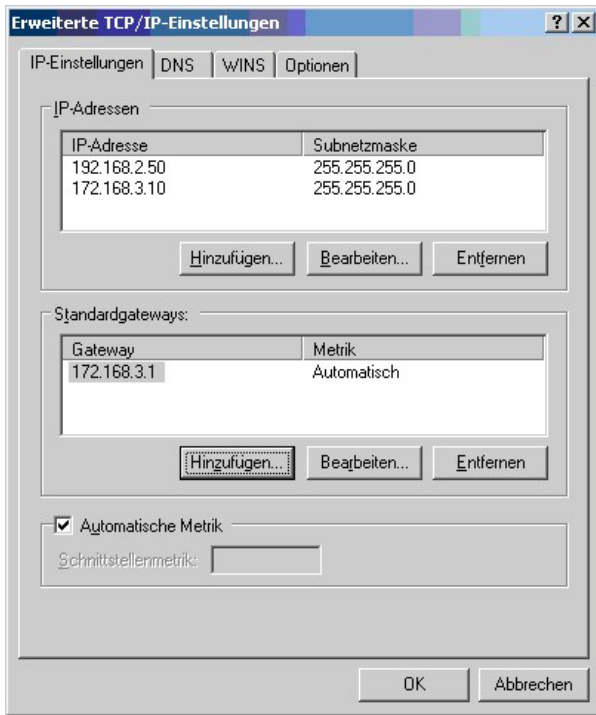


Figure 9 IP settings following correct configuration

Step 4

Assign the desired IP address and external subnetwork to port 18:

Routing -> IP -> IP Port Cfg

PortRouting mode: Enable

Enter the IP address: 172.168.3.1/24 in the example.

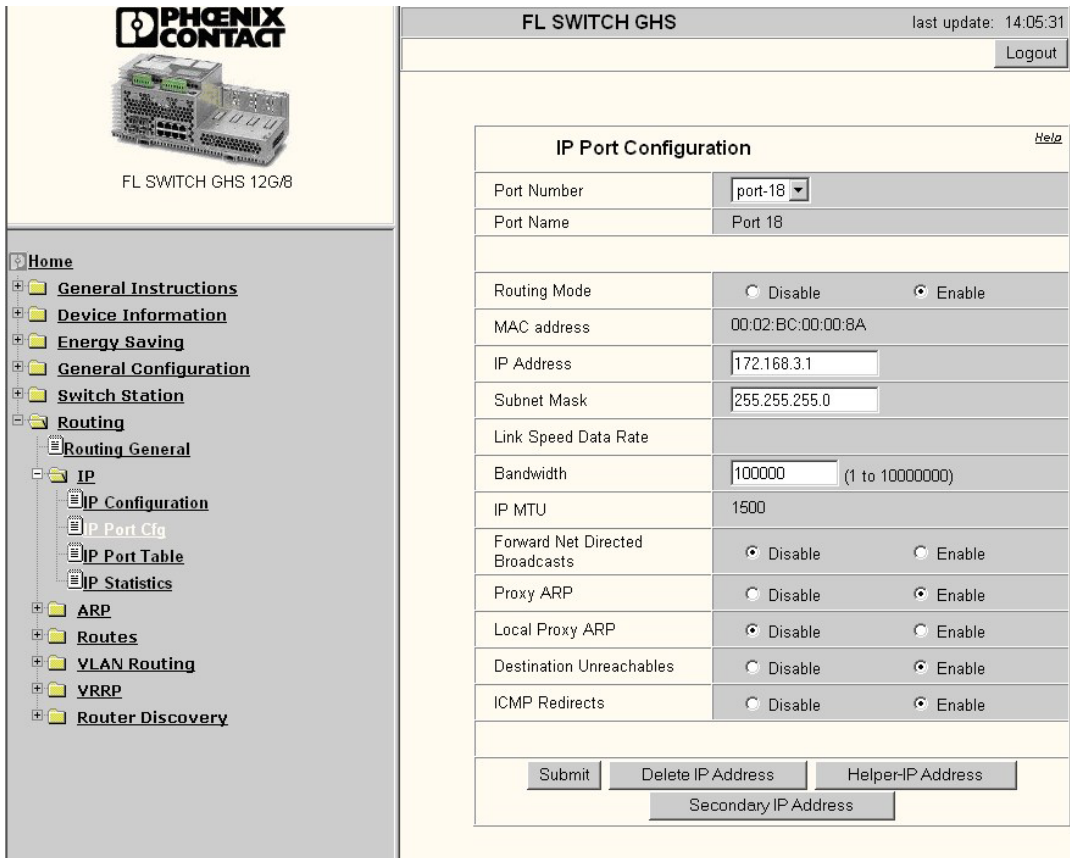


Figure 10 IP configuration of port 18

Once the parameters have been applied

1. the WBM of the GHS can only be reached via 172.168.3.1 and
2. the WBM of the GHS can still be reached via 192.168.2.110 if another port (e.g., 5) is selected on the switch.

