TECHNICAL MANUAL

H49/EN M/J32

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Chapter 1: Introduction

The DS Agile Ethernet products and software applications are designed to meet the needs of a wide range of electrical substations. Emphasis has been placed on compliance with standards, scalability and modularity.

These features mean that the products can be used in most applications, from the most basic to the most demanding. They also ensure interoperability with other vendors.

GE Grid Solutions provides a range of Ethernet products such as switches, which take into account the compulsory requirements of electrical substations, including power supply and immunity to environmental constraints.

GE Grid Solutions provides solutions to specific requirements such as network redundancy management.

The products can be used independently or be integrated to form a DS Agile system, which is a Digital Control System (DCS).

1.1 Key Features

Ports:

- Up to 6 1Gbps ports, copper or fiber.

Redundancy Communication Protocols:

- Parallel Redundancy Protocol accordingly to IEC 62439-3 (2016) Clause 4 (PRP).
- High Availability Seamless Redundancy Protocol accordingly to IEC 62439-3 (2016) Clause 5 (HSR).
- PRP and HSR RedBox, HSR QuadBox and PRP-HSR coupling.

Network Protocols:

- Simple Network Management Protocol an Internet protocol for managing and monitoring devices on IP networks (SNMP).
- Network Time Protocol (NTP) and Precision Time Protocol (PTP) according to IEEE 1588 V2/IEC61588 Ed.2 (2009) provides highly accurate time synchronization.
- Usual secured network protocols are supported: SSH, SFTP, HTTPS. Non-secured protocols are disabled by default.

Network standards:

- IEEE 802.1Q (2014): Networking standard that supports virtual LANs (VLANs) on an Ethernet network.
- IEEE 802.1p defined in IEEE 802.1Q (2014): Class of service (CoS), is a 3-bit field called the Priority Code Point (PCP) within an Ethernet frame header when using VLAN tagged frames.
- C37.238 (2011): IEEE Standard Profile for use of PTP (Precision Time Protocol) in power system applications.

Cyber security:

- NERC CIP (North American Electric Reliability Corporation - Critical Infrastructure Protection): set of requirements designed to secure the assets required for operating North America's bulk electric system.
- IEEE 1686 (2013): Standard for IED Cyber security capabilities.
- WIB 2.0: Process industry security standard; Working-party on Instrument Behavior. The main parts of the WIB requirements will be merged under the roof of IEC 62443 Industrial Network and System Security.
- CIS: Hardened following Center for Internet Security recommendations.

Safety and environment:

- IEC 61850-3 (2013): General requirements for communication networks and systems for power utility automation.
- IEC 60255-27 (2013): Product safety requirements for measuring relays and protection equipment.
- IEEE 1613 (2009): Environmental and testing requirements for communications networking devices installed in electric power substations.
- IEEE 1613-1 (2013): Environmental and testing requirements for communications networking devices installed in transmission and distribution facilities.

1.2 Ordering Options

Variants	Order Number													
Model Type		1 - 3	4	5	6	7	8	9	10	11	12	13	14	15
H49 IEC61850 HSR/PRP Switch	Reason	H49												
Port 1														
None			0											
One 1 Gbps LC-type connector multi mode fiber 1000BASE-SX Ethernet for up to 0.5 km			A											
One 100 Mbps LC-type connector multi mode fiber 100BASE-FX Ethernet for up to 2 km			B											
One 1 Gbps RJ45 copper 100BASE-TX/1000BASE-T Ethernet ports			C											
One 1 Gbps LC-type connector single mode fiber 1000BASE-LX Ethernet for up to 10 km			D											
One 100 Mbps LC-type connector single mode fiber 100BASE-FX Ethernet for up to 2 km			E											
One 100 Mbps LC-type connector single mode fiber 100BASE-FX Ethernet for up to 15 km			F											
Port 2														
None				0										
One 1 Gbps LC-type connector multi mode fiber 1000BASE-SX Ethernet for up to 0.5 km				A										
One 100 Mbps LC-type connector multi mode fiber 100BASE-FX Ethernet for up to 2 km				B										
One 1 Gbps RJ45 copper 100BASE-TX/1000BASE-T Ethernet ports				C										
One 1 Gbps LC-type connector single mode fiber 1000BASE-LX Ethernet for up to 10 km				D										
One 100 Mbps LC-type connector single mode fiber 100BASE-FX Ethernet for up to 2 km				E										
One 100 Mbps LC-type connector single mode fiber 100BASE-FX Ethernet for up to 15 km				F										
Port 3														
None					0									
One 1 Gbps LC-type connector multi mode fiber 1000BASE-SX Ethernet for up to 0.5 km					A									
One 100 Mbps LC-type connector multi mode fiber 100BASE-FX Ethernet for up to 2 km					B									
One 1 Gbps RJ45 copper 100BASE-TX/1000BASE-T Ethernet ports					C									
One 1 Gbps LC-type connector single mode fiber 1000BASE-LX Ethernet for up to 10 km					D									
One 100 Mbps LC-type connector single mode fiber 100BASE-FX Ethernet for up to 2 km					E									
One 100 Mbps LC-type connector single mode fiber 100BASE-FX Ethernet for up to 15 km					F									
Port 4														
None						0								
One 1 Gbps LC-type connector multi mode fiber 1000BASE-SX Ethernet for up to 0.5 km						A								
One 100 Mbps LC-type connector multi mode fiber 100BASE-FX Ethernet for up to 2 km						B								
One 1 Gbps RJ45 copper 100BASE-TX/1000BASE-T Ethernet ports						C								
One 1 Gbps LC-type connector single mode fiber 1000BASE-LX Ethernet for up to 10 km						D								
One 100 Mbps LC-type connector single mode fiber 100BASE-FX Ethernet for up to 2 km						E								
One 100 Mbps LC-type connector single mode fiber 100BASE-FX Ethernet for up to 15 km						F								
Port 5														
None							0							
One 1 Gbps LC-type connector multi mode fiber 1000BASE-SX Ethernet for up to 0.5 km							A							
One 100 Mbps LC-type connector multi mode fiber 100BASE-FX Ethernet for up to 2 km							B							
One 1 Gbps RJ45 copper 100BASE-TX/1000BASE-T Ethernet ports							C							
One 1 Gbps LC-type connector single mode fiber 1000BASE-LX Ethernet for up to 10 km							D							
One 100 Mbps LC-type connector single mode fiber 100BASE-FX Ethernet for up to 2 km							E							
One 100 Mbps LC-type connector single mode fiber 100BASE-FX Ethernet for up to 15 km							F							
Port 6														
None								0						
One 1 Gbps LC-type connector multi mode fiber 1000BASE-SX Ethernet for up to 0.5 km								A						
One 100 Mbps LC-type connector multi mode fiber 100BASE-FX Ethernet for up to 2 km								B						
One 1 Gbps RJ45 copper 100BASE-TX/1000BASE-T Ethernet ports								C						
One 1 Gbps LC-type connector single mode fiber 1000BASE-LX Ethernet for up to 10 km								D						
One 100 Mbps LC-type connector single mode fiber 100BASE-FX Ethernet for up to 2 km								E						
One 100 Mbps LC-type connector single mode fiber 100BASE-FX Ethernet for up to 15 km								F						
Reserved									0	0	0	0	0	
Design Suffix														
Initial Issue														B

Chapter 2: Safety Information

2.1 Health and Safety

Personnel associated with the equipment must be familiar with the contents of this Safety Section, or the Safety Guide (SFTY/4L M).

When electrical equipment is in operation, dangerous voltages are present in certain parts of the equipment. Improper use of the equipment and failure to observe warning notices will endanger personnel.

Before working on the equipment, it must first be electrically isolated.

Only qualified personnel may work on or operate the equipment. Qualified personnel are individuals who:

- Are familiar with the installation, commissioning, and operation of the equipment and the system to which it is being connected.
- Are familiar with accepted safety engineering practices and are authorized to energize and de-energize equipment in the correct manner.
- Are trained in the care and use of safety apparatus in accordance with safety engineering practices.
- Are trained in emergency procedures (first aid).

Although the documentation provides instructions for installing, commissioning and operating the equipment, it cannot cover all conceivable circumstances. In the event of questions or problems, do not take any action without proper authorization. Please contact the appropriate technical sales office and request the necessary information.

2.2 Symbols

Throughout this manual, you will come across the following symbols. You will also see these symbols on parts of the equipment.

Caption:
Refer to equipment documentation. Failure to do so could result in damage to the equipment.

Caution:
Risk of electric shock.

⏚ Earth terminal.

⏚ Protective Earth terminal.

2.3 Installation, Commissioning and Servicing

2.3.1 Lifting Hazards

Plan carefully, identify any possible hazards and determine whether the load needs to be moved at all. Look at other ways of moving the load to avoid manual handling. Use the correct lifting techniques and Personal Protective Equipment to reduce the risk of injury.

Many injuries are caused by:

- Lifting heavy objects.
- Lifting things incorrectly.
- Pushing or pulling heavy objects.
- Using the same muscles repetitively.

2.3.2 Electrical Hazards

⚠ Caution:
All personnel involved in installing, commissioning, or servicing this equipment must be familiar with the correct working procedures.

⚠ Caution:
Consult the equipment documentation before installing, commissioning, or servicing the equipment.

⚠ Caution:
Always use the equipment in a manner specified by the manufacturer. Failure to do so will jeopardize the protection provided by the equipment.

⚡ Caution:
Removal of equipment may expose hazardous live parts. Please refer to user documentation before disassembly.

⚡ Caution:
Isolate the equipment before working on the terminal strips.

⚡ Caution:
Use a suitable protective barrier for areas with restricted space, where there is a risk of electric shock due to exposed terminals.

Caution:
Disconnect power before disassembling. Disassembly of the equipment may expose sensitive electronic circuitry. Take suitable precautions against electrostatic voltage discharge (ESD) to avoid damage to the equipment.

Caution:
NEVER look into optical fibres. Always use optical power meters to determine operation or signal level.

Caution:
Insulation testing may leave capacitors charged up to a hazardous voltage. At the end of each part of the test, discharge the capacitors by reducing the voltage to zero, before disconnecting the test leads.

Caution:
Operate the equipment within the specified electrical and environmental limits.

Caution:
Before cleaning the equipment, ensure that no connections are energized. Use a lint free cloth dampened with clean water.

2.4 Decommissioning and Disposal

Caution:
Before decommissioning, completely isolate the equipment power supplies (both poles of any Vdc supply). The auxiliary supply input may have capacitors in parallel, which may still be charged. To avoid electric shock, discharge the capacitors using the external terminals before to decommissioning.

Caution:
Avoid incineration or disposal to water courses. Dispose of the equipment in a safe, responsible an environmentally friendly manner, and if applicable, in accordance with country-specific regulations.

Chapter 3: Copyrights & Trademarks

3.1 Copyrights

Under the copyright laws, this publication may not be reproduced or transmitted in any form, electronic or mechanical, including photocopying, recording, storing in an information retrieval system, or translating, in whole or in part, without the prior written consent of GE Grid Solutions Trademarks.

DS Agile, DS Agile SCE, DS Agile aView, DS Agile OI, DS Agile SMT, DS Agile C26x and GE Grid Solutions - are trademarks of GE Grid Solutions. Product and company names mentioned herein are trademarks or trade names of their respective companies.

3.2 Warnings Regarding Use of GE Grid Solutions Products

GE Grid Solutions products are not designed with components and testing for a level of reliability suitable for use in connection with surgical implants or as critical components in any life support systems whose failure to perform can reasonably be expected to cause significant injuries to a human.

In any application, including the above reliability of operation of the software products can be impaired by adverse factors, including - but not limited to - fluctuations in electrical power supply, computer hardware malfunctions, computer operating system malfunctions, software suitability, suitability of compilers and development software used to develop an application, installation errors, software and hardware compatibility problems, malfunctions or failures of electronic monitoring or control devices, transient failures of electronic systems (hardware and/or software), unanticipated uses or misuses, or errors by the user or application designer (adverse factors such as these are collectively termed "System failures").

Any application where a system failure would create a risk of harm to property or persons (including the risk of bodily injuries and death) should not be reliant solely upon one form of electronic system due to the risk of system failure to avoid damage, injury or death, the user or application designer must take reasonable steps to protect against system failure, including - but not limited - to back-up or shut-down mechanisms, not because the end-user's system is customized and differs from GE Grid Solutions testing platforms but also because a user or application designer may use GE Grid Solutions products in combination with other products.

These actions cannot be evaluated or contemplated by GE Grid Solutions.

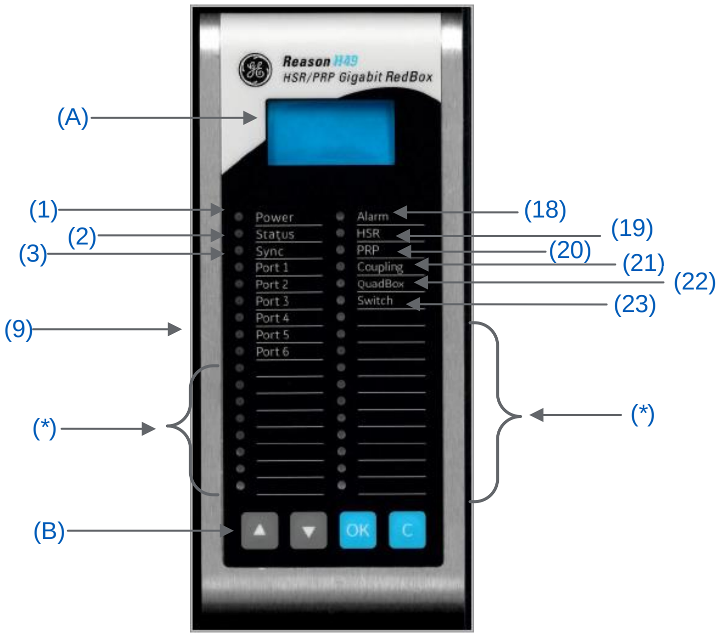
Thus, the user or application designer is ultimately responsible for verifying and validating the suitability of GE Grid Solutions products whenever they are incorporated in a system or application, even without limitation of the appropriate design, process and safety levels of such system or application.

Chapter 4: Functional Description

4.1 Hardware

The following sections show different views of the device together with its components.

4.1.1 Front Panel



S1601ENc

Figure 1: Reason H49 Front View

The front panel of the Reason H49 switch contains the following items:

Item	Description
A	Liquid crystal display (LCD) with 4 lines of 16 characters: Line 1: Empty Line 2: H49 Line 3: IP address (255.255.255.255) Line 4: Empty
B	Navigation buttons to access and browse the device menu.

Reason H49 is configured through the web application user interface (detailed later in this document) or using configuration file.

Signification of the LEDs

Light Emitting Diodes (LEDs) and alarm contacts indicate the status of the product and its ports:

LED rank	Signification	Color	Description	Activity
1	**Power** 1 LED	Green	Powered on	
		Off	Switch is off	
2	**Operating state** 1 LED (boot, ok, alarm)	Amber (default)	As long as the CPU board has not booted.	
		Green	Healthy (board works, no contact alarm)	
3	**Time Synchronization** 1 LED	Green	PTP or NTP synchronization	
		Red	No synchronization or Switch in Grandmaster	
4 to 9	**Port activity** 6 LEDs	Green	1Gbits/s	
		Amber	100Mbits/s	
		Red	Not forwarding (access violation, wrong MAC address)	
			No traffic	On
			Signs of activity	Blinking
			Not plugged or disabled by configuration	Off
18	**Alarm** 1 LED	Red (default)	Power redundancy alarm	
19	**HSR RedBox** 1 LED	Green		
20	**PRP RedBox** 1 LED	Green		
21	**PRP-HSR Coupling** 1 LED	Green		
22	**HSR QuadBox** 1 LED	Green		
23	**Standard Switch** 1 LED	Green		
*		Alternatively, Red, Green and Amber	LED chaser	

4.1.2 Bottom view

Reason H49 is a 6-port switch, supporting any combination of 100Mbps and 1Gbps RJ45 copper or LC optical fiber ports.

The following figure presents the bottom view of the device together with its components.

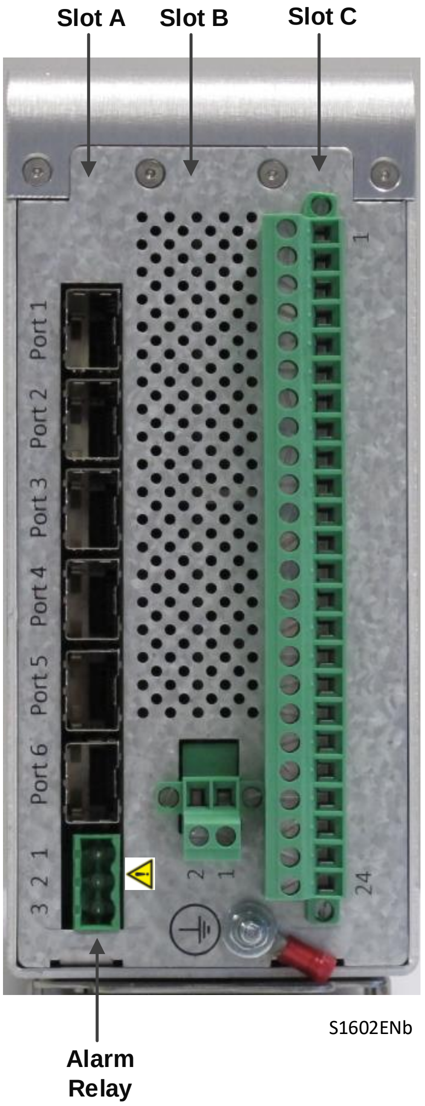


Figure 2: Reason H49 Bottom View

Multi-mode SFP transceivers are used for connections up to 2km, and single-mode SFP transceivers can be used for distances up to 15km.

Description of the slots

Slot	Board	Description
A	SRPV3	**Communication port** • Port 1 to port 6: SFP transceiver optical/copper
		Alarm Relay Connector • Pin1: Normally Open • Pin2: Common • Pin3: Normally Closed

Slot	Board	Description
B	BIU261D	**Secondary Power Supply** • Pin2: In- • Pin1: In+
C	BIU261D	**Primary Power Supply** • Pin1 to Pin21: Not Connected • Pin22: Earth • Pin23: In+ • Pin24: In-

4.2 Parallel Redundancy Protocol (PRP)

The Parallel Redundancy Protocol (PRP) is implemented according to the definition in the standard IEC 62439-3 (2016) Clause 4.

PRP allows seamless switchover and recovery in case of network disruption (for instance cable, driver, switch or controller failure).

A PRP compatible device has two ports operating in parallel, each port being connected to a separate local area network (LAN) segment. IEC 62439-3 (2016) Clause 4 assigns the term DANP (Doubly Attached Node running PRP) to such devices. Critical devices should be doubly attached using two ports. The two LANs have no connection between them and are assumed to be fail-independent.

A source DANP sends the same frame over both LANs and a destination DANP receives it from both LANs within a certain time, consumes the first frame and discards the duplicate. In the following figure, DANP1 and DANP2 implement this redundancy.

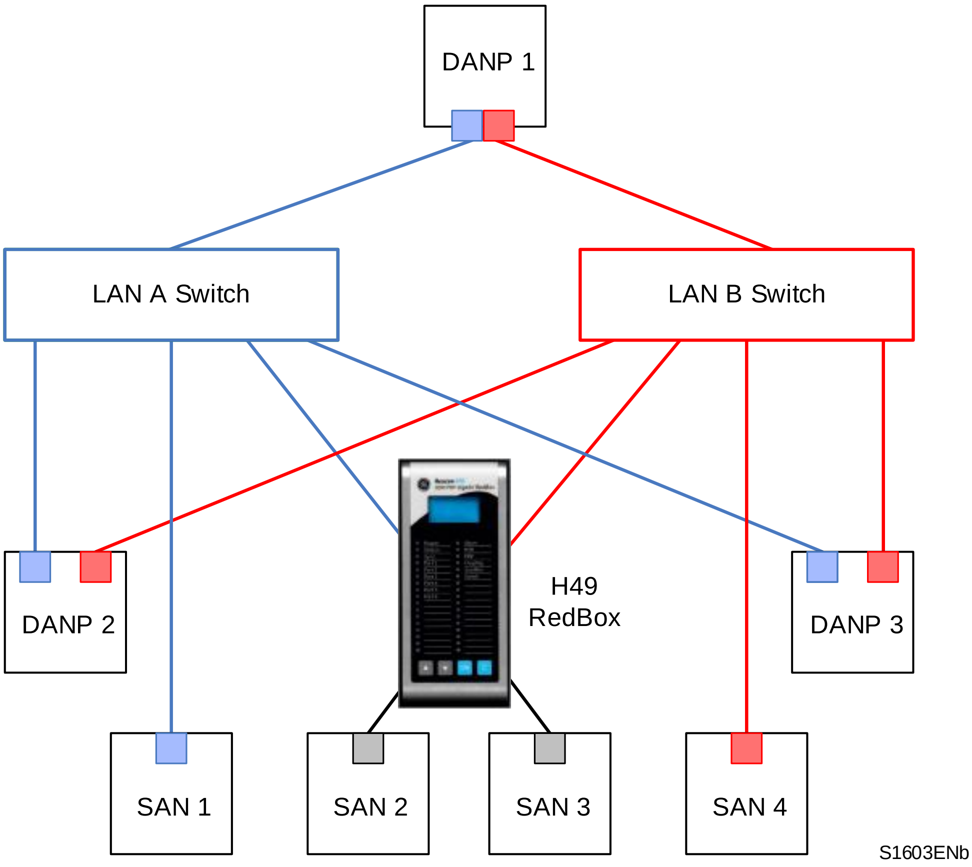


Figure 3: Example PRP Redundant Network

Singly Attached Nodes (SAN) are connected to only one LAN (see SAN 1 and SAN 4 in previous figure) and they do not implement any redundancy. They can, however, be connected to both LANs, via the Reason H49 switch that converts a singly attached node into a doubly attached node. It acts as a redundancy box or RedBox.

Devices with single network cards such as personal computers, printers, etc., are singly attached nodes that may be connected into the PRP network via a RedBox as shown in the following figure.

This is the case for SAN2 and SAN3. Because these SANs connect to both LANs, they can be considered as Virtual Doubly Attached Nodes and described as VDANs.

Reason H49 can be configured as PRP RedBox and connect up to four SANs to the PRP network as shown in the following figure:

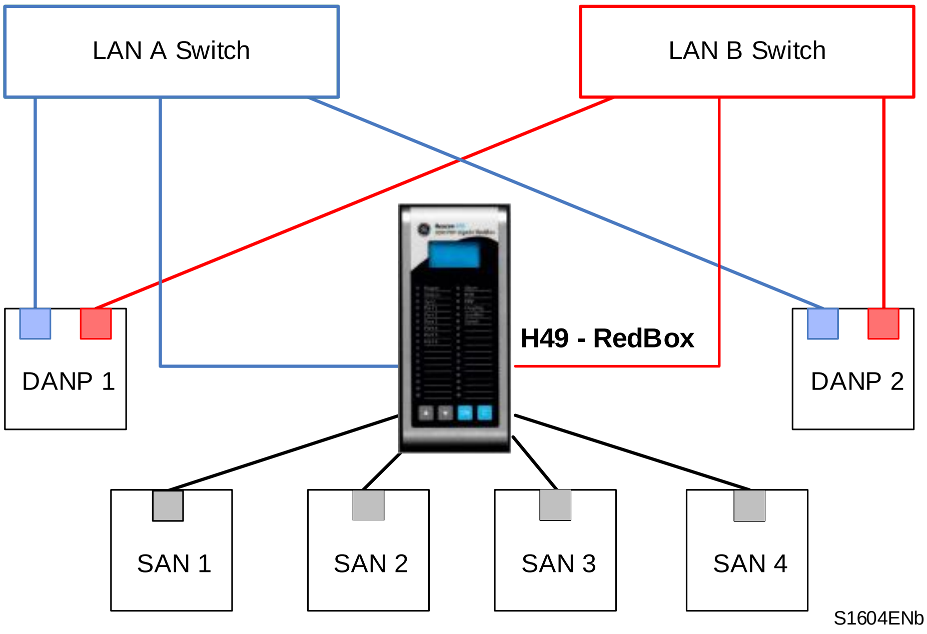


Figure 4: Reason H49 connecting four SANs to the PRP Network

4.3 High-availability Seamless Redundancy (HSR) Protocol

The HSR protocol is implemented accordingly to IEC 62439-3 (2016) Clause 5.

