Luminex
Lighting Control Equipment

Safety Ring Switch

User Guide

Safety Ring Switch User Guide
Document lu_01_00009_man

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Limited warranty

Unless otherwise stated, your product is covered by a one (1) year parts and labor limited warranty. It is the owner's responsibility to furnish receipts or invoices for verification of purchase, date, and dealer or distributor. If purchase date cannot be provided, date of manufacture will be used to determine warranty period.

Returning under warranty

Any Product unit or parts returned to Luminex LCE must be packaged in a suitable manner to ensure the protection of such Product unit or parts, and such package shall be clearly and prominently marked to indicate that the package contains returned Product units or parts. Accompany all returned Product units or parts with a written explanation of the alleged problem or malfunction.

Freight

All shipping will be paid by the purchaser. Items under warranty shall have return shipping paid by the manufacturer only in the European Union. Under no circumstances will freight collect shipments be accepted. Prepaid shipping does not include rush expediting such as air freight. Air freight can be sent customer collect in the European Union.

Warranty is void if the product is misused, damaged, modified in any way, or for unauthorized repairs or parts.

Packaging

- 1 x Safety Ring Switch
- 1 x User guide

Overview

This manual will help you install and maintain the Safety Ring Switch. The Ring Switch allows you to implement the traditional star topology, or ring topology to take advantage of network path redundancy. The switch can be used right out of the box without configuration; or through some simple configuration steps, some powerful managed switch features can be enabled such as traffic prioritization and port mirroring.

Star Topology

Ring Topology

Operation

In the Safety Ring Switch, messages are intelligently routed for the sake of increasing the efficiency and reliability of your network. Unlike an Ethernet hub, a switch will forward packets to specific ports to reduce unnecessary traffic on network paths, thus optimizing network efficiency. Most importantly, by using a Ring Switch, you can implement redundant paths in a network by allowing ring topology (for a more resilient network). Ring topology is important in path redundancy because no matter where in the ring that a path gets "cut", all devices connected to a node in the ring will still be able to communicate with each other.

Backup Path

Active Path

Conventional switches and hubs cannot be used in ring topologies because of broadcast storms. Broadcast storms can bring a network to a stop if conventional switches or hubs are being used in a ring topology because of broadcast message reproduction. Using Ring Switches in the loop will prevent broadcast storms because they have the intelligence to
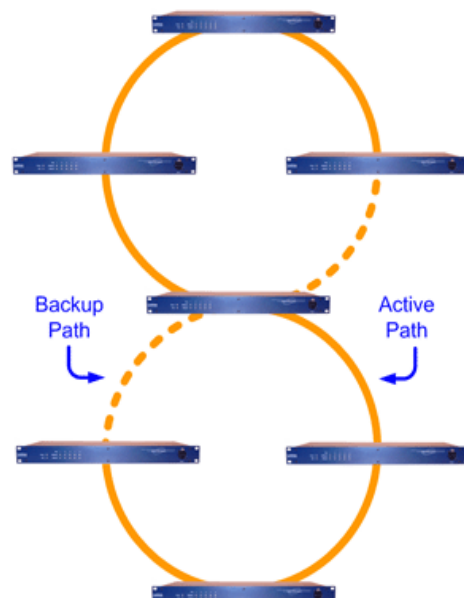
detect loops and to assign the necessary ports to be in the backup (disabled) state. These backup ports will be instantly enabled should the primary path in their respective ring fail. See picture to the right:

The Ring Switch supports 10BaseT (10 Mbps), and 100BaseT (100 Mbps) on its RJ45 ports. Each of these ports will independently auto-sense the speed, allowing you to interface to regular or fast Ethernet devices. They also have 100BaseF (100 Mbps) fiber optic port(s).

Performance specifications

Ports	5 or 9
Port types	10/100BaseT (Shielded RJ45), 100BaseF (SC connectors),
Ethernet switch type	Intelligent Store and Forward with Safety Ring plus some management capabilities
Ethernet protocols supported	All IEEE 802.3
RJ45 operation	Auto negotiation, Auto-Crossover and Auto-Polarity
Fiber operation	Multimode with distances up to 2 km

Connectivity

Front panel
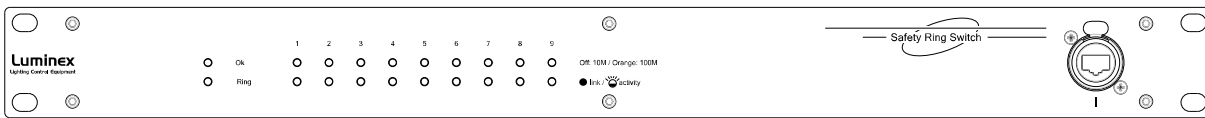
1 x Neutrik Ethercon connector for Ethernet port 1.

Rear panel
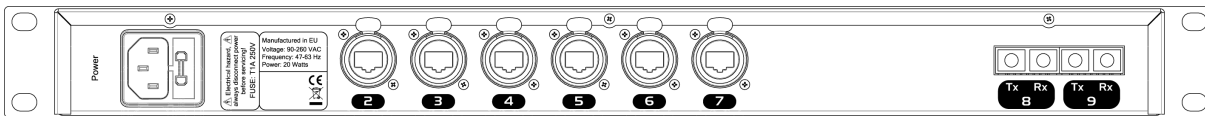
- **Mains**

The device operates with an AC voltage between 90V and 260V within a frequency range of 47Hz and 63Hz.