Step 5

Configure port 14 with the device and assign the external subnetwork:

Routing -> IP -> IP Port Cfg -> PortRouting mode: Enable

Enter the IP address: 172.168.2.1 in the example

The screenshot displays the web management interface for a Phoenix Contact FL SWITCH GHS 12G/8. The main content area is titled "IP Port Configuration" and includes a "Help" link. The configuration form contains the following fields and options:

- Port Number: port-14 (dropdown menu)
- Port Name: Port 14
- Routing Mode: Disable Enable
- MAC address: 00:02:BC:00:00:86
- IP Address: 172.168.2.1
- Subnet Mask: 255.255.255.0
- Link Speed Data Rate: 100 Full
- Bandwidth: 100000 (1 to 10000000)
- IP MTU: 1500
- Forward Net Directed Broadcasts: Disable Enable
- Proxy ARP: Disable Enable
- Local Proxy ARP: Disable Enable
- Destination Unreachables: Disable Enable
- ICMP Redirects: Disable Enable

At the bottom of the form, there are buttons for "Submit", "Delete IP Address", "Helper-IP Address", and "Secondary IP Address".

Figure 11 IP configuration of port 14

The device WBM can be reached via the IP address (FL SWITCH MM HS in the example).

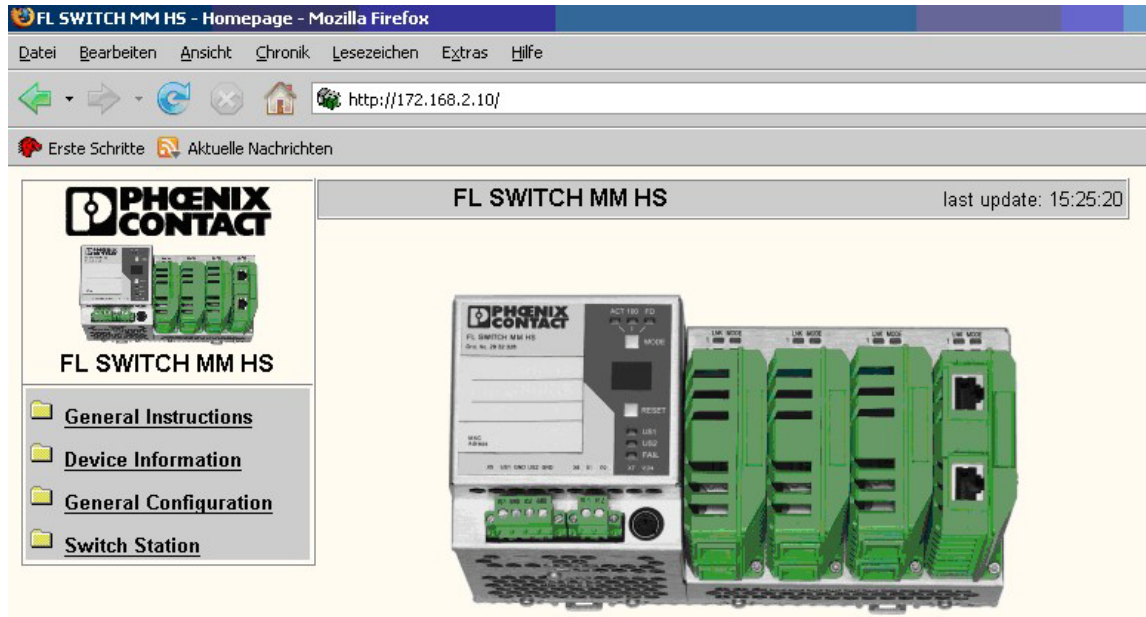


Figure 12 WBM for the connected device

The route that is currently set can be identified by selecting Routing -> Routes -> Current Routes.

Current Routes Help				
Total Number of Routes		3		
Network Address	Subnet Mask	Protocol	Next Hop Port	Next Hop IP Address
172.168.2.0	255.255.255.0	Local	port-14	172.168.2.1
172.168.3.0	255.255.255.0	Local	port-18	172.168.3.1
172.168.4.0	255.255.255.0	Local	port-17	172.168.4.1
<input type="button" value="Refresh"/>				

Figure 13 Current routes for the GHS

2.2 Scenario 2: VLAN-specific routing

If you want several ports of the GHS to belong to the same subnetwork, VLAN-specific routing is used.

Assumption: GHS can be reached via port 18, IP: 172.168.3.1/24

This involves repeating steps 1 to 4 (see page 2 ff).