HSR allows seamless communication in case of a single network disruption (for instance cable, driver, switch or controller failure).

An HSR-compatible device has two ports operating simultaneously, both ports being connected to the same LAN. IEC 62439-3 (2016) Clause 5 assigns the term DANH (Doubly Attached Node running HSR) to such devices. Reason H49 is a DANH.

The figure below shows an example of an HSR network. The doubly attached nodes HSR RedBox, DANH 1 and DANH 2 send and receive HSR frames in both directions, while the singly attached nodes SAN 1 and SAN 2 can only send and receive frames without HSR header.

Singly attached nodes can, however, be connected to HSR ring, via a device which converts a singly attached node into a doubly attached node. Devices performing this function are often referred to as redundancy boxes or RedBoxes. Thus, devices with single network cards such as personal computers, printers, etc., are singly attached nodes that may be connected to the HSR network via a RedBox as shown in the figure.

Because these SANs are connected to the HSR network, they can be considered as Virtual Doubly Attached Nodes and described as VDANs.

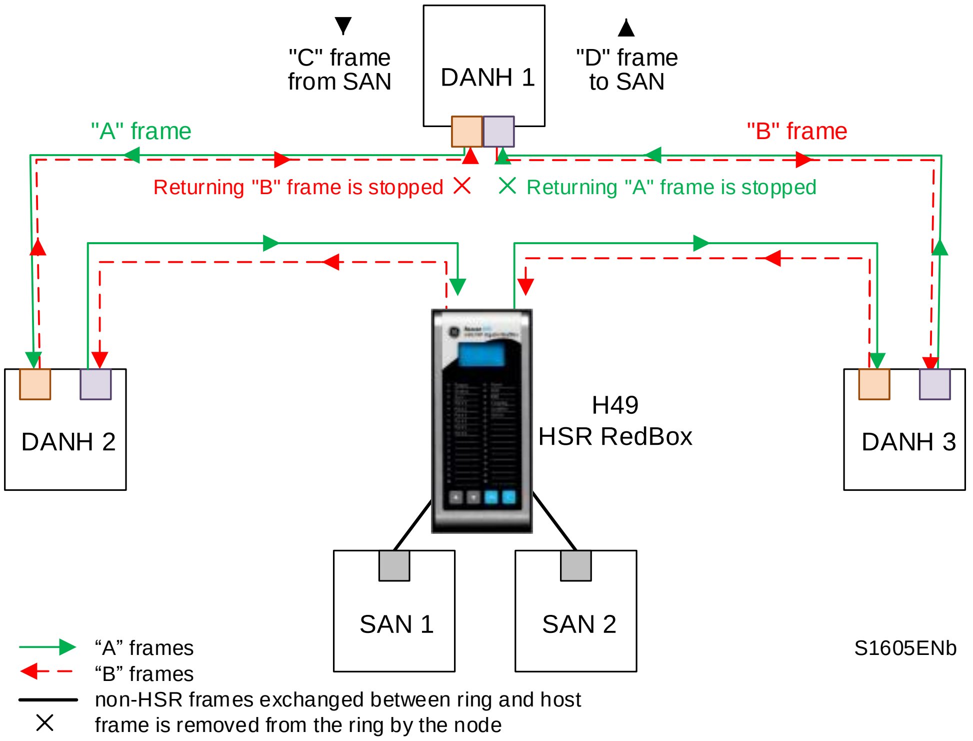

"C" frame from SAN
DANH 1
"D" frame to SAN
"A" frame
"B" frame
Returning "B" frame is stopped ×
× Returning "A" frame is stopped
H49
HSR RedBox
DANH 2
DANH 3
SAN 1
SAN 2
S1605ENb
"A" frames
"B" frames
non-HSR frames exchanged between ring and host
frame is removed from the ring by the node

Figure 5: Example HSR Redundant Network

HSR is based on a ring-type architecture to achieve its network path redundancy. Duplicate packets, identified as “A” and “B”, are sent in opposite directions of the ring to achieve redundancy down to the packet level. When a packet arrives at a DANH node, the node will determine if the packet is addressed to it or to another destination.

- If the packet is addressed to the node, then
    - It will process it or
    - It will discard it if it is a duplicate packet
- If the packet is for another destination, then
    - If the DANH device receives a frame that it originally sent, it does not forward it
    - Otherwise, it will simply forward the packet on to the next node in the network.

Frames sent by a SAN device (see “C” frames in the following figure) are converted into two “A” and “B” frames and sent over the HSR network.

Received frames that are addressed to a SAN managed by a Redbox (such as MMS messages) are not forwarded on to the HSR network.

There are two basic operation principles, depending on whether the broadcasted frames are multicast (e.g. GOOSE) or unicast (e.g. MMS reports).

- **Multicast (e.g. GOOSE)**: A source DANH sends a frame over both ports (“A”-frame and “B”-frame). The destination DANH receives, in a fault-free state, two identical frames from each port within a certain interval, passes the first frame on to its higher layers. A source DANH discards any duplicate multicast frame from the ring.
- **Unicast (e.g. REPORT)**: A destination node of a unicast frame does not forward a frame for which it is the only destination. It removes the unicast frame from the ring.

4.4 HSR Quadbox

It is possible to connect two HSR rings when the traffic flow exceeds the capabilities of a single ring. However, transmission delays from end to end are not improved. This connection is possible thanks to quadruple port devices with forwarding capabilities called QuadBoxes as shown in the following figure.

Although one QuadBox is sufficient to forward traffic, two QuadBoxes are used to prevent a single point of failure. A QuadBox forwards frames over each ring as any HSR node, and passes the frames unchanged to the other ring, except if the frame can be identified as a frame not to be forwarded to the other ring. To this effect, a QuadBox is expected to filter traffic based for instance on multicast filtering or on VLAN filtering. There is no learning of MAC addresses in a QuadBox, though, since the learning of MAC addresses on specific ports of a QuadBox device could lead to a short break in communication if the QuadBox that has learned an address and is forwarding network traffic fails.

With QuadBoxes realized as single physical entities, the two interconnected rings share the same redundancy domain concerning fault tolerance. If one QuadBox breaks down, both interconnected rings are in a degraded state and cannot tolerate a further fault.

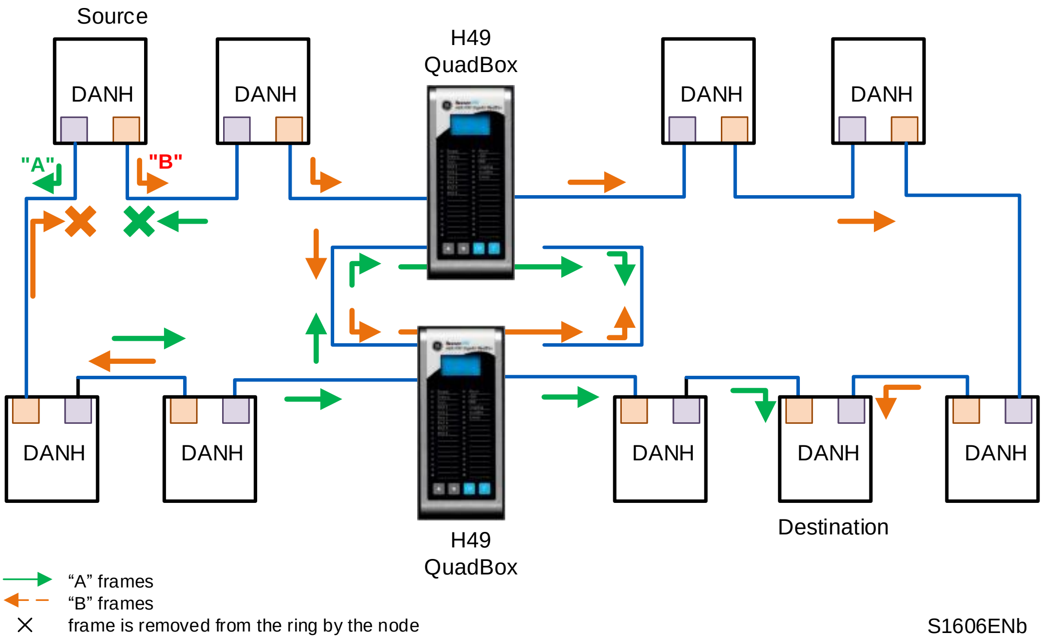


Figure 6: Two QuadBoxes linking two HSR Rings

The presence of two QuadBoxes on the same ring causes that two copies of the same frame are transferred from the first ring to the second, each generating other two copies.

This does not cause four frames to circulate on the second ring, since, when a copy from a first QuadBox reaches the second QuadBox on the same second ring, the second QuadBox will not forward it if it already sent a copy that came from its interlink.

Conversely, if the second QuadBox did not yet receive a copy from its interlink, it will forward the frame, but not the copy that comes later from the interlink.

When a QuadBox receives a frame that it itself injected into the ring or a frame that the other QuadBox inserted into the ring, it forwards it to the interlink and to its other port if it did not already send a copy. This duplicate will be discarded at the other end of the interlink. This scheme may cause some additional traffic on the interlink, but it allows to simplify the design of the logic.

Note:
The maximum time skew between two frames of a pair is about the same as if all nodes were on the same ring.

4.5 PRP-HSR Coupling

An HSR network may be coupled to a PRP network through two RedBoxes, one for each LAN as shown in the figure here below. In this case, the RedBoxes are configured to support PRP traffic on the interlink and HSR traffic on the ring ports.

The sequence number from the PRP RCT is reused for the HSR tag and vice versa, to allow frame identification from one network to the other and to identify pairs and duplicates on the HSR ring, introduced by a twofold injection into the ring through the two HSR RedBoxes.

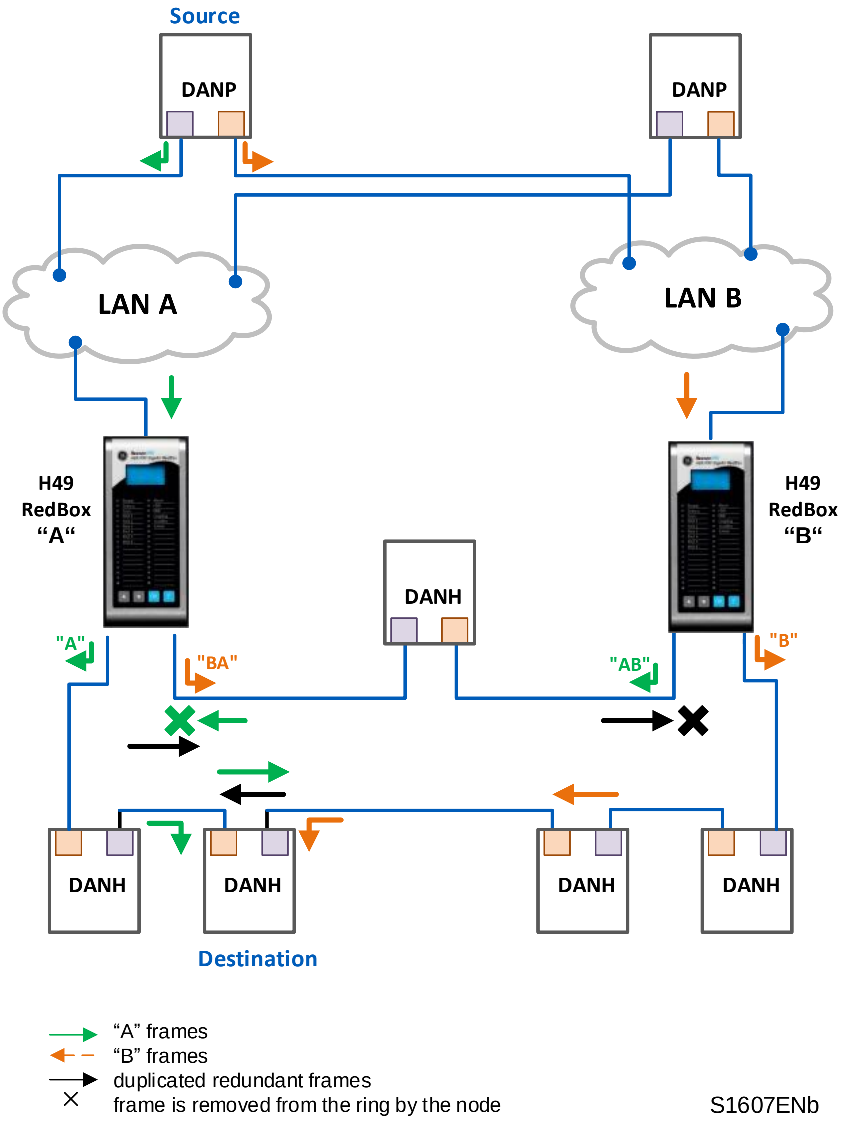


Figure 7: Coupling two PRP LANs to an SRS Ring

The HSR RedBoxes for connecting the ring to a PRP network operate identically to those used to attach SANs, except that they are configured as RedBox "A" or RedBox

“B” to accept PRP frames on their interlink. In the figure here above, RedBox A and RedBox B would send the same frame (A and AB, respectively B and BA), but if a RedBox receives the frame before it could send it itself, it refrains from sending it.

In the figure here above, RedBox A will not generate an “A“ frame on behalf of LAN A if it previously received the same frame as “AB“ from the ring, or conversely, RedBox “B” will generate an “AB” frame if it did not previously receive an “A” frame from the ring, which is the case whenever frame “A” is not a multicast frame.

Multicast frames or unicast frames without a receiver in the ring (see figure here above) are removed by the RedBox that inserted them into the ring, if they originated from outside the ring.

The following figure shows the same coupling when the source is within the ring.

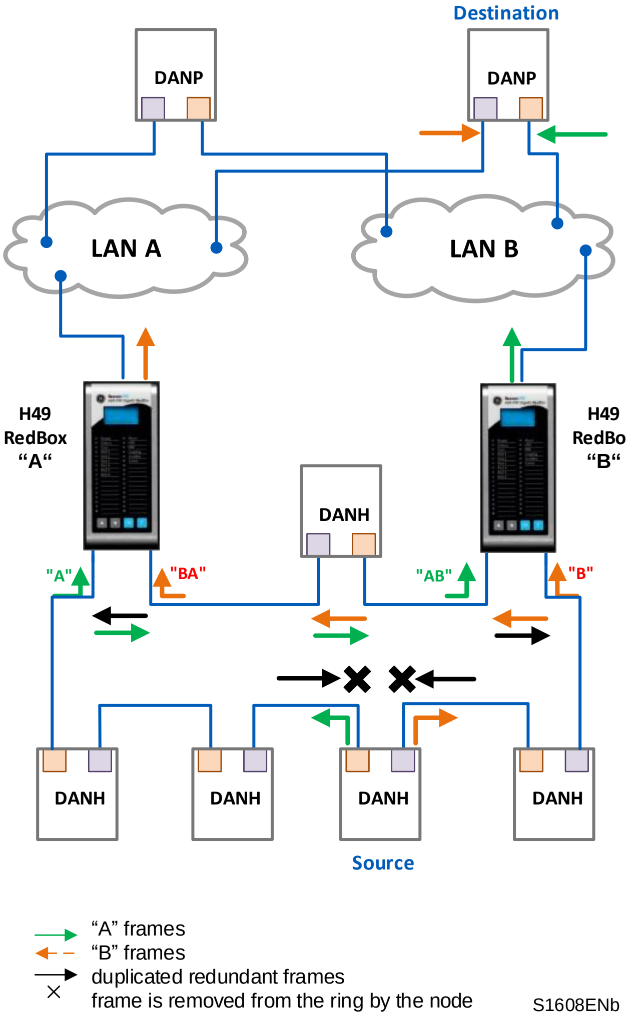


Figure 8: Coupling an HSR Ring to two PRP LANs

To avoid reinjecting a frame into the PRP network through the other RedBox, each HSR frame carries the identifier of the PRP network from which the frame came originally. Therefore, RedBoxes are to be configured with the NetId of the PRP network to which they are attached.

Other combinations of PRP and HSR networks are allowed. Some of them are explained in the following sections.

4.5.1 Connecting several PRP Networks to an HSR Ring

A **maximum of 6 PRP networks** can be connected to an HSR ring, each being identified by a 3- bit NetId.

The two RedBoxes that connect a PRP network with an HSR ring are configured with the NetId (1..7) and the LanId (A=0/B=1), see the following figure.

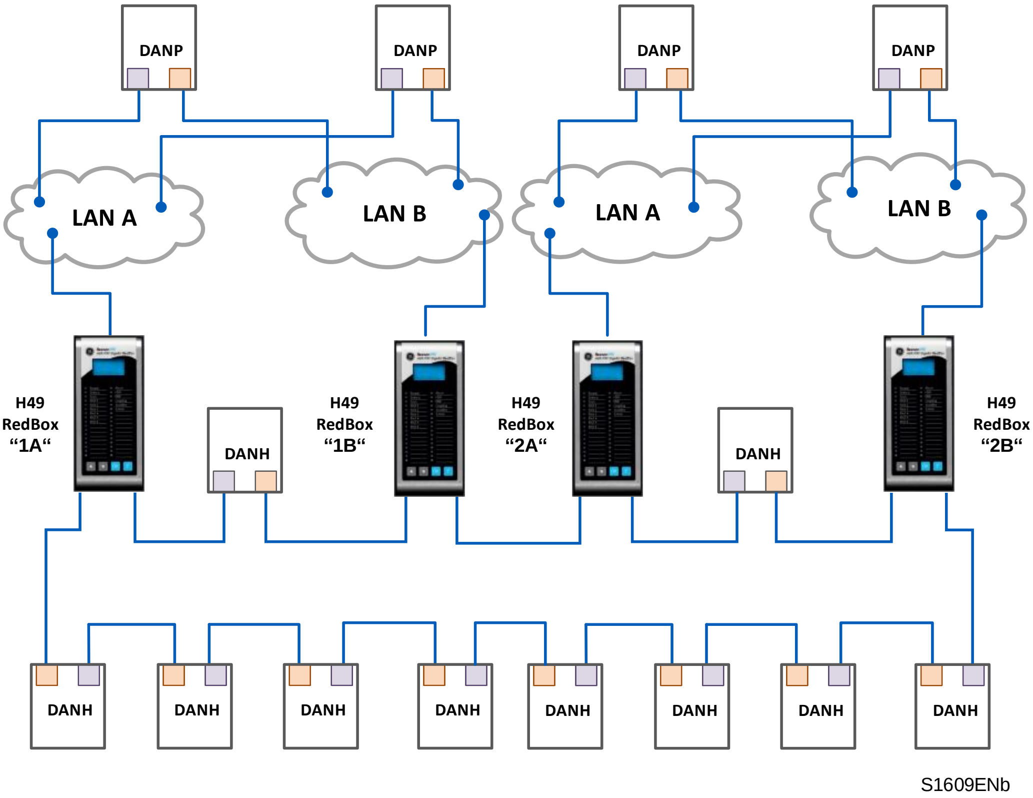


Figure 9: Coupling one HSR ring to several PRP Networks

To prevent reinjection of frames coming from one PRP network into another PRP network or from the same, a RedBox only forwards from the HSR ring frames that do not carry its own NetId. When inserting into the ring a PRP frame from LAN A or from LAN B of a PRP network with a given NetId, a RedBox inserts into the PathId of the HSR tag its own NetId and the LanId, i.e. one of "2"/"3", "4"/"5", "6"/"7", "8"/"9", "A"/"B", "C"/"D" or "E"/"F", depending if it is RedBox A or B.

Conversely, when forwarding a frame from the ring to a PRP network, a RedBox insert the LanId "A" or "B" into the RCT, depending if it is RedBox A or RedBox B.

4.5.2 Connecting one PRP Networks to several HSR Rings

A PRP network can be connected to any number of HSR rings, but these rings cannot be connected between themselves, neither by QuadBoxes nor by another PRP network since this would create loops.

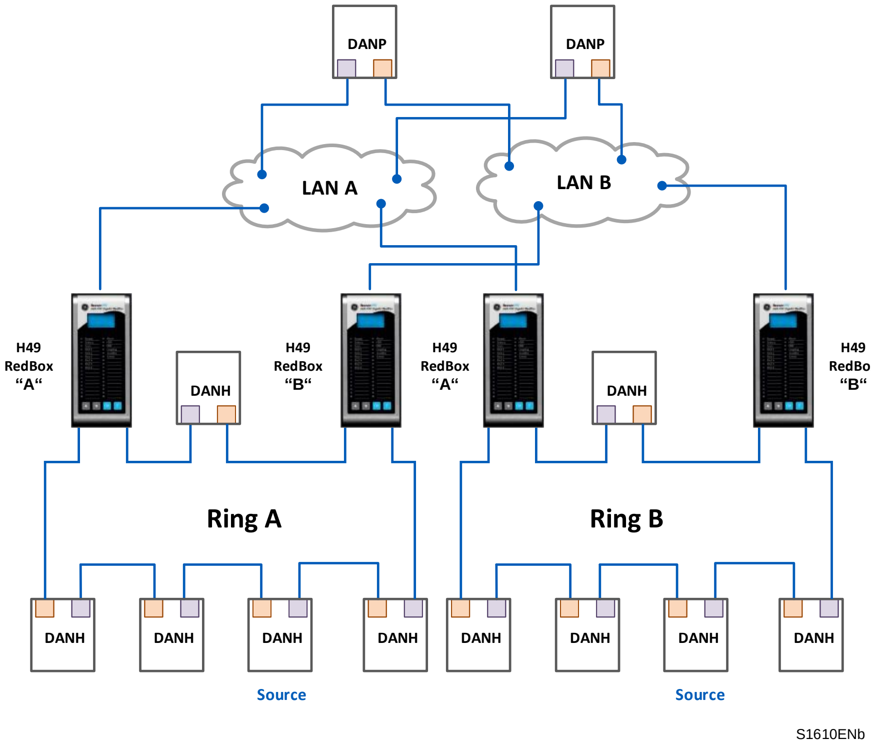


Figure 10: Coupling Several HSR Rings to a PRP Network

4.6 Standard Switch

Reason H49 can be configured as a standard Ethernet Switch. In this case, it manages up to six Ethernet ports.

Reason H49 using auto-negotiation:

- Automatically determines the speed of transmission on the 10/100/1000 Base ports according to the following standards:
  - IEEE 802.3u – 100BaseTX, 100BaseFX.
  - IEEE 802.3ab – 1000BaseTX
  - IEEE 802.3z – 1000BaseLX, 1000BaseSX
- Determines whether communication is half-duplex or full-duplex and adapts accordingly.

Addressing:

- Each Ethernet device inserts its unique “MAC address” into each message it sends.
- The receiving port automatically recognizes the MAC address in a received frame and stores it.
- Once an address is recognized and stored, the switch will forward frames to the appropriate port.
- Up to 512 MAC addresses can be stored and monitored at any time.