An IEC V-lock socket is located at the rear of the unit. Please use an IEC plug compliant cable to feed power to the unit.
Luminex recommend the use of a power cable, fitted with an IEC Volex V-Lock connector. The V-Lock system offers a reliable way to connect the power cable to the unit.

!!! This equipment must be earthed !!!

- **Ethernet connections**

6 x Neutrik Ethercon connectors for Ethernet ports 2 to 7.

2 x Duplex SC connectors for Multimode fiber ports 8 and 9.

LED Indicators

Overview

The Safety Ring Switch has 2 communication LEDs for each port, and in addition, two LEDS (OK and Ring) provide switch and network status. Refer to the pictures below for the location of these LEDs.
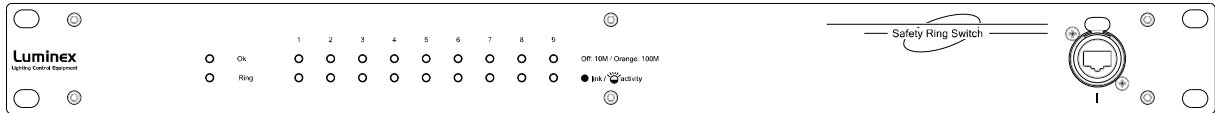
OK LED

The OK LED is a bi-colour LED. The LED will be ON green as long as power is applied and all configured rings have continuous ring integrity.

Here are the possible states for the OK LED:

- ➢ **OFF** – This would indicate that the unit is not powered.

- ➢ **ON ORANGE** – One of the active rings for which this switch is a member of has encountered a segment failure.

- ➢ **ON GREEN** – Power on the unit is ok, and no problem is encountered on active rings.

- ➢ **Blinking orange / green** – There are three blink rates:

  - ➢ Continuous rapid blinking orange: The user has selected the Operations → Wink command, to visually identify the unit.

  - ➢ Rapid blinking orange, with a single short pause: Should the OK LED blink rapidly for about 5 seconds and then pause for about 1 second, this indicates that the switch is in the boot-up process.

  - ➢ Long GREEN, short ORANGE: If the OK LED is GREEN for about 1.9 seconds and ORANGE for .1 seconds, an internal error has occurred in the Safety Ring switch.

Ring LED

The Ring LED turns ON when all rings enabled in the switch have continuous ring integrity. This LED also has the following indications.

- **OFF**: The Safety Ring switch has not been configured for any rings.

- **Blinking**: One or more rings have been configured for the Safety Ring switch, but a break has been discovered for one or more of the configured rings. Neighboring Safety Ring switches are responding, so the break is at another location.

- **Blip**: (Long OFF – Short ON) One or more configured rings have been broken. The break has been detected to be local to one of the ports.

In simple rings, the segment with the problem will most likely be between the two Safety Ring switches with their RING LEDs in the blip state.

Port LEDs

There are two LEDs per port. One LED indicating the speed (10/100/1000) and one to indicate link and activity. The port states and LED blinking are described below:

- **Link/activity OFF** - This would indicate that there is not a proper Ethernet connection (Link) between the port and another Ethernet device. Make sure the proper cable type is in use and that it has been plugged securely into the ports at both ends.

- **Link/activity ON Solid (not flashing)** – This would indicate that there is a proper Ethernet connection (Link) between the port and another Ethernet device, but no communications activity is detected.

- **Link/activity Blinking** – This would indicate that there is a proper Ethernet connection (Link) between the port and another Ethernet device, and that there is communications activity detected on the port. Note that a port LED will blink when there is any kind of communication activity detected on the port, even if the communication involves an Ethernet device other than the Safety Ring switch, and even if the port of the Safety Ring switch has been disabled.

- **Speed OFF** – 10Mbs (10BaseTX) connection is detected.
- **Speed ORANGE** – 100Mbs (100BaseTX) connection is detected.

Overview

The Safety Ring Switch provides Ethernet and fiber connections to devices on the factory floor through star or ring topology. When wiring the Ring Switch in a ring topology, it is important that only Safety Ring Switches are used for each node in the ring. With proper ring wiring, all nodes in the ring can maintain the same data connectivity should a path in the ring be "cut".

RJ45 Wiring guidelines

Use data-quality (not voice-quality) twisted pair cable rated category 5 or better with standard RJ45 connectors with or without Neutrik Ethercon connectors. For best performance use shielded cable. Straight through or crossover category 5 cable can be used regardless of the type of device connected to the Ring Switch. This is because the Ring Switch supports auto-mdi/mdix-crossover.

Pair #	Wire	Pin #
1-White/Blue	White/Blue	5
	Blue	4
2-White/Orange	White/Orange	1
	Orange	2
3-White/Green	White/Green	3
	Green	6
4-White/Brown	White/Brown	7
	Brown	8
568-B diagram		

Pair #	Wire	Pin #
1-White/Blue	White/Blue	5
	Blue	4
2-White/Green	White/Green	1
	Green	2
3-White/Orange	White/Orange	3
	Orange	6
4-White/Brown	White/Brown	7
	Brown	8
568-A diagram		

Notes for wiring diagrams above:

- ➢ For patch cables, 568-B wiring is by far, the most common method.

- ➢ There is no difference in connectivity between 568B and 568A cables. Either wiring should work fine on any system.

- ➢ For a straight through cable, wire both ends identical.

- ➢ For a crossover cable, wire one end 568A and the other end 568B.