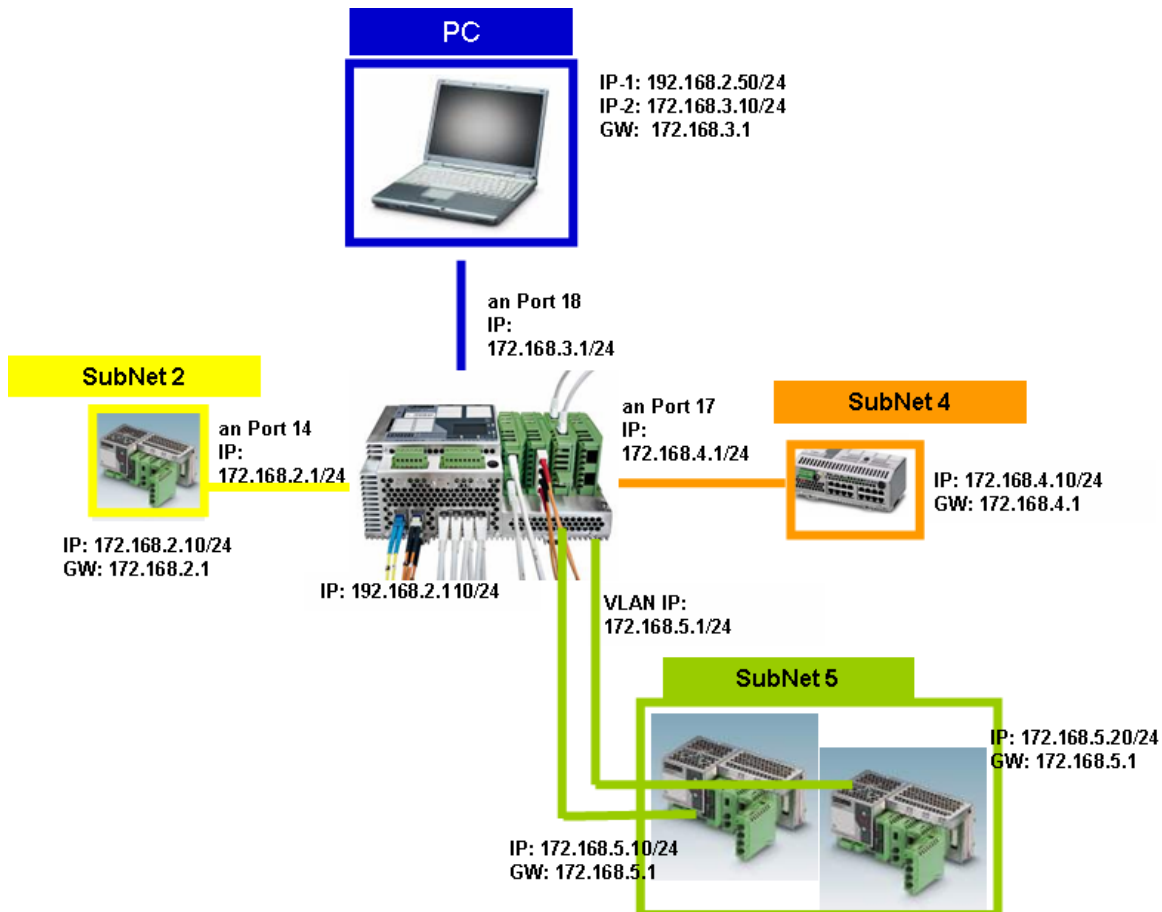


Figure 14 Scenario 2: VLAN-specific routing

Ports 19 and 20 are to form the VLAN; the devices with IPs 172.168.5.10/24 and 172.168.5.20/24 are connected to the specified ports.

Step 1:

Switch on the VLAN -> Enable Tagging.

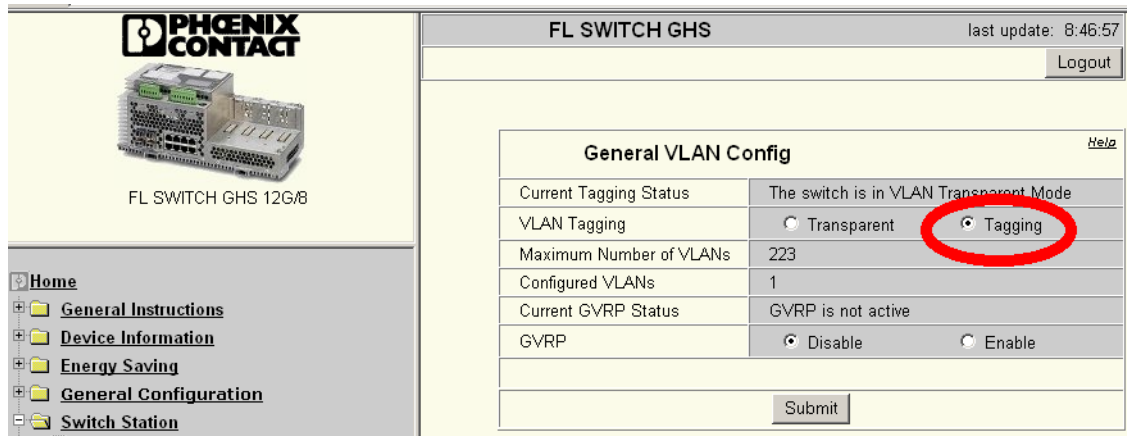


Figure 15 Enabling "Tagging" for the GHS

Step 2:

Assign the VLAN name ("Erweiterung" in the example) **AND** define the ports (whether "Tagged" or "Untagged", etc).