4.7 Time Synchronization

Reason H49 supports real-time clock synchronization for the timestamp of logs or events through the following network protocols:

- Precision Time Protocol (PTP in accordance with IEEE/IEC 61588 (2009)).
- Network Time Protocol (NTP).

The time protocol used is independent of the network architecture (HSR or PRP). Thus, the time server can be placed in either the HSR ring or one of the PRP LANs.

It is important to emphasize that the time server shall be placed in a VDAN device; in other words, it shall be linked to the network through a RedBox.

Note:
The Reason H49 switch does not support Spanning Tree Protocol (STP, RSTP, MSTP).

4.7.1 Precision time synchronization (PTP)

Time synchronization from a master clock synchronized to the global positioning satellite (GPS) system is accepted over the network according to IEEE/IEC61588 Ed.2. (2009).

PTP synchronizes all clocks within a network by adjusting distributed clocks to a grandmaster clock. PTP enables distributed clocks to be synchronized and maintained to sub-microsecond accuracy.

Figure 11: Example of PRP/HSR Architecture with the Precision Time Protocol (PTP)

> *Note:*
> *On PTP protocol, a time discrepancy of 60 milliseconds per 24h is reported on Reason H49 (equipped with a SRPv3 version x) and used as Master Clock (M1) (case VDAN-P Grandmaster Clock not available).*

4.7.2 NTP time synchronization

Network Time Protocol (NTP) is a networking protocol for clock synchronization between computer systems over packet-switched, variable-latency data networks.

Reason H49 supports NTP as shown in the figure below.

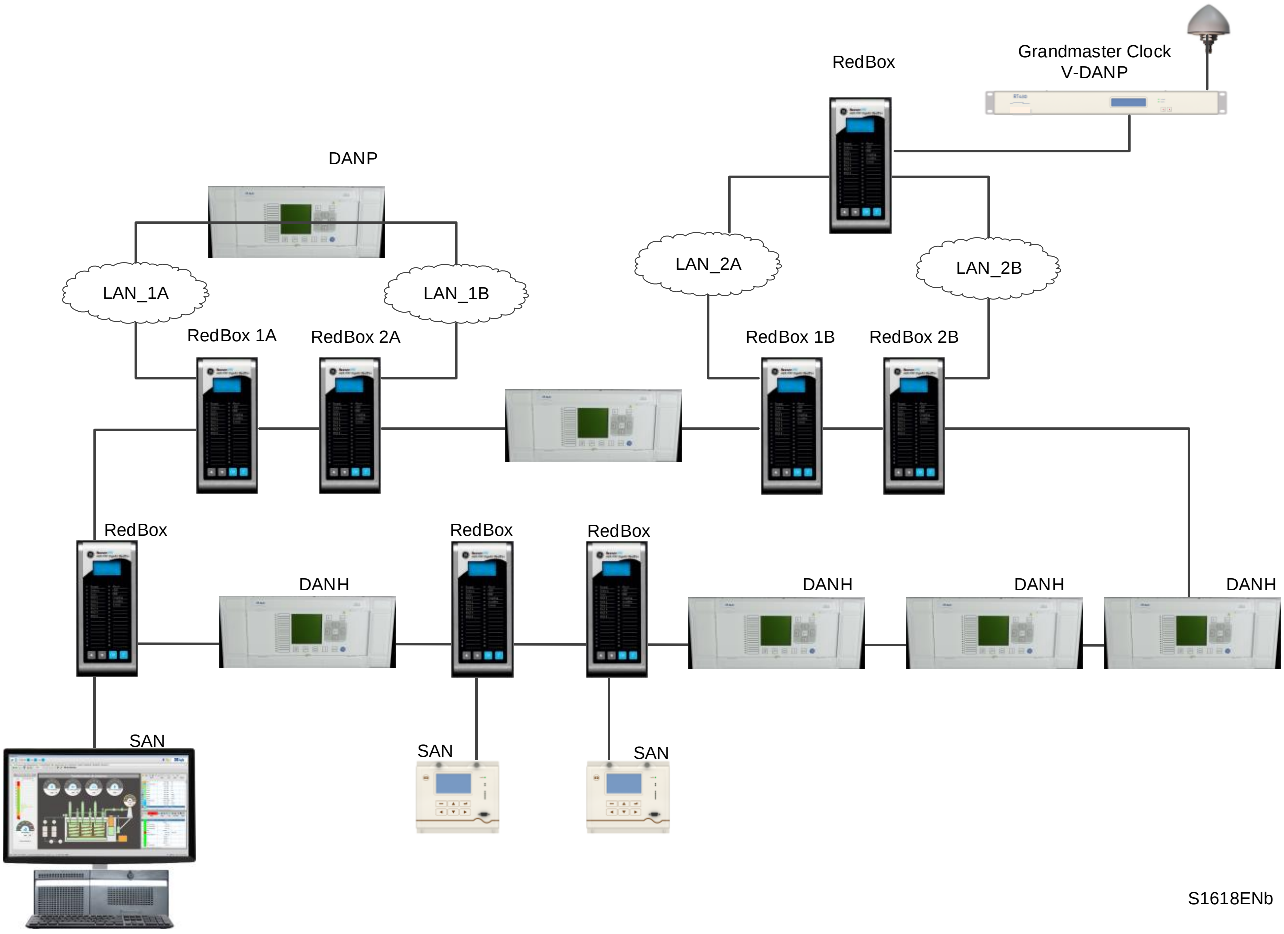


Figure 12: Example of NTP Synchronization

4.7.2.1 Time Zone

The internal clock of Reason H49 can be synchronized using NTP protocol, which sends the UTC time (Greenwich Mean Time). When using the equipment in other regions, the time zone may be set manually to correct the internal clock.

4.8 SNMP

Simple Network Management Protocol (SNMP) is the network protocol developed to manage devices on an IP network.

To exchange information, SNMP relies on a **Management Information Base (MIB)** that contains information about parameters to supervise. A MIB format is a tree structure, with each node identified by a numerical Object Identifier (OID). Each OID identifies a variable that can be read or set via SMP with the appropriate software.

4.8.1 Supported MIB

The SNMP MIB consists of distinct OIDs, each of which refers to a defined collection of specific information used to manage devices over the network.

GE Grid Solutions management information bases (MIB) use the following types of object identifiers (OID):

- BRIDGE-MIB (RFC 1493).
- SNMPv2-MIB (RFC 1907).
- TCP-MIB (RFC 2012).
- UDP-MIB (RFC 2013).
- SNMPv2-SMI (RFC 2578).
- SNMPv2-TC (RFC 2579).
- RMON-MIB (RFC 2819).
- IF-MIB (RFC 2863).
- PRP/HSR MIB (IEC 62439-3).
- Power Profile MIB (IEEE C37.238).

4.8.1.1 Get MIB Files

The MIB files supported by the H49 are included in release delivery package.

To get the MIB files, the following prerequisites must be observed:

- Windows operating system
- 7-zip application
- H49 Release delivery package

1 Unzip the H49 release delivery package:

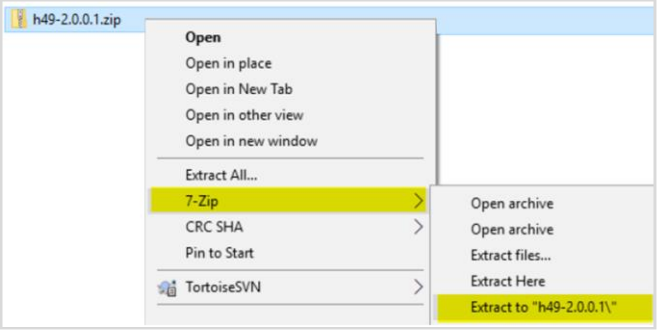


Figure 13: Release delivery package Zip

2 Open the H49 unzipped folder:

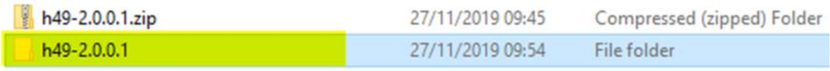


Figure 14: Unzipped folder

3 Unzip the *.tar.gz file to folder *.tar:

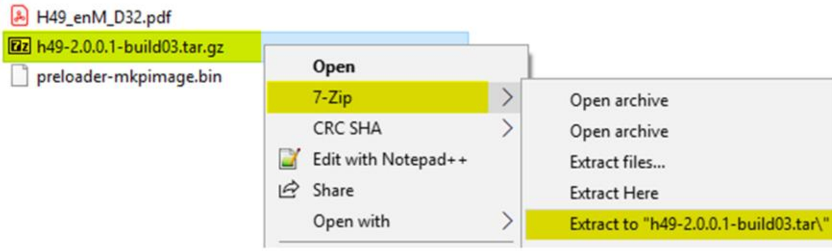


Figure 15: Unzipped *.tar folder

4 From the unzipped folder, unzip the *.tar file:

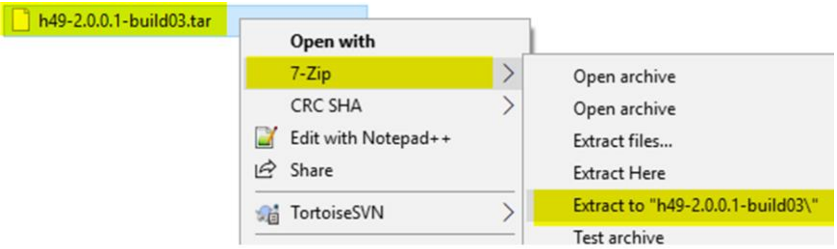
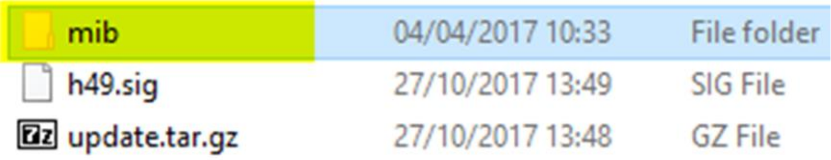


Figure 16: Unzipped *.tar folder

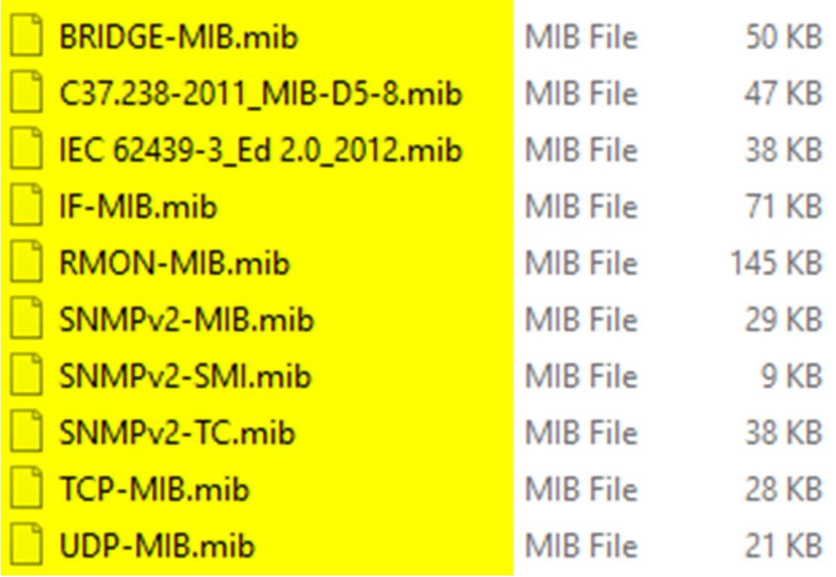
5 Open the unzipped folder to find MIB folder:



mib	04/04/2017 10:33	File folder
h49.sig	27/10/2017 13:49	SIG File
update.tar.gz	27/10/2017 13:48	GZ File

Figure 17: MIB folder

6 MIB files are available in the MIB folder:



BRIDGE-MIB.mib	MIB File	50 KB
C37.238-2011_MIB-D5-8.mib	MIB File	47 KB
IEC 62439-3_Ed 2.0_2012.mib	MIB File	38 KB
IF-MIB.mib	MIB File	71 KB
RMON-MIB.mib	MIB File	145 KB
SNMPv2-MIB.mib	MIB File	29 KB
SNMPv2-SMI.mib	MIB File	9 KB
SNMPv2-TC.mib	MIB File	38 KB
TCP-MIB.mib	MIB File	28 KB
UDP-MIB.mib	MIB File	21 KB

Figure 18: MIB files

MIB files can be imported in a MIB browser application in order to get the H49 exposed SNMP information.

Based on these MIB files, the MIB browser application will display the H49 SNMP OID detailed information as well as their functional description.

To get all H49 information, SNMPv3 must be used.

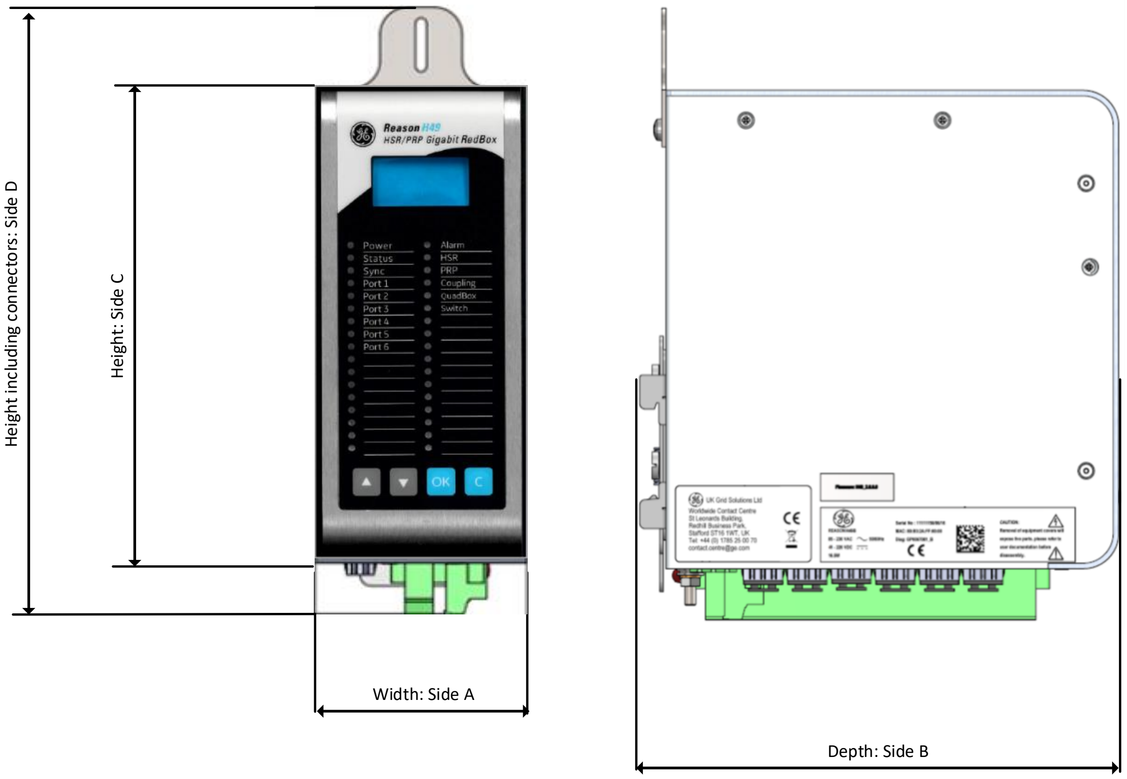
4.8.2 SNMP Traps

The SNMP agent in the Reason H49 switch can send SNMP traps to the management station. Traps are change-of-state messages alerting the SNMP manager to a condition on the network. A trap message is sent to alert the management station to some event or condition on the switch such as:

- Loss of communication on one port.
- Loss of power supply input.
- Loss of time synchronization (PTP).
- Resource exhaustion.

Chapter 5: Installation

5.1 Dimensions



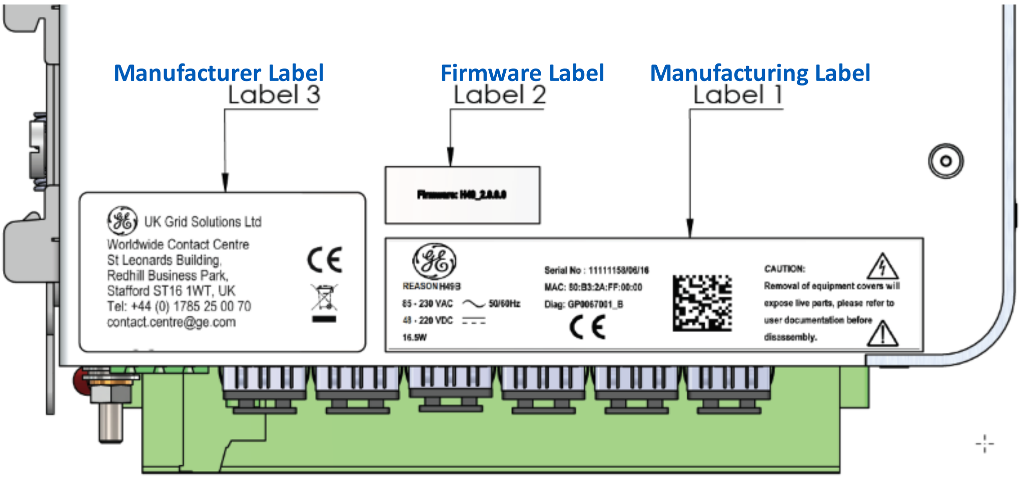
S1380ENa

Figure 19: Front Face and side with dimensions

Item	Unit	Min	Max
Width: Side A	mm	74.8	75.2
Depth: Side B	mm	175.14	177.26
Height: Side C	mm	175.8	176.2
Height: Side D	mm	224.12	226.12

5.2 Device Labeling

The figure below shows an example of the standard labels stuck to the Reason H49 switch:



S1616ENc

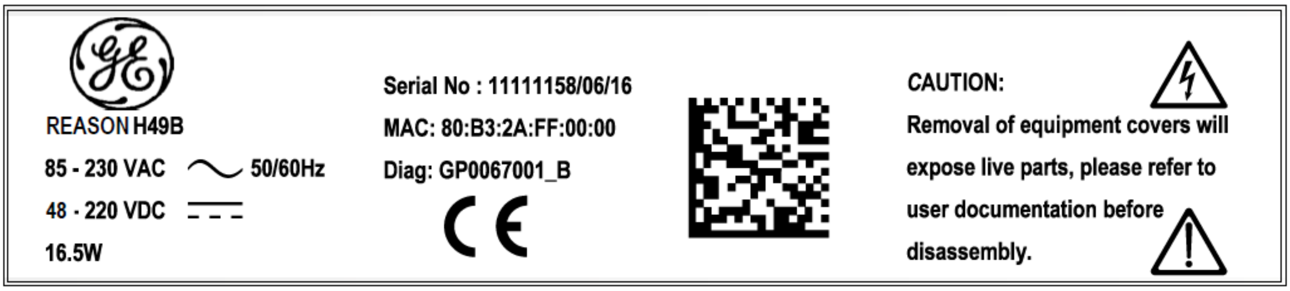
Figure 20: Example of Device Labeling

Main information present in these labels includes:

- Company
- Product name
- Cortec code
- Voltage range
- Serial number
- Caution notice
- Firmware version
- MAC address

The following tables give the details of the label components.

5.2.1 Manufacturing Label



REASON H49B

85 - 230 VAC ∼ 50/60Hz

48 - 220 VDC ⎓

16.5W

Serial No : 11111158/06/16

MAC: 80:B3:2A:FF:00:00

Diag: GP0067001_B

CE

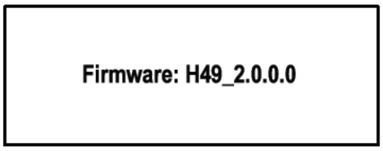
CAUTION:

Removal of equipment covers will expose live parts, please refer to user documentation before disassembly.

Figure 21: Manufacturing Label

Label1 - Manufacturing Label
Label 20x94mm
Diagram number: GP0067001_B Reference of the product: GP0067001 Version of the product: B
Serial number: 11111158/06/16 Unique serial number: 8 numerical digits: 11111158 Date of manufacturing /MM/YY: /06/16
Barcode content description: DSAGILEH4900000000000B_11111158_80B32AFF0000 Cortec number: DSAGILEH4900000000000B Serial number without the manufacturing date: 11111158 MAC Address: 80B32AFF0000

5.2.2 Firmware Label



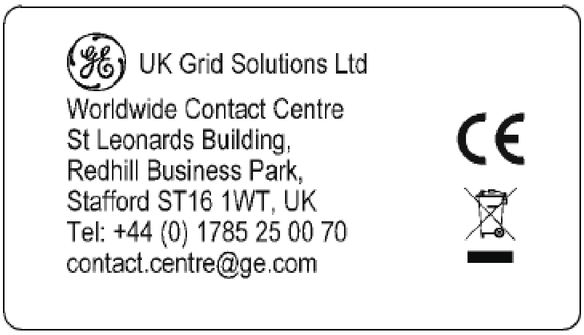
Firmware: H49_2.0.0.0

Figure 22: Firmware Label

Label2 - Firmware Label
Label 10x27mm
Firmware version: H49_2.0.0.0 Name of the product: H49 First digit: Major functional version (2) Second digit: Compatibility indicator version (0) Third digit: Maintenance/Evolution/Bug fix version (0) Fourth digit: Second level maintenance version (0)

Note:
Firmware label is given as an example. Check last issue of datapack for correct firmware label.

5.2.3 Manufacturer Label



UK Grid Solutions Ltd
Worldwide Contact Centre
St Leonards Building,
Redhill Business Park,
Stafford ST16 1WT, UK
Tel: +44 (0) 1785 25 00 70
contact.centre@ge.com

CE

Figure 23: Manufacturer Label

Label3 - Manufacturer Label
Label 28x50mm Font: Alstom regular, black
Content: manufacturer contact information

5.3 Mounting

Reason H49 is designed to be mounted **vertically** on a standard DIN Rail.

For this purpose, two adjustable mounting brackets are located on the back of the H49, one at the top and one at the bottom of the rear face as shown below:

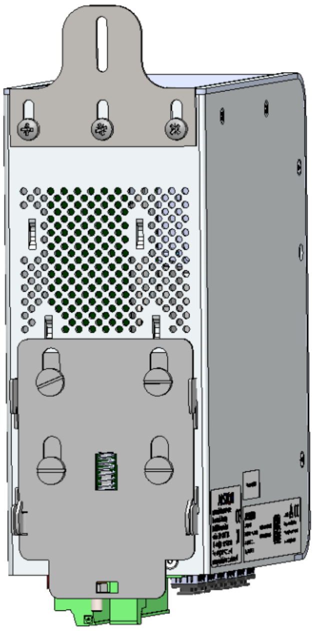


Figure 24: Reason H49 DIN Rail Mounting Details - Rear View with Mounting Rack

Optional **Weidmuller FM4 TS35** mounting clip can also be used, as shown in the following figure (to be ordered separately).

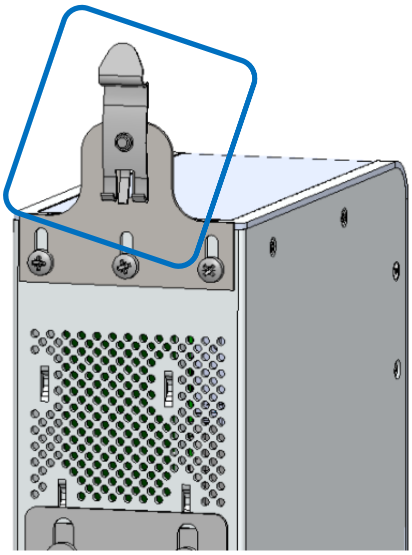


Figure 25: Reason H49 DIN Rail Mounting Details - Rear View with Weidmuller Clip

5.3.1 Recommendations for Electromagnetic compatibility

⚠

Caution:
Reason H49 operates within -25°C/+55°C in normal conditions. As heat within the Reason H49 switch is channeled to the enclosure, it is recommended that 1,5 cm of space be kept between each switch mounted within the DIN Rail to allow for a small amount of airflow.
A closer spacing will result in higher device operating temperature.

