GE Consumer & Industrial
Multilin

UR Switch Module Ethernet Communications Switch

Quickstart Guide

Firmware Revision 3.x

Manual P/N: 1601-9042-A1
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UL # E83849

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To the extent required the products described herein meet applicable ANSI, IEEE, IEC, and UL standards; but no such assurance is given with respect to local codes and ordinances because they vary greatly.

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GE Multilin UR Switch Module Quickstart Guide for revision 3.x.

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Part number: 1601-9042-A1 (June 2008)

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UR Switch Module
Ethernet Communications Switch
QuickStart Guide

QS.1 Introduction to Twisted Pair and Fiber Optic Ethernet LANs

This section will provide a brief review of modern Ethernet media, before covering the steps used to configure the Multilink switch for typical protective relaying applications. For this discussion the IP addresses that will be used, are in the range of 3.94.247.1 to 3.94.247.254 using a subnet mask of 255.255.252.0. This same range of addresses can be used for testing purposes but you should contact your IT support group for a valid range of addresses to be used for your particular application.

QS.1.1 Ethernet Physical Layer: Twisted Pair Copper vs Fiber Optic

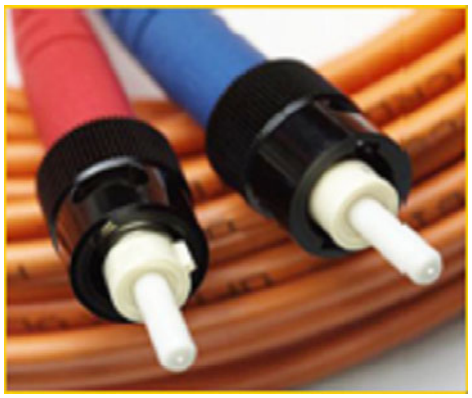
Today, the two most popular physical layer standards for Ethernet are twisted pair copper cable and fiber optic cable. Twisted pair copper cable is easier to terminate, and has a lower installation cost, but is susceptible to electrical noise. In addition, a single run of twisted pair cable is distance-limited.

Fiber optic media can typically be applied over much longer distances, is immune to electrical noise, and, while being more difficult to terminate, the availability of pre-fabricated cables has dramatically reduced the complexity of installation within the substation.

Twisted Pair copper cable

- Easy to Terminate
- Low installation costs
- Susceptible to noise interference
- Limited to 100m
- Either shielded or unshielded (UTP)

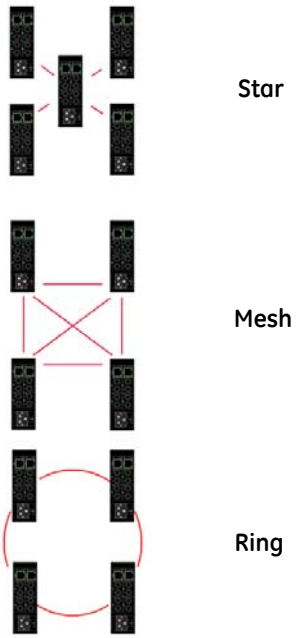
Fiber



- Longer distances possible, limited only by attenuation
- Immune to electrical noise
- More difficult termination and splicing
- Slightly higher cost for cable
- Two categories:
    - multi-mode
    - single-mode

QS.1.2 Supported Network Topologies

With both media, supported topologies include **Star**, **Mesh**, and **Ring**. The port that connects one switch to another is often called the uplink port and with many switches the uplink port can operate at much higher baud rates than the standard ports. The link formed by the connection of several switches' higher speed uplink ports is often referred to as a backbone.



Star Architecture

- Single point of failure before loss of communications
- Additional Ethernet Switches Required

Mesh Architecture

- Multiple points of failure required before loss of communications
- Additional Fiber Cables required

Ring Architecture

- Full Network Redundancy
- Allows for Fastest Network Recovery *
- Most Cost Effective Solution

* RO mode has typical recovery time of ≤ 5 ms/hop.

QS.2 10BaseT and 100BaseT Media

10BaseT and 100BaseT are the two most common twisted pair copper media standards. There are also several popular fiber optic media standards which we will review later in this section. With respect to 10 or 100BaseT, the 10 or 100 designation indicates a baud rate of either 10 or 100 megabits per second (Mbs). Base stands for baseband while the T stands for twisted pair.

Since many twisted pair interfaces can work at either baud rate the designation 10/100BaseT has evolved to indicate this capability. Cable can be either unshielded twisted pair (UTP) or shielded twisted pair (STP).

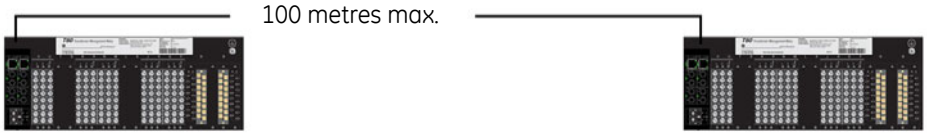
We recommend category 5e (see below) for applications up to 1000 Mbs.

Unshielded Twisted Pair cable:

- Category 1: Used for telephone communications; not suitable for transmitting data.
- Category 2: Capable of transmitting data at speeds of up to 4 Mbps.
- Category 3: Can be used in 10BaseT networks; can transmit data at speeds up to 10 Mbps.
- Category 4: Used in Token Ring networks; can transmit data at speeds up to 16 Mbps.
- Category 5: Capable of transmitting data at speeds up to 100 Mbps.
- Category 5e*: Used in networks running at speeds up to 1000 Mbps (1 Gbps).
- Category 6: Consists of four pairs of 24-gauge copper wires, which can transmit data at speeds of up to 1000 Mbps.

* Recommended

Ethernet: Unshielded Twisted Pair



:

RJ45 Pin # (END 1)	Wire Color	Diagram End #1	RJ45 Pin # (END 2)	Wire Color	Diagram End #2
1	White/Orange		1	White/Orange	
2	Orange		2	Orange	
3	White/Green		3	White/Green	
4	Blue		4	Blue	
5	White/Blue		5	White/Blue	
6	Green		6	Green	
7	White/Brown		7	White/Brown	
8	Brown		8	Brown	

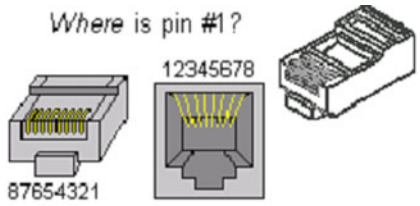
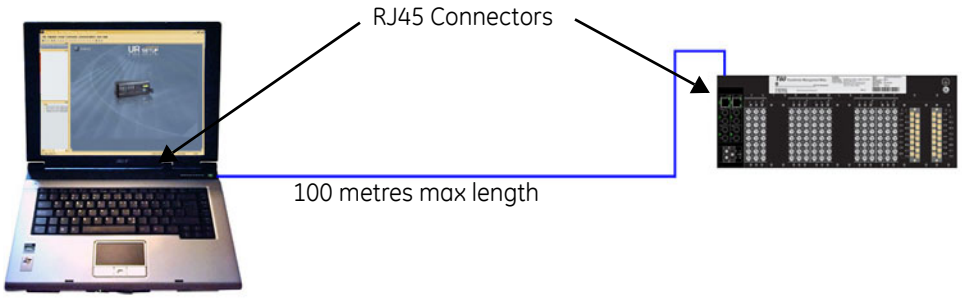


FIGURE QS–1: Pin Layout for a RJ45 Ethernet Straight-through Cable

The cable itself consists of four pairs of wires terminated in RJ45 connectors. The maximum permitted cable length is 100 meters. The cable pin connections can be one of two configurations: the first is called a "straight-through" cable and the second is called either a "crossover" or "patch" cable.

Given that the UR-2S/2T supports autonegotiate, a straight-through or crossover cable may be used to connect or establish a point-to-point Ethernet LAN between two Ethernet devices, as shown here.



RJ45 Pin # (END 1)	Wire Color	Diagram End #1
1	White/Orange	
2	Orange	
3	White/Green	
4	Blue	
5	White/Blue	
6	Green	
7	White/Brown	
8	Brown	

RJ45 Pin # (END 2)	Wire Color	Diagram End #2
1	White/Green	
2	Green	
3	White/Orange	
4	Blue	
5	White/Blue	
6	Orange	
7	White/Brown	
8	Brown	

FIGURE QS–2: Pin Layout for RJ45 Ethernet Crossover (Patch) Cable

The pin and wire configuration of a patch or crossover cable used to connect or establish a point-to-point Ethernet LAN between two Ethernet devices, is shown above.

QS.3 Hubs and Switches

Two of the major Ethernet network components are **hubs** and **switches**. A switch has many advantages over a hub. Hubs simply transfer information from one port to all other ports. Since a hub has no way of handling media contention, collisions can occur, necessitating all segments connected to a hub to work in a half-duplex mode.

Switches on the other hand, are capable of buffering messages, thus allowing full duplex operation. A switch will also learn the MAC addresses of devices connected to each of it's ports and will then route messages to only that port to which the destination device is connected, thereby reducing data traffic on the network. Switches that use configuration software to customize both switch and traffic are called "managed switches." Other switches - ones that have fixed configurations - are referred to as "unmanaged switches."

QS.3.1 Fiber Optic Ethernet:

Fiber optic Ethernet is rapidly becoming the medium of choice in applications, such as power system applications, where longer distances and immunity to EMI are of importance. Having stated this, the higher cost and the difficulty of terminating fiber cables allows twisted pair to continue to play a role were appropriate.

The wavelengths of light used in fiber optic communication are 820, 1300 and 1550 nanometers (nm) because it has been found that these wavelengths are attenuated least as they travel through the fiber optic medium. Compatible ports must operate at the same light wavelength, and must be linked with appropriate fiber. There are two categories of fiber optic cable: multi-mode and single-mode. Note that until recently, cable used with 820nm wavelength light was offered only in multi-mode, while cable used with 1300nm wavelength light was offered with both single- and multi-mode compatibility. Cable compatible with 1550nm wavelength light is offered only in single-mode.

Wavelengths of light

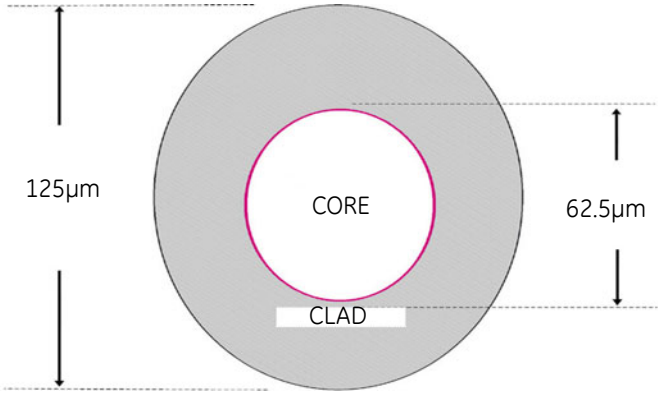
	Multi-Mode	Single-Mode
820nm	X	X
1300nm	X	X
1550nm	N/A	X

Note that both devices must use the same wavelength of light.

QS.3.2 Single and Multi-mode cable

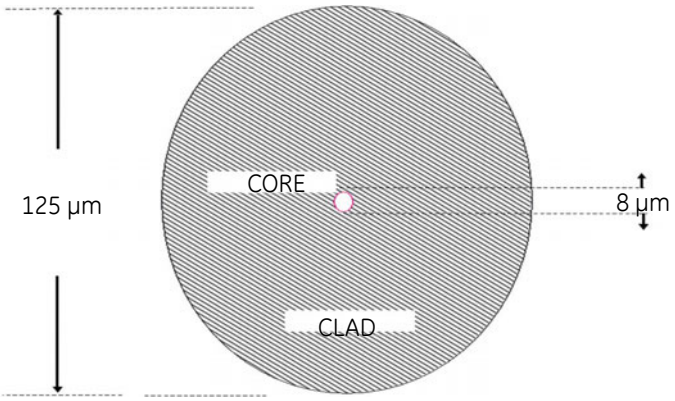
Fiber Cable Cross Section and Physical Specifications

Multi Mode



- 62.5/125 µm
- 50/125 µm*

Single Mode



- 9/125 µm

* Will become more popular as baud rate goes up

The above are scaled drawings of both a 62.5/125 µm multi mode fiber and 9/125µm single-mode fiber. The outer cladding of both is 125 micrometers in diameter. The multi-mode core, at 62.5 micrometers, is a little thinner than the average human hair. The core of

the 9/125 micrometer fiber is 8 microns in diameter (almost an eighth of that of the multi-Mode fiber) surrounded by a second outer layer of cladding. This cladding can pass a light signal, so for this reason the fiber is referred to as 9 by 125 micrometer fiber.

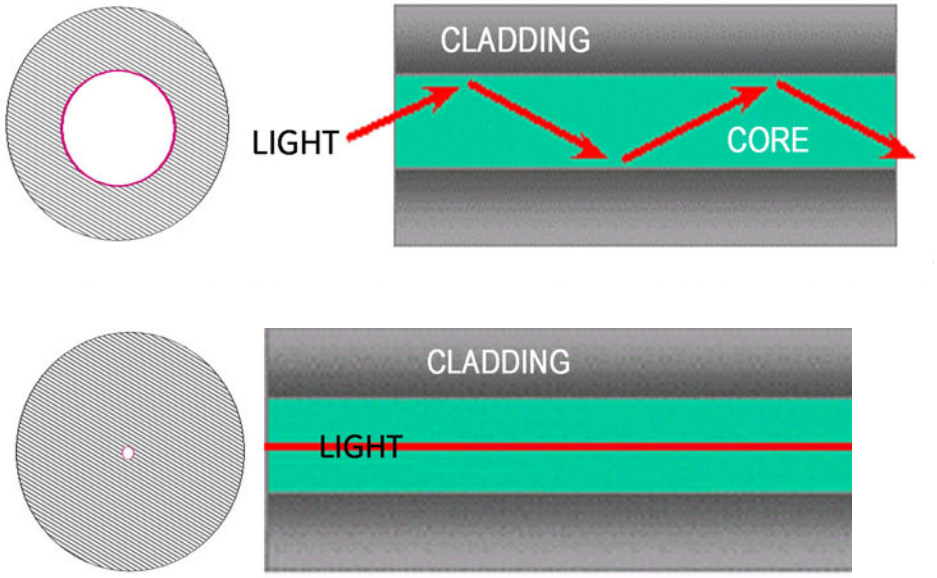


FIGURE QS–3: Differences between Multi-Mode and Single-Mode Cable

Difference between Single-mode and Multi-mode Cable

The difference between multi-mode and single mode cable can be best described as follows:

With multi-mode fiber the index of refraction at the surface between the core and the cladding is such that there is total internal reflection of the light being transmitted down the core. Picture this by imagining that the clad is a tube whose interior surface is polished so smooth, it is like a mirror. Light shinning at one end of the tube will either travel straight down the tube or will travel down the tube by reflecting of the inner mirrored surface.

Single mode fiber can be described as an elongated lens that is continuously focusing the light into the centre of the fiber. Using these two analogies it can be imagined that in the single mode fiber more light travels through far less fiber medium resulting in far less attenuation per unit distance than in multi-mode fiber. As a result, for a given wavelength of light, single mode fiber typically has less attenuation per unit distance than multi-mode fiber.

QS.3.3 Optical Power Budget

Inevitably the question that arises is, "What is the maximum practical communication distance when using a fiber optic cable?". The answer isn't straightforward; it must be calculated in the following way:

First the Optical Power Budget is determined by subtracting the receiver's rated sensitivity from the transmitter's rated power, both of which are rated in decibels of light intensity. For example, if a particular transmitter is rated at -15 db and the receiver's sensitivity is rated

at -31 db the difference of 16 db is the Optical Power Budget. The Optical Power Budget can be thought of as the maximum permitted attenuation of the light signal as it travels from the transmitter to the receiver, while still permitting reliable communication.

The next step is to calculate the worst case optical power budget by subtracting from the optical power budget, 1 dB for LED aging and 1 dB for each pair of connectors (referred to as insertion loss).

The final step is to divide the calculated result by the rated cable loss per kilometer in order to determine the maximum distance. For costly installations it is recommended to always measure the actual cable loss before and immediately after installation, in order to verify that the cable was installed correctly. To avoid damaging the receiver, ensure that the maximum optical input power of the receiver isn't exceeded.

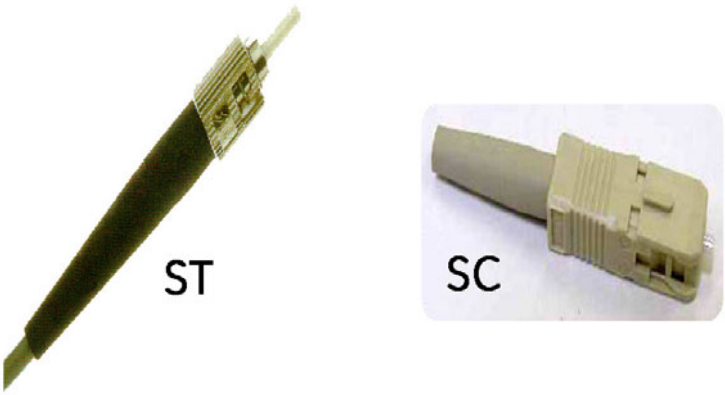


FIGURE QS–4: Common Fiber Optic Connectors

Several styles of connector are used to terminate to, and attach the end of the fiber cable. The ST and SC connectors are among the more popular. The UR Switch module supports 2 copper ports and 4 fiber ports (ST connectors).