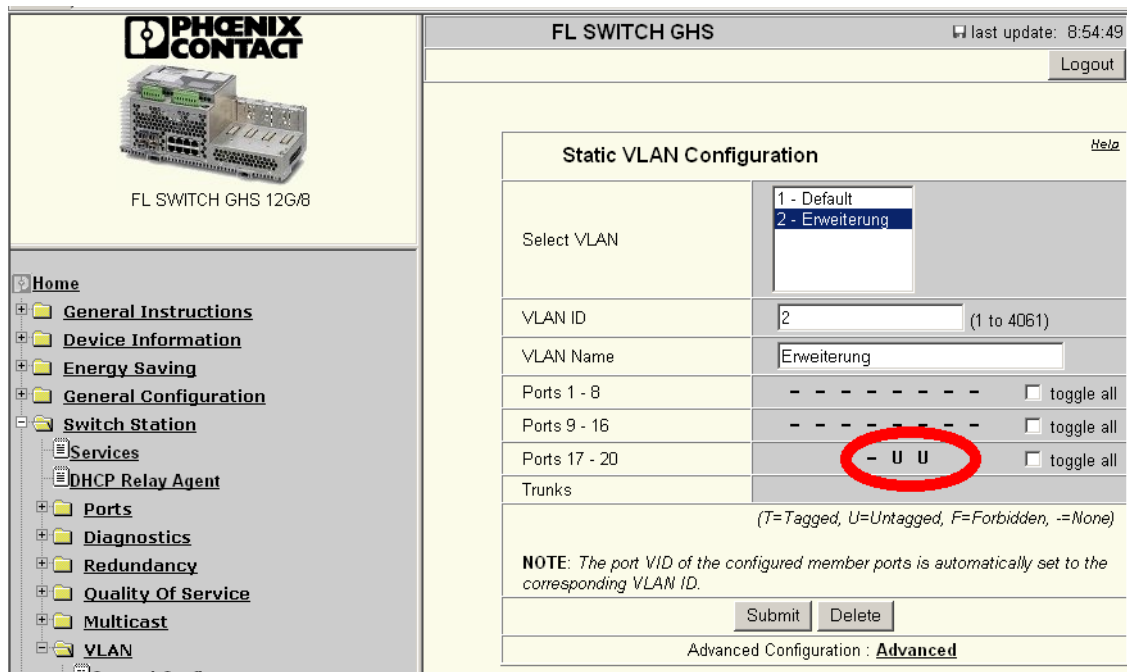


Figure 16 Defining the VLAN properties of the ports

Step 3:

Assign the selected ports to a VLAN ID; in this example, ports 19 + 20 are assigned to VLAN ID 2.

The screenshot shows the web interface for the FL SWITCH GHS 12G/8. The left sidebar contains a navigation menu with categories like Home, General Instructions, Device Information, Energy Saving, General Configuration, and Switch Station. The main content area is divided into two sections:

VLAN Port Configuration: This section shows a form for configuring a specific port. The 'Port Number' dropdown is set to 'port-19', which is circled in red. The 'Port Name' is 'Port 19', 'Port VLANID' is '2', and 'Port Priority' is '0'. There are radio buttons for 'Ingress Filtering' and 'GVRP Status', both currently set to 'Disable'. A 'Submit' button is at the bottom.

Current VLANs: This section displays a table of current VLAN configurations. The table has columns for VID, Status, Group, and MemberShip. Two VLANs are listed:

VID	Status	Group	MemberShip
1	Static / Management VLAN	Ports1-8	U U U U U U U U
		Ports9-16	U U U U U U U U
		Ports17-20	U U U U
2	Static	Ports1-8	- - - - - - - -
		Ports9-16	- - - - - - - -
		Ports17-20	- - - - U U

 The 'U U' entries for ports 17-20 in VLAN 2 are circled in red. A note below the table explains the symbols: '(T=Tagged, U=Untagged, -=Non Member)'.

Figure 17 Configuration of the VLAN ports

Step 4:

Assign an IP address to VLAN ID 2.

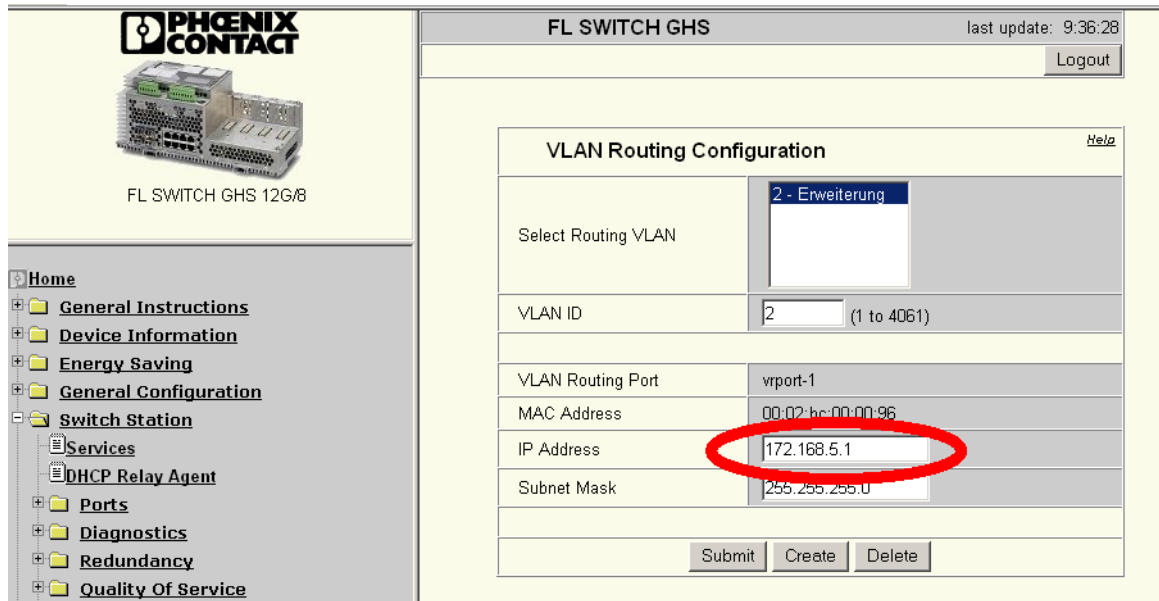


Figure 18 IP configuration of the VLAN

The switch assigns the VLAN routing port name to the VLAN ports, in this example: vrport-1. This also appears in the VLAN Routing Table.