- ➢ Do not confuse pair numbers with pin numbers. A pair number is used for reference only (eg: 10BaseT Ethernet uses pairs 2 & 3). The pin numbers indicate actual physical locations on the plug and jack.

The maximum cable length for 10/100BaseT is typically 100 meters (328 ft.).

Ethernet Fiber wiring guidelines

The Safety Ring Switch has two pair of multimode fiber ports. The maximum segment length is up to 2 km.

Each fiber optic port on the switch is comprised of a pair of SC style connectors. For each fiber port there is a transmit (TX) and receive (RX) signal. When making your fiber optic connections, make sure that the transmit (TX) port of the switch connects to the receive (RX) port of the other device, and the receive (RX) port of the switch connects to the transmit (TX) port of the other device. See images below.

The ACT/LNK LED will be ON when you have made a proper connection.

Duplex operation

The RJ45 ports will auto-sense for Full or Half duplex operation, while the fiber ports are configured for full duplex operation. Note: Fiber devices with half duplex settings should still communicate with the switch. If otherwise then contact your switch vendor.

Network device check

The Safety Ring Switch is capable of supporting 10/100BaseT and 100 or 1000BaseF. Make sure you connect the appropriate devices to each port.

Overview

The Safety Ring Switch has all the networking capability of a typical unmanaged switch plus some advanced capability that you would only find in a managed switch. Like an unmanaged switch, the Ring Switch is "plug and play" meaning that it can be used right out of the box - without any user configuration. This includes the ring functionality, which is already pre-configured in the switch. For most applications this is all that is needed. For advanced applications you can use the Safety Ring Switch Tools (Windows software utility) to enable some advanced capabilities such as priority queuing for prioritizing your traffic, message rate filtering for broadcast storm protection and port mirroring for diagnostics.

Important Note: Only use Safety Ring Switches when connecting switches in a ring. The Safety Ring Switches use a specialized high-speed ring algorithm that only they will understand. Otherwise, these Ring Switches are fully IEEE 802.3 compatible.

Ring setup & operation

For ring operation in most applications, no user configuration is necessary. The Safety Ring Switches can be ordered pre-configured with 1 or more pairs of ports setup for ring operation. Just connect the ring-configured ports of your Ring Switches in a ring by connecting the last switch back to the first. Make sure you use only the ring configured ports for your ring connections. The non-ring ports should be used to connect to your Ethernet devices such as ArtNet nodes, light or sound desks, sound convertors, etc.
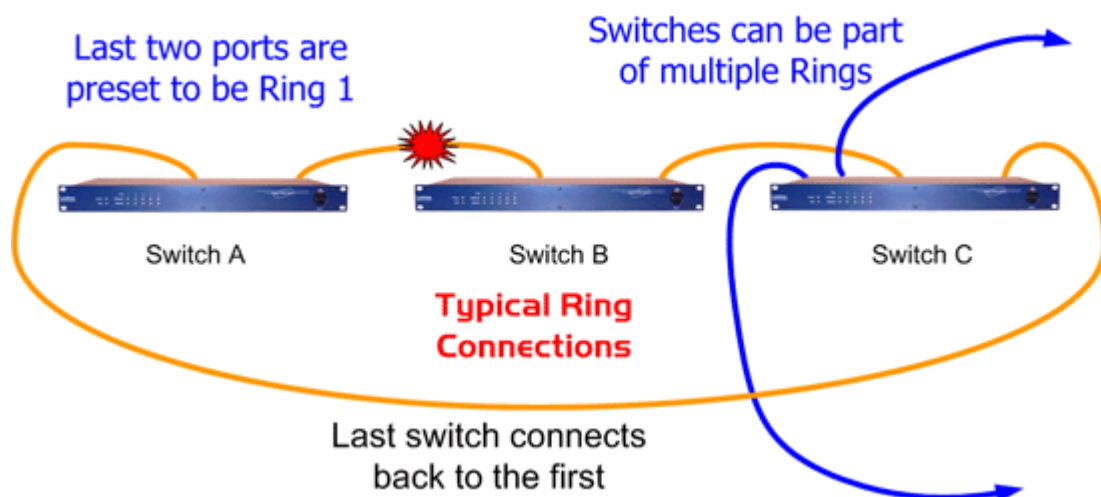
Ring algorithm and performance

The Safety Ring feature utilizes a special algorithm that assures very fast recovery times. Each Safety Ring switch utilizes the special high-speed algorithm to keep track of the health of the ring. In a healthy ring (a complete ring), one ring switch will be automatically picked to act as a master (switch with lowest MAC address) for the ring network. Alternatively, you can designate one of your ring switches to be the master using the Ethernet Switch Tools. It is the master switch's job to determine which one of its local ring ports are to be in the forwarding or backup state. The ring port chosen to be in the backup state is where the backup segment of the ring will be. By default, the ring port with the higher port number will become the backup port.

All ring switches in the ring must have a way to keep track of each other in case a failure in communication occurs along the ring. To keep track of the health of the ring, the Ring switches periodically send test messages to each other. Therefore, when a ring gets "cut" at a certain location, the Ring switches will know and they will take the appropriate action to bring the network back online. The time that it takes for the last Ring switch to "know" and take appropriate action to rectify the communication problem will be when the link loss "recovers".

Recovery time can be estimated by multiplying 5 mS times the number of switches, and then adding 30 mS (for loss of link errors) or 60 mS (for message loss errors). For example, a ring of 10 switches would have a recovery time of 80 mS for the typical loss of link type errors.