QS.3.4 Maximum fiber segment length calculation:

The maximum fiber segment length between two adjacent switches or between a switch and a device is calculated in the following way:

First, calculate the optical power budget (OPB) of each device using the manufactures data sheets. Shown below are sample data sheets.

$$OPB = P_{T(min)} - P_{R(min)}$$

where:

OPB = Optical Power Budget

P_T = transmitter output power

P_R = receiver sensitivity

UR-2S and UR-2T fiber optic port specifications:

The worst case optical power budget (OPBWORST) is then calculated by taking the lower of the power budgets for the two devices, calculated above, and subtracting 1 dB for LED aging and then subtracting the total insertion loss. The total insertion loss is calculated by multiplying the number of connectors in each single fiber path by 0.5 dB. For example, with a single fiber cable between the two devices there would be a minimum of two connections in either transmit or receive fiber paths for a total insertion loss of 1db for either direction:

Total insertion loss = number of connectors x 0.5db

Total insertion loss = 2 x 0.5 dB = 1.0 dB.

Example: Assuming 62.9/125µm cable

Speed	Mode	λ	Size	P_T	P_R
100 Mb FX	multi	1300 nm	62.5/125 µm 50/125 µm	-20 to -23.5 dB	-31 dB -31 dB

If we were calculating the worst-case optical power budget between two UR-2T or UR-2S devices using a single fiber cable the result would be 7 dB:

OPB_{WORST} = OPB - 1 dB (LED aging) - total insertion loss

OPB_{WORST} = 10 dB - 1 dB - 1 dB

OPB_{WORST} = 8 dB

To calculate the maximum fiber length, divide the worst-case optical power budget by the cable attenuation per unit distance specified in the manufacturers data sheets. For example a typical attenuation for 62.5/125 mm glass fiber optic cable is approximately 2.8dB per kilometer. If we were using a cable with this attenuation in our example the maximum fiber length would be approximately 2.5 km.

Maximum fiber length = worst case OPB (in dB)/cable loss (in dB per km)

Maximum fiber length = 8 dB/2.8 dB/km= 2.8 km

Again, the customer must use the attenuation specified within the manufacturer's data sheets for accurate calculation of the maximum fiber length.

QS.3.5 UR-2S and UR-2T 10/100 BaseT Switch Ports

MAXIMUM 10 MBPS ETHERNET SEGMENT LENGTHS

Unshielded twisted pair	100 m (328 ft.)
Shielded twisted pair	150 m (492 ft.)
10Base-FL multi-mode fiber optic	2 km (6562 ft.)

MAXIMUM STANDARD FAST ETHERNET SEGMENT LENGTHS

10BaseT (CAT 3, 4, 5 UTP)	100 m (328 ft.)
10BaseTX (CAT 5 UTP)	100 m (328 ft)

QS.4 Introduction to the 2S and 2T UR Managed Switch Modules:

The UR-2S and UR-2T embedded managed Switch modules are supported in 9S CPU racks with firmware ≥5.5x. The module communicates with the UR through an internal Ethernet port, referred to as the "UR Port" or "Port 7," and provides the UR with six external Ethernet ports: two 10/100BaseT and four Multi-mode ST 100 Base Fx ports. This greatly simplifies the network configuration:

NOTE

The Ethernet Switch Module should be powered up before, or at the same time as, the UR Relay. If not, the Switch Module will not be detected on power-up and the EQUIPMENT MISMATCH: ORDERCODE XXX self-test warning will be issued.

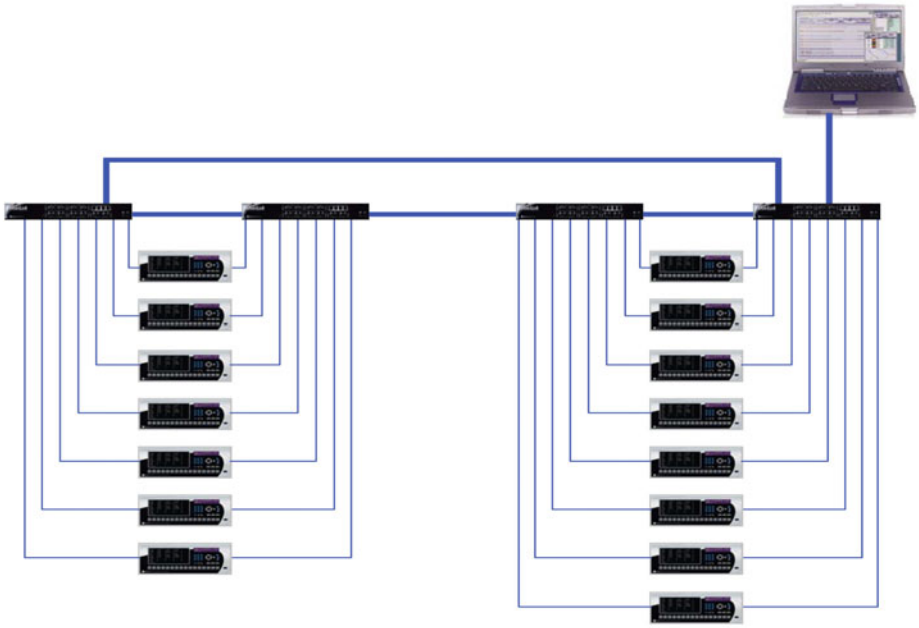


FIGURE QS–5: Traditional Redundant UR LAN Topology

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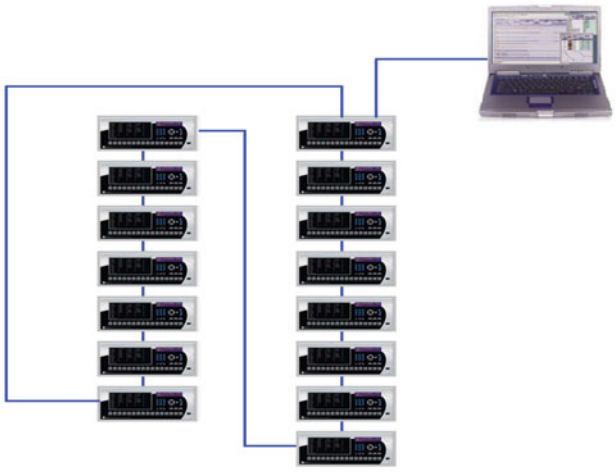


FIGURE QS–6: Switch-enabled UR LAN Topology

NOTE

- RSTP supports 16 switches in a Mess/Ring.
- RO Mode supports a maximum of 18 switches in a ring.
- With STP there is no limit.

QS.4.1 Hardware Overview

The 2S and 2T managed Switch modules provide two 10/100 BaseT and four Multi-mode ST 100 base Fx external Ethernet ports in addition to a serial console port.

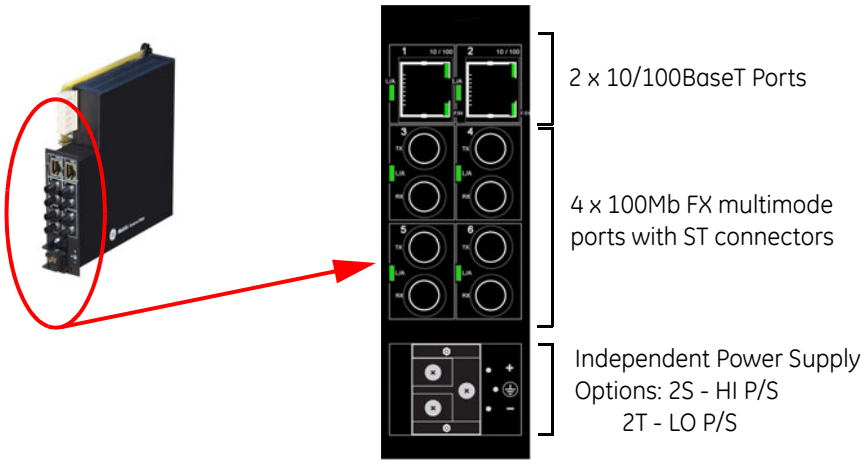


FIGURE QS–7: Rear View Showing I/O Ports

Table QS–8: Console Port Pin Assignment

Pin	Signal	Description
1	CD	Carrier Detect (not used)
2	RXD	Receive Data (input)
3	TXD	Transmit Data (output)
4	open	not used
5	GND	Signal Ground
6 to 9	open	not used

FIGURE QS–9: Front View Showing Console Port

QS.4.2 2S and 2T LED indicators

The function of the 2S and 2T Switch modules LED indicators is as shown below.

Copper ports have 3 LEDs indicating:

1. 10 or 100 MB
2. Full or Half Duplex
3. Linkup and Activity

Fiber Ports have 1 LED indicating:

1. Linkup and Activity

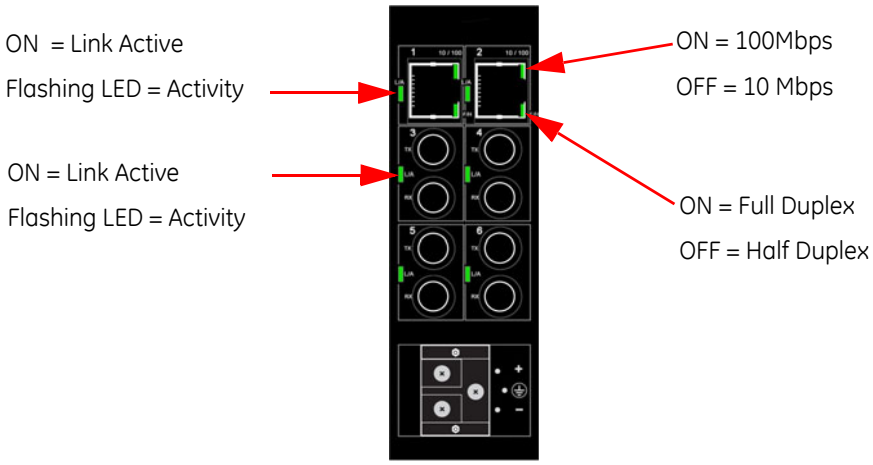


FIGURE QS–10: LED Functions

QS.4.3 Hardware Installation

With power removed, the Switch module is mounted into slot W and is then connected to a suitable source of external power via the connector located on the back of the module.

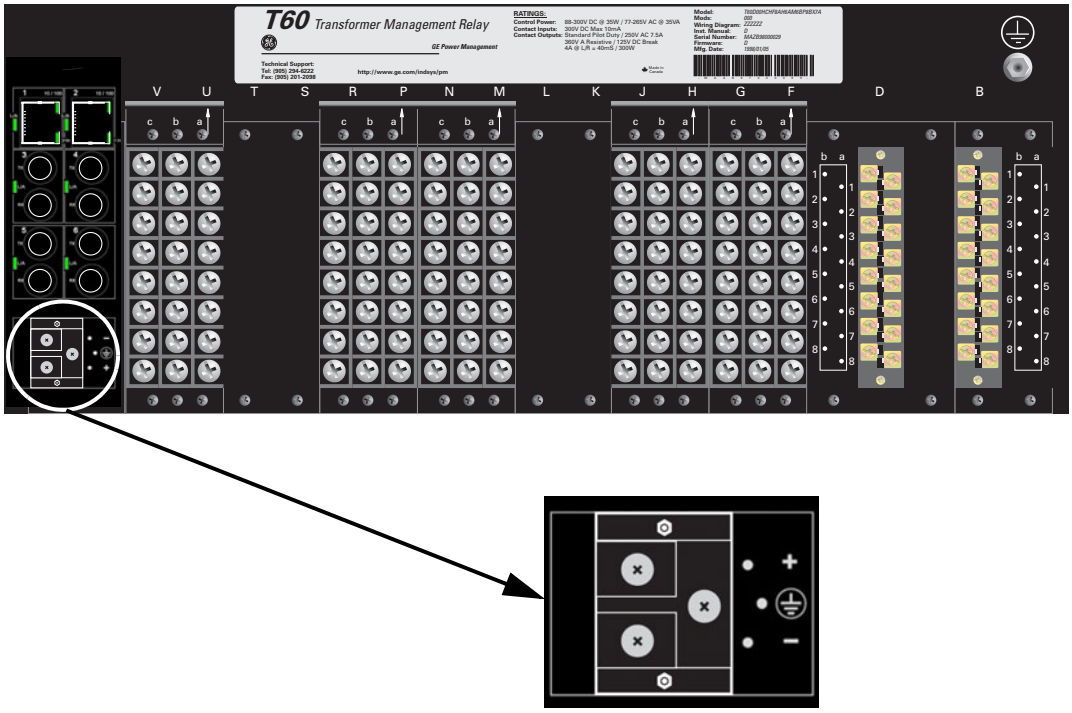


FIGURE QS–11: Rear view of UR chassis

- = Neutral or negative

+ = Line or positive

= Ground

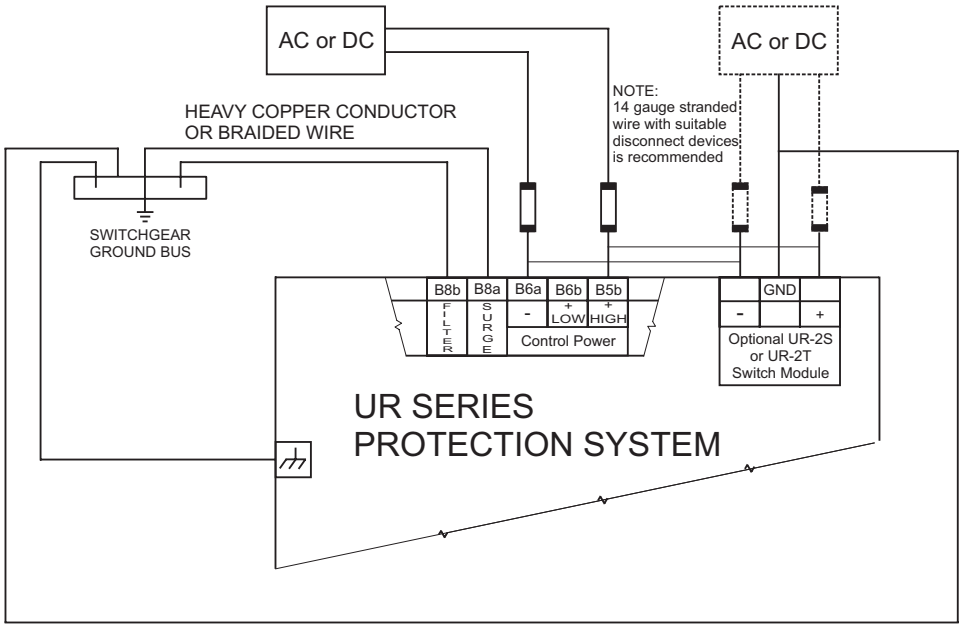


FIGURE QS–12: UR Switch Module Wiring Diagram

QS.4.4 initial Configuration Procedure

CAUTION

Ensure Switch is configured before connecting to network devices.

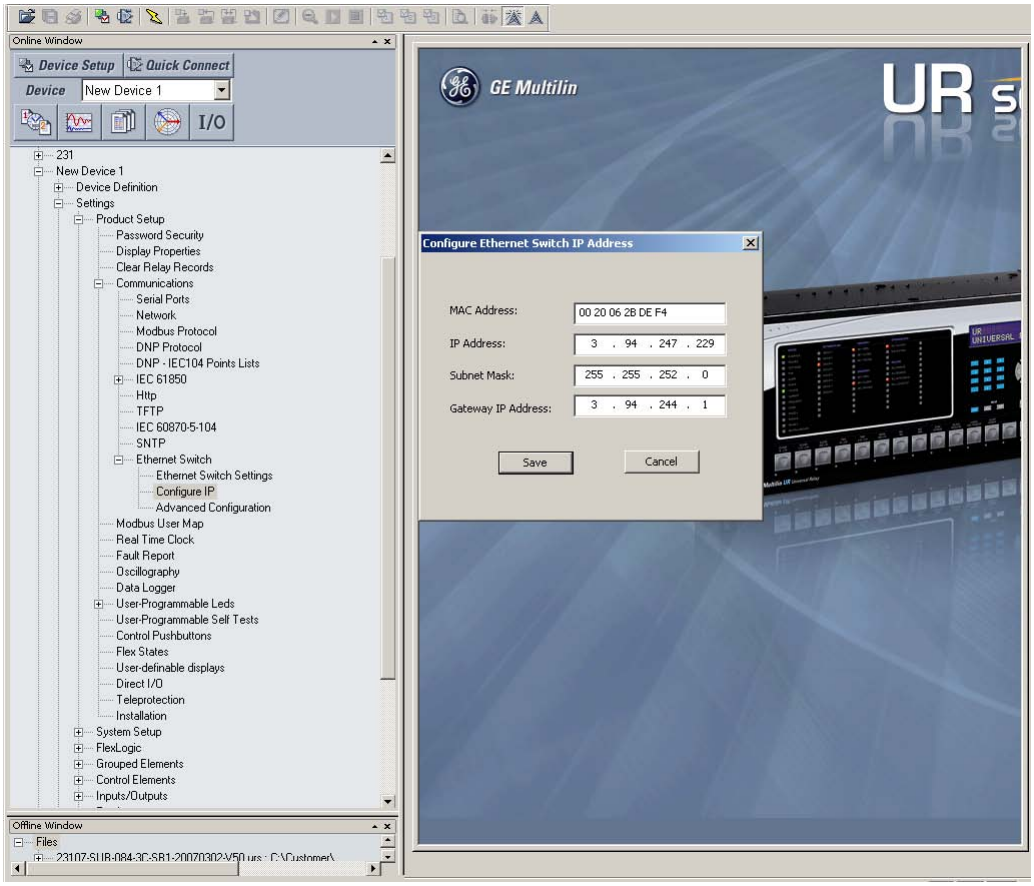
A suitable IP address and subnet mask must be assigned to both the Switch and the UR relay for correct operation. The Switch has been shipped with a default IP address of 192.168.1.2 and a subnet mask of 255.255.255.0. Consult your network administrator to determine if the default IP address, subnet mask or default gateway needs to be modified.