⚠

Caution:
The orientation in which the Reason H49 is fitted on the DIN Rail is a key factor to optimal performance. Reason H49 requires to be installed vertically on the DIN rail. Other position would lead to inadequate ventilation and result in increased heat generation.

Chapter 6: Connection

As well as connections to the Ethernet network, Reason H49 requires auxiliary power supply connection and safety earth connection. Alarm outputs are provided and these should be connected for system supervision.

The locations of the various connection points are detailed section Bottom view.

6.1 General Wiring

Only two wires can be screwed together on any one connector. The AC and DC signal and communication wires should use separate shielded cable.

Caution:
A high rupture capacity (HRC) fuse must be used for auxiliary supplies (for example Red Spot type NIT or TIA) with the following characteristics:

- Current rating: 16 Amps
- Minimum dc rating: 220 V dc
- gG operating class in accordance with IEC 60269

The fuses must be connected in series with the positive auxiliary supply input connections for both primary (Pin 23) and secondary (Pin 1) BIU261D inputs.

Wires should be connected with the power supply connectors unplugged. Each wired signal has to be tested before plugging and fixing the connectors. The connectors have to be fixed on the Reason H49 case with the screws available at each extremity of the connector.

For connection of the protective (earth) conductor, refer to chapter **6.2 Earth Wiring** page **44**.

6.1.1 Well-organized Wiring

Caution:
Improperly installed cabling can affect device performance and generate interferences.

To avoid interferences, careful placement of cables is required. The principle consists in physically separating power sources (AC/DC) and communication cables (i.e. high voltage from RJ45/Copper). This is even more important when devices receive time synchronization from PTP master clock.

Whenever possible, use cableways or troughs.

6.2 Earth Wiring

6.2.1 Protective Earth Wiring

This equipment requires a protective conductor (earth) to ensure user safety according to the definition in the standard IEC 60255-27: 2005 Insulation Class 1.

Warning:
– To preserve the device's safety features, the protective conductor (earth) MUST not BE disturbed when connecting or disconnecting functional earth conductors, such as cable screens, to the PCT stud.
– The protective conductor must be connected first, in such a way that it is unlikely to be loosened or removed during installation, commissioning or maintenance. This MAY be achieved by use of an additional locking nut.

Caution:
Always place the protective conductor (earth) as shown on the diagram below.

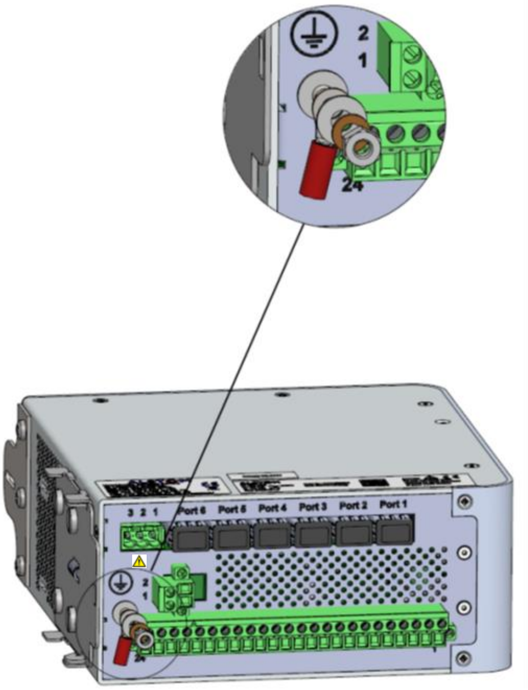


Figure 26: Protective Earth Screw

The protective conductor (earth) must be as short as possible, with low impedance. The best electrical conductivity must be maintained at all times, particularly the contact resistance of the plated steel stud surface.

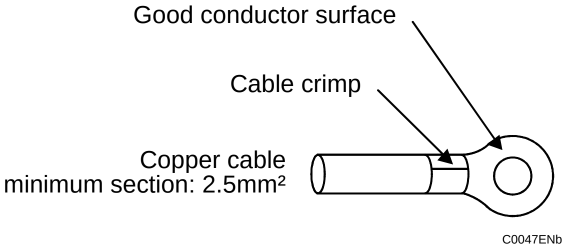


Figure 27: Example of Earth Cable

6.2.2 Casing / Earth Interconnection

To protect against disturbances, each Reason H49 must be carefully and correctly interconnected.

Within Reason H49 equipment, earth and casing must be connected to a grid-like grounding system in the shortest possible way using low impedance (at high frequencies), wide and short electrical connections (wires or braids) as specified in the IEC 61000-5 standard.

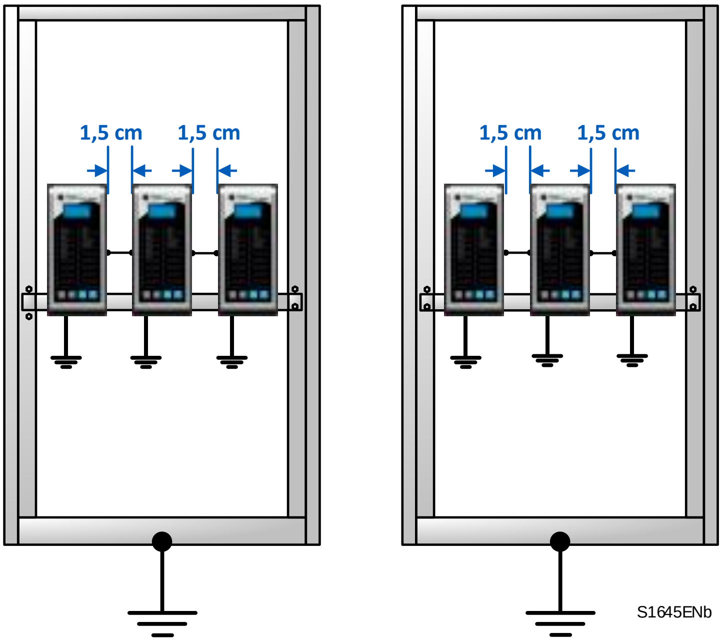


Figure 28: Recommended mounting and Casing / Earth interconnection

6.3 Power Supply Wiring

Reason H49 contains a Basic Interface Unit (BIU261D) board, which includes two redundant power supply inputs, as shown in the following figure:

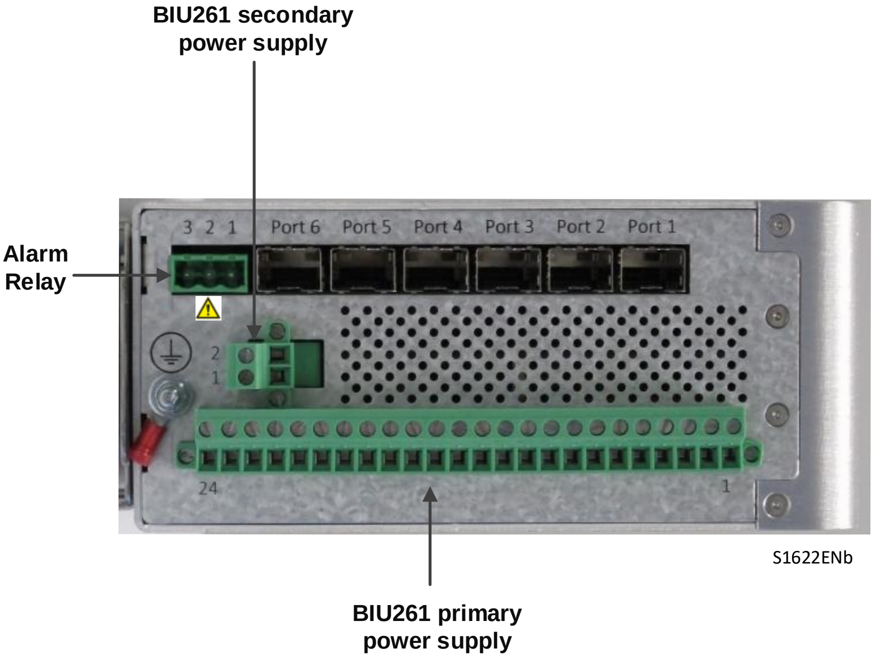


Figure 29: Reason H49 Power Supply Wiring

BIU261D primary power supply

The primary power supply is connected using a 24-way connector block:

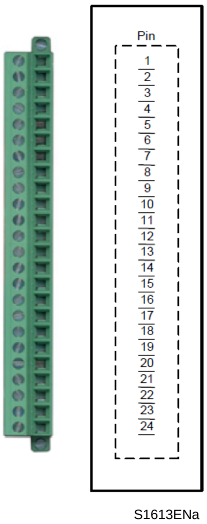


Figure 30: Typical 24-way Female Connector

BIU261D primary power supply

Pin n°	Description	
1 to 21	Not used	
22	Voltage input: GND	
23	Voltage input: AC/DC	(+)
24	Voltage input: AC/DC	(-)

> *Note:*
> *Inputs must be connected to the specified pins. Other pins must remain unused and no other connection has to be made.*

The 24-way connector block characteristics are as follows:

Continuous rating	10A
Connection method	M3 screws
Cable section	2.5mm2
Connection pitch	5.08mm
Insulation between terminals and to the earth	300 V basic insulation
Standards	UL, CSA

> *Note:*
> *The connector is fixed using 2 M3 screws located at each end of the connector.*

BIU261D secondary power supply

The secondary power supply is connected using a 2-way connector block:

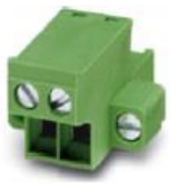


Figure 31: Typical 2-way Female Connector

Pin n°	Description	
1	Voltage input: DC	(+)
2	Voltage input: DC	(-)

The 2-way connector block characteristics are as follows:

Continuous rating	10A
Connection method	M2.5 screws
Cable section	2.5mm2
Connection pitch	5.08mm
Insulation between terminals and to the earth	300 V basic insulation
Standards	UL, CSA

If the primary power supply input is lost while being used, the BIU261D switches to the secondary power supply input. It will switch back to the primary power supply when the latter becomes available again and has been stable for a few seconds.

If the secondary power supply is lost while being used, the BIU261 instantly switches to the primary power supply. It will continue to use the primary power supply source as long as it is available, even when the secondary power supply becomes available again.

Reason H49 supports the following power supply use cases:

	Primary source	**Secondary source**
Use case 1	DC	DC
Use case 2	DC	OFF
Use case 3	OFF	DC
Use case 4	AC	DC
Use case 5	AC	OFF
Nominal Power supply range	**85Vac to 230Vac** **48Vdc to 220Vdc**	**48Vdc 220Vdc**

6.4 Alarm Relay Wiring

The 3-pin connector of the relay alarm on the SRPV3 board allows the following Reason H49 statuses:

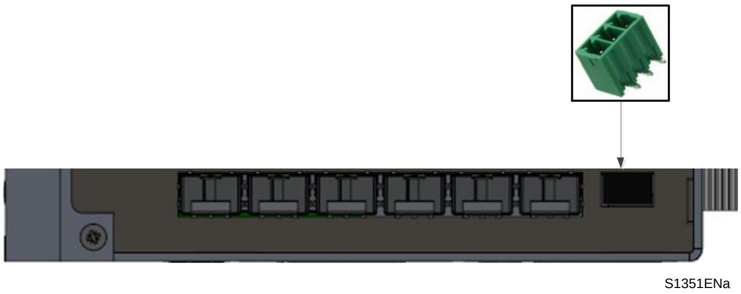


Figure 32: Relay Alarm Wiring

Pin	Signal	Description
1	Normally Open	Closed=Normal Operation Open= Power supply defect (both input voltage sources are down) / Operating System defect (Kernel crash, processor overload, memory leak)
2	Common	
3	Normally Closed	Closed= Power supply defect (both input voltage sources are down) / Operating System defect (Kernel crash, processor overload, memory leak) Open= Normal Operation

6.4.1 Using Terminal Blocks

Printed-circuit board connectors can be used:

Figure 33: Pluggable Terminal Block

The relay alarm connector shall be plugged with MSTB 2,5 HC/ 3-ST-5,08 - 1911978 manufactured by Phoenix Contact.

6.4.1.1 Recommended Wire Size

The minimum **recommended wire size** for terminal blocks is 2.5mm^2.

6.4.1.2 Crimped Ferrule

For safety reasons, wire terminations must be insulated using an insulated crimped ferrule, suitable for 2,5mm^2 wire size.

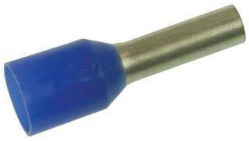


Figure 34: Pluggable Terminal Block

Insulated wire ferrules must be slipped over the stripped cable and crimped to prevent stranded wire from fraying.

⚠ **Caution:**
Refer to section 10.5.3 Auxiliary Fault Relays (Optical Port Alarm) page 134 for electrical characteristics of alarm circuit.

6.5 Ethernet Connections

Reason H49 is easy to install and operate. It is designed to work in an electrical plant environment and it is fully certified IEEE 1613 series, IEC 61850-3 and IEC 60255-27.

Reason H49 connects to the network through a Small Form-factor Pluggable module (SFP), which can be inserted and removed safely while the switch is powered and operating:

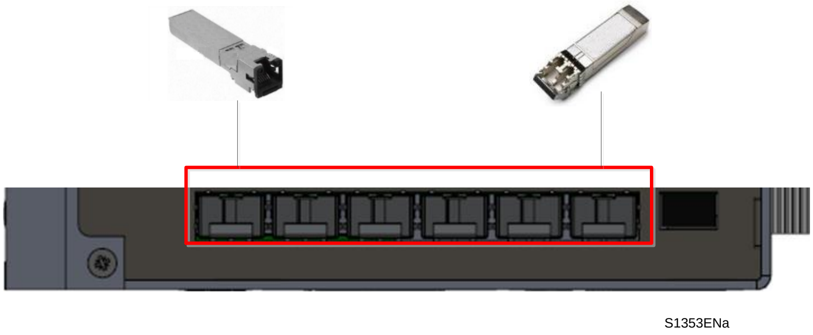


Figure 35: SFP Module Connection

The SFP module is a hot-swappable connector that provides high-speed performance.

Reason H49 supports two kinds of modules:

- Optical LC-type SFP
- RJ45-type SFP.

The table below lists the supported LC-type SFP and references:

Reference	Manufacturer	Description	Connector Type	Image
AFBR-5715ALZ	fit-foxconn	1Gbps Multimode 850nm wavelength	LC Duplex	
HFBR-57E0APZ	AVAGO	100Mbps Multimode 1300 nm wavelength	LC Duplex	
AFCT-5765ALZ	fit-foxconn	100Mbps Single-mode SR (up to 2 km) 1300 nm wavelength	LC Duplex	

Reference	Manufacturer	Description	Connector Type	Image
AFCT-5715ALZ	fit-foxconn	1Gbps Single-mode (up to 10km) 1310 nm wavelength	LC Duplex	
AFCT-5765ATLZ	fit-foxconn	100Mbps Single-mode IR-1 (up to 15 km) 1300 nm wavelength	LC Duplex	

The table below lists the supported RJ45-type SFP and references:

Reference	Manufacturer	Description	Connector Type	Image
ABCU-5741ARZ	fit-foxconn	10/100/1000Mbps	RJ45	

Caution:
Reason H49 is delivered with SFP cap inserted in each SFP cage.
The cap must be inserted in each SFP cage unused. It is a protection against dust.

6.5.1 RJ45-Type Connection

The following figure shows the RJ45-type module used by the Reason H49 switch and its corresponding RJ45 connector.

Insulated cable category 6 or 5e (FTP: Foil Twisted Pair) or insulated (STP – Shielded Twisted Pair) with RJ45 connectors are mandatory.

Note: Do not use RJ45 UTP cable. This kind of cable may disrupt time synchronization.

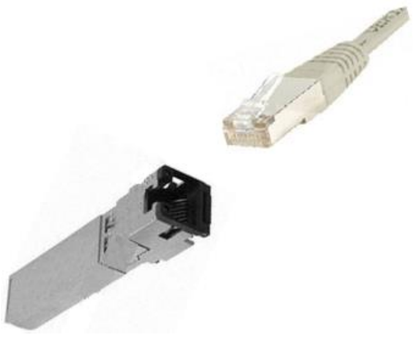


Figure 36: RJ45 SFP Module

CAUTION
Risk of
electric shock

Caution:
When SFP Copper Ethernet modules are used, the connected cables shall be shortened to minimum possible length. We recommend that cables (such as RJ45 category 6 or 5e) do not exceed 3 meters to comply with Electromagnetic compatibility (EMC) requirements.
Connected cables shall not extend beyond the cabinet where the product is used. The equipment connected to both ends of the cable shall be connected directly to a common protective earth point within the same cabinet.

6.5.2 Optical LC-type Connections

The following figure shows the optical LC-type module used by the Reason H49 switch and its corresponding LC-type connector.

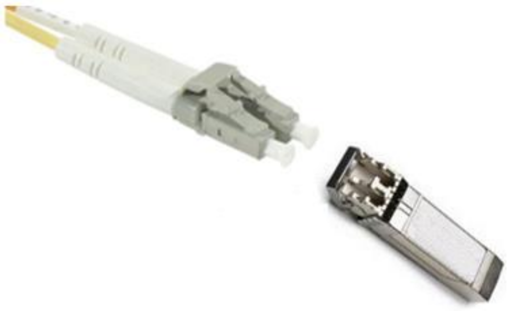


Figure 37: Ethernet Fiber Optic – LC-type Module

Warning about Laser Rays

Caution:
NEVER look into optical fibers. Always use optical power meters to determine operation or signal level.
Non–observance of this rule could possibly result in personal injury.
Signals transmitted via optical fibers are unaffected by interference. The fibers guarantee electrical isolation between the connections.
If electrical to optical converters are used, they must have management of character idle state capability (for when the fiber optic cable interface is "Light off").

LC-type small form-factor pluggable (SFP) modules shall be used. LC/ST or LC/SC optical patch cords may be used to connect the board to devices fitted with ST or SC connectors.

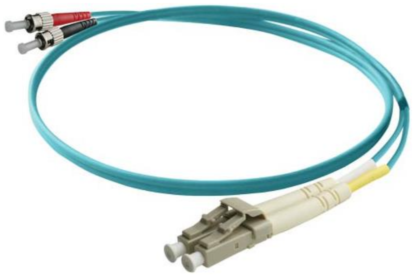


Figure 38: Example of Optical Patch Cord (Multimode Duplex LC/ST)

6.6 Fiber Optic Budget Calculations

Optical power is expressed in Watts. However, the common unit of power measurement is the dBm, defined by the following equation: Power (dBm) = 10 log Power (mW) / 1 mW.

The fiber optic budget is the difference between the power emitted into the fiber and the sensitivity (minimum amount of power required) of the receiver connected through the fiber optic cable.

Link Power Budget = Transmitter Power (dBm) - Receiver Sensitivity (dBm). The distance over which the signals can be transmitted and successfully received is affected by the optical loss as shown in the figure below.

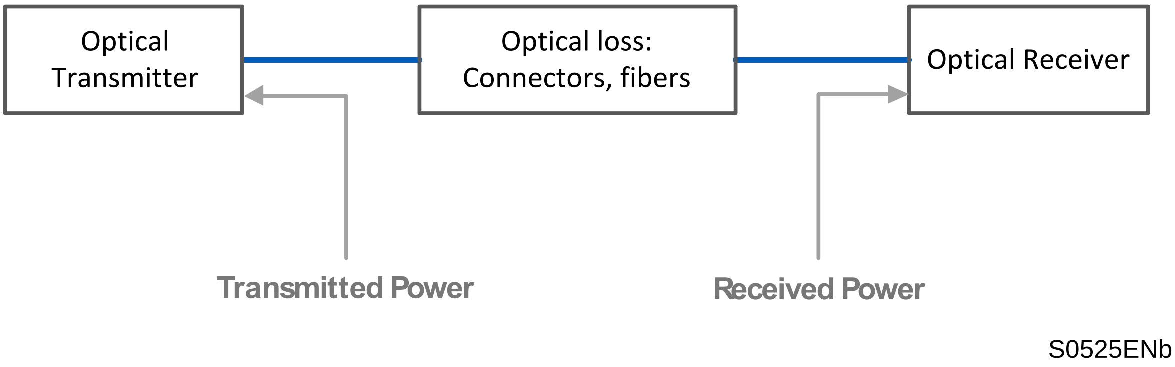


Figure 39: Fiber Budget

For this product, the optical budget is given in the table below.

Fiber type	Multimode 62.5/125 micron	Single mode 9/125 micron
Power coupled into fiber	-19 dBm	-15 dBm
Sensitivity	-31 dBm	-34 dBm

In calculating the maximum distance, the following figures can be used as a guide, but you should check with your supplier for precise figures.

Fiber type	Multimode	Single mode
Link budget	12 dB	19 dB
Typical connector loss (1 per receiver, 1 per transmitter)	0.8 dB	0.8 dB
Safety Margin	4 dB	4 dB
Allowed link attenuation	6.4 dB	13.4 dB
Typical cable attenuation	1 dB/km	0.4 dB/km
Maximum range	2 km	15 km
Insertion of a patch panel (per panel)	2 dB	1 db

6.7 Power up

The following indicators are displayed during the power-up process:

- LED 1 is green
- LED 2 is amber
- LED 18 indicates the state of the redundant power supply

At the end of the power-up process, the following indicators are displayed:

- The LCD screen displays “H49” and the device’s IP address
- LED 1 is green
- LED 2 is green

Refer to section **4.1.1 Front Panel** page **16** for LEDs indications.

Chapter 7: Settings

To take full advantage of all the features available from the Reason H49 switch, the device must properly be configured for your network.

There are several ways to configure the Reason H49 switch:

- A **web user interface**, accessible via the switch’s built-in web server.
- An **SNMP** interface can be used to read/write some settings
- **CLI** (command Line Interface) can be used to read/write most settings (SSH).

> *Note:*
> *This chapter only explains how to configure the Reason H49 switch through the embedded web server. However, an appendix, at the end of this document, describes the command lines supported by the SSH service.*

7.1 Connecting to Reason H49

To access the embedded web server from a PC connected to the same LAN as the Reason H49 switch, the PC and the Reason H49 switch must be on the same subnet.

The default IP address of the Reason H49 switch is **192.168.254.254** and the sub mask is **255.255.0.0**.

Your PC IP address must be set in the same LAN for initial configuration.

> *Note:*
> *The device connects to the network through a Small Form-factor Pluggable module (SFP). Refer to the Ethernet Connections section to see the references of the supported RJ45-type SFP module.*

7.2 Accessing the Web User Interface

The Reason H49 web user interface provides an easy way to modify the switch’s configuration settings and access the built-in network and security administration functions.

The web user interface can be accessed via a web browser.

Once your PC is connected to the same LAN and subnet as the Reason H49, open the switch’s web user interface as follows:

1 Open one of the following recommended web browsers:

Browser name	Manufacturer
Chrome	Google
Internet Explorer	Microsoft
Mozilla Firefox	Mozilla Foundation Mozilla Corporation
Safari	Apple Inc.