Master switch selection

As mentioned above, the ring switch with the lowest MAC address will automatically become the master and block one of its ports (highest number port). Alternatively, you can designate one of your ring switches to be the master using the Ethernet Switch Tools. There is a simple check box where you can select "Automatic" or "This Switch" for the master ring switch selection. This advanced capability allows you to control where the backup port will be in your network. The ring switch to be designated the master must be running firmware v0103 or newer. Only the ring switch that is designated the master needs to be running the newer firmware. All other ring switches can be running older firmware. It is recommended that only one ring switch be designated as the master. If more than one is designated as the master then the one with the lowest MAC address will prevail.

Safety Ring Switch Tools

In some applications it may be desirable or required to adjust the Ring Switches parameters for proper or best operation. A Microsoft Windows software utility called "Safety Ring Switch Tools" is provided to make these adjustments. Using the "auto-find" feature in the utility, you will be able to

pick from a list of detected Ring Switches and load custom configurations via Ethernet. The auto-find feature eliminates the hassle of loading via a serial connection and the overhead time spent assigning IP addresses. Refer to the online help for details on using the Safety Ring Switch Tools.

IMPORTANT NOTE: Your computer must be on the same local network as the Ring Switch for the Ethernet Switch Tools to operate properly. Also, your computer must have updated Raw Ethernet Socket (WinPcap) support installed. When installing the Ethernet Switch Tools, the installation program will call the WinPcap installation program.

Port Configuration

Safety Ring Switches auto-negotiate port settings. In most applications port settings are best left in the default "Auto" connection mode. For special situations, the ports can be "Fixed" to restrict communications to only 10, or 100 Megabits per second, with either half or full duplex. Flow control can be enabled or disabled as well. Port configuration settings are adjustable using the Safety Ring Switch Tools.

Fault tolerant rings

A network backbone wired in a ring type topology is one of the best choices for a fault-tolerant network. By default, Ring Switches may be factory preset to have zero, one, or two rings enabled. Factory presetting a ring configuration skips the step of using the Ethernet Switch Tools to enable your rings so you can have the convenience of "plug and play" operation.

To change the ring configuration in the switch, simply launch the Safety Ring Switch Tools and choose the desired pair of ports for your new enabled ring. The Ring LED will be lit if all rings (one or two) that are enabled in this switch have continuous ring integrity.

For a ring to function, all switches in the path of the ring must have Safety Ring support. Do not connect rings within rings. Only simple non-overlapped rings are allowed. Two active rings cannot share a network segment. It is possible to join two rings together by configuring two rings in a single switch. The ports used for each ring must be distinct, so that no network segment is shared by both rings. See for ring wiring examples and guidelines.

Message rate filtering

(Broadcast storm protection)

Poorly configured applications and devices or malicious users can flood your network with broadcast packets that are forwarded to all ports and can quickly consume most of a network's bandwidth. The Safety Ring Switch provides protection against broadcast storms by limiting the quantity of broadcast and multicast messages. This protection is disabled by default because broadcast is used by most light and sound protocols.

Priority queuing

(Traffic Prioritization using QoS, CoS, ToS/DiffServ)

With priority queuing configured in the Ring Switch, low priority data will not interfere with your time critical data again. Network traffic can be prioritized to achieve the performance that time-sensitive data demands. Refer to the Safety Ring Switch Tool's on-line help for more information and details on configuring priority queuing.

Port mirroring

This advanced diagnostic capability allows messages from one or more ports to be copied to another port. Then a port analyzer or "sniffer" program can be used to monitor the traffic without affecting the operation of the switch. Configuring the Safety Ring Switch for port mirroring is done through the Safety Ring Switch Tools. See the on-line help for details.

Note: With firmware 0103 or newer, only one monitor (destination) port is allowed. However, multiple source ports can be chosen.

Ring configurations

Configuring rings in your switch

First and foremost, make sure that ring operation is enabled for the appropriate ports. In other words it is required to tell the Ring Switch what ports it is going to use as ring ports (unless the Ring Switch was purchased with rings pre-configured). Never wire a Ring Switch in a ring topology without having the ports that are used in the ring configured as ring ports (See diagram below).
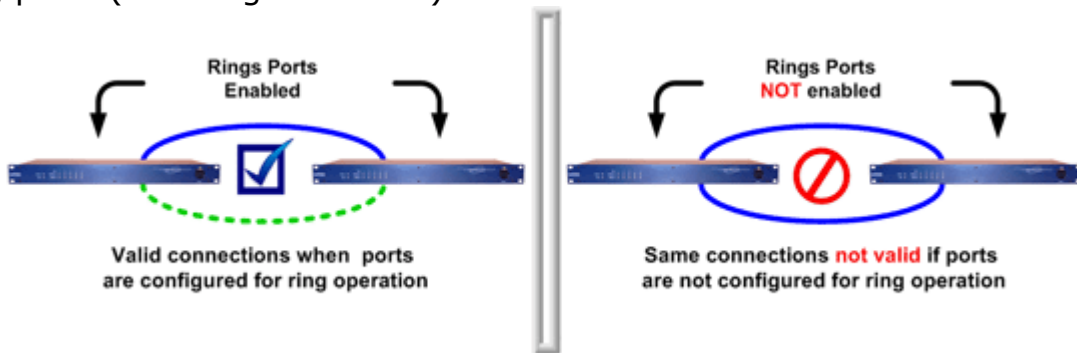
Valid ring topologies