QS.4.5 Configuring the Switch IP Address and Subnet Mask using EnerVista UR Setup Software.

In our example configuration of both the Switch's IP address and subnet mask must be changed to 3.94.247.229 and 255.255.252.0 respectively. The IP address, subnet mask and default gateway can be configured using either EnerVista UR Setup software, the Switch's Secure Web Management (SWM), or through the console port using CLI.

In this example EnerVista UR setup software will be used.

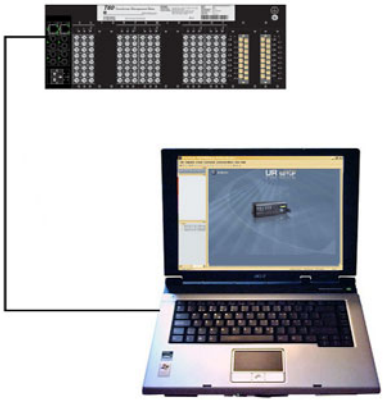
- ▷ From the Product setup menu select **Communications > Ethernet Switch > Configure IP**.
- ▷ Enter the Switch's MAC address (located on the module), IP address that you want to set in the switch, and Subnet Mask.



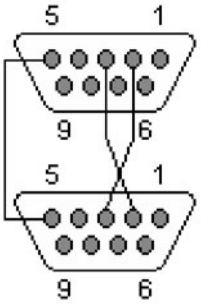
▷ Select **Save** and after a short delay you should get a confirmation that the switch has been successfully configured.

Once both the switch and UR's IP address and Subnet Mask have been configured, power must be cycled to both the switch and relay.

QS.4.6 Assigning an IP Address to the UR Switch Module using the Console Port

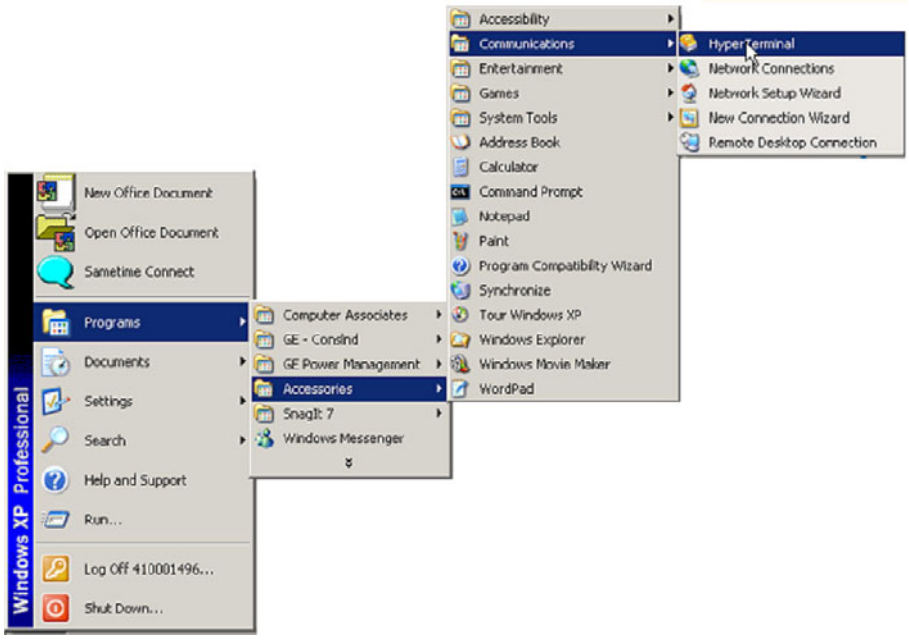


DB9 Female to DB9 Female Cable Pin-out	
Pin 2	Pin 2
Pin 3	Pin 3
Pin 5	Pin 5



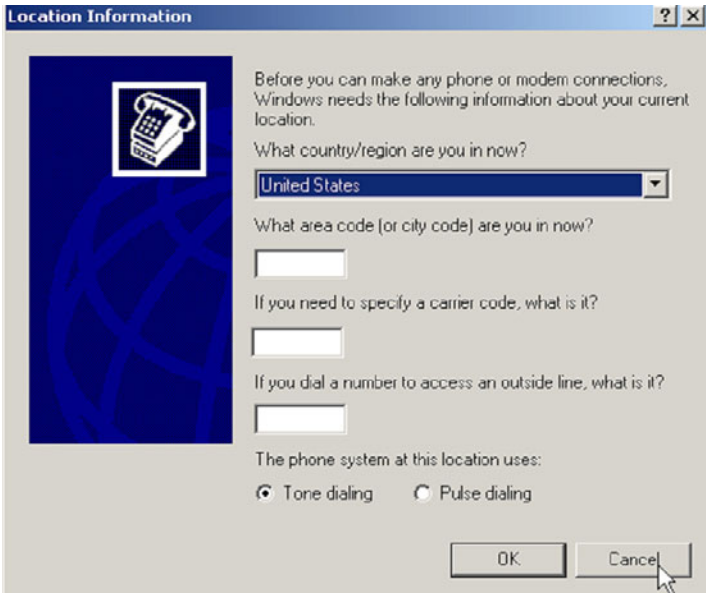
The Switch has been shipped with a default IP address of 192.168.1.2 and a subnet mask of 255.255.255.0. Consult your network administrator to determine if the IP address, subnet mask or default gateway needs to be modified. In our example test network, the administrator has given us IP addresses ranging from 3.94.247.1 to 3.94.247.254 with a subnet mask of 255.255.252.0.

The console port must be connected to the computer's serial port using a serial cable with a pin-out as shown above. Note that both ends of the cable are terminated in a DB9 pin female connector. Pins 5 of this cable are connected together while pin 2 at one end is connected to pin 3 at the other end. Once you have connected the computer's serial port to the switch's console port, you can launch Hyperterminal as shown below.

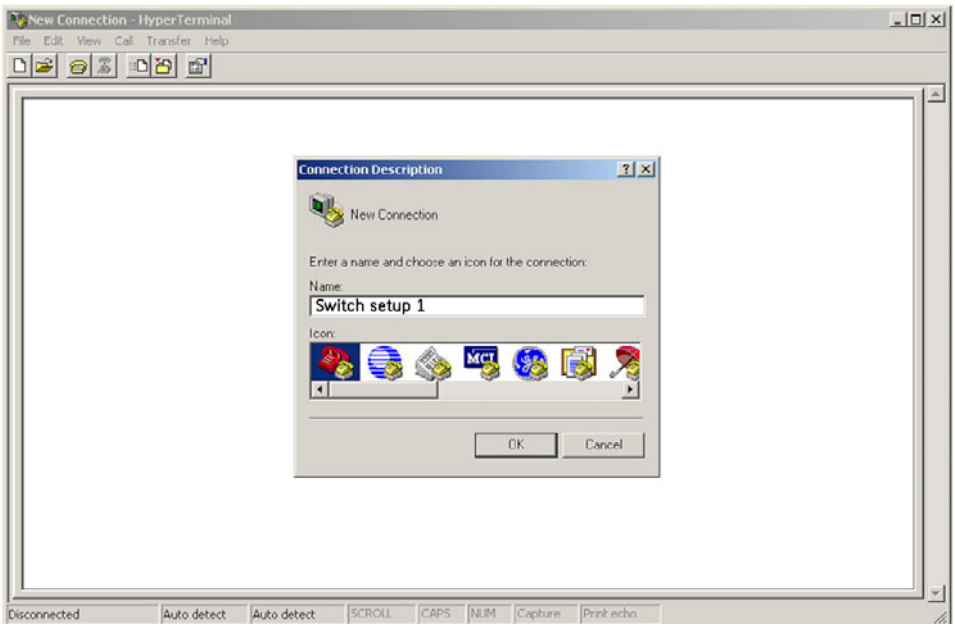


The Hyperterminal utility application is a convenient standard software tool that will be used to configure the Switch. This program is found on most Windows-based operating systems under **Programs > Accessories > Communications > Hyperterminal**.

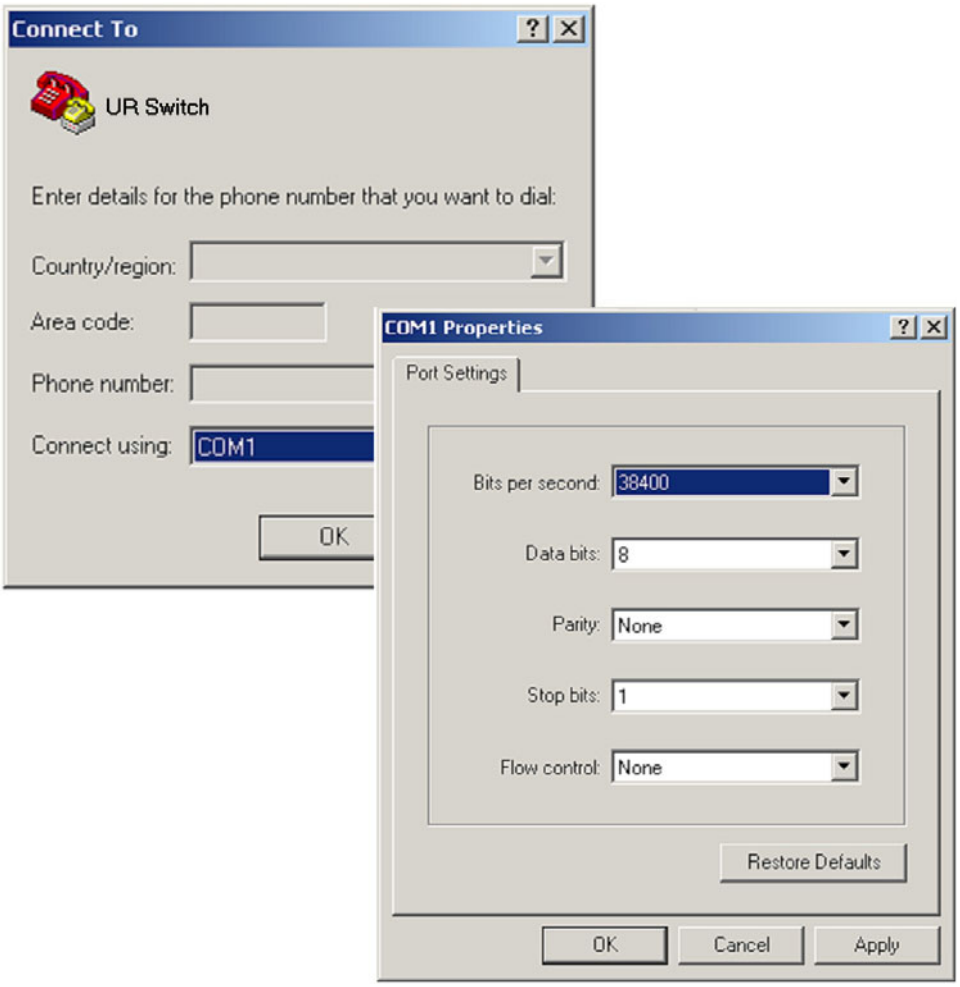
▷ Once the Hyperterminal application is launched you will need to cancel Hyperterminal's dial sequence by left mouse clicking on the **Cancel** pushbutton. This will allow you to access Hyperterminal's configuration menus.



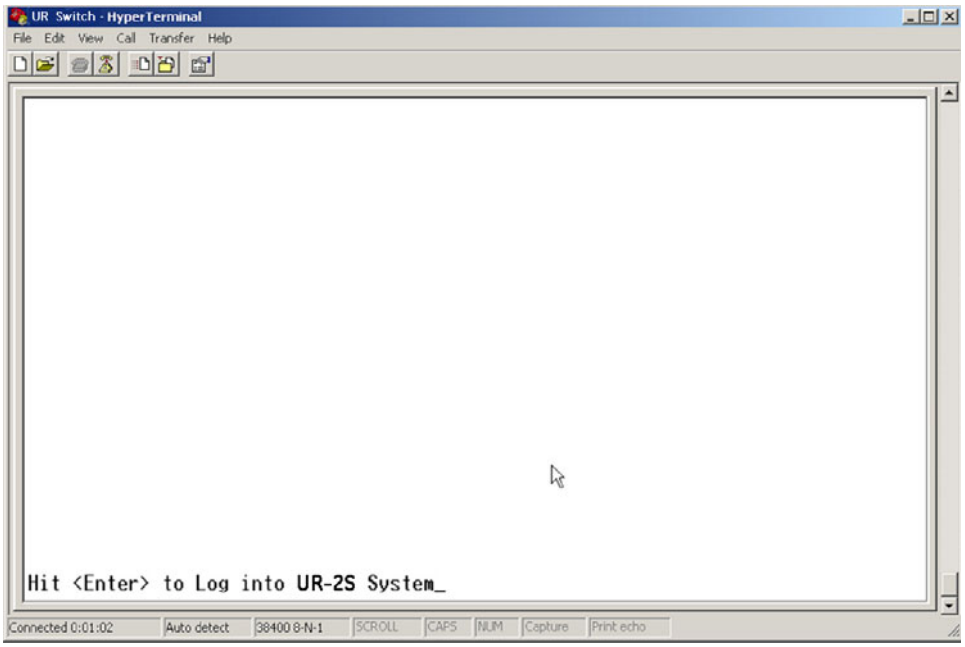
▷ Select an icon and name to use for saving the new Hyperterminal configuration.



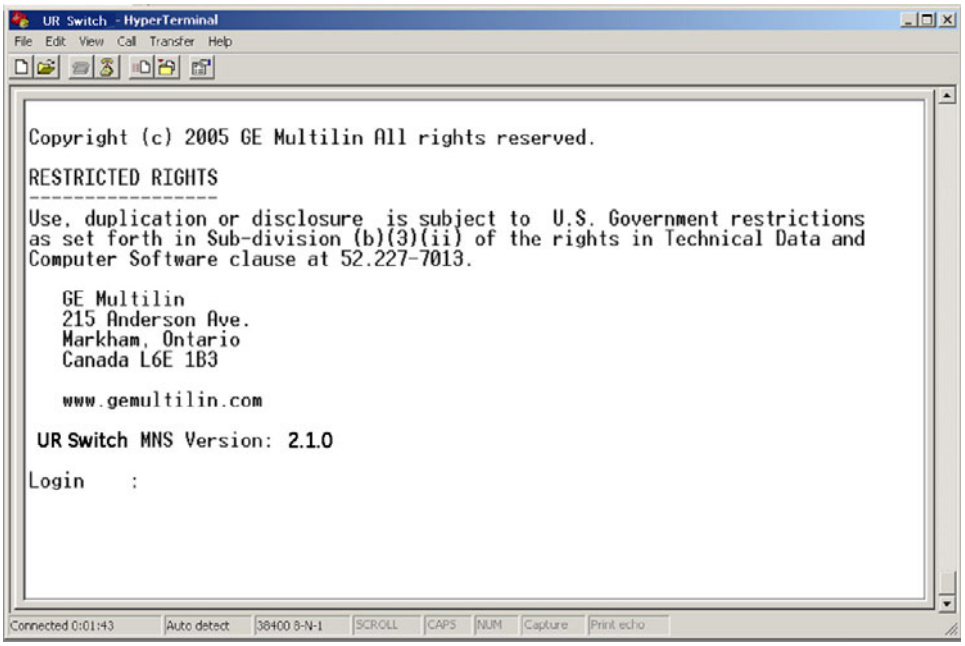
- ▷ Select the computer's serial port that is connected to the UR Switch.
- ▷ Select **OK**.
- ▷ In the next window set the baud rate to **38400**, data bits to **8**, **no parity**, **one stop bit** and set the flow control to **none**.
- ▷ Click on the **OK** icon to attempt communication to the UR Switch.



▷ Press the **Enter** key until the message **Hit <Enter> to log into UR-2S (or 2T) system** is displayed.



▷ Press the **Enter** key one more time to get the **Login** prompt.