The screenshot shows the 'VLAN Routing Table' with a 'Refresh' button below it. The table has the following data:

VLAN ID	Port	MAC address	IP Address	Subnet Mask
2	vrport-1	00:02:BC:00:00:96	172.168.5.1	255.255.255.0

Figure 19 The VLAN Routing Table for the GHS

2.3 Scenario 3: Static routing

Access one terminal from a PC via 2 routers.

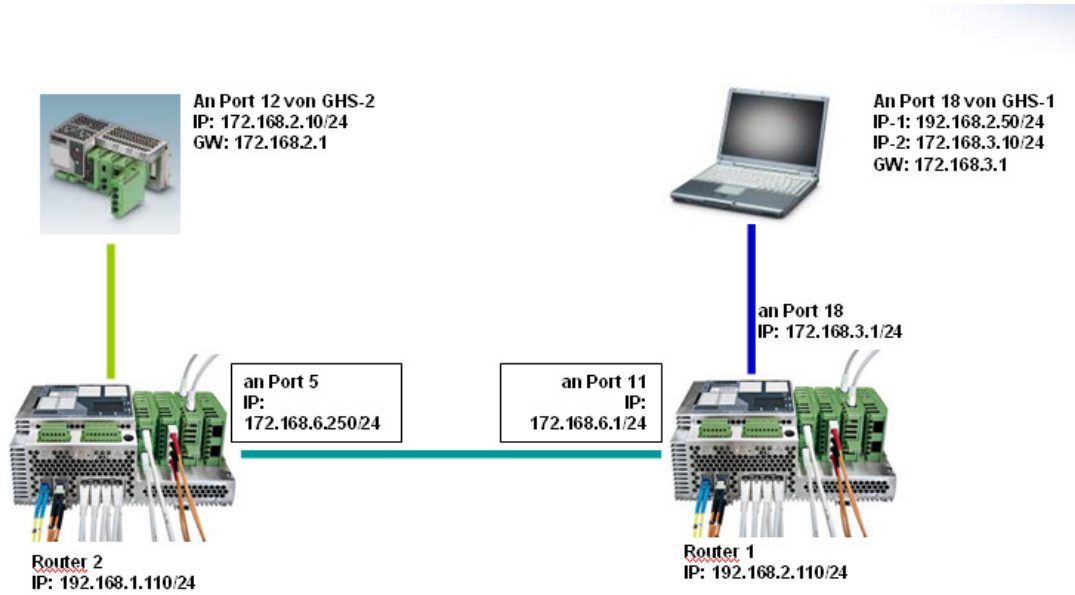


Figure 20 Scenario 3: Static routing

Assumption: PC connected to router 1 via port 18, port IP address: 172.168.3.1/24.

The terminal is connected to router 2 via port 12, port IP address: 172.168.2.1/24.

This involves repeating steps 1 to 4 (see page 2 ff).

Step 1:

Configuration of router 1:

Define port 11 of router 1 as the gateway: Assign the IP address and enable routing mode.

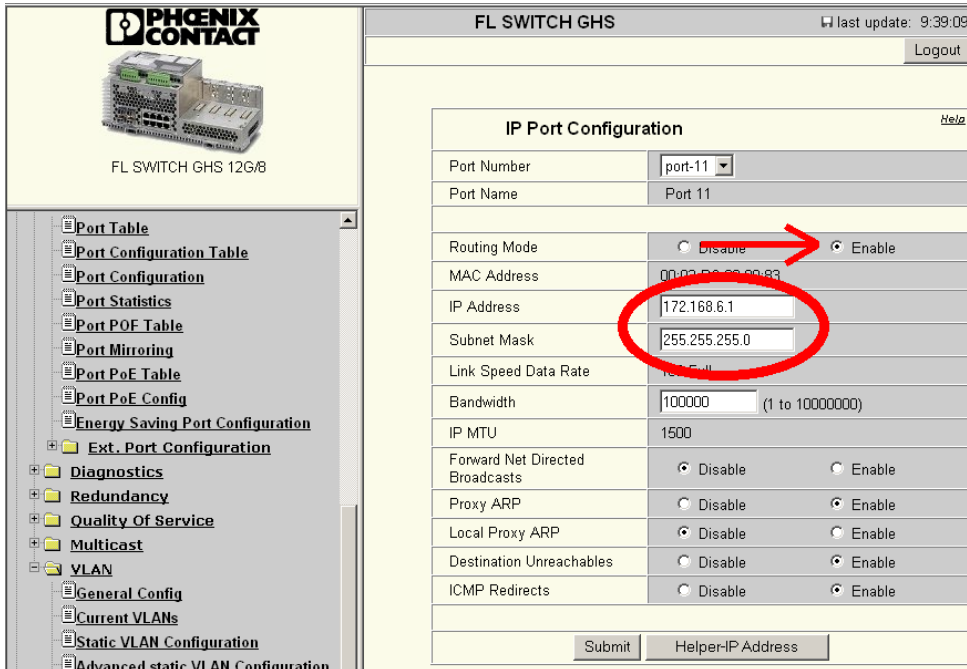


Figure 21 Enabling routing mode

Step 2:

Select the STATIC route type from the menu Routing -> Routes -> Static Routes.