Below are examples of how you should wire your Ring Switches together. In general, you should keep your topology simple.
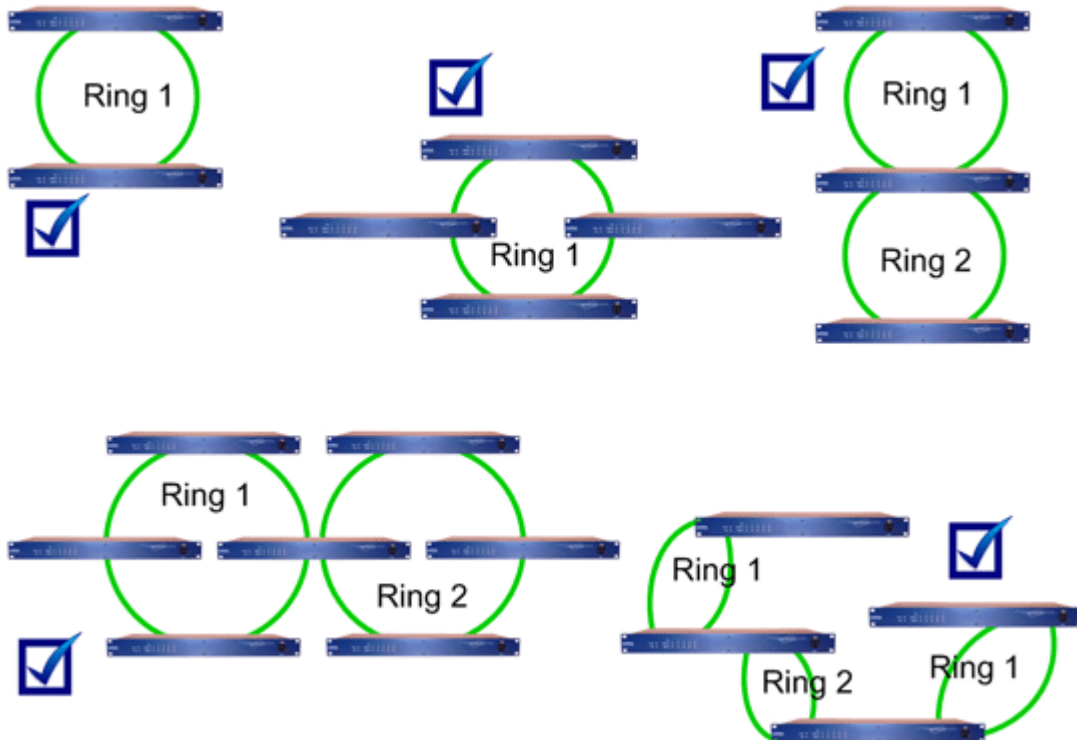
Invalid ring topologies

The examples below are invalid ring topologies. Do NOT connect Ring Switches in the ways shown below, as they will lead to unpredictable network performance. Paths indicated by the color red create unintended rings (see unintended rings example below).

Unintended ring example

Refer to the diagram below. In this example, the top and bottom Ring Switches have been software configured for two rings each. The left and right Ring Switches have been software configured for one ring each. The physical connections for the two rings are shown in blue and orange.

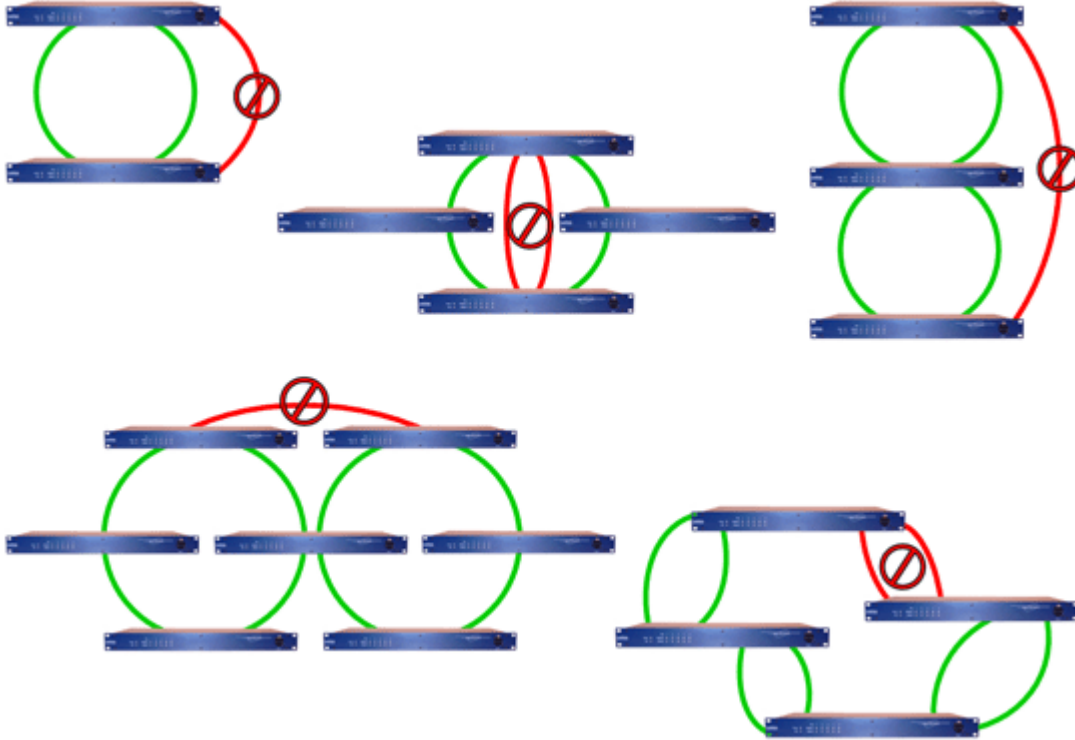Since the rule for configuring Ring Switches is to make sure that each Ring Switch knows about all rings that are attached to it, it would appear that the example below is legal. However, this is not the case. There are actually more than two ring paths that were created. There are multiple paths that traffic can use to move from the top Switch and back to the top Switch. The same applies to the bottom Switch. These unintended Ring paths that top Switch and bottom Switch don't know about are labeled as Unintended Rings A, B, C, and D.