▷ Enter the login name **manager** and the default password **manager**.
Once you are successfully logged in, the prompt will change to the model number of the Switch to which you are connected, followed by the pound (#) sign, indicating a successful login.

```
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   GE Multilin
   215 Anderson Ave.
   Markham, Ontario
   Canada L6E 1B3

   www.gemultilin.com

UR-2S Version: 2.0.1

Login    : manager
Password : *******
UR-2S#ipconfig ip=3.94.247.229 mask=255.255.252.0 dgw=3.94.244.1

  IP Parameters Set.
UR-2S#_
```

```
   Canada L6E 1B3

   www.gemultilin.com

UR-2S Version: 2.0.1

Login    : manager
Password : *******
UR-2S#ipconfig ip=3.94.247.229 mask=255.255.252.0 dgw=3.94.244.1

  IP Parameters Set.
UR-2S#save

  Saving current configuration...
  Configuration saved

  Saving current event logs...
  Event logs saved

UR-2S#reboot

  Proceed on rebooting the switch? [ 'Y' or 'N' ]

  Do you wish to save current configuration? [ 'Y' or 'N' ]_
```

A valid IP address and subnet mask can now be programmed into the Switch using the IP config command as follows:

- Type in "**ipconfig ip=**".
- Enter the IP address (in our example we will use a unique address between 3.94.247.1 and 3.94.247.254), followed by a space.
- Type in "**mask=**" and enter the mask (in our example system we would use 255.255.252.0).
- If a default gateway is also required enter a space and type "**dgw=**"
- Enter the IP address of the gateway, then select the **enter** key. The switch will then indicate that the parameters have been set.
- Save the settings using the **Save** command.

▷ Reboot the switch using the **Reboot** command as shown.
Note when asked to save the current configuration enter **Y** for Yes.

```
UR-2S#show setup

  Version             :  UR-2S build 2.1beta Dec  3 2007 16:25:26
  MAC Address         :  00:20:06:2b:de:94
  IP Address          :  3.94.247.229
  Subnet Mask         :  255.255.252.0
  Gateway Address     :  3.94.244.1
  CLI Mode            :  Manager
  System Name         :  UR-2S
  System Description  :  6 Port Modular Ethernet Switch
  System Contact      :  multilin.tech@ge.com
  System Location     :  Markham, Ontario
  System ObjectId     :  1.3.6.1.4.1.13248.12.16
  System Serial No    :
  System Order Code   :
```

▷ Once the Switch has rebooted, you will need to login again.

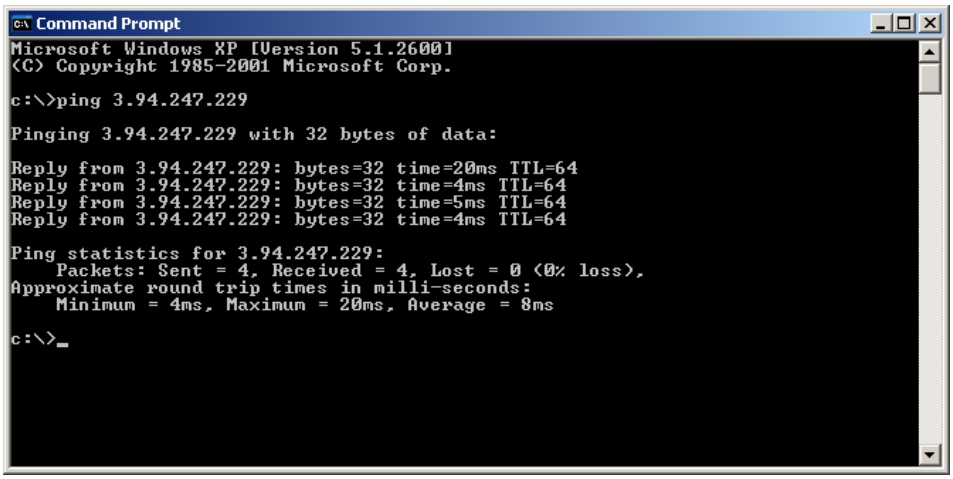
▷ To confirm that the IP address and subnet mask were saved correctly enter the command "**show setup**" followed by the **Enter** key.
The Switch will then provide an on-screen list of the switch's settings including the switch's IP address and subnet mask, and, if programmed, the default gateway.
Once you have verified that the IP, subnet mask and default gateway settings are correct you can configure the Switch via the web interface.

▷ If the computer is already on a network, connect the Switch to the network.

The next step is to test communications to the switch with the ping command:

▷ From the command prompt type in **PING 3.94.247.229**.

▷ Press the **Enter** key.



If communication is working correctly you should get a response from the Switch. If there is a problem you will get four consecutive timeout error messages. If this occurs check the media, ensure that the IP address subnet mask has been set correctly, and try again.

NOTE

Given that the UR-2S/2T supports Autonegotiation, a straight-through or crossover cable may be used to directly connect a PC to the Switch.

▷ **If the computer isn't connected to the network you will require a straight-through or a crossover cable and will need to set up a static IP address to test.**

QS.4.7 Assigning a static IP Address to a personnel computer

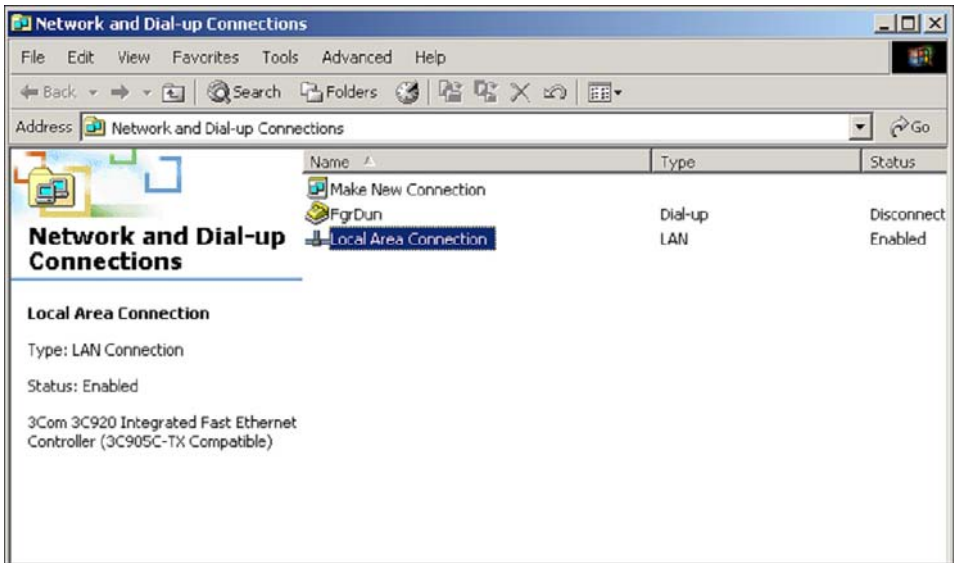
The Switch can be completely configured using the console port (after configuration of the IP address and subnet mask, the Switch can be configured using the WEB interface).

In order to configure the Switch using the web-based interface, the computer must be assigned an IP address and subnet mask. If the computer has already been assigned an IP address or is connected to a network such that the IP address will be automatically assigned, you may proceed to configure the Switch through the web Interface.

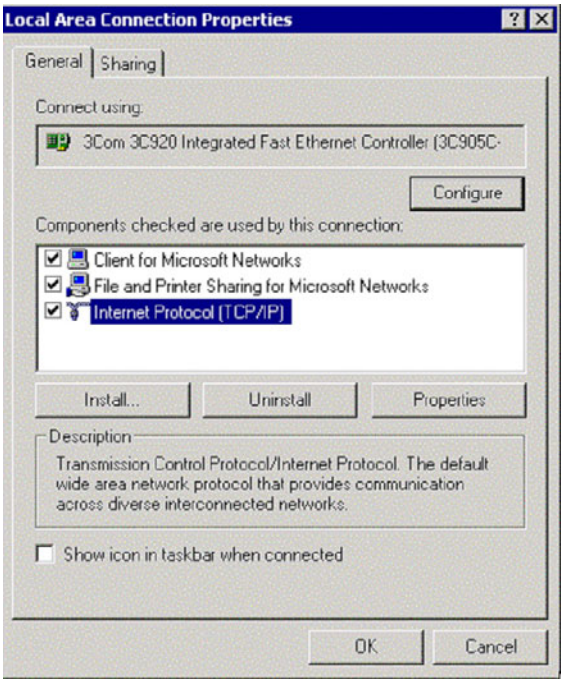
▷ **Obtain an IP address, subnet mask, and possibly a gateway address from your LAN Administrator.**
There are rules associated with the assignment of these numbers which go well beyond this introduction. As mentioned at the beginning of this guide, for our test network we will be using a subnet mask of 255.255.252.0 for all computers and relays on the network.
The IP address of each device on the network must be unique. Given that the switch was already assigned the IP address 3.94.247.229, we are left with 253 unique addresses.

▷ **Once the computer has booted up, right click on the icon labeled "My Network Places".**

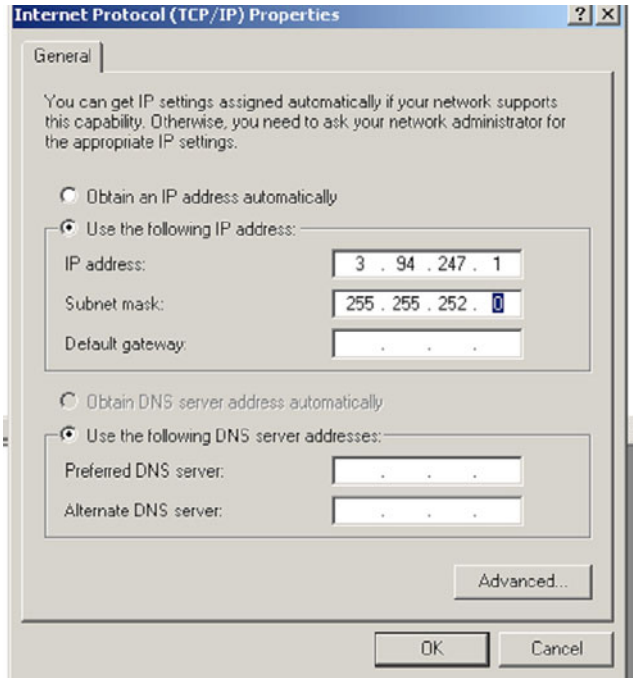
▷ **Select Properties.**



- Right mouse click on the "**Local Area Connections**" icon.
- Select **Properties**.



▷ Locate and click on the Ethernet card (it will have **TCPIP Protocol** as part of its name).
The Ethernet card is typically referred to as an **Ethernet adaptor**.



▷ Select "**Use the following IP address**".

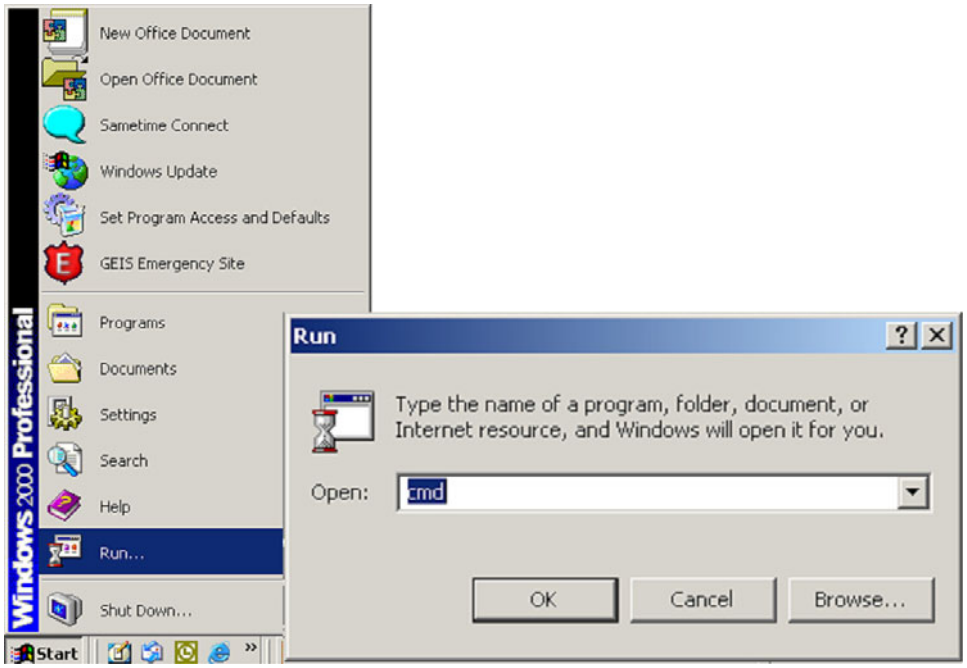
▷ Enter a unique IP address (from 3.94.247.001 to 3.94.247.254 if using our test network address range).

▷ Enter the subnet mask which, if using our test network, will be 255.255.252.0.).

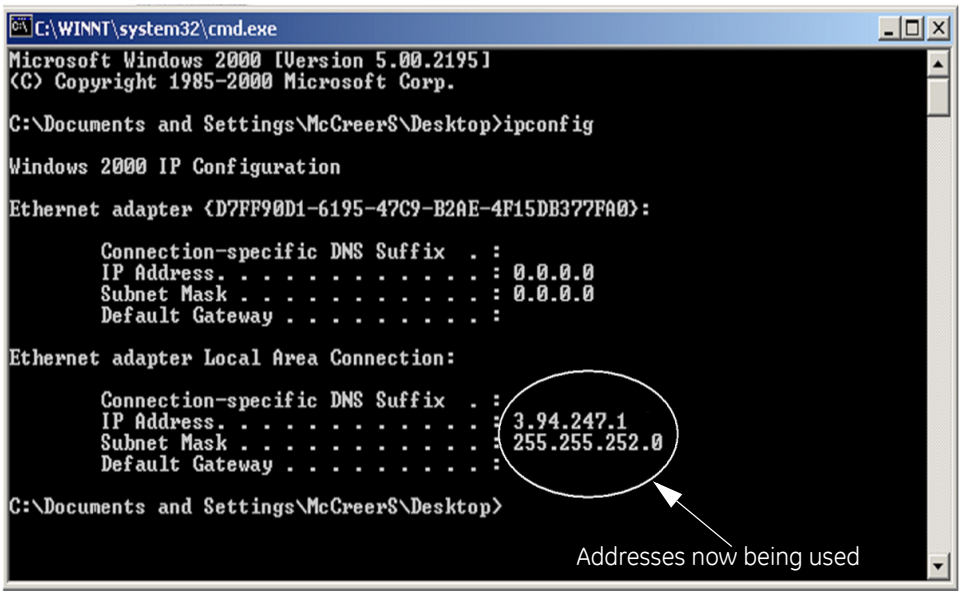
▷ Plug into the switch and ensure that the link LED comes on.

▷ Select **OK**, then **OK** again to exit the LOCAL AREA NETWORK PROPERTIES menu.

▷



- Select **Run.**
- Enter **CMD** to start the DOS shell.

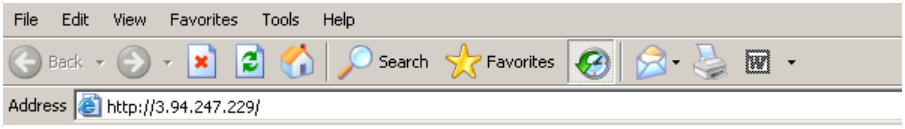


Once the DOS shell has launched you will be presented with a DOS window.

- At the DOS prompt enter the command "**ipconfig**" followed by the **Enter** key.
  This is the command that will cause the Ethernet adaptor to immediately use the IP, and Subnet Mask addresses just

programmed.
An on-screen report will appear indicating which addresses are now being used by the adapter.

The computer's configuration is complete.

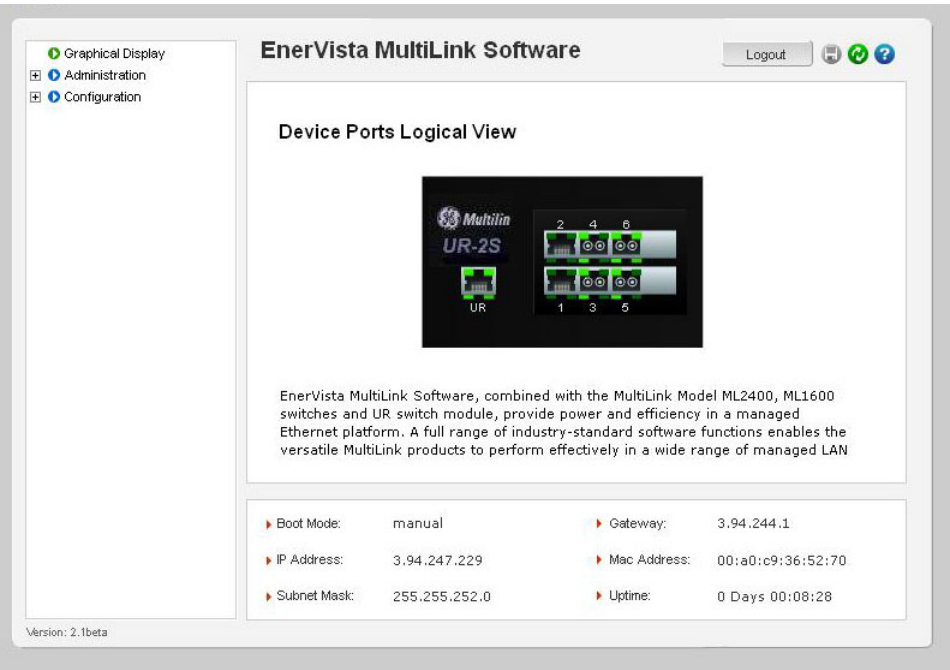


▷ Launch **Internet Explorer** and enter the IP address of the Switch in order to go to the Switch's web page.