Step 3:

First, you need to define a network address, as everything for subnetwork 172.168.2.x must be sent via router 2. In our example, router 2 can only be reached via port 5 on this router, which has the IP address 172.168.6.250. It is crucial for port 5 of router 2 and port 11 (172.168.6.1) of router 1 to be located in the same subnetwork.

Packets destined for 172.168.2.x must, therefore, be sent to router 2 via port 11 of this router. For this to happen, the port IP address of router 2 (172.168.6.250) must be entered in "Next Hop IP Address".

The screenshot shows the 'Router Route Entry Create' form with the following details:

- Page header: FL-SWITCH-GHS, last update: 13:44:38, Logout button.
- Form title: Router Route Entry Create (with a Help link).
- Route Type: Static (dropdown menu).
- Network Address: 172.168.2.0 (text input).
- Subnet Mask: 255.255.255.0 (text input).
- Next Hop IP Address: 172.168.6.250 (text input).
- Preference: 1 (text input, with a range of 1 to 255).
- Buttons: Submit, Cancel.

Figure 22 Router configuration

The screenshot shows the 'Static Routes' table with the following data:

Network Address	Subnet Mask	Next Hop IP	Next Hop Port	Preference	Remove
172.168.2.0	255.255.255.0	172.168.6.250	port-11	1	<input type="checkbox"/>

Buttons: Submit, Add Route.

Figure 23 The configured routes in the GHS

Step 4:

Configuration of router 2:

Define port 5 as the gateway: Assign the IP address and enable routing mode.

IP Port Configuration Help	
Port Number	port-5
Routing Mode	<input type="radio"/> Disable <input checked="" type="radio"/> Enable
MAC address	00:02:BC:00:00:7D
IP Address	172.168.6.250
Subnet Mask	255.255.255.0
Link Speed Data Rate	
Bandwidth	100000 (1 to 10000000)
IP MTU	1500
Forward Net Directed Broadcasts	<input checked="" type="radio"/> Disable <input type="radio"/> Enable
Proxy ARP	<input type="radio"/> Disable <input checked="" type="radio"/> Enable
Local Proxy ARP	<input checked="" type="radio"/> Disable <input type="radio"/> Enable
Destination Unreachables	<input type="radio"/> Disable <input checked="" type="radio"/> Enable
ICMP Redirects	<input type="radio"/> Disable <input checked="" type="radio"/> Enable
<input type="button" value="Submit"/> <input type="button" value="Helper-IP Address"/>	

Figure 24 Configuration of router 2

Step 5:

Define port 12 as the gateway:

Assign the IP address for the downstream subnetwork and enable routing mode.

IP Port Configuration Help	
Port Number	port-12
Routing Mode	<input type="radio"/> Disable <input checked="" type="radio"/> Enable
MAC address	00:A0:45:29:ED:F2
IP Address	172.168.2.1
Subnet Mask	255.255.255.0
Link Speed Data Rate	100 Full

Figure 25 Configuration of port 12



Port 5 of router 2 (172.168.6.250) and port 11 of router 1 (172.168.6.1) are located in the same subnetwork.

Step 6:

Define the network address for the data packet return path.

You need to define a network address for the return path, as everything for subnetwork 172.168.3.x must be sent via router 1. In our example, router 1 can only be reached via port 11 on this router, which has the IP address 172.168.6.1. Enter the port IP address of router 1 (172.168.6.1) in the "Next Hop IP Address" field.

Router Route Entry Create Help	
Route Type	Static
Network Address	172.168.3.0
Subnet Mask	255.255.255.0
Next Hop IP Address	172.168.6.1
Preference	1 (1 to 255)
<input type="button" value="Submit"/> <input type="button" value="Cancel"/>	

Figure 26 Entering a static route

Static Routes					Help
Network Address	Subnet Mask	Next Hop IP	Next Hop Port	Preference	Remove
172.168.3.0	255.255.255.0	172.168.6.1	port-5	1	<input type="checkbox"/>

Figure 27 The route table

2.4 Scenario 4: VRRP

The terminals are connected redundantly by 2 routers and the router ports are configured.