Since the top Ring Switch and bottom Ring Switch don't know about these extra ring paths, they aren't included in A or B's ring algorithm. Paths that are not included in the ring algorithm will result in harmful broadcast storms, as will happen when conventional switches are connected in a ring topology.

Intended Ring	Unintended Ring	Unintended Ring
🟧 Ring 1	🟧 Unintended Ring A	🟧 Unintended Ring C
🟦 Ring 2	🟦 Unintended Ring B	🟦 Unintended Ring D
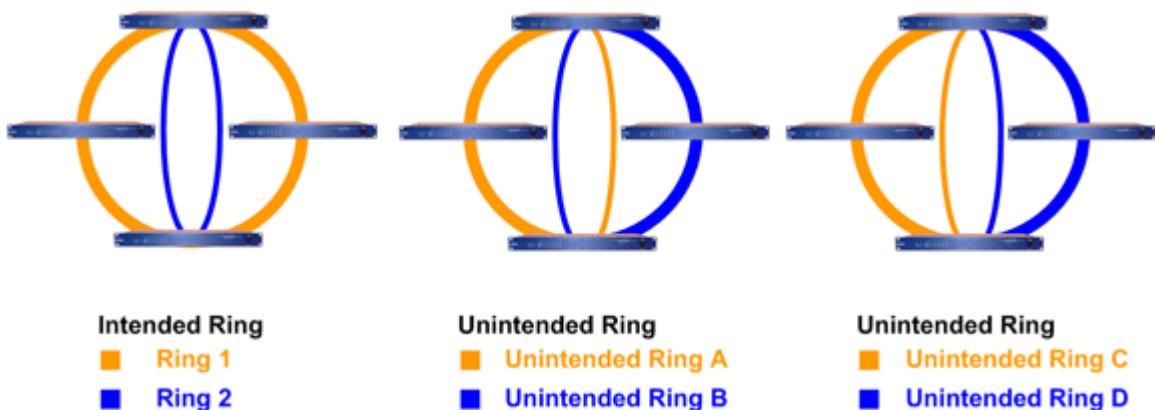
Switch status

You can keep track of the status of your Ring Switches at all times. To check the status of a Ring Switch visually, you can monitor the Ring Switch's indicator LEDs. To monitor the status remotely, you can use Modbus over Ethernet (UDP).
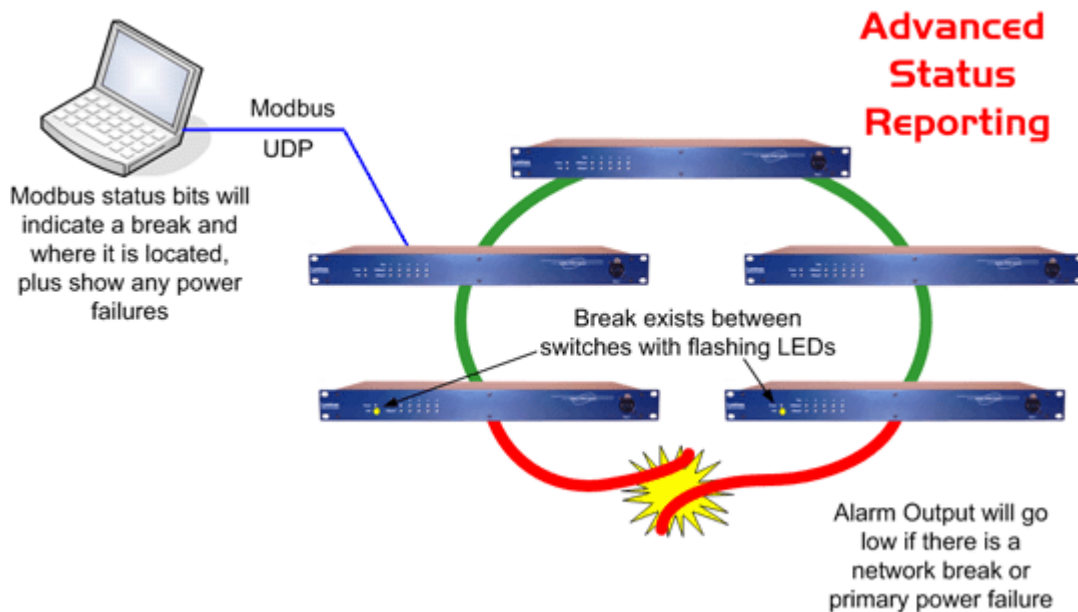
Visual status monitoring

The status of your Safety Ring Switches can be easily ascertained by simply looking at their LED indicators. The LEDs can be used to quickly see the status or to locate a network problem. See for details on the LED indicators.