2 In the web browser's address bar, type the default Reason H49's IP address: **192.168.254.254** and press **Enter** on your keyboard.

Note:
The embedded web server only supports the ***secure HTTPS protocol****. When you access the server via https, you may see a warning dialogue indicating that the certificate was signed by an unknown authority. This is expected as the certificate provided by default is self-signed. To avoid this message in the future, you can choose to install a properly signed certificate.*

7.3 Logging In

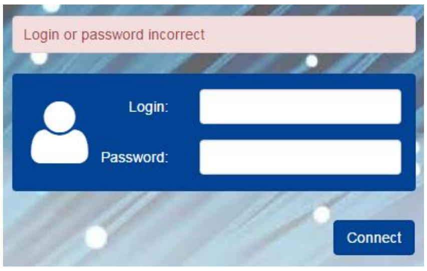
The web login window prompts you for a login name and password.

Use the following default values:

- Login: **user**
- Password: **user**

Note: See the Cyber Security section for more information on user accounts.

If an error occurs during the authentication process, an information message appears on screen, as shown in the following figure.



Login or password incorrect

Figure 40: Reason H49 Web User Interface - Error during Login Process

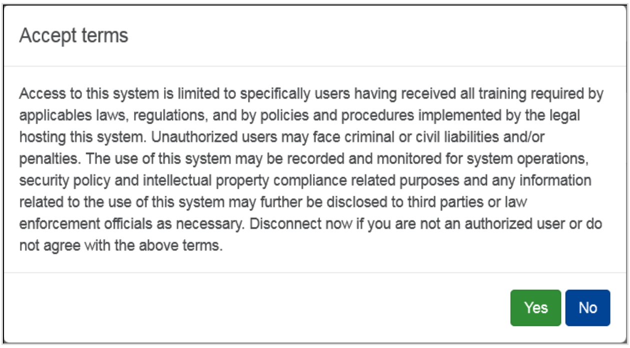
When connecting to Reason H49 for the first time, the system prompts the user to change the default password.

- Enter a new password and confirm.

Note:
*The new password must match the **Password complexity** parameter, which is enabled by default in Reason H49 web user interface. Refer to section **8.1.5 Password Management**, page **114** for more information.*

Upon successful authentication, the user is granted authorization for access.

Read the Software License agreement and click **Yes** to agree to the terms:



Accept terms

Access to this system is limited to specifically users having received all training required by applicables laws, regulations, and by policies and procedures implemented by the legal hosting this system. Unauthorized users may face criminal or civil liabilities and/or penalties. The use of this system may be recorded and monitored for system operations, security policy and intellectual property compliance related purposes and any information related to the use of this system may further be disclosed to third parties or law enforcement officials as necessary. Disconnect now if you are not an authorized user or do not agree with the above terms.

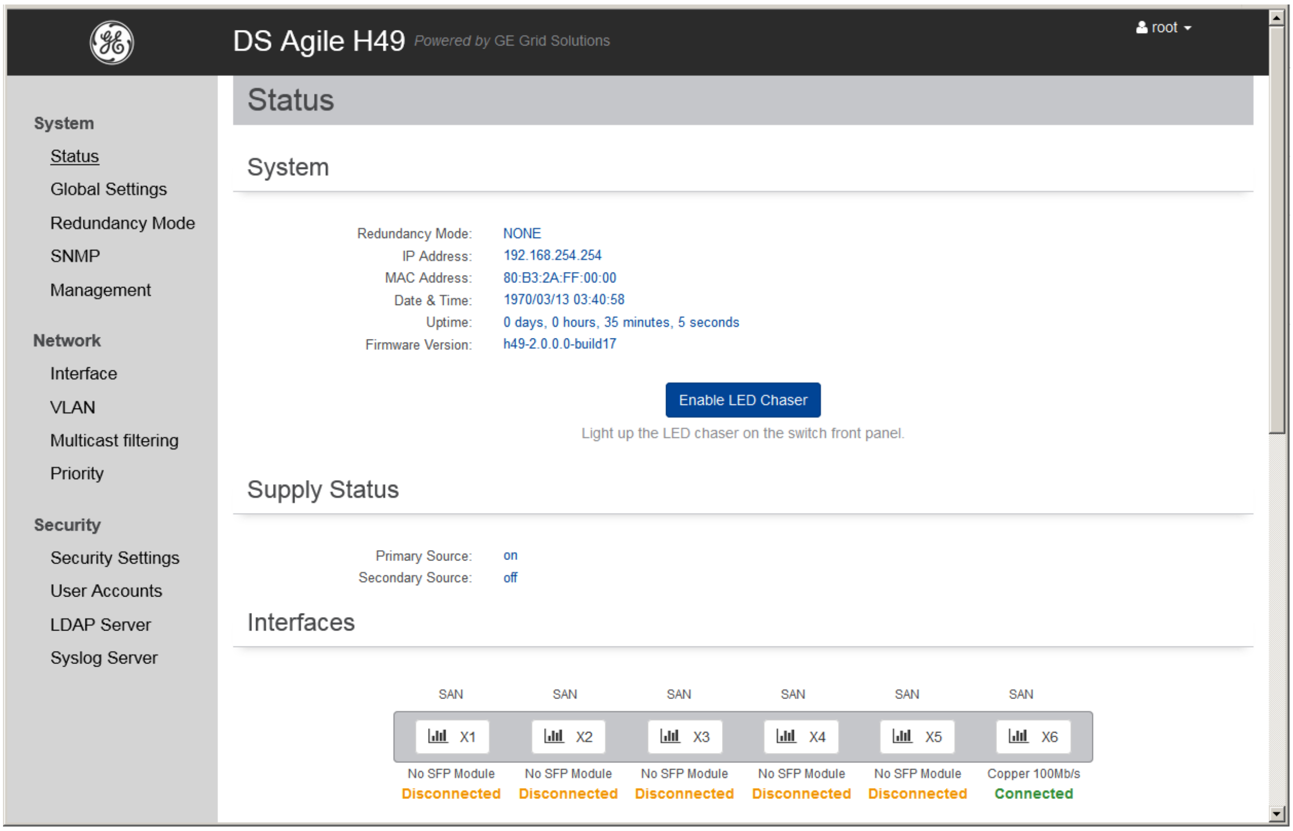
Figure 41: Reason H49 Web User Interface - Agreement Conditions

7.4 Feature Overview

The embedded web user interface consists of two areas:

- A configuration menu, on the left side of the window, which is organized into three main sections;
  - System
  - Network
  - Security
- A setting panel, on the right.

Navigate through the configuration menu to access each of the switch's functions.



Status

System

Redundancy Mode:	NONE
IP Address:	192.168.254.254
MAC Address:	80:B3:2A:FF:00:00
Date & Time:	1970/03/13 03:40:58
Uptime:	0 days, 0 hours, 35 minutes, 5 seconds
Firmware Version:	h49-2.0.0.0-build17

Light up the LED chaser on the switch front panel.

Supply Status

Primary Source:	on
Secondary Source:	off

Interfaces

SAN	SAN	SAN	SAN	SAN	SAN
X1	X2	X3	X4	X5	X6
No SFP Module	No SFP Module	No SFP Module	No SFP Module	No SFP Module	Copper 100Mb/s
Disconnected	Disconnected	Disconnected	Disconnected	Disconnected	Connected

Figure 42: Reason H49 Web User Interface – Start Page

7.4.1 System

The **System** section provides the current configuration of the Reason H49 switch together with its status.

It also allows the user to update the main system attributes.

7.4.1.1 Status

To get the global status of the Reason H49 switch, click **Status** in the **System** section:

The top part of the page shows the following information:

Attribute	Description
Redundancy mode	Selected redundancy mode
IP address	Device's IP address
MAC address	Device's MAC address
Date & Time	Device's clock date and time
Uptime	Elapsed time since last reboot
Firmware Version	Version of the firmware currently running on the device

LED Chaser

The LED chaser of the Reason H49 is a function used to identify correctly a given device amongst others.

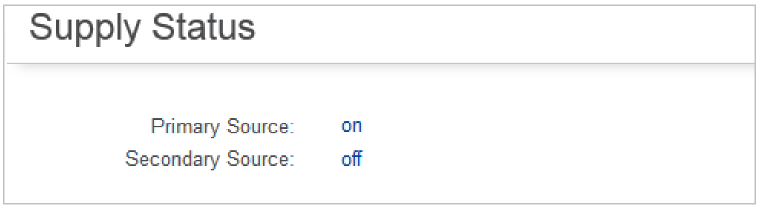
It consists in sequentially lighting all the LEDs in the front panel one after the other, eight at a time.

- Click **Enable LED Chaser** to activate the LED chaser and make the device's LEDs blink in sequence.
- Click again to stop the **LED chaser** (Disable LED Chaser button), or press the "C" button on the device front panel.

Alternatively, the LED chaser can be stopped by pressing the "C" button in the front panel.

Supply Status

This area shows information about the input voltage sources (Primary voltage source/Secondary voltage source):



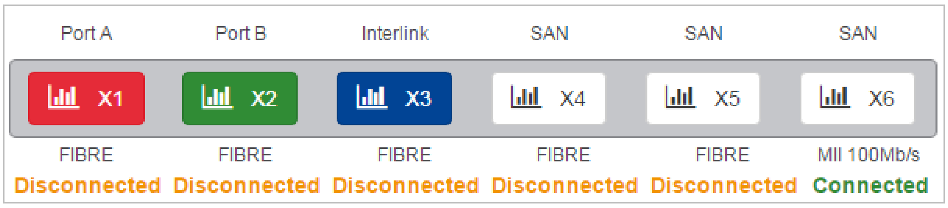
Supply Status

Primary Source: on
Secondary Source: off

Figure 43: Reason H49 Web User Interface – Power Supply Status

Interfaces

This area displays the interface status:



Port A	Port B	Interlink	SAN	SAN	SAN
X1	X2	X3	X4	X5	X6
FIBRE	FIBRE	FIBRE	FIBRE	FIBRE	MII 100Mb/s
Disconnected	Disconnected	Disconnected	Disconnected	Disconnected	Connected

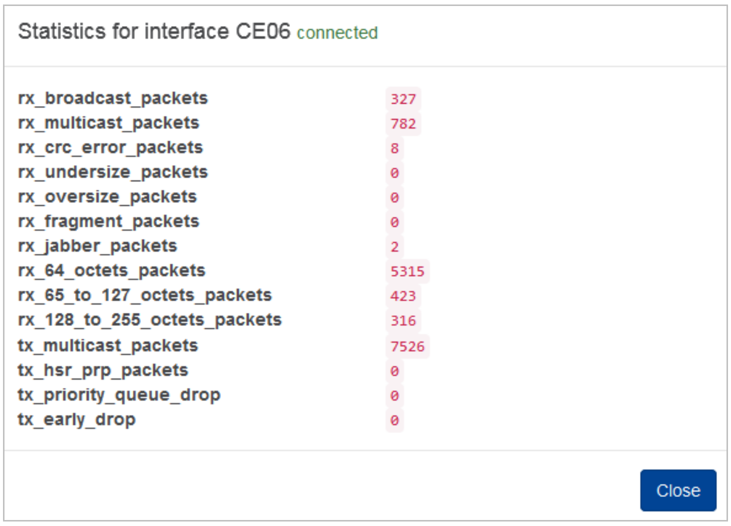
Figure 44: H49 Web User Interface – Interfaces Status

> *Note:*
> *The interface configuration is done in the* ***System*** *>* ***Redundancy Mode*** *page.*

Each interface has a colored button and some details:

Attribute	Description
Button color	Display the port type in accordance of colors. • **Red**: Redundant interface Port A • **Green**: Redundant interface Port B • **Blue**: PRP coupling interface • **White**: Standard interface • **Grey**: The port is not available in the selected redundancy mode.
Media and speed state of interfaces X1 to X6	• Copper 10/100/1000 Mbps • Fiber 100 Mbps • Fiber 1000 Mbps
Connection state of interfaces X1 to X6	• **Green**: Connected • **Yellow**: Disconnected • **Red**: Disabled These settings can be modified in the **Network > Interface** page.

Click a connected interface to get the status of the packets sent:



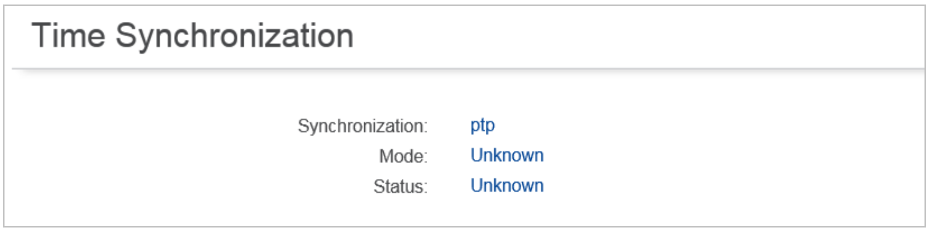
Statistics for interface CE06 connected

rx_broadcast_packets	327
rx_multicast_packets	782
rx_crc_error_packets	8
rx_undersize_packets	0
rx_oversize_packets	0
rx_fragment_packets	0
rx_jabber_packets	2
rx_64_octets_packets	5315
rx_65_to_127_octets_packets	423
rx_128_to_255_octets_packets	316
tx_multicast_packets	7526
tx_hsr_prp_packets	0
tx_priority_queue_drop	0
tx_early_drop	0

Figure 45: H49 Web User Interface – Statistics of a Connected Interface

Time Synchronization

This area displays read-only information about the device’s time synchronization protocol.



Time Synchronization

Synchronization: ptp
Mode: Unknown
Status: Unknown

Figure 46: Reason H49 Web User Interface – Time Synchronization Status

This information comes from the configuration done in the **System** > **Global Settings** page.

The following attributes are also displayed according to the selected value.

> *Note:*
> *when the device uses its Local clock as time source, then no other attribute is displayed in this section.*

NTP attributes

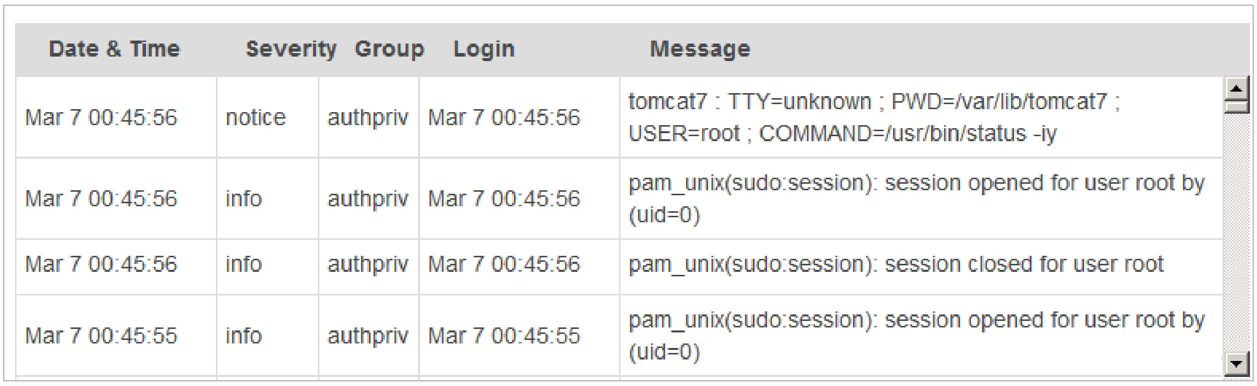
Attribute	Description
Mode	System's time synchronization mode: • Disable • Client • Client/Server • Server
Status	Time synchronization status: • Synchronized • Not synchronized

PTP attributes

Attribute	Description
Mode	Synchronization mode of the system: • Disable • Boundary clock • Transparent clock - E2E • Transparent clock - P2P A label “Slave” or “Master” indicates the current state as time Master or Slave.
Status	• Synchronized to a Master clock • Not synchronized to a Master clock
Grandmaster ID	Grandmaster MAC address
Time Source	• Atomic clock • GPS • Terrestrial radio • Hand set • Internal oscillator • Other
Clock Accuracy	Case time error (its magnitude) between time that the device provided a traceable time (Applicable only for PTP clock mode) 25ns | 100ns | 250ns | 1us | 2.5us | 10us | 25us | 100us | 250us | 1ms | 2.5ms | 10ms | 25ms | 100ms | 250ms | 1s | 10s | >10s

Logs

This area displays the log messages in a Syslog format. The syslog level is divided in 4 categories: error, warning, notice and information:



Date & Time	Severity	Group	Login	Message
Mar 7 00:45:56	notice	authpriv	Mar 7 00:45:56	tomcat7 : TTY=unknown ; PWD=/var/lib/tomcat7 ; USER=root ; COMMAND=/usr/bin/status -iy
Mar 7 00:45:56	info	authpriv	Mar 7 00:45:56	pam_unix(sudo:session): session opened for user root by (uid=0)
Mar 7 00:45:56	info	authpriv	Mar 7 00:45:56	pam_unix(sudo:session): session closed for user root
Mar 7 00:45:55	info	authpriv	Mar 7 00:45:55	pam_unix(sudo:session): session opened for user root by (uid=0)

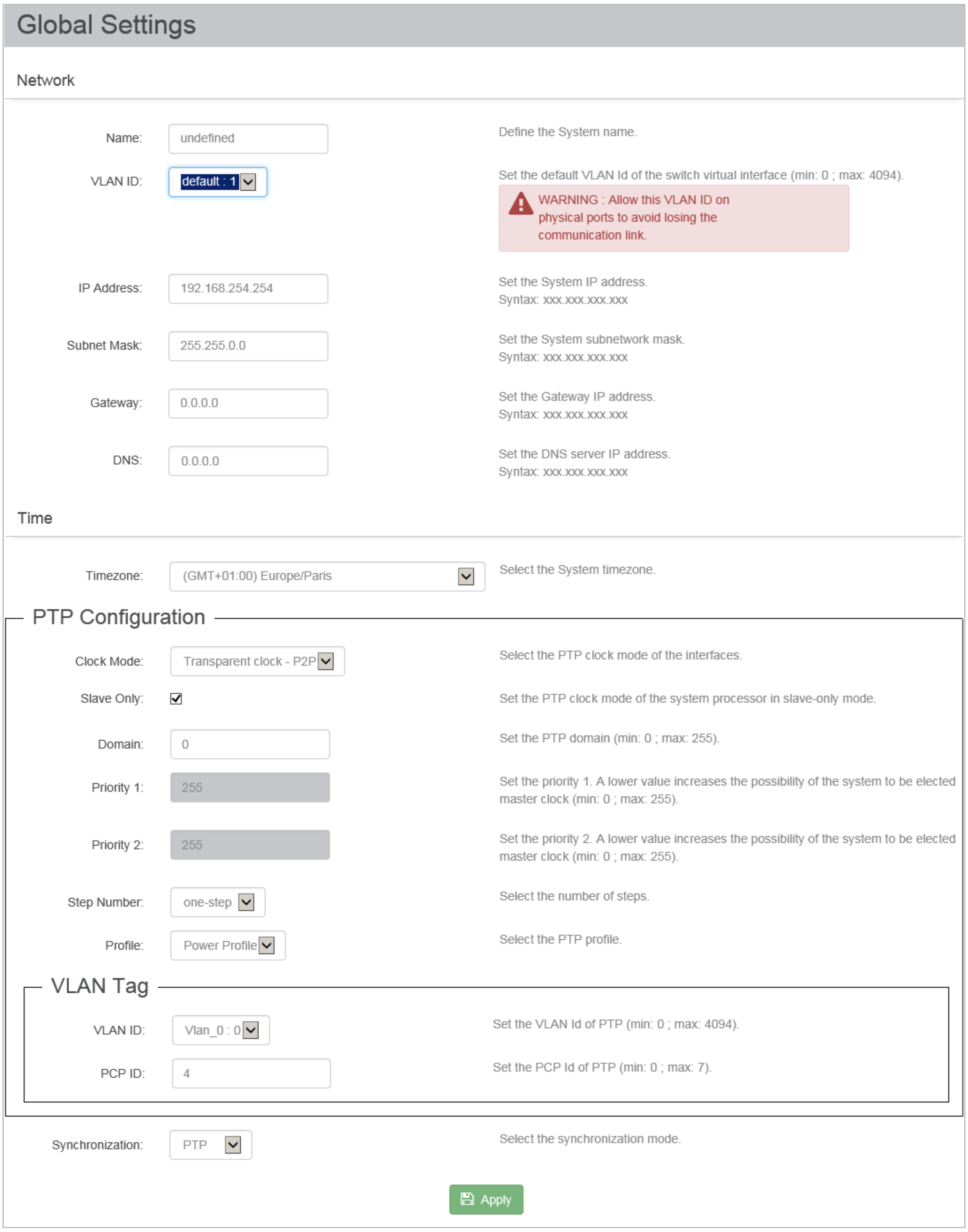
Figure 47: Reason H49 Web User Interface – Logs Status

The following table gives a description of each table columns:

Attribute	Description
Date & Time	Date and time of log generation
Severity	Log's severity level: • Alert • Critical • Debugging • Emergency • Error • Informational • Notice • Warning
Group	Group name of the Syslog message defined in the Cyber Security system specifications • Authentication • Security • System • Command
Login	Username at the origin of the Syslog message.
Message	Message content

7.4.1.2 Global Settings

To configure the global settings of the Reason H49 switch, click **Global Settings** in the **System** section.



Global Settings

Network

Name:	undefined	Define the System name.
VLAN ID:	default : 1	Set the default VLAN Id of the switch virtual interface (min: 0 ; max: 4094). WARNING : Allow this VLAN ID on physical ports to avoid losing the communication link.
IP Address:	192.168.254.254	Set the System IP address. Syntax: xxx.xxx.xxx.xxx
Subnet Mask:	255.255.0.0	Set the System subnetwork mask. Syntax: xxx.xxx.xxx.xxx
Gateway:	0.0.0.0	Set the Gateway IP address. Syntax: xxx.xxx.xxx.xxx
DNS:	0.0.0.0	Set the DNS server IP address. Syntax: xxx.xxx.xxx.xxx

Time

Timezone:	(GMT+01:00) Europe/Paris	Select the System timezone.

PTP Configuration

Clock Mode:	Transparent clock - P2P	Select the PTP clock mode of the interfaces.
Slave Only:	☑	Set the PTP clock mode of the system processor in slave-only mode.
Domain:	0	Set the PTP domain (min: 0 ; max: 255).
Priority 1:	255	Set the priority 1. A lower value increases the possibility of the system to be elected master clock (min: 0 ; max: 255).
Priority 2:	255	Set the priority 2. A lower value increases the possibility of the system to be elected master clock (min: 0 ; max: 255).
Step Number:	one-step	Select the number of steps.
Profile:	Power Profile	Select the PTP profile.

VLAN Tag

VLAN ID:	Vlan_0 : 0	Set the VLAN Id of PTP (min: 0 ; max: 4094).
PCP ID:	4	Set the PCP Id of PTP (min: 0 ; max: 7).

Synchronization:	PTP	Select the synchronization mode.

Figure 48: Reason H49 Web User Interface – Global Settings

Network

The **Network** area allows the user to modify the usual TCP/IP network parameters.