▷ At the switch's login web page, enter the default Login name which is "**manager**".

▷ Enter the default login Password which is again "**manager**".

▷ Left mouse click on the **Login** pushbutton to attempt to log in.



If you have successfully logged in you will be presented with a graphic of the particular Switch to which you are connected.

QS.4.8 Self-test Errors and Meaning

NOTE

Be sure to enable the **Ethernet Switch Fail** function under **Product Setup > User-Programmable Self-tests**, and **Port Events** under **Product Setup > Communications > Ethernet Switch**.

Activation Setting (set to "Enabled")	Event Name	Event Cause	Possible Causes
ETHERNET SWITCH FAIL FUNCTION	ETHERNET MODULE OFFLINE	No response has been received from the Ethernet module after 5 successive polling attempts.	• Loss of Switch power • IP/Gateway/Subnet incompatibility between the CPU and the Switch module. • UR Port (Port 7) being configured wrongly/ blocked • Switch IP Address assigned to another device in the same network.
PORT n EVENTS	ETHERNET PORT n OFFLINE	An active Ethernet port has returned a "Failed" status.	• Ethernet connection broken. • An inactive port's events have been enabled.

No setting required; the UR will read the state of a general purpose I/O port on the main CPU upon power-up and create the error if there is a conflict between the I/O state and the order code.	EQUIPMENT MISMATCH: Card XXX Missing	The UR has not detected the presence of the Ethernet Switch via the bus board.	Relay failed to see Switch module on power-up, because Switch won't power up or is still powering up. To clear fault, cycle power to the UR Relay.

QS.5 Tagged VLAN's

VLAN is short for virtual LAN. A VLAN creates separate network segments that can span multiple switches. A VLAN is a group of ports designated by the switch as belonging to the same broadcast domain. VLANs provide the capability of having multiple networks co-existing on the same switch. Separation of traffic and security are just two advantages of VLANs.

VLANs can be port-based or tag-based. Port VLANs set a specific port or group of ports to belong to a VLAN. When using tag-based VLANs, a tag - a "VLAN identifier" - is sent as part of the message. This tag allows the message to move across multiple switches whose ports are part of the same tagged VLAN. Note that the UR Port (Port 7), being the port connected to the UR relay, must therefore be included in all VLANs from which the relay is to receive or transmit data.

Background

The IEC 61850 Fixed GOOSE peer-to-peer communication service is an enhanced version of IEC GSSE peer-to-peer service with the additional ability to assign a priority and a "tag" to the multi-cast messages.

QS.5.1 Configuring Tagged VLANs

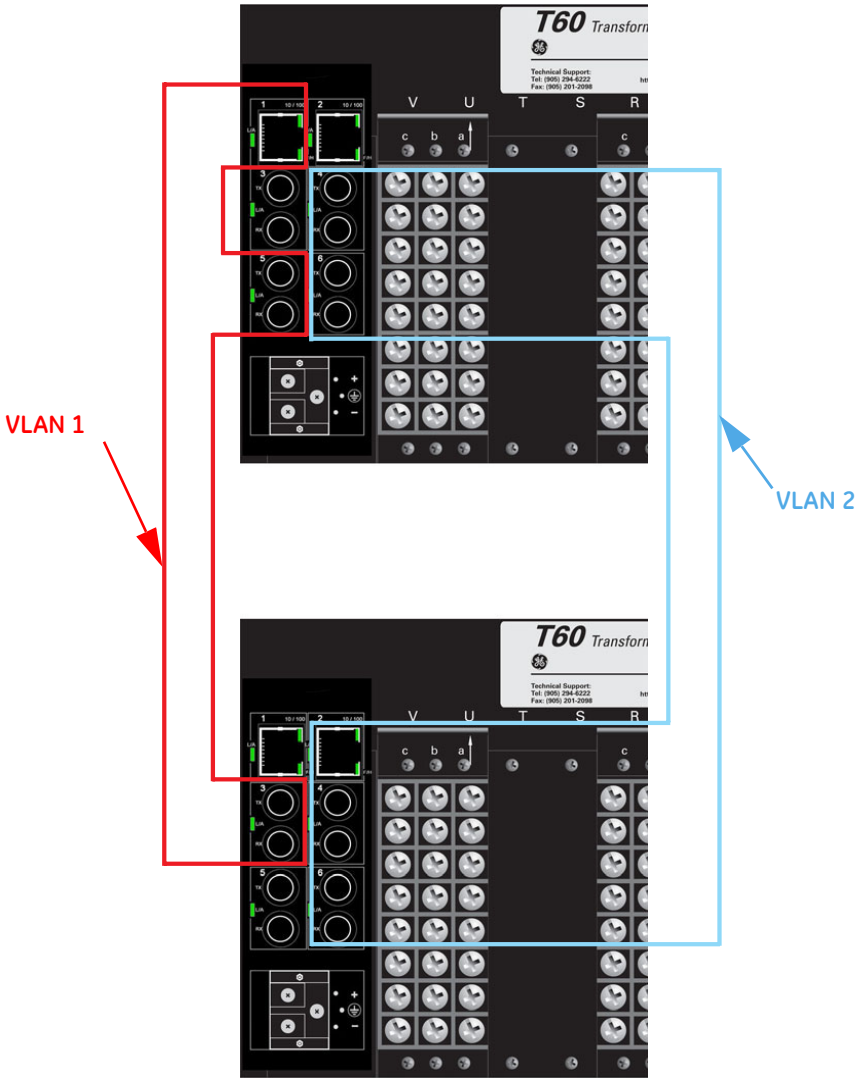


FIGURE QS–13: Tagged Virtual LANs

Configuring a VLAN within the Switch

To configure a VLAN within the switch:

- First determine which physical ports are to be part of the tag-based VLAN.
- Take note the names of the associated ports displayed on the home page.
  In our example we want the ports named A5 and A6 and A7 to be part of the new VLAN.
- Once the port names have been determined, open the main port configuration page by double clicking on one of the port icons.

In this page we can see that the port named A5,A6 and A7 have been assigned port number 5, 6 and 7 respectively. .

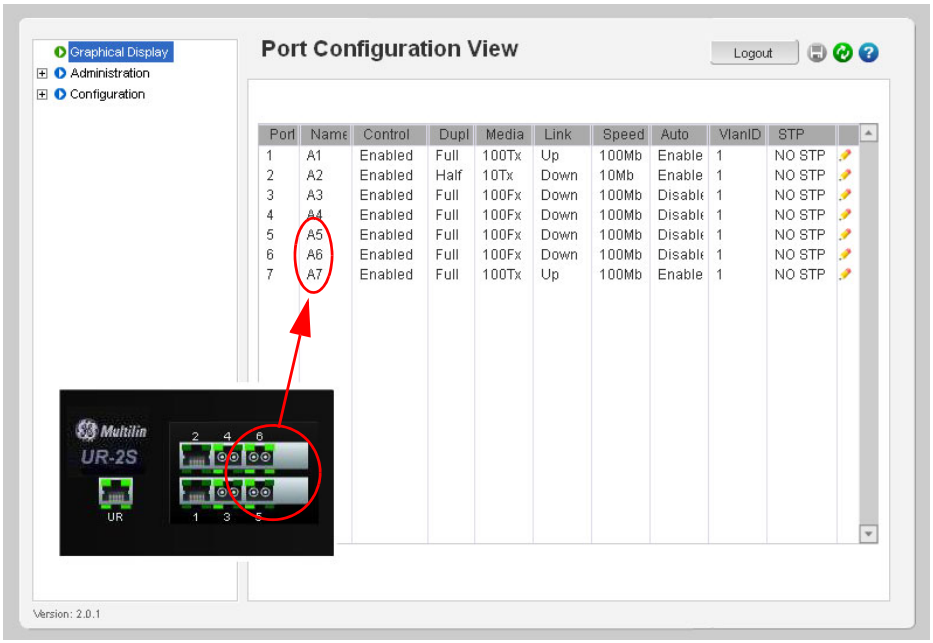
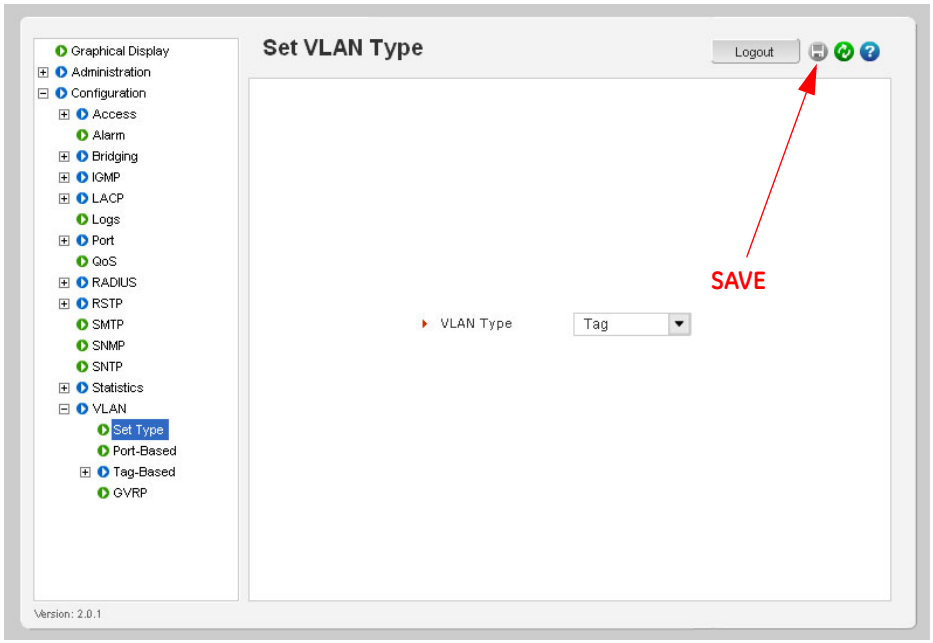
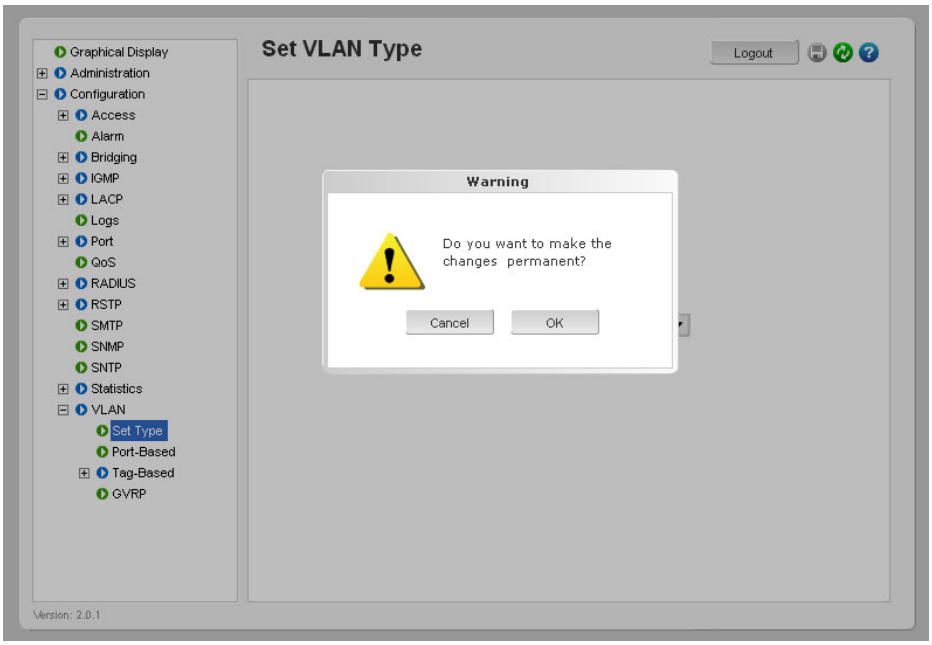


FIGURE QS–14: Associated Port Numbers; 7 is connected to the UR

- Now open the VLANs menu and select the **Type** menu.
- In this menu set the VLAN type to **tag**.
- Select the **Save** icon.

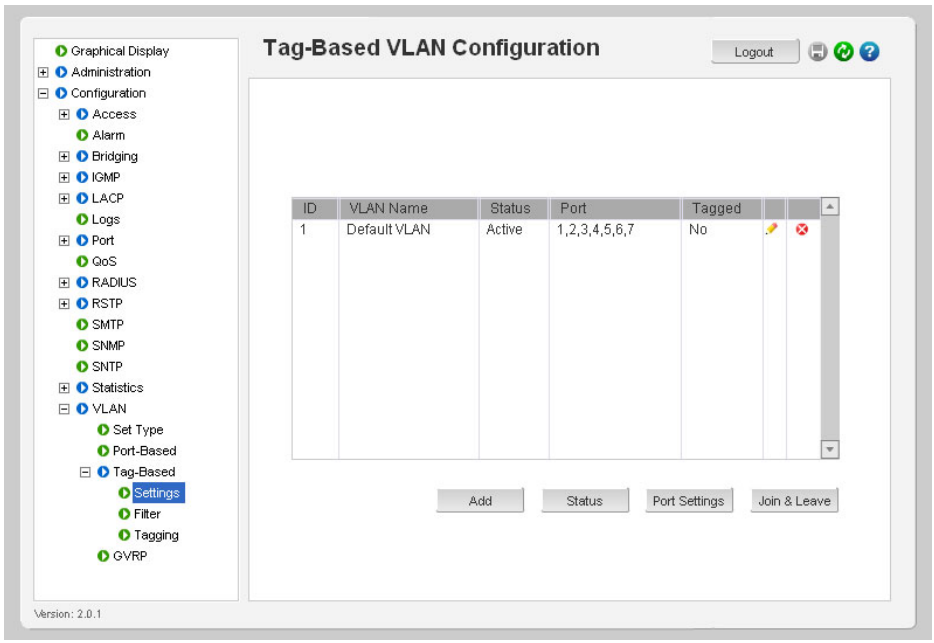




We have now configured the Switch to support Tag-based VLANs

We can now proceed to the Tag-based VLAN menu . From the Tag-based VLAN menu we can see that all ports have been assigned to default to Tag-based VLAN 1.

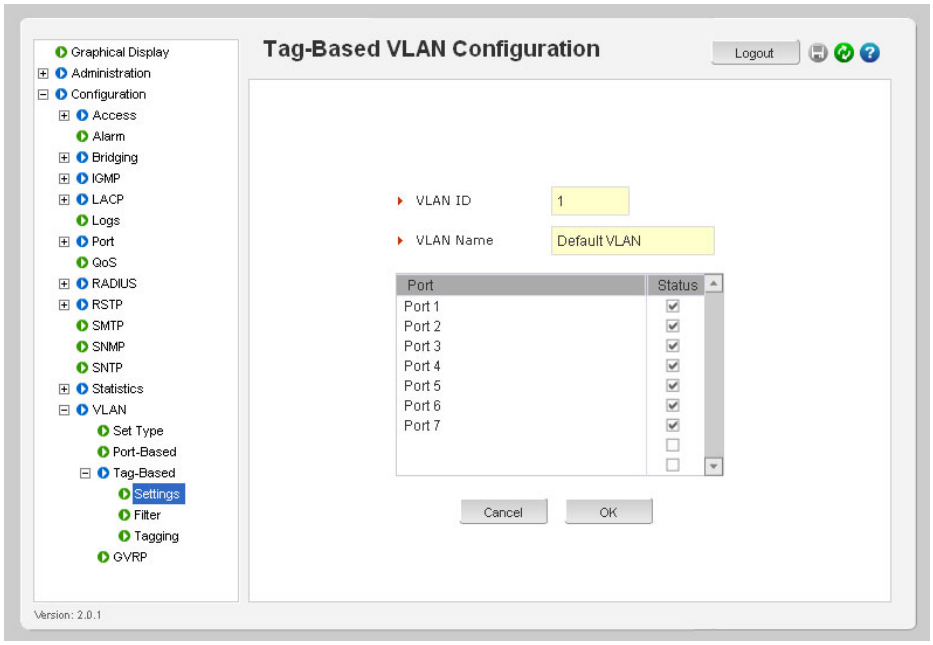
▷ To create a new Tag-based VLAN click on the **Add** icon..