- **Port Status (ACT/LNK LED)**

  After all Ethernet and/or fiber connections are made, check the LED's corresponding to the ports that each of the devices are connected to. Ensure that for each port that is in use, the link/activity LED is on or blinking. If a port link/activity LED is off, go back and check for connectivity problems between that port and the network device connected to that particular port. In addition, the speed LED should indicate the speed for which your device is connected at (off – 10Mbps, orange – 100Mpbs).

- **Power & Switch Status (OK LED)**

  The Ring Switch has an OK LED that indicates the power and operational status. It is ON solid green when there are no errors. It

will go ORANGE if a ring break is detected. The OK LED will also flash if the switch is being "winked", is in the boot-up mode, or an internal error was detected.

- **Ring Status (Ring LED)**

  The Ring Switch has a Ring LED that indicates the status of your ring connections. It is ON solid when all rings handled by the switch have continuous integrity. It will be blinking if there is broken ring segment but all adjacent switches are responding. It will be OFF if the switch is not configured for any rings. The ring LED will Blip (mostly OFF, with a quick ON) when a configured ring has been broken and the break is local to one of the ports of the switch. Typically the network with the fault will be between the two switches with Ring LEDs in the Blip state. This makes tracking down faults quick and simple.

Remote status monitoring

There are two ways to remotely monitor the status of your Safety Ring Switch network.

The first method is to use the Safety Rings Switch Tool's status display. This display will show the status of the selected Ring Switch by providing details such as port, power, and ring states. Find more details about how to use this display by referring to the Safety Ring Switch Tool's on-line help.

The second method that can be used for determining the state of your Ring Switch network is via Modbus UDP. See the Modbus UDP topic below for detailed information about how to take advantage of this feature.

- **Modbus/UDP**

  Through Modbus UDP (Note: TCP is not supported), you can remotely monitor the status of the Safety Ring Switch. Using the Safety Ring Switch Tools, the Ring Switch can be configured as a Modbus slave station with its own Modbus station number and IP address.

  The Ring Switch has a set of predefined Modbus registers for status reporting. Refer to the table below for the register assignments.

Modbus Address	Status	Modbus Address	Status
10001	Link on port 1	10019	Ring 1: Second port is passing data (not blocked)
10002	Link on port 2	10020	Ring 2 complete
10003	Link on port 3	10021	Ring 2: First port is passing data (not blocked)
10004	Link on port 4		

Modbus Address	Status	Modbus Address	Status
10005	Link on port 5	10022	Ring 2 second port is passing data (not blocked)
10006	Link on port 6		
10007	Link on port 7	10030	OK output ON (no alarms) Output will be ON if both power and all enabled rings are complete.
10008	Link on port 8		
10009	Link on port 9		
10017	Ring 1 complete	10031	First power input valid
10018	Ring 1: First port is passing data (not blocked)	10032	Second power input valid

NOTE: It is recommended that you keep the poll time of your Modbus master driver or hardware device to a reasonable rate. If you poll a Ring Switch at a rapid rate, the performance of the switch may be reduced. The fastest poll time you should run will depend on the application. As a guideline, a poll time of 500 mS or greater should not adversely affect the performance of your Ring Switch.

Features & Capabilities

This section explains the primary Ethernet and fiber capabilities of the Ring Switch.

10BaseT and 100BaseT Auto-detection

Standard Ethernet (10BaseT) has a maximum speed of 10 Mbps (half duplex mode) or 20 Mbps (full duplex mode). Fast Ethernet (100BaseT) has a maximum speed of 100 Mbps (half duplex mode) or 200 Mbps (full duplex mode). The 10/100 RJ45 ports automatically support two speeds.

100BaseF (multimode and singlemode) fiber optic port

The fiber optic port found is classified as 100BaseF and supports 100 Mbps operation. Multimode allows for multiple wavelengths over a cable with a core diameter of typically 50 or 62.5 microns. The maximum distance for multimode is up to 2 km.

2K or 8K MAC addresses with automatic learning, aging and migration

Each Ethernet device inserts its unique "MAC" address into each message it sends out. The port on the switch used for a given MAC address is automatically learned when a frame is received from that address. Once an address is learned, the switch will route messages to only the appropriate port, instead of broadcasting messages out all ports like a hub. A time stamp is also placed in memory when a new address is learned. This time stamp is used with the aging feature, which will remove unused MAC addresses from the table after 300 seconds. If a device moves, the associated port on the switch will be changed (migrated) as needed. Up to 8,192 MAC addresses can be stored and monitored at any time.

3.2 Gbps combined bandwidth

The fast Ethernet switches have 3.2 Gbps. This means that they can support full duplex communications on all ports at the same time.

Auto-crossover (auto-mdi/mdix)

The RJ45 ports of the Safety Ring Switch will automatically detect the cable type (straight-thru vs. cross-wired) and re-configure themselves accordingly.

Auto-polarity

The auto-polarity feature corrects reversed polarity on the transmit and receive twisted pair.

Automatic power saving

If there is no cable on a port, most of the circuitry for that port is disabled to save power.

Auto-sensing speed and flow control

The RJ45 ports of the Safety Ring Switch will auto-negotiate with the connected device to determine the optimal speed and flow control for each port.

Back pressure for half-duplex

The Safety Ring Switch will apply "back pressure" when necessary with half-duplex operation. This "back pressure" will reduce congestion on busy networks.

Broadcast storm protection

Each port can be configured to filter out undesirable broadcast and multicast messages.

Buffering

SRAM is used for buffering the messages. The Ring Switches have 1 Mbits (128 Kbytes). The buffer size is automatically allocated for each port as necessary.