An explanation of each configuration item is given in the following table:

Attribute	Description	Factory Default
Name	Name of the system	**Undefined**
VLAN ID	Default VLAN ID. It identifies the individual VLANs you create on your network.	
IP Address	IP address in IPV4 format which identifies the switch on a TCP/IP network.	**192.168.254.254**
Subnet Mask	Identifies the type of network to which the H49 is connected.	**255.255.0.0** *(Class B network)*
Gateway	IP address of the router that connects the LAN to an outside network. Make sure that Reason H49 can access the gateway: • If no gateway is connected to the network, enter a “dummy” gateway IP address that **is NOT** in the same range as the Reason H49 switch. • If a gateway is connected to the network, the gateway IP address **MUST BE** in the same range as the Reason H49 switch.	**0.0.0.0**
DNS	IP address of the DNS Server used by your network.	**0.0.0.0**

Time

The Time area allows the user to set the time, date and other time source attributes for the system and the PTP settings:

Attribute	Description
Timezone	Allows conversion from GMT (Greenwich Mean Time) to local time. Use the drop-down list to select the time zone of the system.

> *Note:*
> *Changing the time zone will automatically correct the current time. You should configure the time zone before setting the time.*

Synchronization

Reason H49 are delivered with a default date set to 1st January 1970.

Before starting to configure the switch, it's important that the time on your device is accurate.

Reason H49 synchronization mode can be:

- Manual (the device uses its Local clock as time source)
- NTP
- PTP

If Reason H49 is synchronized through a NTP or PTP server

- Make sure that time, date and other time source attributes (NTP or PTP) are configured properly, at **System > Global Settings** menu. If settings are not defined or incorrect, make the relevant changes.

If Reason H49 is NOT synchronized through a NTP or PTP server

You may set the switch internal clock to your date and time manually.

The default Reason H49 clock is set to UTC (Coordinated Universal Time, originally known as Greenwich Mean Time, or GMT). The UTC base time equals to **0** (based at Greenwich, England).

To properly set the H49's clock and time zone, you should proceed in the following sequence:

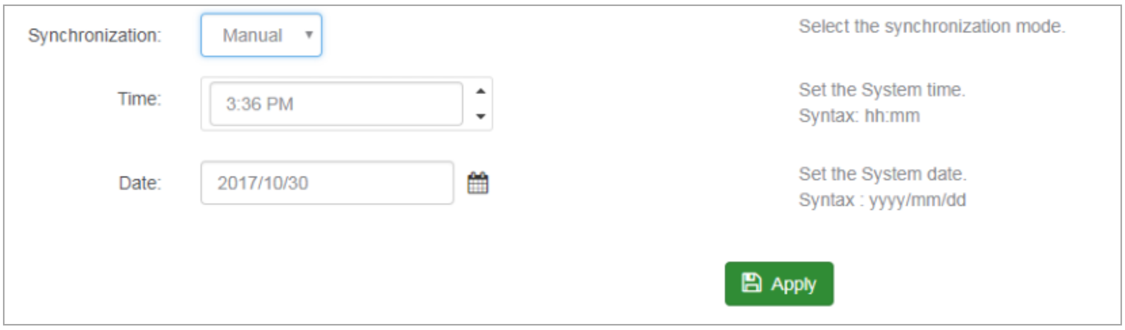
3 Select **Manual** from the **Synchronization** drop-down list;

4 Convert your local time to **UTC 0** and enter the converted time in the **Time** entry field. *For example, if your local time is 5:00 PM and the offset to UTC **0** is **+3**, then, subtract +3 from 5:00 PM. The setting to be entered in the **Time** entry field will be 2:00 P.M*

5 Set the current date using the **Date** calendar;

6 Set the time zone to your current location using the **Timezone** drop-down list above.

7 Click on **Apply** to save your changes.



Synchronization: Manual — Select the synchronization mode.

Time: 3:36 PM — Set the System time. Syntax: hh:mm

Date: 2017/10/30 — Set the System date. Syntax : yyyy/mm/dd

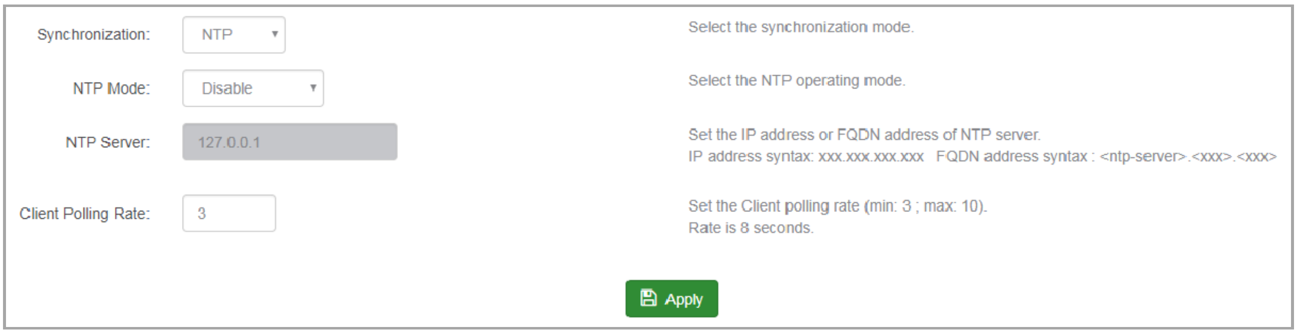
Note: if you cannot access the Reason H49 web user interface, you may also set the system date and time manually through the Secure Shell (SSH) console by running the following command lines, sequentially (i.e on separate lines):

`system -t local`

`date MMDDhhmmYY.ss` *(MM for month, DD for day, hh for hour, mm for minutes, YY for Year and ss for seconds).*

`hwclock -w`

NTP Configuration



Synchronization: NTP — Select the synchronization mode.

NTP Mode: Disable — Select the NTP operating mode.

NTP Server: 127.0.0.1 — Set the IP address or FQDN address of NTP server.
IP address syntax: xxx.xxx.xxx.xxx FQDN address syntax : <ntp-server>.<xxx>.<xxx>

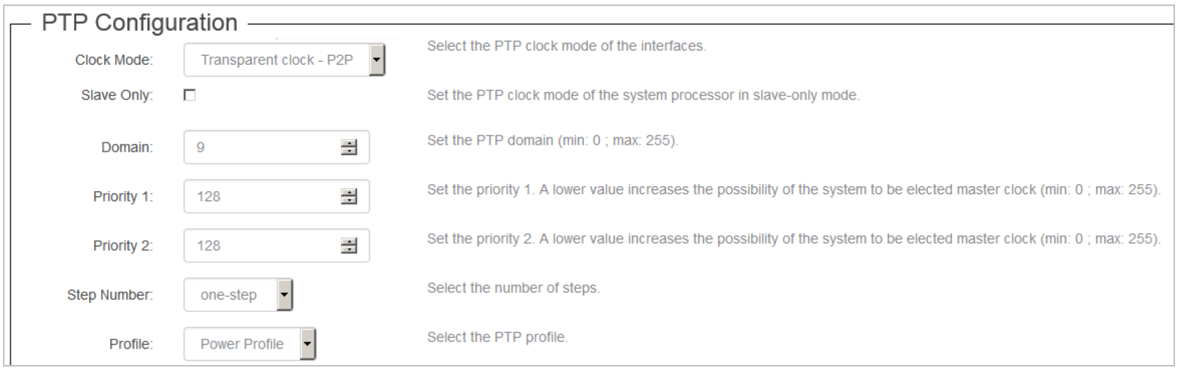
Client Polling Rate: 3 — Set the Client polling rate (min: 3 ; max: 10).
Rate is 8 seconds.

Figure 49: Reason H49 Web User Interface – NTP Settings

Set the following NTP settings:

Attribute	Description	Factory Default
NTP Mode	Use the drop-down list to select the NTP operating mode: • Disable • Client • Client/Server • Server	**Disable**
NTP Server	Set the IP address or THE Fully Qualified Domain Name (FQDN) of NTP server.	**127.0.0.1**

PTP Configuration



PTP Configuration

Clock Mode: Transparent clock - P2P — Select the PTP clock mode of the interfaces.

Slave Only: □ — Set the PTP clock mode of the system processor in slave-only mode.

Domain: 9 — Set the PTP domain (min: 0 ; max: 255).

Priority 1: 128 — Set the priority 1. A lower value increases the possibility of the system to be elected master clock (min: 0 ; max: 255).

Priority 2: 128 — Set the priority 2. A lower value increases the possibility of the system to be elected master clock (min: 0 ; max: 255).

Step Number: one-step — Select the number of steps.

Profile: Power Profile — Select the PTP profile.

Figure 50: Reason H49 Web User Interface – PTP Settings

Set the following PTP settings:

Attribute	Description	Factory Default
Clock Mode	Use the drop-down list to select the PTP switching mode: • Disable • Boundary clock • Transparent clock - E2E • Transparent clock - P2P	**Transparent clock - E2E**
Slave Only	Set Reason H49 as a PTP slave-only. It means that the device will not postulate as time master during a selection campaign.	**Enabled**
Domain	Enter the PTP domain between 0 and 255	**0**
Priority 1	Enter the priority level to turn the H49 as the Master clock. Priority 1 goes from 0 to 255. Lowest values increase the probability for the device to be elected Master clock.	**255**
Priority 2	Enter the priority level to turn the H49 as the Master clock. Priority 2 goes from 0 to 255. Lowest values increase the probability to be elected Master clock.	**255**
Step Number	Select the device’s step synchronization mode.	**One-step**
Profile	Selects the PTP profile • Default L2 • Power profile	**Power Profile**

VLAN Tag

Enable or disable the VLAN tag for PTP messages.

Attribute	Description	Factory Default
VLAN ID	Set the VLAN ID of the PTP frames.	**0**
PCP ID	Set the priority code point (PCP) of the PTP frames.	**4**

7.4.1.3 Redundancy Mode

Setting up communication redundancy on your network provides a backup data transmission route in the event that the communication is lost.

To set up the H49 redundancy mode, click **System > Redundancy Mode**.

Click the desired redundancy mode among the preset switch configurations:

Selected Redundancy Mode	Description
None	Uses Reason H49 as a standard switch. All the ports are enabled by default.
PRP RedBox	Ports 1 and 2 are reserved for redundant connection to LAN A and LAN B respectively. 4 Ports are available for SAN connections.
HSR-PRP Coupling RedBox	• Ports 1 and 2 are reserved for redundant connection to HSR ring. • Port 3 is reserved for one of the PRP LANs. • 3 Ports are available for SAN connections.
HSR RedBox	Ports 1 and 2 are reserved for redundant connection to HSR ring. 4 Ports are available for SAN connections.
HSR QuadBox	In this configuration, 4 ports are reserved for coupling functions. • Ports 1 & 2 are reserved for redundant connection to HSR ring A. • Ports 3 & 4 are reserved for redundant connection to HSR ring B. The two remaining ports are inoperative. Note: Pay attention when using this configuration since no more standard Ethernet ports will be available and you will need to connect to the device by using an HSR compliant device (another H49 for example).

In order to facilitate identification, each port is colored in relation to its configured function:

Color	Description
Red	Redundant port
Green	Redundant port
Blue	HSR/PRP coupling port
White	Standard port
Grey	OFF port

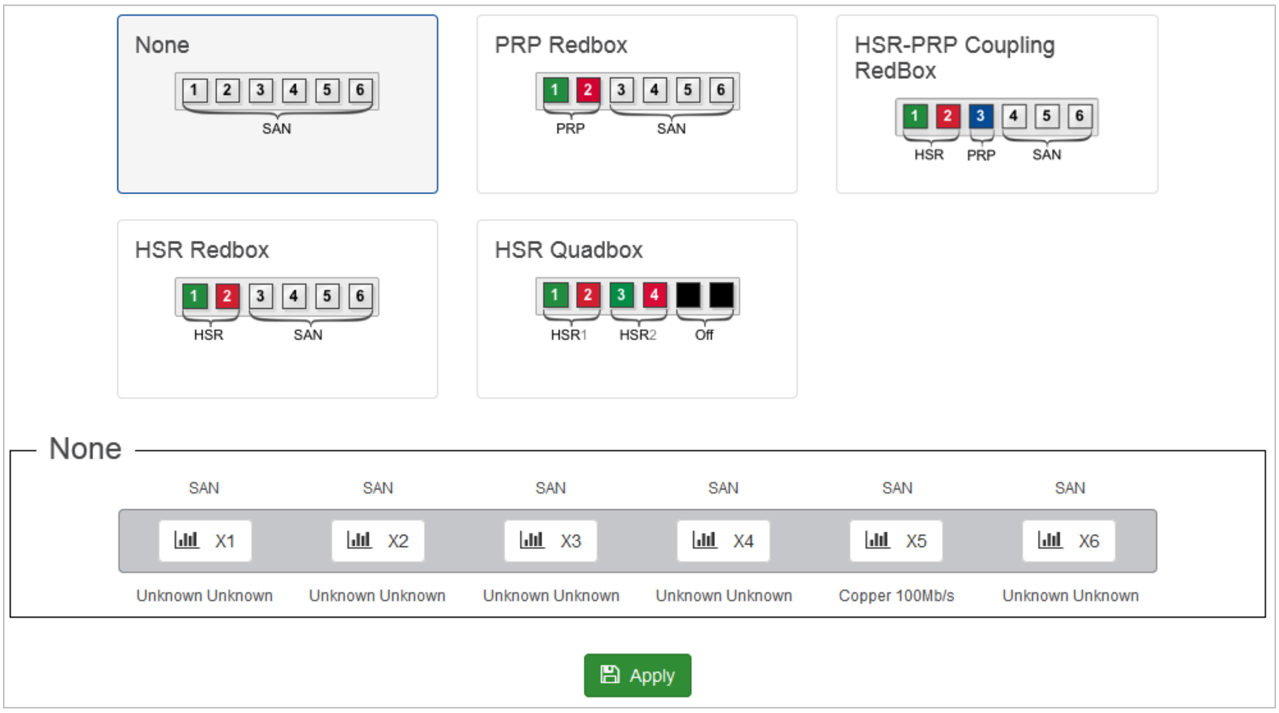
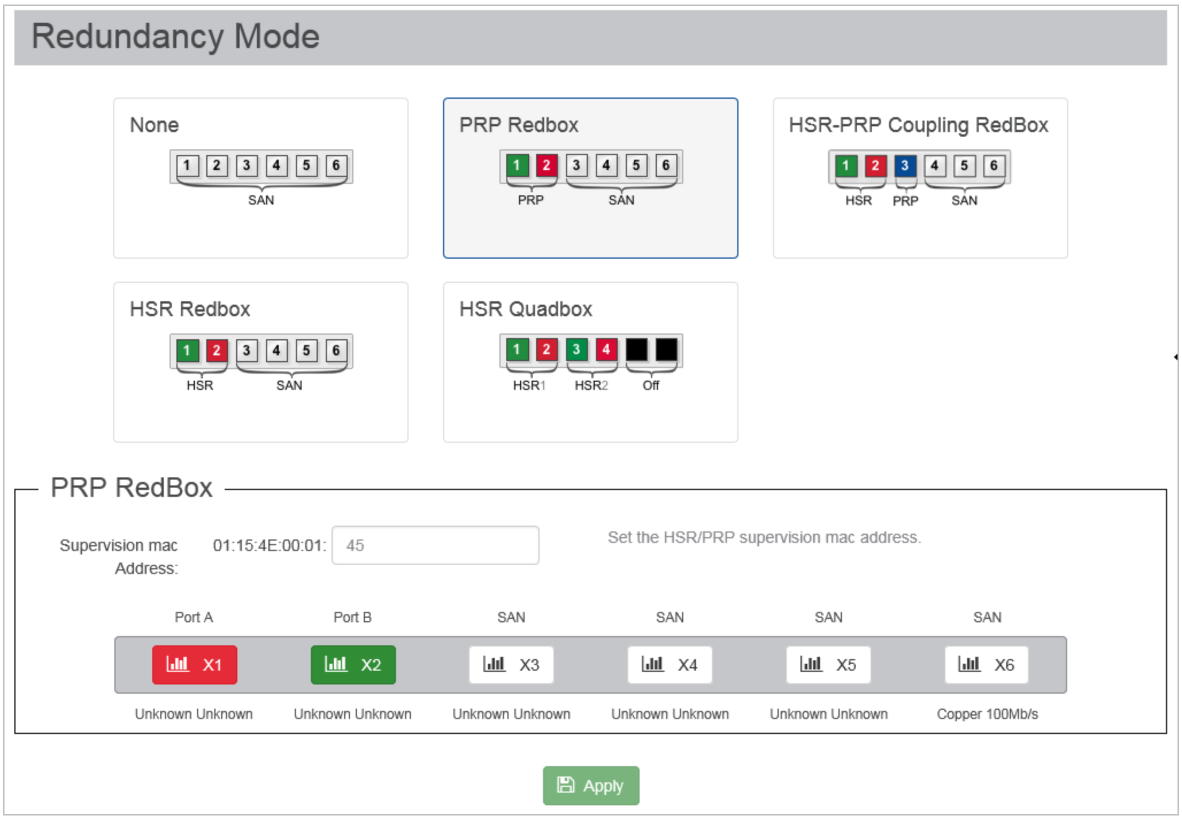


Figure 51: Reason H49 Web User Interface – No Redundancy Mode Selected

Redundancy Mode Details

The lower part of the page changes according to the selected redundancy mode (highlighted in blue):



Redundancy Mode

None

PRP Redbox

HSR-PRP Coupling RedBox

HSR Redbox

HSR Quadbox

PRP RedBox

Supervision mac Address: 01:15:4E:00:01: 45

Set the HSR/PRP supervision mac address.

Port A	Port B	SAN	SAN	SAN	SAN
X1	X2	X3	X4	X5	X6
Unknown Unknown	Unknown Unknown	Unknown Unknown	Unknown Unknown	Unknown Unknown	Copper 100Mb/s

Figure 52: Reason H49 Web User Interface – PRP RedBox Mode Selected

Set the settings for the selected redundancy mode:

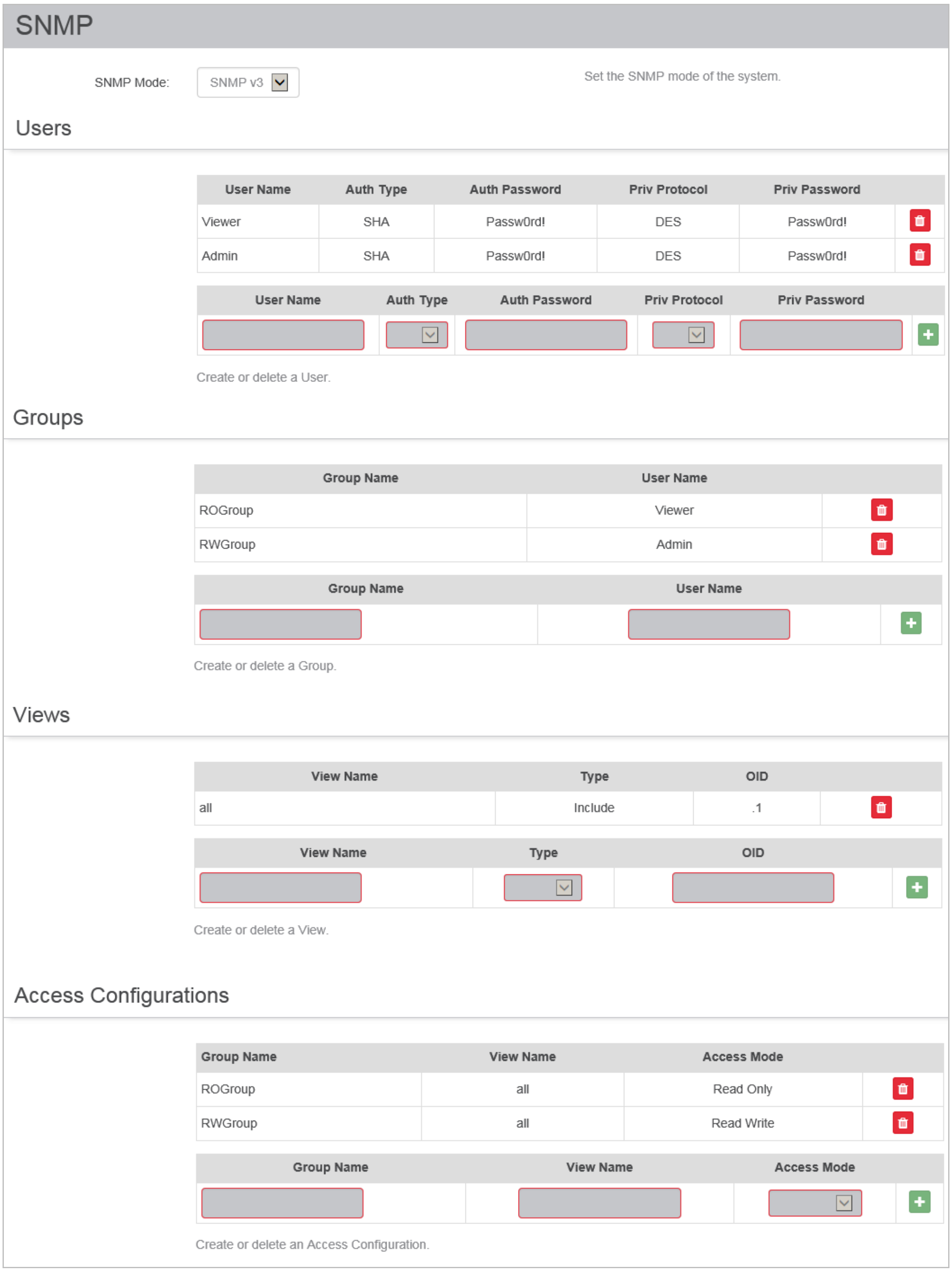
Attribute	Description
Supervision Mac Address	Set the PRP or HSR supervision Mac Address
Network ID	Only displayed for “HSR/PRP coupling” redundancy mode. It is an integer between 1 and 6 allowing the device to identify the network and to avoid duplicated packages. Note: When coupling rings with two RedBoxes, both RedBoxes must be configured with the same Network ID.
LAN ID	Only displayed for “HSR/PRP coupling” redundancy mode. It identifies the PRP LAN to be connected to the device. Note: When coupling a ring with two RedBoxes, one shall be set on LAN A and the other one shall be set on LAN B. Pay attention not to configure both RedBoxes on the same LAN.

Note:
When switching from one redundancy mode to another, reboot Reason H49 to apply changes in the Start-up configuration. The system and network configuration will be erased except the ***Name****;* ***IP address****;* ***Subnet mask*** *and* ***Gateway*** *attributes set in the* ***Global Settings*** *>* ***System*** *page. The security settings will be kept.*

7.4.1.4 SNMP

Reason H49 implements **Simple Network Management Protocol** (SNMP) and is capable of exchanging information with other SNMP devices on the network. This information is saved in the Management Information Base (MIB) of the switch.

To configure the SNMP settings of the switch, click **System** > **SNMP**:



SNMP

SNMP Mode: SNMP v3

Set the SNMP mode of the system.

Users

User Name	Auth Type	Auth Password	Priv Protocol	Priv Password	
Viewer	SHA	Passw0rd!	DES	Passw0rd!	🗑
Admin	SHA	Passw0rd!	DES	Passw0rd!	🗑

User Name	Auth Type	Auth Password	Priv Protocol	Priv Password	
					+

Create or delete a User.

Groups

Group Name	User Name	
ROGroup	Viewer	🗑
RWGroup	Admin	🗑

Group Name	User Name	
		+

Create or delete a Group.

Views

View Name	Type	OID	
all	Include	.1	🗑

View Name	Type	OID	
			+

Create or delete a View.

Access Configurations

Group Name	View Name	Access Mode	
ROGroup	all	Read Only	🗑
RWGroup	all	Read Write	🗑

Group Name	View Name	Access Mode	
			+

Create or delete an Access Configuration.

Figure 53: Reason H49 Web User Interface – SNMP Page

The content of this page depends on the selected SNMP version.