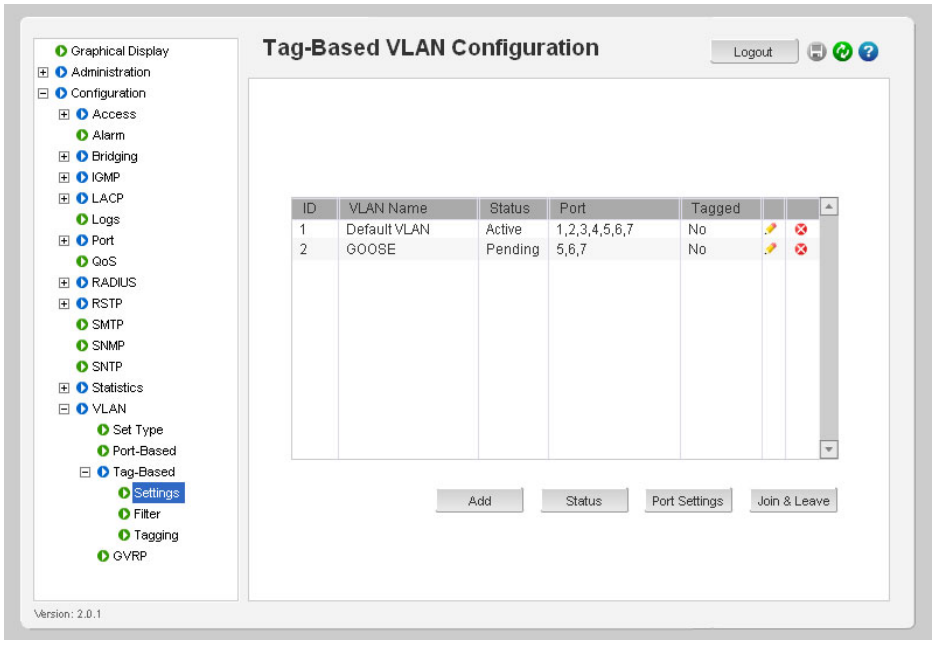
A screen will open that will allow you to configure a new Tag-based VLAN.

Within this screen:

- Enter the new VLAN ID number (or tag) and the name of the VLAN. We will use a tag of two and a VLAN name of GOOSE.
- Left mouse-click on the check boxes corresponding to ports 5, 6 and 7 to add them to VLAN 2.
- Select **Save**.
- **OK** to exit.

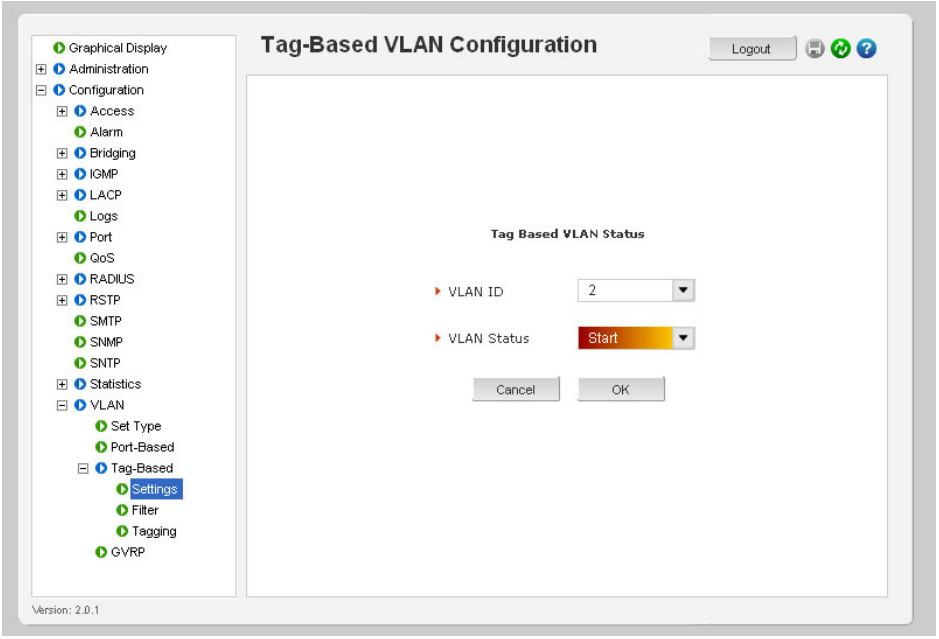


You will notice below, that the status of the VLAN named GOOSE is displayed as **Pending**. To activate VLAN 2 proceed as follows.



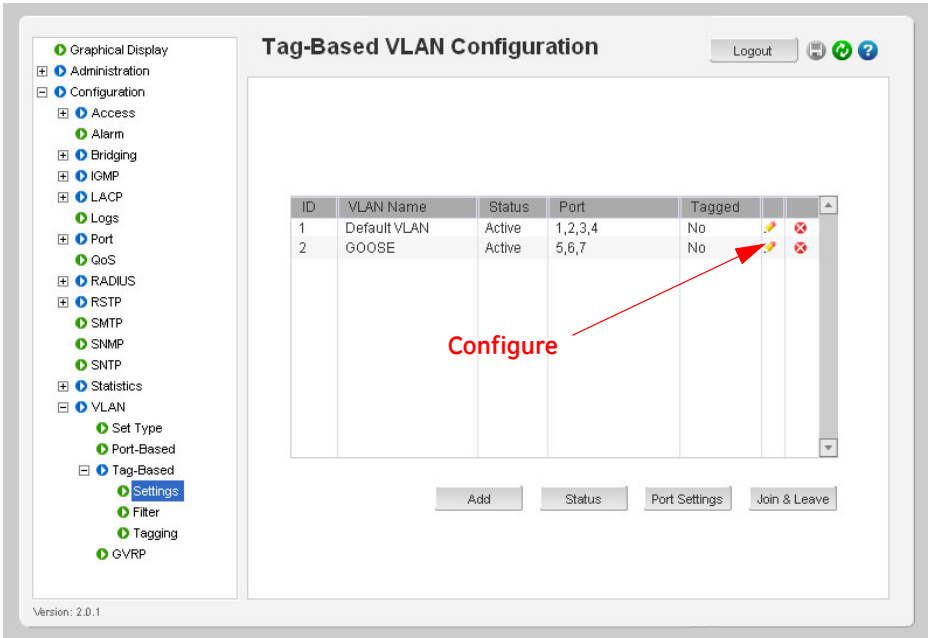
▷ Select **Status**.

▷ Once in the Status menu, set the VLAN ID to **2** and the VLAN status to **start**.



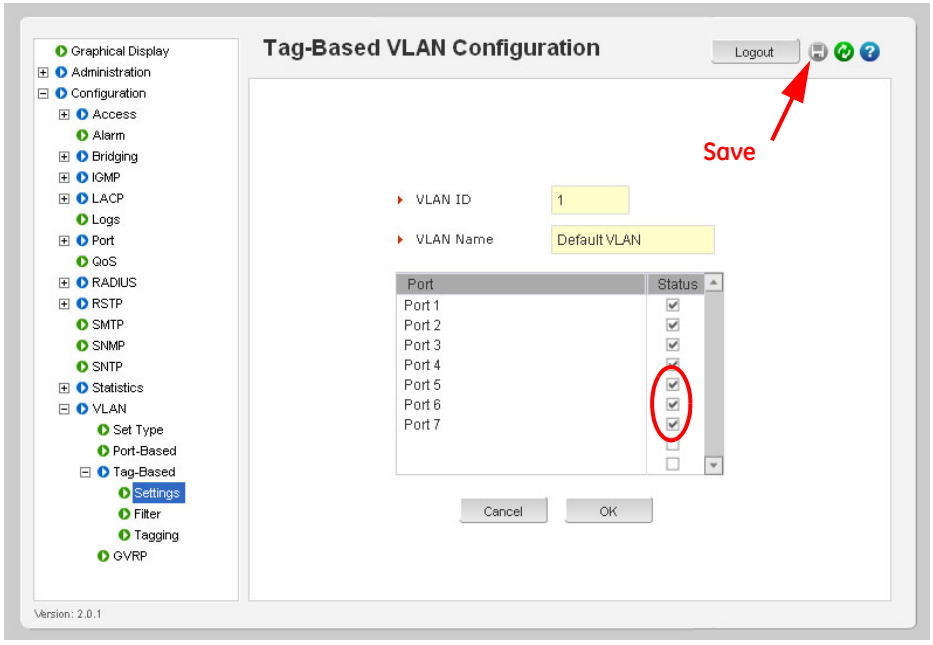
▷ Select **OK** to start VLAN 2.

You will notice that VLAN 2 is now active.

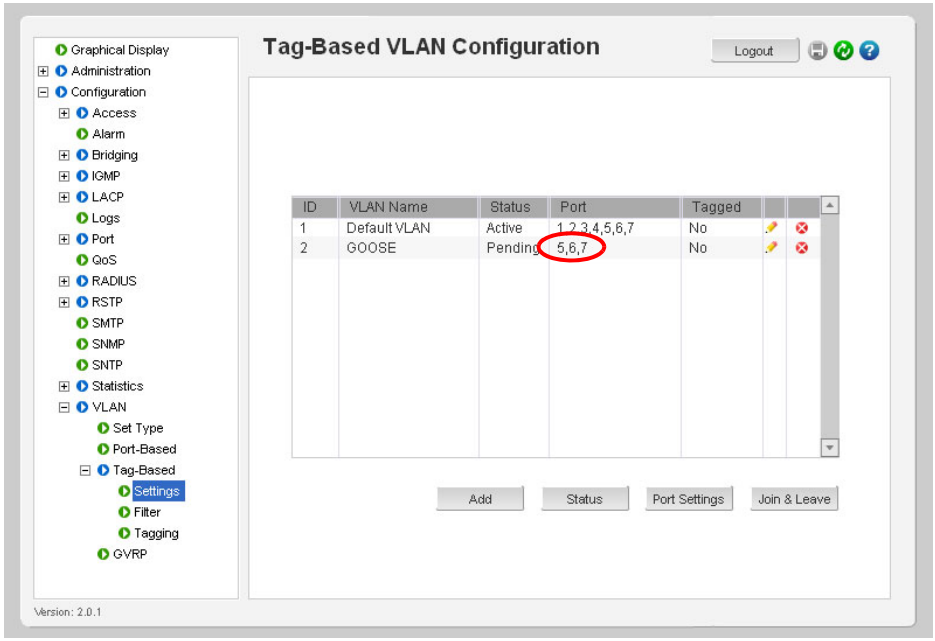


You will notice that VLAN 2 is now active but the ports 5,6 and 7 have been removed from the default tagged based VLAN1. You can add them back into the default tagged based VLAN 1 if you wish such that they are part of both VLAN 1 and VLAN 2. To do this select the configure ICON for the default tagged based VLAN1.

- ▷ **Add ports 5,6 and 7 to tagged based VLAN 1 by checking the corresponding boxes.**
- ▷ **Select the Save icon at the top of the screen then select OK to return to the main tag VLAN menu.**



Note that ports 5, 6, and 7 are now part of both VLAN1 and VLAN 2.



You have now completed the exercise.

QS.5.2 Configuring the UR Switch for Ring Only Mode

NOTE

By setting STP type to RSTP two choices of the span tree algorithm will be available: the standard **RSTP** (Rapid Spanning Tree Protocol) or the high speed "**Ring Only Mode**"
For information about RSTP setup, refer to the User Manual.

This feature can be used only when the Switches are connected to form a single ring topology. This means that only two ports per Switch are used to form the ring; all other ports will not be part of this ring or another ring. RO mode has typical recovery time of ≤ 5 ms/hop.

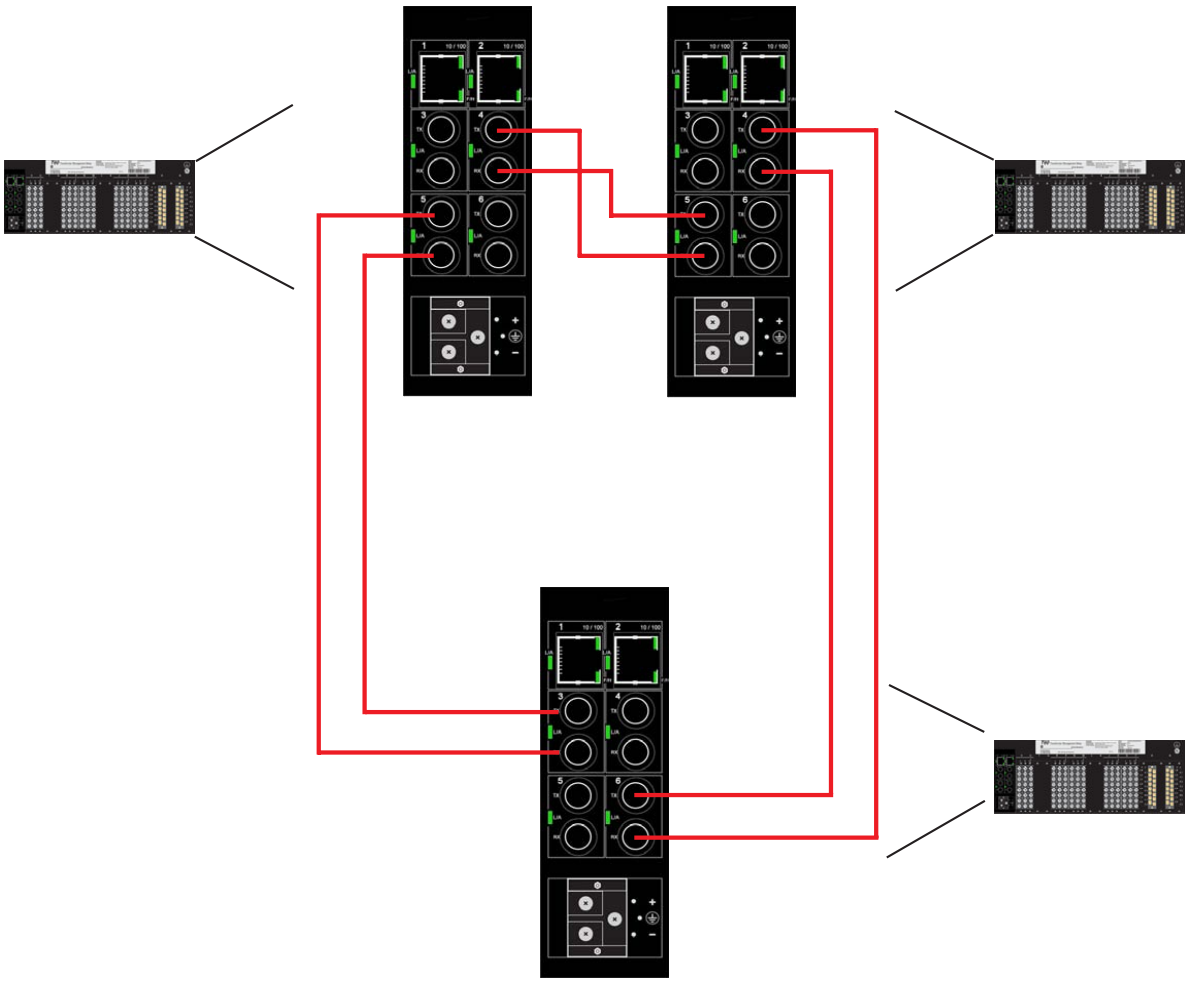


FIGURE QS–15: Configuration of UR Switch Ring-only Mode

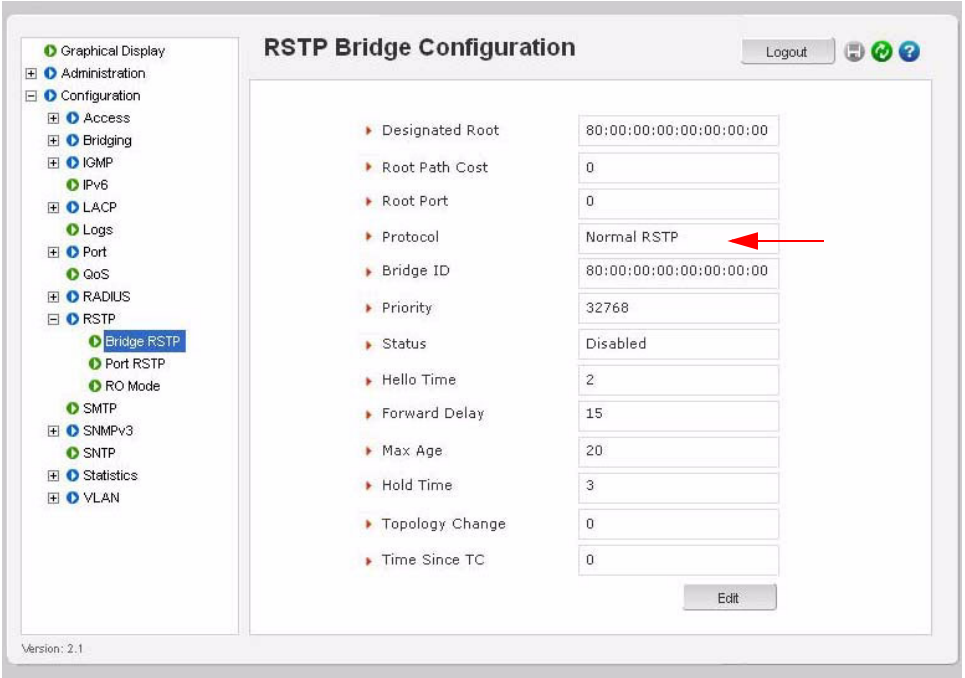
.