Flow control

These switches automatically support flow control frames on both the transmit and receive sides. Back-pressure flow control for half-duplex ports and pause-frame flow control for full-duplex ports.

Forwarding

These switches support store and forward mode. They will forward messages with known addresses out only the appropriate port. Messages with unknown addresses, broadcast messages, and multicast messages will get forwarded out all ports except the source port.

Full / Half duplex operation

The RJ45 ports of these switches support both full and half duplex operation. The fiber optic port(s) are full duplex but can be interfaced to device with half or full duplex.

Illegal frames

Illegal frames as defined by IEEE 802.3 will be dropped. This includes short frames, long frames, CRC error frames and alignment error frames.

IEEE 802.3 compliant

Safety Ring Switches strictly abide to the IEEE 802.3 standard for 10BaseT, 100BaseT and 100BaseF Ethernet communications.

Latency

The typical latency of a message is 5 microseconds (@ 100 Mbps) plus the frame time. The latency is the time it takes a message to be routed internal to a switch from one port to another. This time is highly

dependent on the amount of network activity, the speed and the features enabled in the switch.

Non-blocking

This means that the switches offer the best in performance and are capable of full-wire speed transmissions.

Port Mirroring

Powerful diagnostic mode that lets you map messages between ports.

Plug and play

This means that most functions or features of these switches are automatic and that there are minimal or no optional parameters that need to be set. Just plug in your Ethernet cables, apply power, and the unit will immediately begin to operate. The Ring Switches can even be factory pre-configured to your exact needs.

Priority queuing or Traffic Prioritization

The Ring Switches support QoS (Quality of Service), CoS (Class of Service), ToS (Type of Service), and DS (Differentiated Services) mechanism for ensuring the priority traffic is handled properly. These advanced parameters can be set via the configuration utility.

Protocol independent

These switches will work with all popular Ethernet protocols and networks such as TCP/IP, the Internet (IP), UDP, NetBEUI, and many more. It is compatible with all protocols that run over standard Ethernet (IEEE 802.3). In fact, it will support packets of different protocols simultaneously.

Technical specifications

Copper RJ45 Ports: (10/100BaseT or 10/100/1000BaseT)	
Connectors	Shielded Neutrik Ethercon
Protocols supported	All standard IEEE 802.3
Ethernet compliancy	IEEE 802.3, 802.3u, 802.3x, 802.3z, 802.1p and more
Auto-crossover	RJ45 MDI/MDIX (allows you to use straight or cross wired cables)
Auto-negotiating	10BaseT or 100BaseT as applicable
Auto-sensing	Full or half duplex
Auto-polarity	Yes, on the TD and RD pairs
Flow control	Yes, for Half or full duplex
Half or full duplex	Yes, automatic or configurable
Ethernet isolation	1500 VRMS 1 minute
Plug and play	Yes with factory pre-configuration available for special parameters
Cable requirements	Twisted pair (Cat. 5 or better) (shielded recommended)
Max. cable distance	100 meters

SC Fiber Ports: (100BaseF multimode)	
100BaseFX ports	2
Fiber port mode	Multimode (mm)
Fiber port connector	Duplex SC
Optimal fiber cable	62.5/125 µm
Center wavelength	1300 nm
TX output power	Contact your switch vendor
RX input sensitivity	Contact your switch vendor
Max. distance (full duplex)	2 km
Half and full duplex	Software Configurable
Ethernet compliance	100BaseFX
Eye safety	IEC 60825-1, Class 1; FDA 21 CFR 1040.10 and 1040.11

General:		
Operation	Intelligent store & forward, non-blocking	
Ethernet protocols supported	All IEEE 802.3	
Typical latency for 10 Mbps	16 us + frame time	Varies on load & settings
Typ. latency for 100/1000 Mbps	5 us + frame time	
MAC addresses supported	2K	
Buffer memory	1 Mbits (128 Kbytes)	
Buffer allocation per port	Automatic and dynamic	
Memory bandwidth	3.2 Gbps for full-wire speed on all ports	
Address learning	Automatic	
Address aging	Remove old address after 300s	
Address migration	Automatic	

Back pressure	Automatic for half-duplex
Illegal frames	Dropped per 802.3
Flow control	Yes, for half and full duplex
Traffic prioritization	802.1p, QoS, CoS, ToS/DS
Status Reporting	Power & operational status
Modbus over Ethernet (UDP)	Modbus status registers
Real-Time Ring™ Features	Fault-tolerant loop support
Maximum switches in ring	50+
Dual ring support	Yes
Link loss recovery time	Less than 30 mS plus 5 mS per hop
Environmental	
Input power (typical with all ports active) (Max. 10 W)	Max. 10W
Input voltage	90 - 260 VAC / (120-370 VDC)
Frequency	47 - 63 Hz
Fuse	125V, 1A, Slow blow only (5mm x 20mm) 250V, 1A, Slow blow only (5mm x 20mm)
Ethernet isolation	1500 VRMS 1 minute
Operating temperature range	-40 to +85 °C
Storage temperature range	-40 to +85 °C
Humidity (non-condensing)	5 to 95% RH
Dimensions (L x W x H)	482 x 172 x 44 (mm) 19" x 6,8" x 1,75" Package: 520 x 235 x 50 (mm)
Weight	2,2 kg

Additional Documentation

All additional documentation can be downloaded from our web pages in the support section.

Http://www.luminex.be

--> Support

> ➤ Safety Ring Switch Tools: The installer can be freely downloaded from our website.

Safety Ring Switch