Reason H49 supports three versions of SNMP:

- **SNMPv1**: SNMPv1 uses a community string for authentication. The SNMP agent accesses all objects with read-only permissions using the community string public and/or all objects with read/write permissions using the community string private.

- **SNMPv2c**: SNMPv2c is a later version of the SNMP protocol. It supports the same community-based security standard.

- **SNMPv3**: SNMPv3 is the most secure protocol. It supports the View-Based Access Control Model and User-Based Security Model along with encryption and Authentication features.

The following table summarizes the sections corresponding to each SNMP version.

	V1	V2C	V3
Communities	Yes	Yes	No
Groups	Yes	Yes	Yes
Users	No	No	Yes
Views	Yes	Yes	Yes
Access configurations	Yes	Yes	Yes

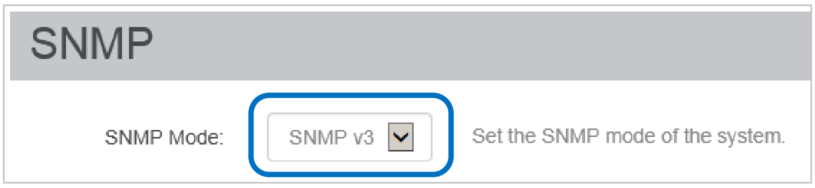
Throughout the page:

- Click the **+** button to add a new element and set the related attributes as detailed below,

- Click the remove button in front of the desired row, to delete an element from a section.

SNMP Version selection

From the SNMP mode drop-down list, select the desired SNMP protocol version to be used to manage the switch:


SNMP

SNMP Mode: SNMP v3 Set the SNMP mode of the system.

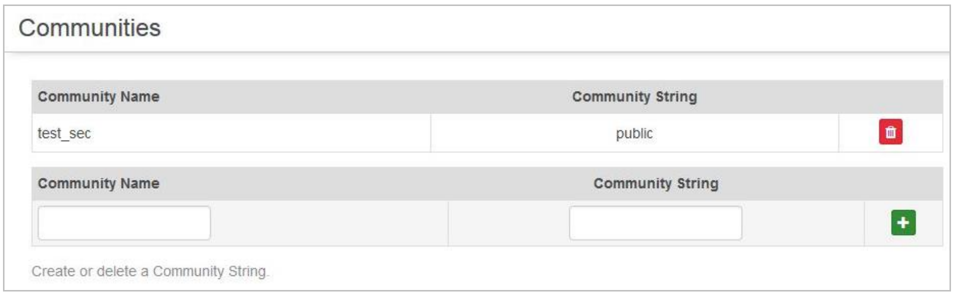
Figure 54: Reason H49 Web User Interface – SNMP Version Section

Attribute	Description
SNMP mode	• SNMP v1 • SNMP v2c • SNMP v3 • Disable If the “Disable” option is selected then the SNMP protocol will be disabled in the device.

SNMP v1 and v2c

Communities

This section allows the user to create a new community by defining the community name and the community string (access mode):



Communities

Community Name	Community String	
test_sec	public	🗑

Community Name	Community String	
		+

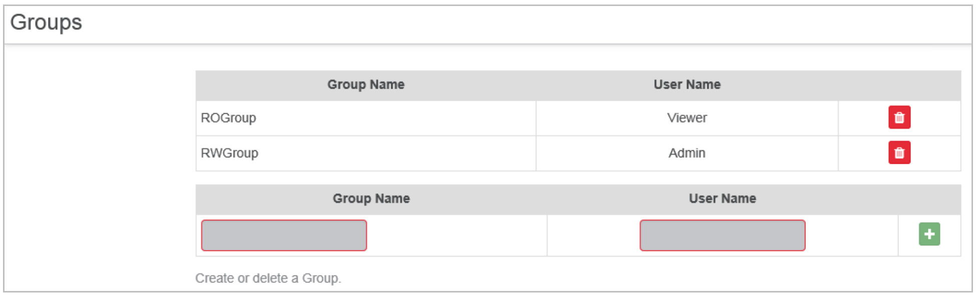
Create or delete a Community String.

Figure 55: Reason H49 Web User Interface – SNMP Community Section

Attribute	Description
Community Name	Name of the community
Community String	Authentication key to access the device (acts as a password)

Groups

Manage user groups by defining the group name and the related community name:



Groups

Group Name	User Name	
ROGroup	Viewer	🗑
RWGroup	Admin	🗑

Group Name	User Name	
		+

Create or delete a Group.

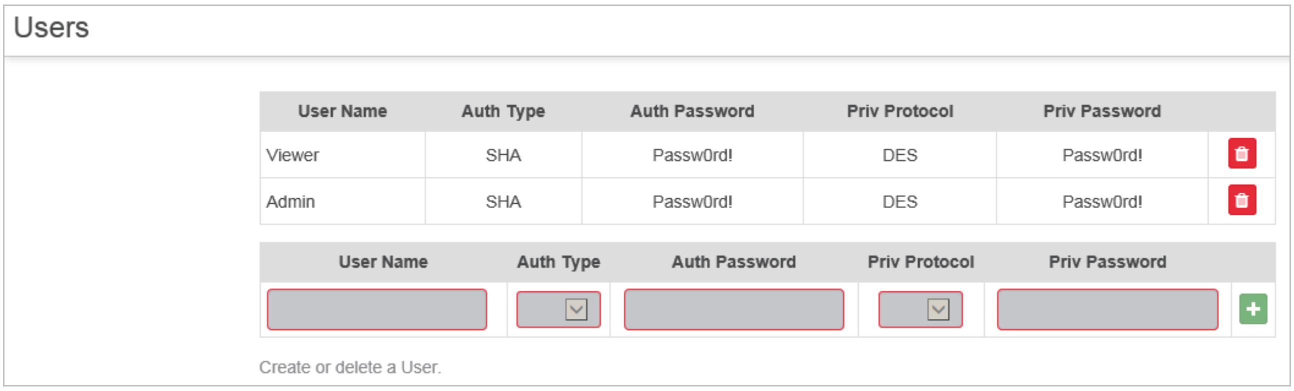
Figure 56: Reason H49 Web User Interface – SNMP Group Section for SNMP v1/v2c

Attribute	Description
Group name	A unique group name
Community Name	List of existing communities

SNMP v3

Users

This section allows the user to manage SNMP users:



Users

User Name	Auth Type	Auth Password	Priv Protocol	Priv Password	
Viewer	SHA	Passw0rd!	DES	Passw0rd!	🗑
Admin	SHA	Passw0rd!	DES	Passw0rd!	🗑

User Name	Auth Type	Auth Password	Priv Protocol	Priv Password	
					+

Create or delete a User.

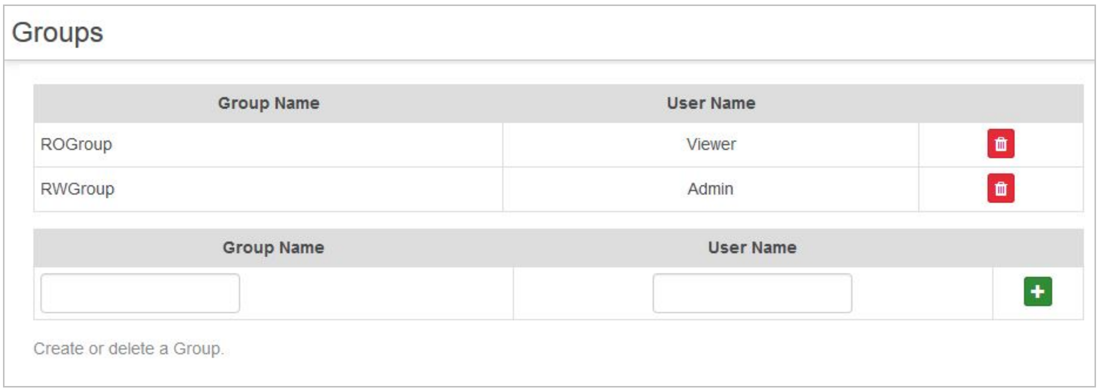
Figure 57: Reason H49 Web User Interface – SNMP User Section for SNMP v3

Set the SNMP users together with their authentication and their privacy attributes as detailed below:

Attribute	Description
User name	User name
Auth Type	Authentication protocol. Select the encryption algorithm for the authentication key: • MD5 (Message-digest algorithm) • SHA (Secure hash algorithm)
Auth Password	User's authentication Password
Priv Protocol	Select the privacy protocol to be used to encrypt the data of the SNMP message • AES (Advanced Encryption Standard) • DES (Data Encryption Standard)
Priv Password	User's privacy password

Groups

Manage user groups by defining the group name and the user that belongs to this group:



Groups

Group Name	User Name	
ROGroup	Viewer	🗑
RWGroup	Admin	🗑

Group Name	User Name	
		+

Create or delete a Group.

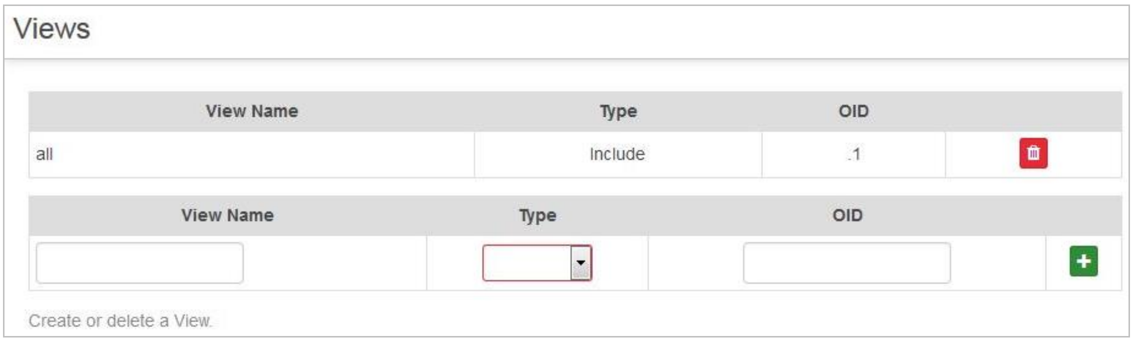
Figure 58: Reason H49 Web User Interface – SNMP Group Section for SNMP v3

Attribute	Description
Group name	A unique group name
User Name	User attached to this group

All SNMP versions

Views

This section allows the user to manage Views by defining their name and their related OID A given View is linked to a single OID (and its sub-OIDs)



Views

View Name	Type	OID	
all	Include	.1	🗑

View Name	Type	OID	
			+

Create or delete a View.

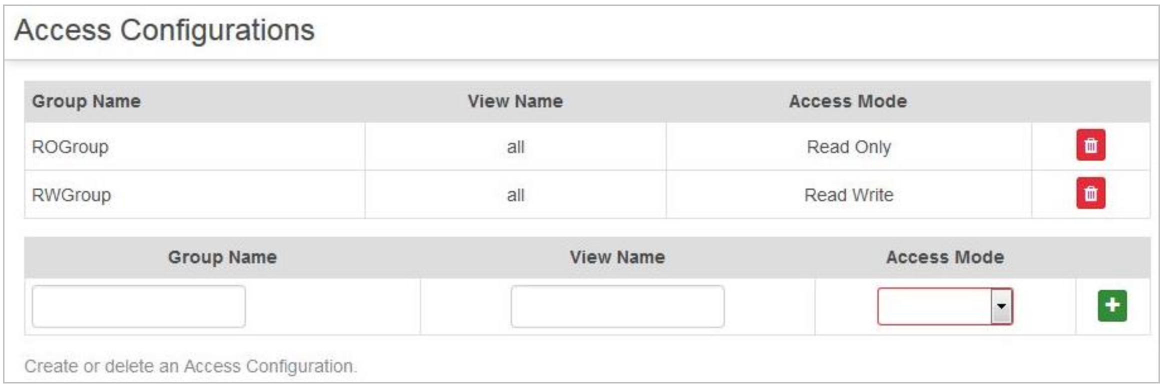
Figure 59: Reason H49 Web User Interface – SNMP View Section

Attribute	Description
View name	A unique View name
Type	Include or Exclude mode: • **Include**: The given OID and all its tree will be visible for the group gathering this view • **Exclude**: The given OID and all its tree will be hidden for the group gathering this view
OID	OID associated with the view

Access Configurations

This section allows the user to link a Group and a View. A Group can gather more than one view.

You shall be careful not gathering two contradictory view in the same group; for example: gathering a View including a given OID and another view excluding the same OID.



Access Configurations

Group Name	View Name	Access Mode	
ROGroup	all	Read Only	🗑
RWGroup	all	Read Write	🗑

Group Name	View Name	Access Mode	
		▾	+

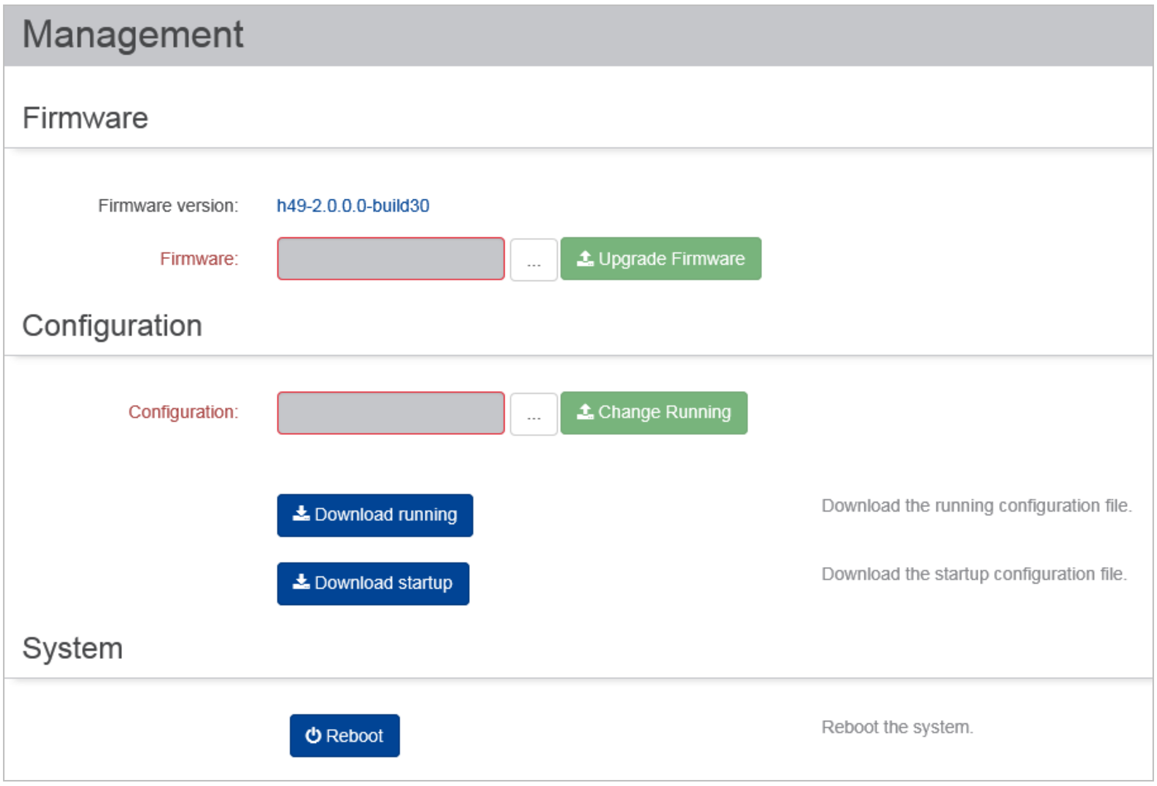
Create or delete an Access Configuration.

Figure 60: Reason H49 Web User Interface – SNMP Access Configuration Section

Attribute	Description
Group name	List of existing groups
View name	List of existing Views
Access Mode	Access mode to the view (Read, Write)

7.4.1.5 Management

This page allows the user to manage the firmware and configuration settings of Reason H49.



Management

Firmware

Firmware version: h49-2.0.0.0-build30

Configuration

Download the running configuration file.

Download the startup configuration file.

System

Reboot the system.

Figure 61: Reason H49 Web User Interface – Device Management

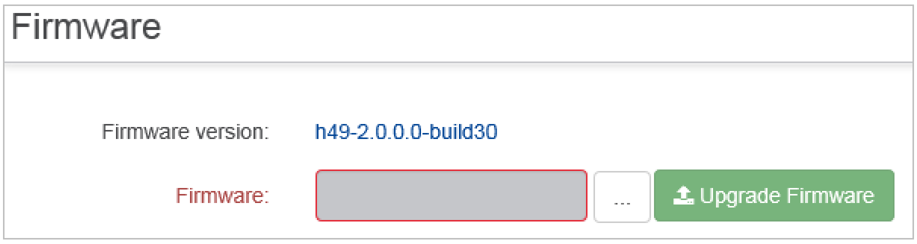
Firmware Update

The Firmware section allows an authorized user to keep Reason H49 up to date with the latest firmware from General Electric or revert the switch to factory settings and firmware.

When firmware update is required, the first step to be done is requiring GE for the firmware file (*.tar.gz). After this file is received, copy the file to the PC on which management interface of the switch is performed.

To update firmware, go to the **System** > **Management** menu.

- Click the "**...**" button and then, select the correct tar.gz file:



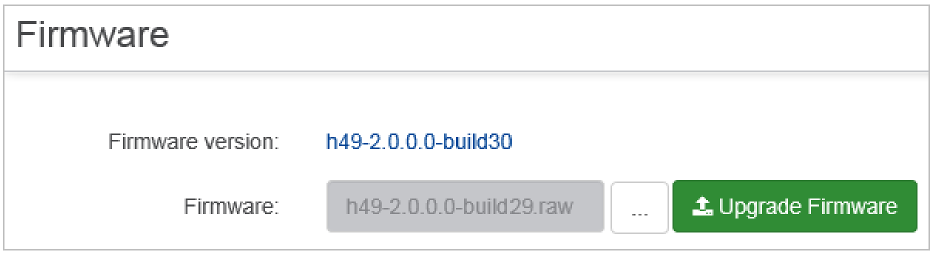
Firmware

Firmware version: h49-2.0.0.0-build30

Firmware:

Figure 62: Reason H49 Web User Interface – Select a Firmware File

- Click the "**Upgrade Firmware**" button to activate the upgrade process:



Firmware

Firmware version: h49-2.0.0.0-build30

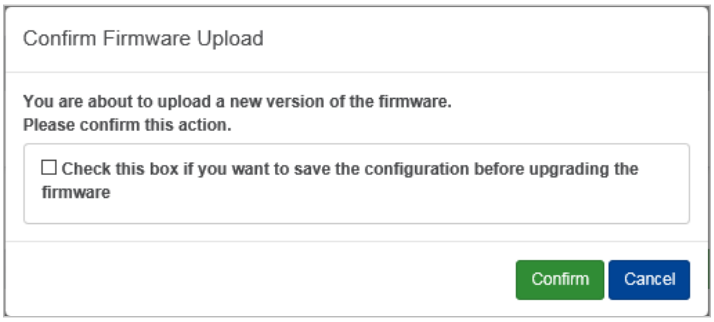
Firmware: h49-2.0.0.0-build29.raw

Figure 63: Reason H49 Web User Interface – Start the Upgrade Process

The package signature is verified before allowing the firmware to be installed.

A popup prompts the user to decide whether he/she wants to keep the existing switch configuration settings (user accounts, logs, date/time…).

- Check the box to save the existing switch configuration and click **Confirm**:



Confirm Firmware Upload

You are about to upload a new version of the firmware.
Please confirm this action.

□ Check this box if you want to save the configuration before upgrading the firmware

Figure 64: Reason H49 Web User Interface – Firmware Upload Confirmation

At the end of the upgrade process, the system will ask for a reboot.

Configuration

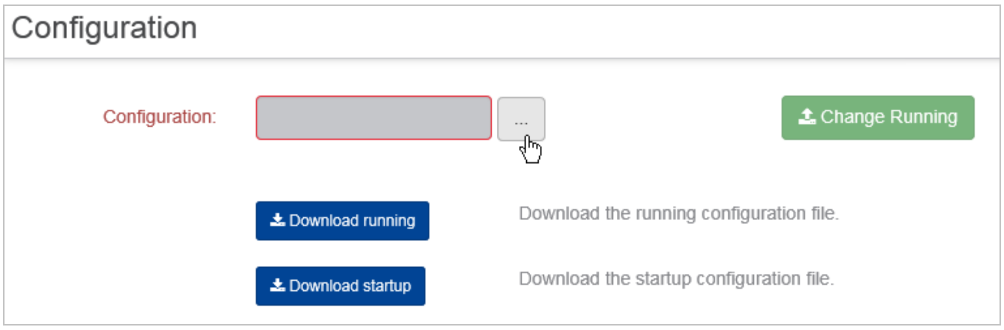
Reason H49 runs internally two configuration files:

- **Running Configuration**: This file is the current configuration of the switch. When the **Apply** button is pressed at any settings menu, changes made at the configuration will be saved at this file. If the switch is restarted, this configuration is discarded and the switch will load, after the reboot, the **Startup Configuration** file;
- **Startup Configuration**: This file represents the configuration that the switch will run after it is powered up or restarted. If a change in the **Running Configuration** was performed and it is requested to maintain the **Running Configuration** at the **Startup Configuration**, the user must save it using the **Save Running as Startup** option, in the **Management** page;

Import a New Configuration File

To import a new configuration file to the device, perform the following steps:

- Click the "**...**" button to navigate to the folder that contains the configuration file and then, select the relevant .yaml, yml file:

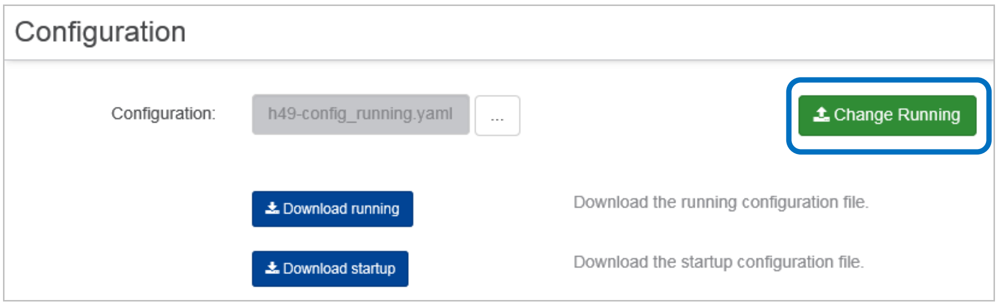


Download the running configuration file.

Download the startup configuration file.

Figure 65: Reason H49 Web User Interface – Select the Configuration File to be imported

- Click "**Change Running**" to import the file.



h49-config_running.yaml

Download the running configuration file.

Download the startup configuration file.

Figure 66: Reason H49 Web User Interface – Start the Upgrade Process

At the end of the upgrade process, the new configuration is running on the device.

Only **System** and **Network** parameters are preserved in **Running** and **Startup** configuration.

A new button invites the user to save the Running configuration as Startup-configuration so it will be preserved after reboot.

Running and Startup configurations are different

When the **Running** and the **Startup** configurations are different, a warning icon is displayed in the navigation menu as shown in the following figure.