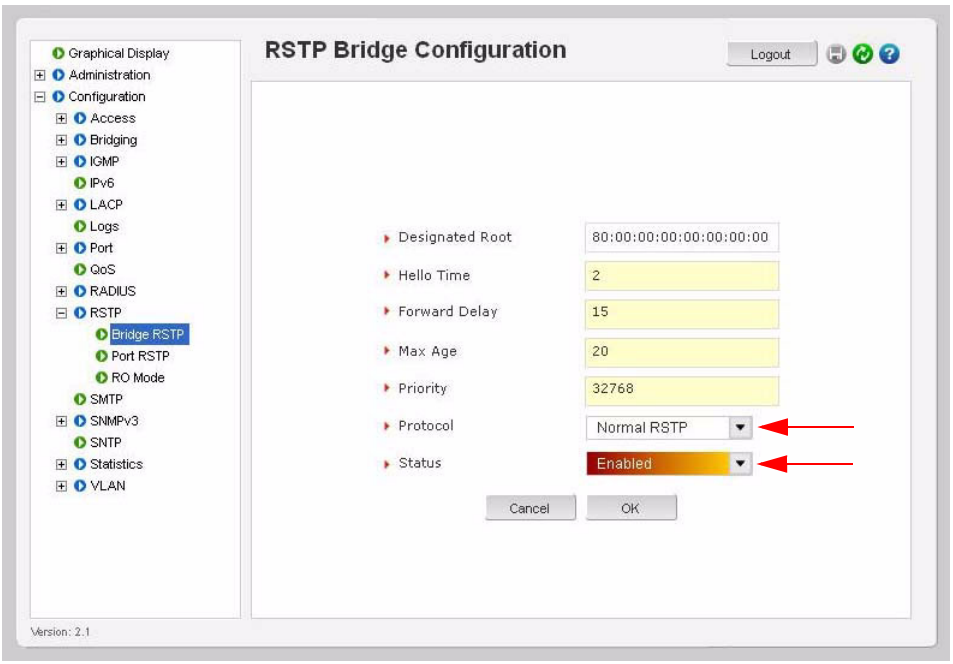
- ▷ from the Administration menu open the **Set** menu.
- ▷ Open the **STP type** setting.
- ▷ Set STP to Rapid Spanning Tree (**RSTP**).

- ▷ **Save** the setting.

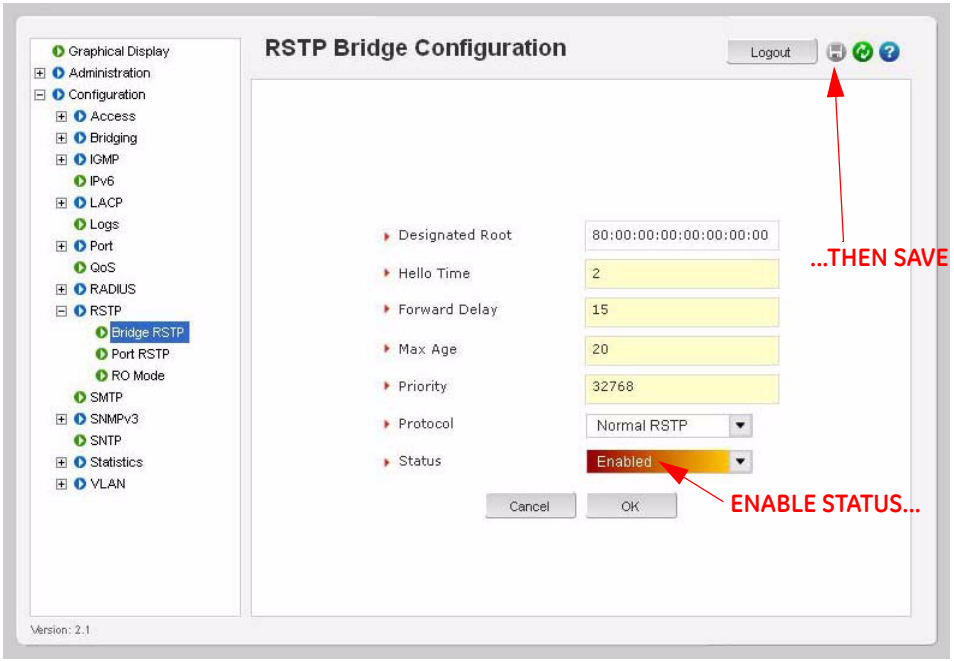
.

- ▷ From the configuration menu open the **RSTP** menu.
- ▷ Select **Bridge RSTP**.
  Note that the protocol is still set to **normal RSTP**.
- ▷ Select the **Edit** icon.

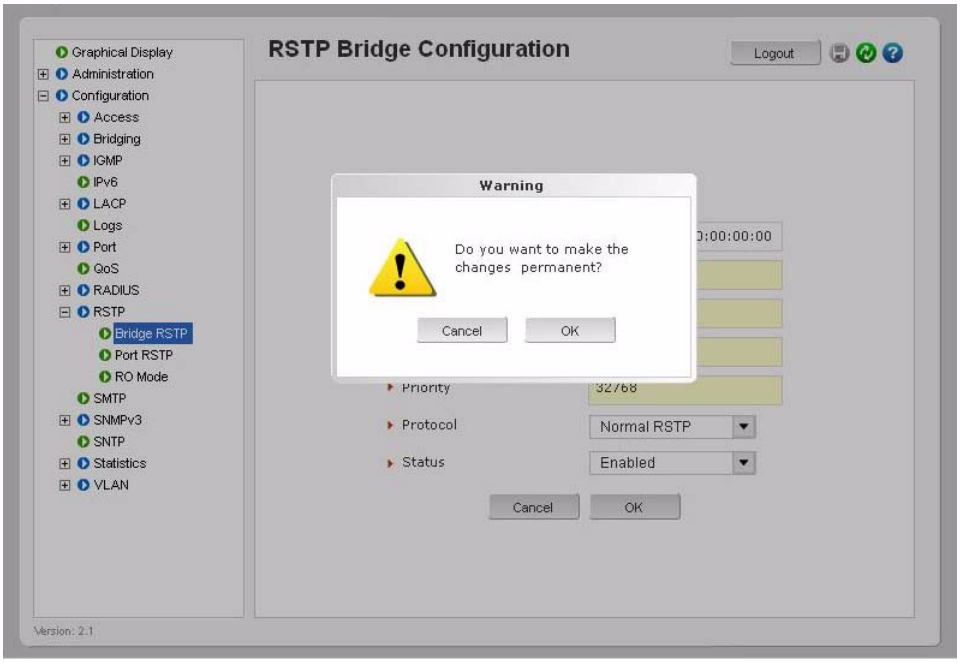


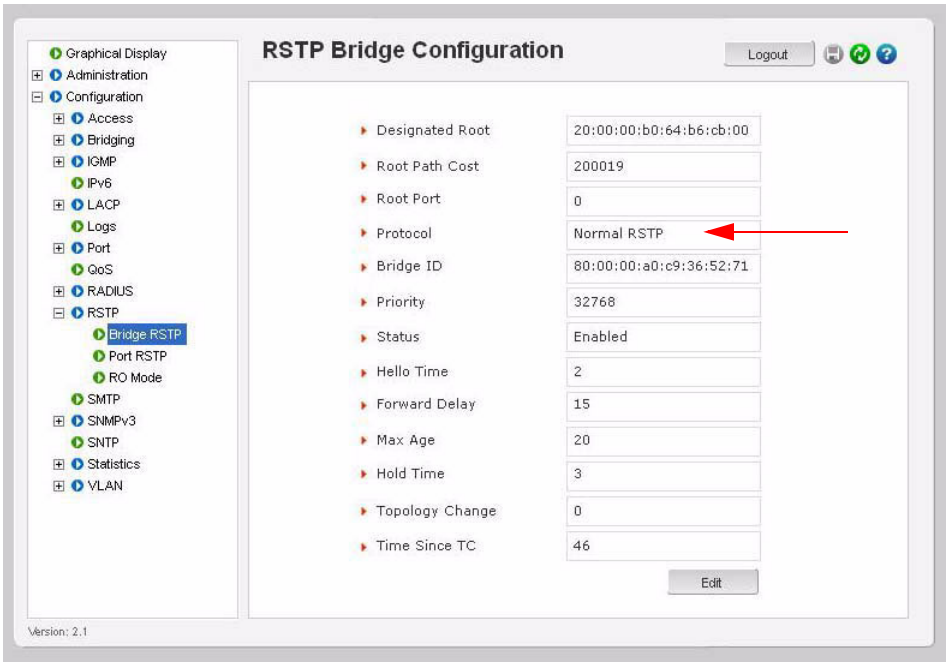


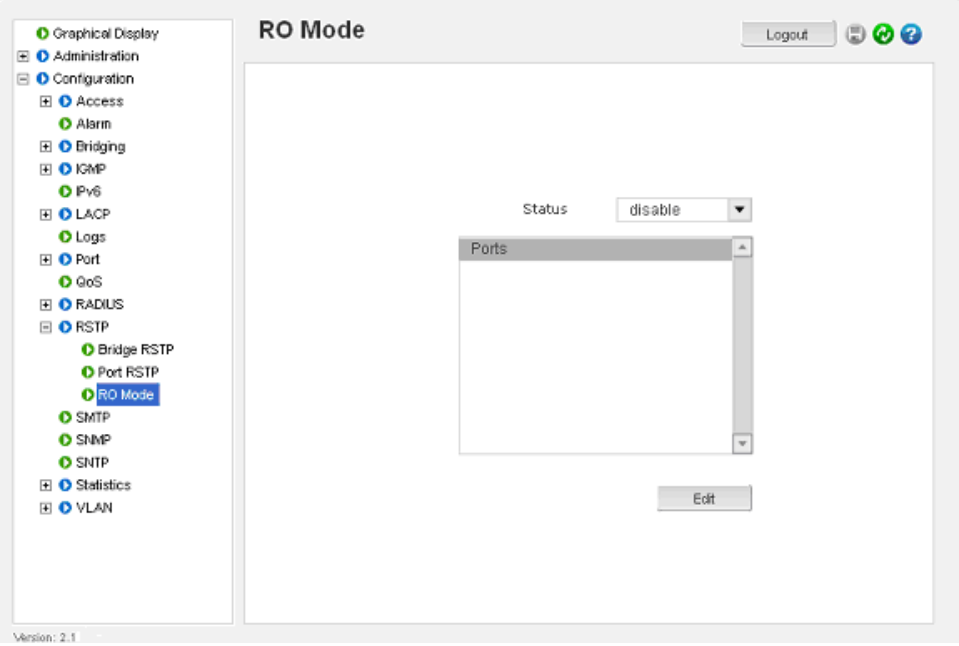
- Once in **Edit** mode, change the **Status** to **Enabled**
- Once these settings have been completed **Save** the configuration.



▷ Once saved, select **OK**, then **OK** again to exit.



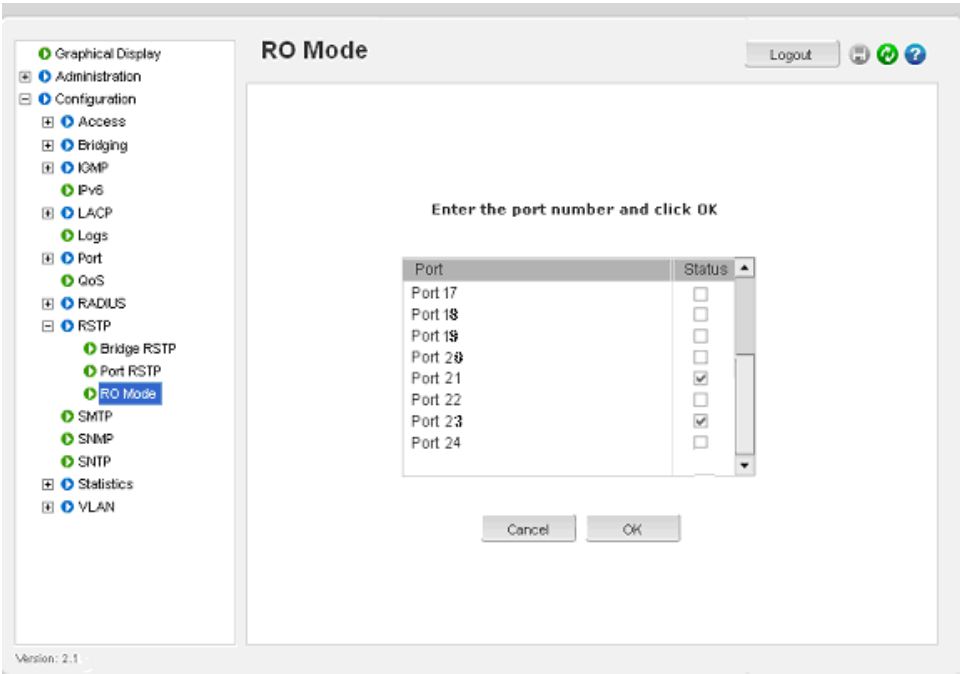




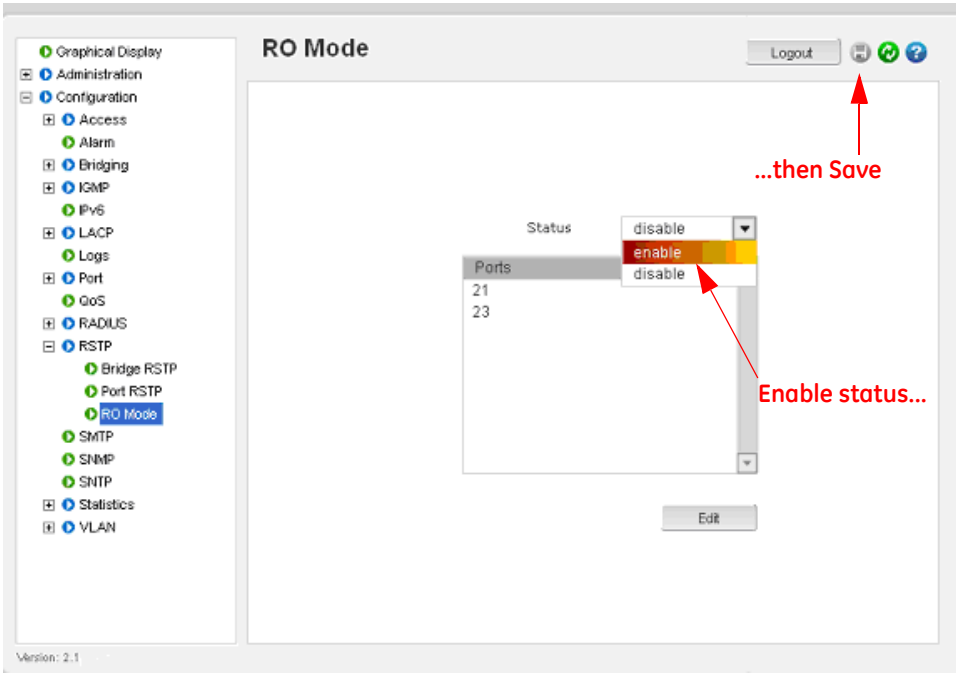
- Select the **Configuration > RSTP > RO Mode** menu as shown above.
- Click the **Edit** button to configure RO Mode.
- Select the desired ports that are part of the ring, as shown below.
- Click **OK** to exit.

NOTE

Only 2 ports can be selected to Ring Only Mode.



▷ Select the **Enabled** option for the Status setting as shown below.

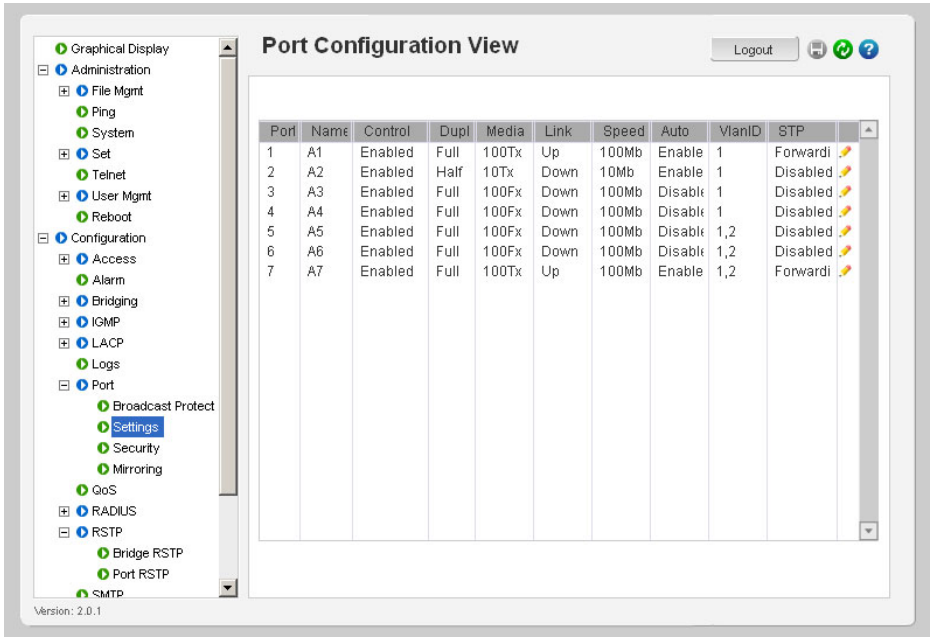


▷ Change status to **Enable**.