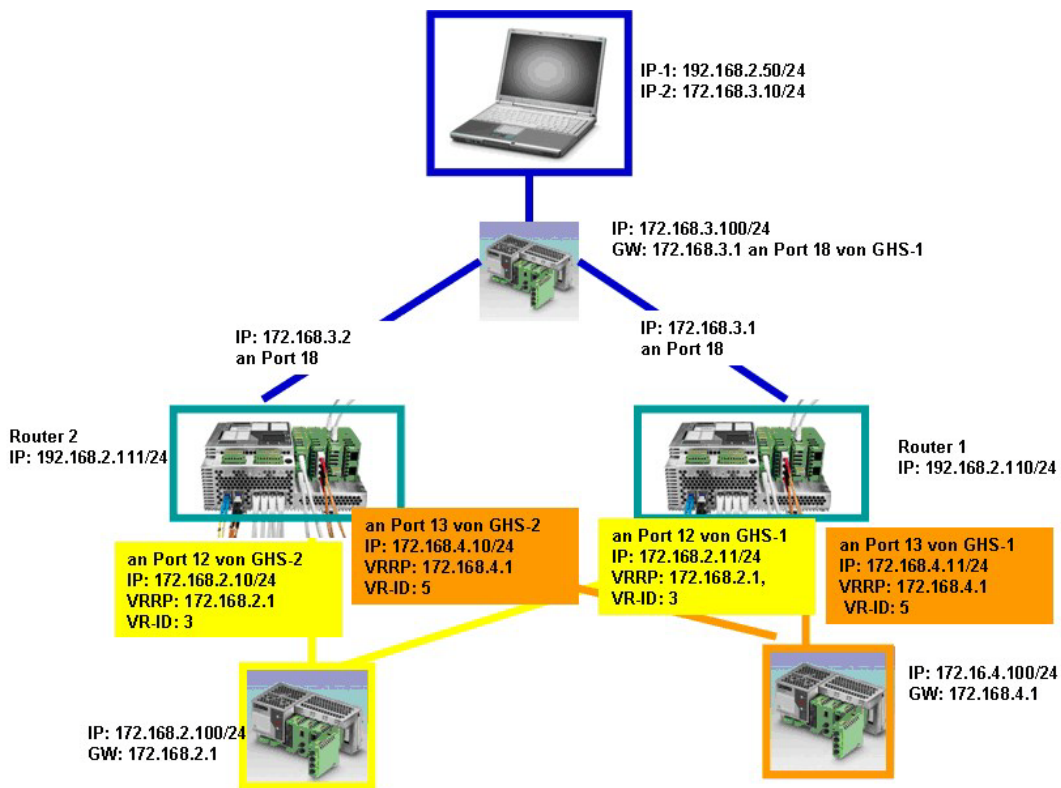


Figure 28 Scenario 4: VRRP

Step 1:

Before you can enable VRRP, you first need to enable the routing mode.

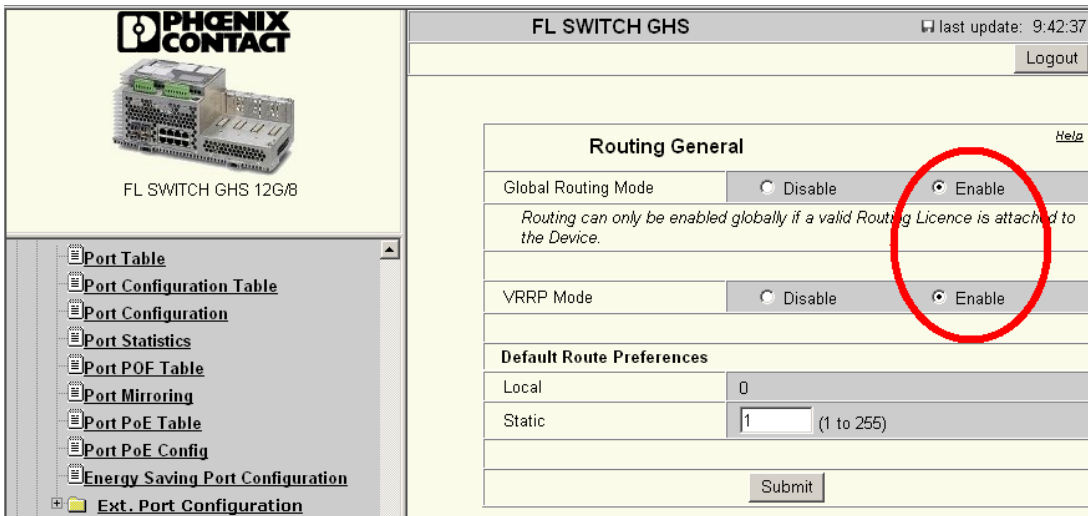


Figure 29 Enabling VRRP

Step 2:

Router 1:

On router 1, both terminals should be connected to ports 12 and 13 as per the drawing (see Figure 28 on page 18). Both ports are located in different subnetworks, in this example: 172.168.2.x and 172.168.4.x.

Router 2:

On router 2, both terminals should likewise be connected to ports 12 and 13. Once again, the ports are located in different subnetworks: 172.168.2.x and 172.168.4.x

Each of the two terminals is connected to both routers. Therefore, both of the connected ports are always located in a dedicated subnetwork. Port 12 = subnetwork 172.168.2.x and port 13 = subnetwork 172.168.4.x.

Router 1, port 12, IP: 172.168.2.11

Router 2, port 12, IP: 172.168.2.10

Router 1, port 13, IP: 172.168.4.11

Router 2, port 13, IP: 172.168.4.10

Step 3:

Routing must now be enabled on for all ports (i.e., ports 12 and 13 of routers 1 and 2) (procedure demonstrated below for one port).