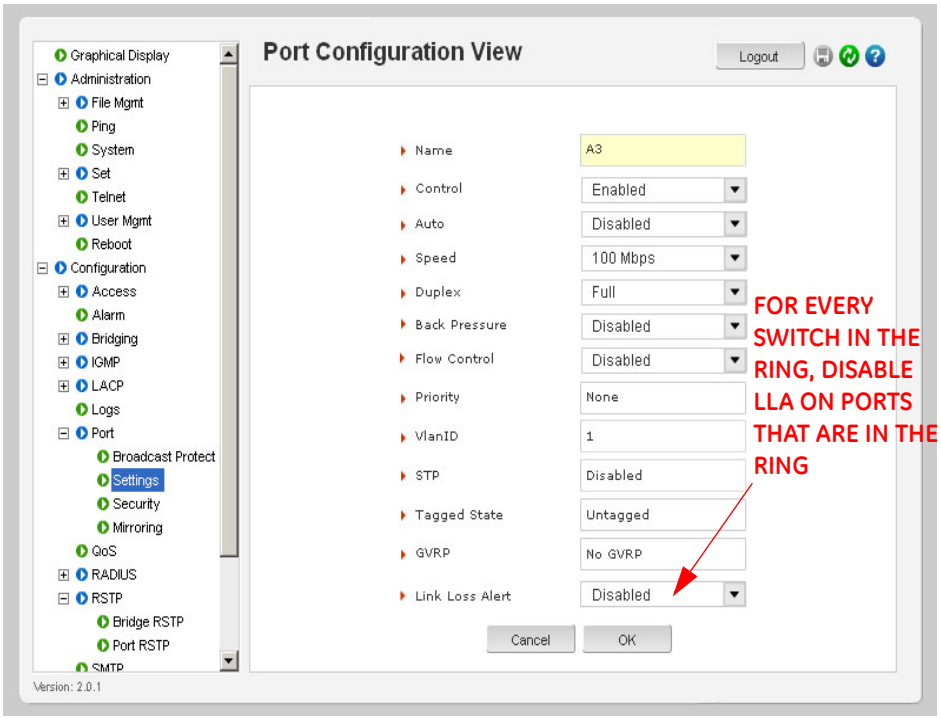
▷ Save the configuration by clicking on the icon.

▷ For proper recovery, disable the **Link Loss Alert** function on all ports forming the ring.

▷ From the main port configuration menu left mouse click on the **Configuration** Icon for each of these ports.



- Within the Port Configuration screen ensure that the Link Loss Alert is set to "**Disabled**".
- **Save** the settings.
- Repeat this procedure for the other other port on each switch that forms the ring.



- Once this procedure has been completed for all ports forming the ring, connect the configured ports into the ring topology as shown below.

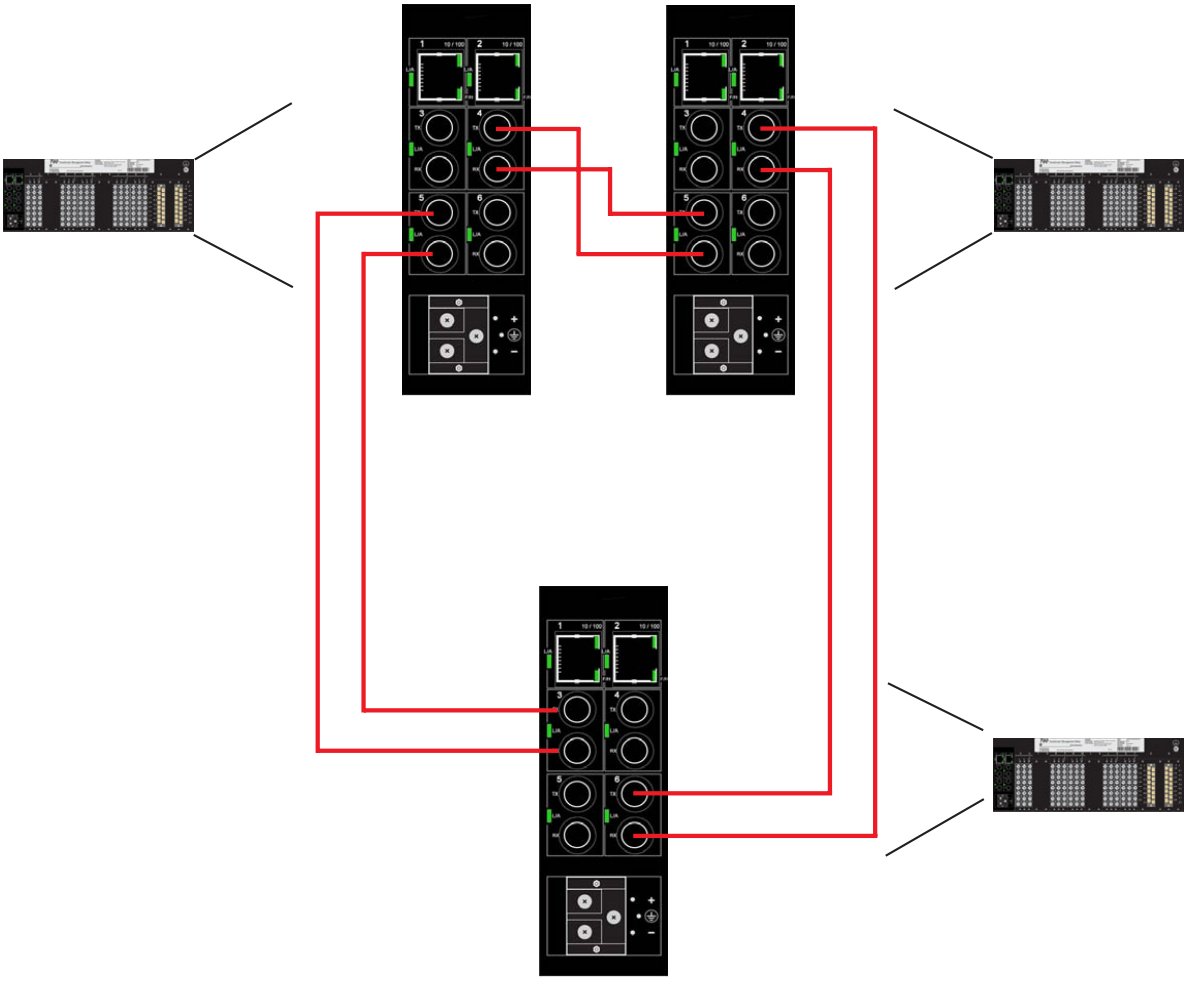


FIGURE QS–16: Configuration of the UR Switch Ring-only mode

You have completed configuration of Ring-only mode.

QS.5.3 Saving and Loading Switch Settings

NOTE

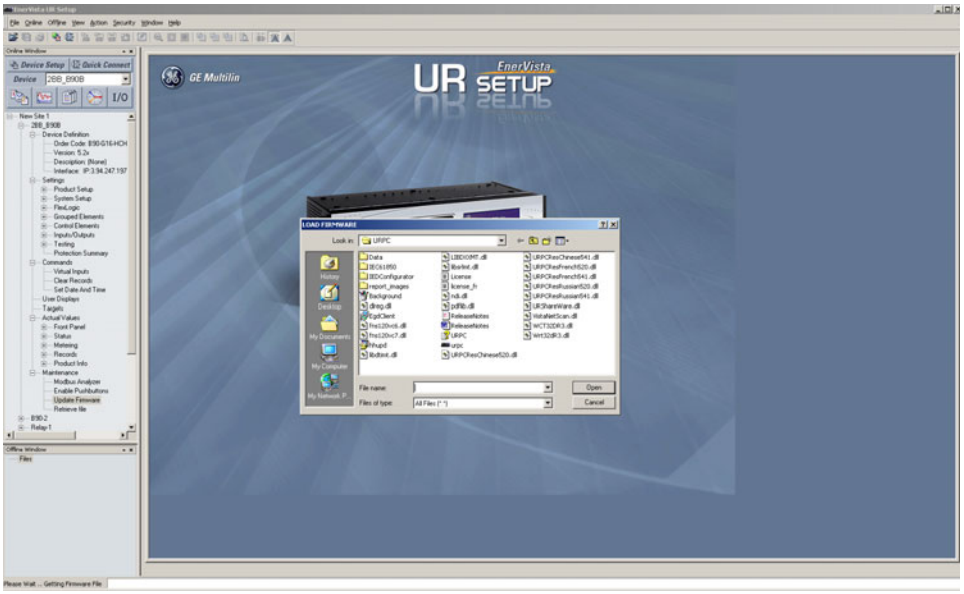
For other methods of transferring Settings Files, please refer to the UR Switch User Manual.

Saving Switch Settings

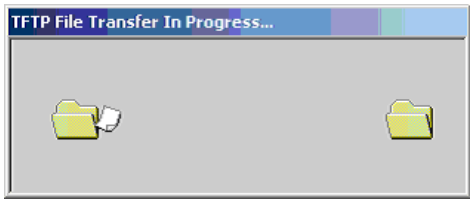
NOTE

Switch Settings Files can be saved and loaded using EnerVista UR Setup, EnerVista Multilink Software, or via the Console port (CLI). To save the Switch Settings File using EnerVista UR Setup, select **Settings > Product Setup > Communications > Ethernet Switch > Ethernet Switch Settings File**.

▷ Select the **Retrieve Switch Settings Files** option.
The following window will appear prompting you to select the location and name of the Settings file to be saved.



Once the **Save** option is selected, the following window will pop up, indicating the Settings file transfer is in progress.



Loading Switch Settings

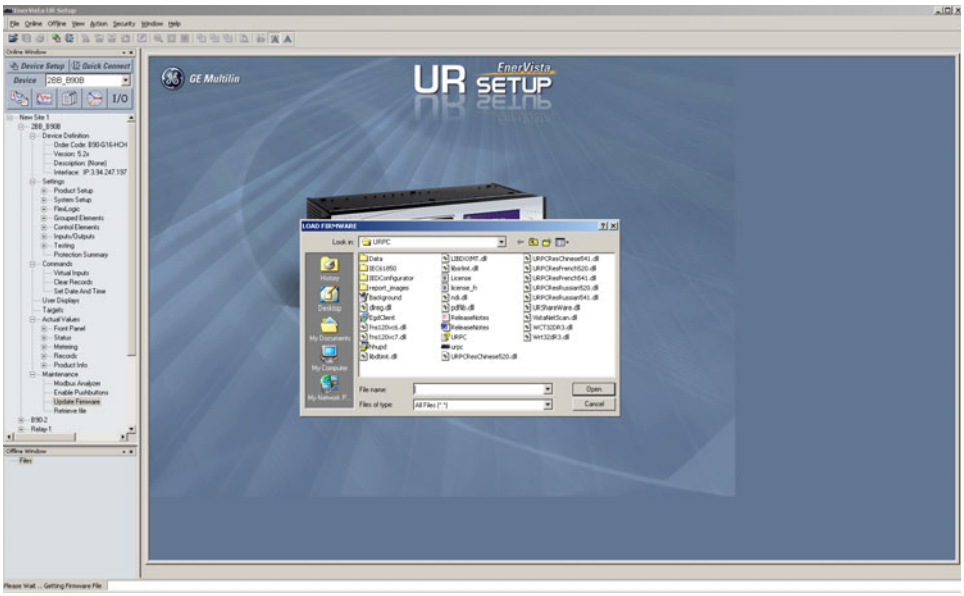
NOTE

Place the Switch offline while transferring Setting Files to the Switch.
When transferring Settings Files from one Switch to another, the IP address of the originating Switch will also be transferred. The user must therefore reset the IP address on the receiving Switch before connecting to the network.

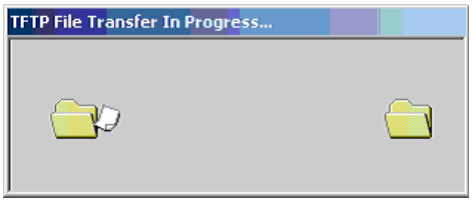
To Load the Switch settings file select **Settings > Product Setup > Communications > Ethernet Switch > Ethernet Switch Settings File > Transfer Settings File.**

▷ Click on the **Transfer Settings** File option.

The following window will pop-up, prompting you to select the location and file to be loaded.



Once **Open** option is selected on the above window another pop-up window will appear as shown below indicating setting file transfer is in progress.



If the Settings File transfer was successful, the window below will appear.

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NOTE

The switch will automatically reboot after a successful Settings File transfer

QS.6 UR Switch Module Firmware Updates

QS.6.1 Updating UR Switch Module Firmware

This section describes the process for upgrading firmware on a UR-2S/T Switch Module.

There are several ways of updating Firmware on a UR Switch Module: EnerVista UR Setup software, Serial using the UR Switch Module's Console port, tftp or through ftp. It's highly recommended to use EnerVista UR Setup software to upgrade Firmware on a UR Switch Module.

NOTE

Firmware upgrade using serial, TFTP, and FTP, are described in the *UR Switch Module manual*.

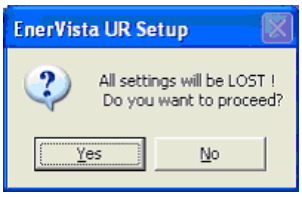
QS.6.2 Selecting the Proper Version

The latest version of the firmware is available as a download from the GE Multilin web site.

To determine the version of firmware currently installed on your Switch, proceed as follows:

▷ Using the EnerVista web interface, log into the Switch using the procedure described earlier. The firmware version installed on the switch will appear on the lower left corner of the screen.

▷ Using the EnerVista UR Setup program, select **Settings > Product Setup > Communications > Ethernet Switch > Firmware Upload**. The following popup screen will appear warning that the settings will be lost when the firmware is upgraded.



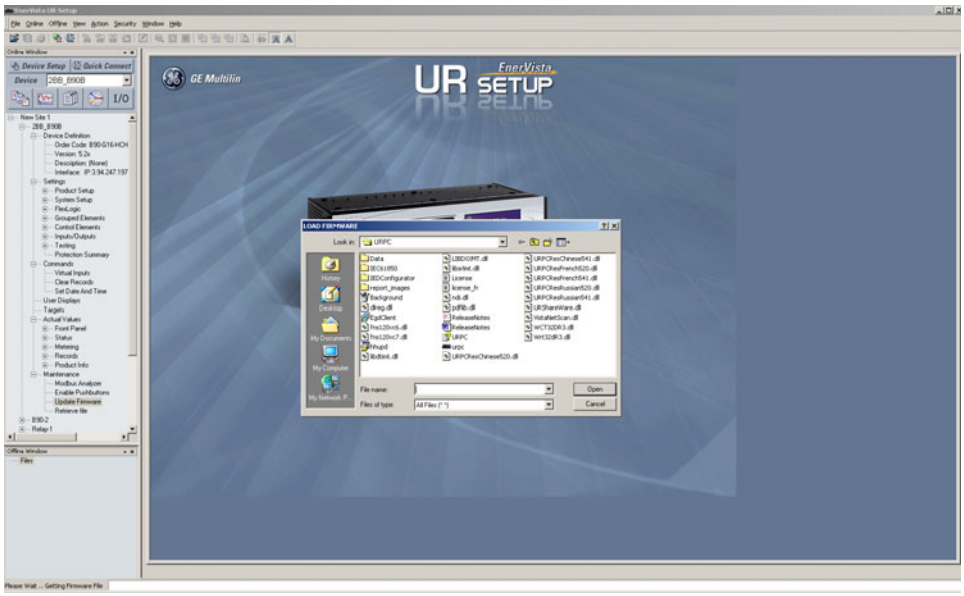
NOTE

It is highly recommended that you save the Switch settings before upgrading Switch firmware.

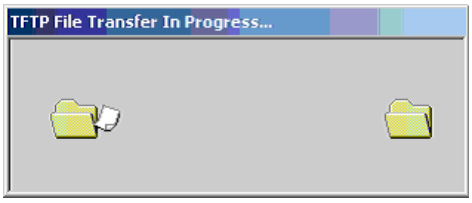
▷ **After saving the Settings file, proceed with the firmware upload by selecting Yes to the above warning.**

Another window will open, asking you to point to the location of the firmware file to be uploaded.

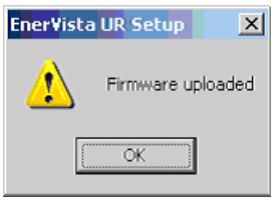
▷ **Select the firmware file to be loaded on to the Switch, and select the Open option.**



The following window will pop up, indicating that the firmware file transfer is in progress.



If the firmware load was successful, the following window will appear:.



NOTE

The switch will automatically reboot after a successful Settings File transfer.

▷ **Once the firmware has been successfully uploaded to the UR Switch Module, load the Settings file using the procedure described earlier.**