The screenshot shows the Phoenix Contact web interface for the FL SWITCH GHS 12G/8. The main configuration area is titled "IP Port Configuration" and includes a "Logout" button. The configuration table is as follows:

IP Port Configuration Help	
Port Number	port-12
Routing Mode	<input type="radio"/> Disable <input checked="" type="radio"/> Enable
MAC address	00:02:BC:00:00:84
IP Address	172.168.2.11
Subnet Mask	255.255.255.0
Link Speed Data Rate	
Bandwidth	100000 (1 to 10000000)
IP MTU	1500
Forward Net Directed Broadcasts	<input checked="" type="radio"/> Disable <input type="radio"/> Enable
Proxy ARP	<input type="radio"/> Disable <input checked="" type="radio"/> Enable
Local Proxy ARP	<input checked="" type="radio"/> Disable <input type="radio"/> Enable
Destination Unreachables	<input type="radio"/> Disable <input checked="" type="radio"/> Enable
ICMP Redirects	<input type="radio"/> Disable <input checked="" type="radio"/> Enable

At the bottom of the configuration area, there are buttons for "Submit", "Delete IP Address", "Helper-IP Address", and "Secondary IP Address".

Figure 30 Enabling routing

Step 4:

Enabling VRRP:

Make the following settings on both routers:

1. Select CREATE to create a VRRP.
2. Define an ID for the connected terminal (in the example: VRID 3 for the terminal on the left and VRID 5 for the one on the right).
3. Assign both ports to the relevant VRRP (in the example ports 12 are associated with VRID 3 and ports 13 with VRID 5).
4. Select enable in each case to activate VRRP mode.
5. Assign an IP address to the VRRP that has been created (in the example: VRID 3: 172.168.2.1 and VRID 5: 172.168.4.1).
6. The IP addresses must be entered as the gateway addresses for the respective terminals.

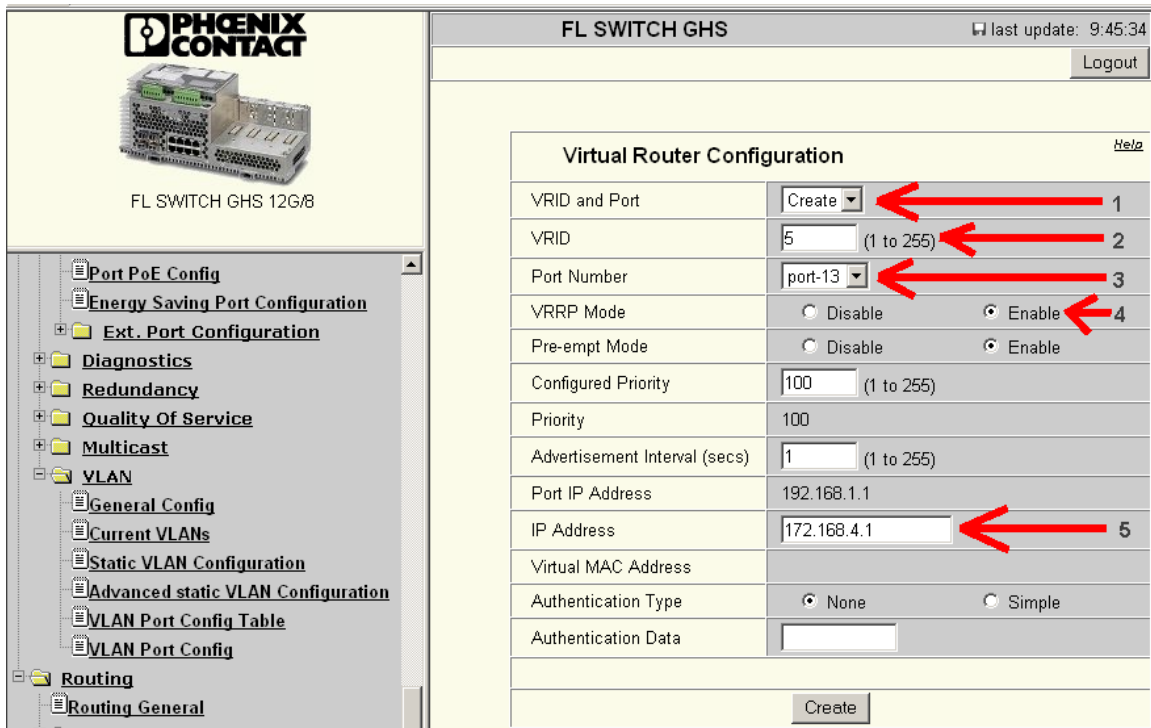


Figure 31 Enabling VRRP

Once everything has been configured, you can access an overview of the parameters by selecting VRRP -> Virtual Router Table.

The screenshot shows the web interface for a Phoenix Contact PXC GBit Modular Switch. The main content area displays the 'Virtual Router Table' for the device 'FL SWITCH GHS 12G/8'. The table contains the following data:

VRID	Port	Priority	Virtual IP Address	State	Status
3	port-12	100	172.168.2.1	Initialize	Enabled
5	port-13	100	172.168.4.1	Initialize	Enabled

The interface also includes a 'Logout' button, a 'Refresh' button, and a navigation menu on the left with options like 'Energy Saving Port Configuration', 'Ext. Port Configuration', 'Diagnostics', 'Redundancy', 'Quality Of Service', and 'Multicast'.

Figure 32 The VRRP parameters