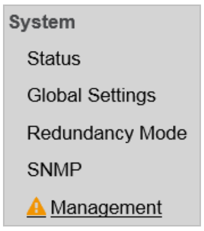
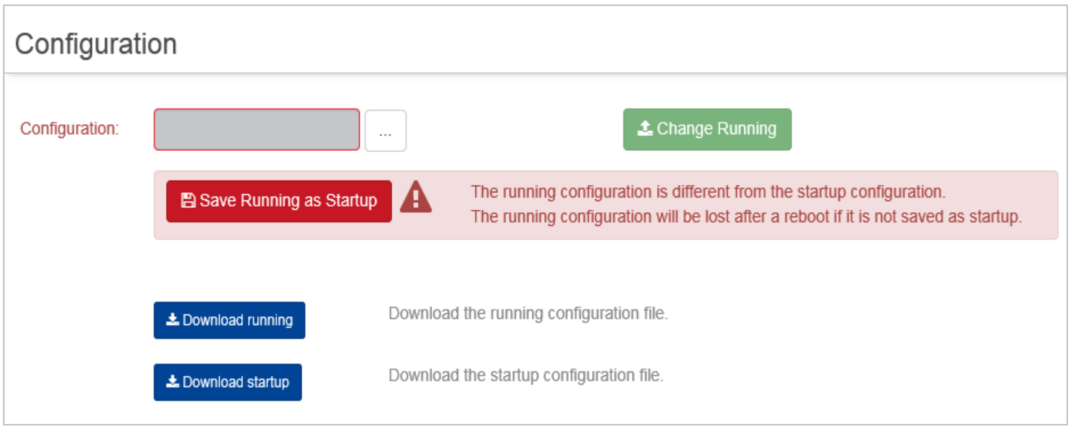


Figure 67: Reason H49 Web User Interface – New Configuration Notification

A message warms the user in the **Management** page, as shown in the following figure:



The running configuration is different from the startup configuration.
The running configuration will be lost after a reboot if it is not saved as startup.

Download the running configuration file.

Download the startup configuration file.

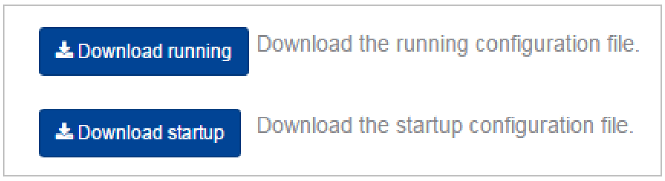
Figure 68: Reason H49 Web User Interface – New Configuration Notification

Export Reason H49 Configuration File

It is possible to export the **Running** and/or the **Startup** configurations of the switch (.yaml file).

> *Note:*
> *SNMP configuration is not included in configuration file exported.*

- Click the corresponding button as shown in the following figure:

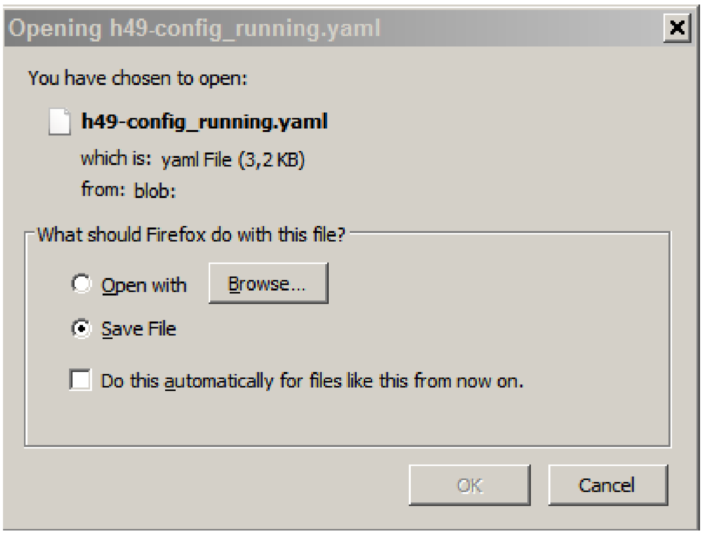


Download the running configuration file.

Download the startup configuration file.

Figure 69: Reason H49 Web User Interface – Downloading Running or Startup Configuration

From the popup that appears on screen, select **Save File** and click **OK** to save it to the local host:



Opening h49-config_running.yaml

You have chosen to open:

h49-config_running.yaml

which is: yaml File (3,2 KB)

from: blob:

What should Firefox do with this file?

○ Open with

● Save File

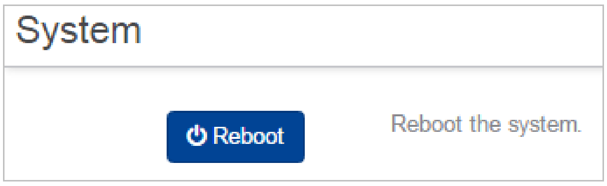
□ Do this automatically for files like this from now on.

Figure 70: Reason H49 Web User Interface – Configuration Export

By default, the file is saved to the **Downloads** folder onto your local host.

System Reboot

The user can reboot the device by clicking the **Reboot** button:



Reboot the system.

Figure 71: Reason H49 Web User Interface – Reboot Button

The system will ask for confirmation before proceeding.

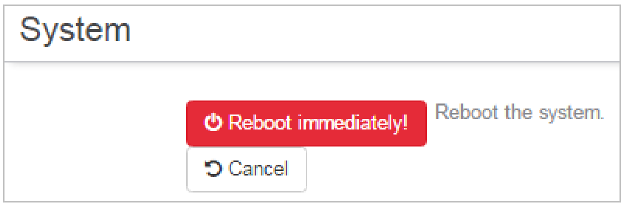


Figure 72: Reason H49 Web User Interface – Confirmation Button

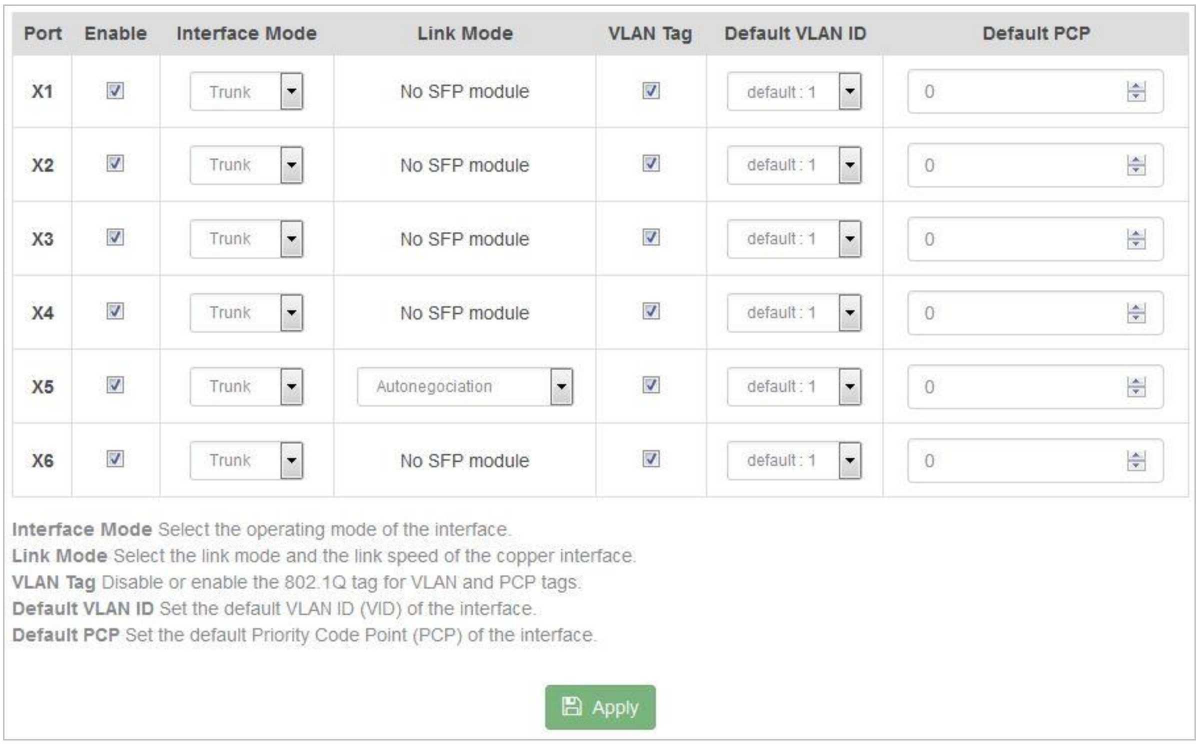
7.4.2 Network

This section provides the current network configuration of the Reason H49 switch.

7.4.2.1 Interface

This page allows the user to configure the device’s interfaces available in the selected redundancy mode.

Each interface is represented by a row in the table.



Port	Enable	Interface Mode	Link Mode	VLAN Tag	Default VLAN ID	Default PCP
X1	☑	Trunk	No SFP module	☑	default : 1	0
X2	☑	Trunk	No SFP module	☑	default : 1	0
X3	☑	Trunk	No SFP module	☑	default : 1	0
X4	☑	Trunk	No SFP module	☑	default : 1	0
X5	☑	Trunk	Autonegociation	☑	default : 1	0
X6	☑	Trunk	No SFP module	☑	default : 1	0

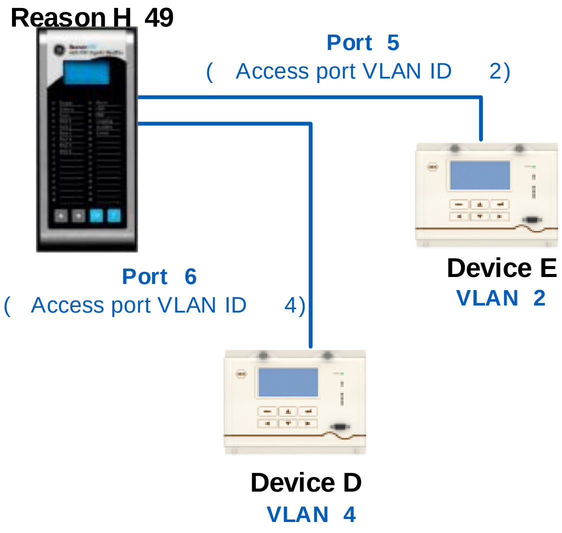
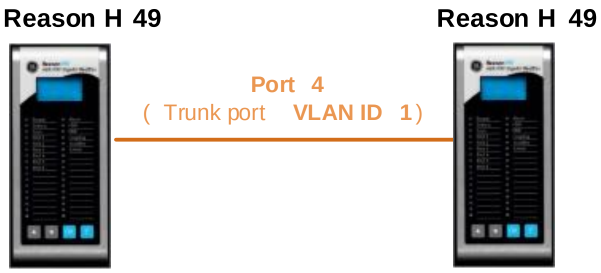
Interface Mode Select the operating mode of the interface.
Link Mode Select the link mode and the link speed of the copper interface.
VLAN Tag Disable or enable the 802.1Q tag for VLAN and PCP tags.
Default VLAN ID Set the default VLAN ID (VID) of the interface.
Default PCP Set the default Priority Code Point (PCP) of the interface.

Figure 73: Reason H49 Web User Interface – Interface Configuration

Note:
When the device is configured in QuadBox mode, ports 5 and 6 are deactivated, thus they are not displayed in the list.

Caution:
Be careful not to disable the port you are using for configuring the device. In the same manner, do not disable all the ports since it will not be possible to connect to the device afterwards. If, for any reason, you have disabled all the ports, reboot manually the device to reload the “Startup” configuration that is supposed to be correct.

Set the interface attributes as detailed in the table below:

Attribute	Description
Enable	Check the box to enable a port.
Interface Mode	Reason H49 interfaces can be configured either as access ports or trunk ports, as follows: - **Access**: An access port can have only one VLAN configured on the interface; it can carry traffic for only one VLAN,  Reason H 49 Port 5 (Access port VLAN ID 2) Port 6 (Access port VLAN ID 4) Device E VLAN 2 Device D VLAN 4 S1381ENa - **Trunk:** A trunk port can have two or more VLANs configured on the interface; it can carry traffic for several VLANs simultaneously. Usually trunk link connection is used to connect two switches or switch to router.  Reason H 49 Reason H 49 Port 4 (Trunk port VLAN ID 1) S1382ENa

Caution:
Wrong VLAN setting on access ports may cause communication failure with Reason H49. In such a case, you shall reset the switch to factory-default configuration, as explained in section “Revert to Default Factory Configuration”.

Link Mode	Select the link mode to be used for copper SFP (10Mbps Full Duplex, 100Mbps Full Duplex, 1000Mbps Full Duplex, Auto-negotiation) This attribute is disabled if the interface is optic fiber.
VLAN Tag	Check the box to enable the 802.1Q tag for VLAN and Priority Code Point (PCP) tags
Default VLAN ID	Enter the default VLAN ID (VID) for untagged devices that connect to that port
Default PCP	Enter the default Priority Code Point of the interface (0 to 7)

7.4.2.1.1 Revert to Default Factory Configuration

You may experience communication failure if VLAN is not properly configured on the Access port. A common method to troubleshoot switching issues consists in reverting Reason H49 to default factory configuration by replacing the raw image stored at switch's memory.

When factory reset is required, the first step to be done is requiring GE for the raw file of the switch (**h49-x.x.x.x-buildxx-xx.tar.gz** file).

After this file is received:

- Copy the **h49-x.x.x.x-buildxx-xx.tar.gz** file to a PC
- Unzip the file until you get the **h49-x.x.x.x-buildxx.raw** file,
- Download and install **Win32DiskImager.exe** application from the link https://sourceforge.net/projects/win32diskimager/.
  This free of charge program is designed to write a raw disk image to a removable device.

Caution:
Disconnect all the power supply connectors before removing the switch case.

- Disconnect all the power supply connectors.
- Remove the switch case by unscrewing the eight (8) cross-head screws as shown on the following figure:

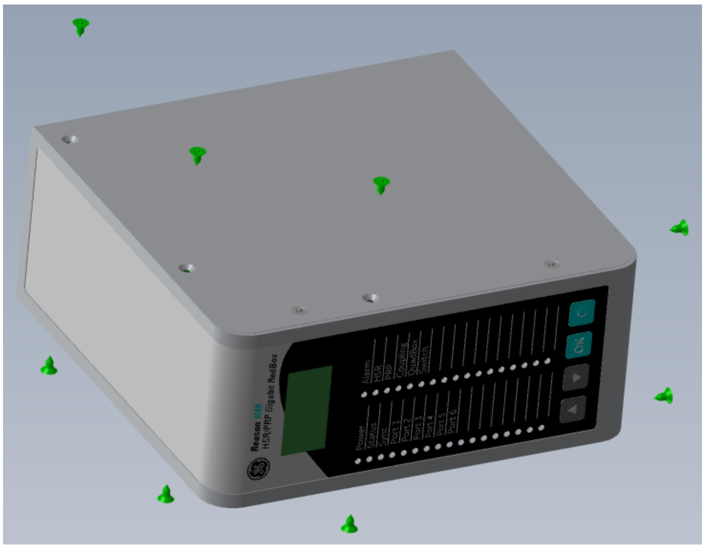


Figure 74: Reason H49 – Location of M6 Screws to be removed

- Remove the micro SD card from the SRPV3 board:

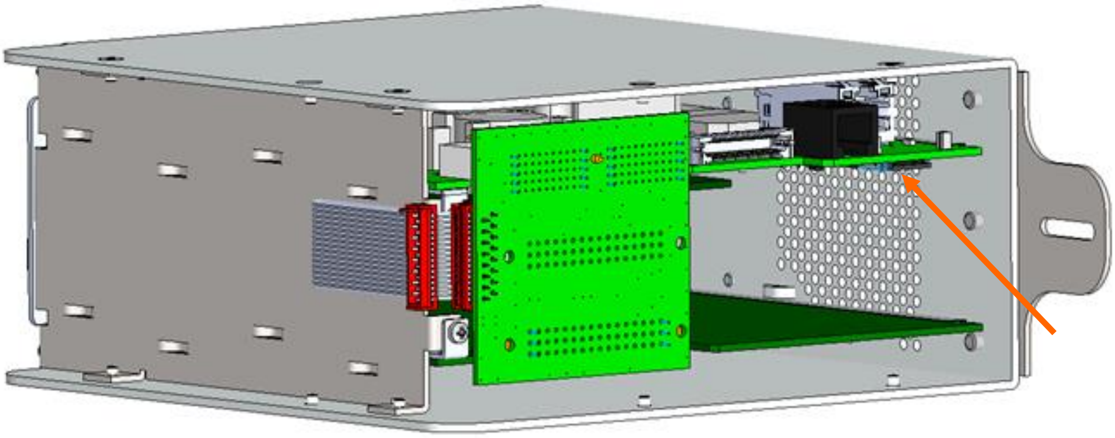
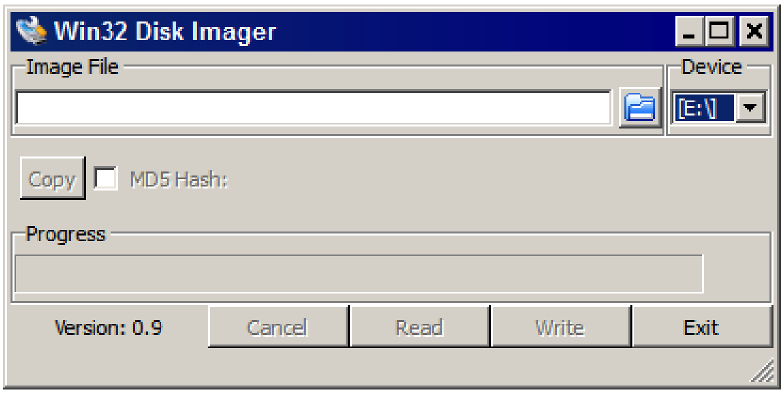


Figure 75: Reason H49 – Location of the Micro SD Card

- Insert the micro SD card into your Windows PC's card reader. You may use an SD card adapter to fit into the SD card slot.

- Run the unzipped Win32DiskImager.exe application.

- From the **Device** drop-down list, select the SD card (ensure that the correct driver is selected):

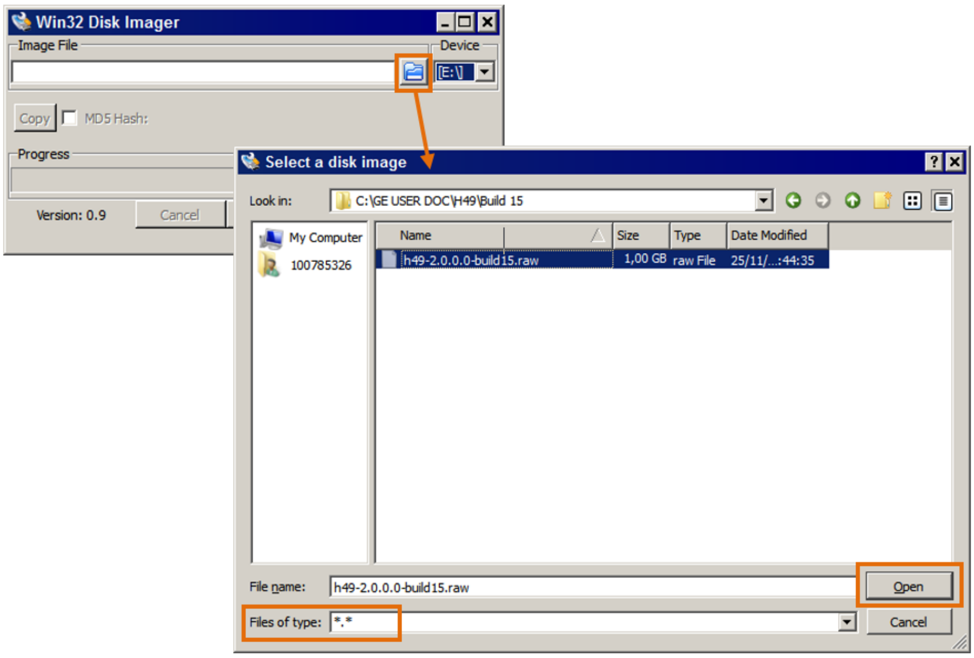


Device: [E:\]

Version: 0.9

Figure 76: Win32DiskImage Program – Select the SD Card Driver

- Click the folder icon to open the file explorer. Set the **Files of type** to *.* and then, select the unzipped raw file. Click **Open**.



Device: [E:\]

Look in: C:\GE USER DOC\H49\Build 15

Name	Size	Type	Date Modified
h49-2.0.0.0-build15.raw	1,00 GB	raw File	25/11/...:44:35

File name: h49-2.0.0.0-build15.raw

Files of type: *.*

Figure 77: Win32DiskImage Program – Select the Raw Image of the Switch

- Click **Write** to copy the RAW image on the SD card:

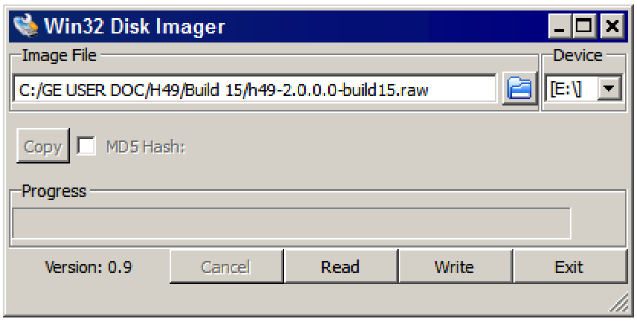


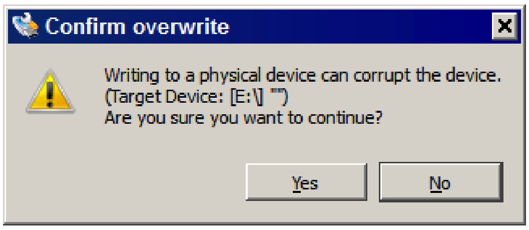
Image File: C:/GE USER DOC/H49/Build 15/h49-2.0.0.0-build15.raw

Device: [E:\]

Version: 0.9

Figure 78: Win32DiskImage Program – Start the File Copy

An information message appears on screen, click **Yes** to continue:



Writing to a physical device can corrupt the device.
(Target Device: [E:\] "")
Are you sure you want to continue?

Figure 79: Win32DiskImage Program – Confirm Overwrite process

- The raw file is being copied on the SD card:

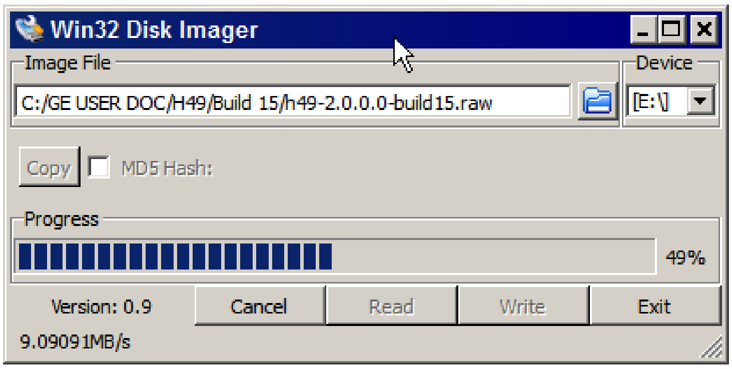


Image File: C:/GE USER DOC/H49/Build 15/h49-2.0.0.0-build15.raw

Device: [E:\]

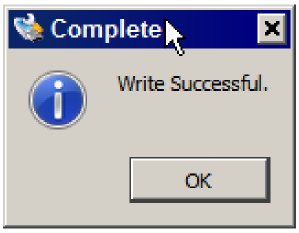
49%

Version: 0.9

9.09091MB/s

Figure 80: Win32DiskImage Program – Overwrite process in progress

- Once the process is complete, click **OK**:



Complete

Write Successful.

Figure 81: Win32DiskImage Program – Overwrite process done successfully

- In the task bar of your PC, click the icon ✓ to safely remove hardware and eject media.
- Remove the micro SD card from your PC and insert it into the SRPV3 board.
- Screw the eight (8) M6 screws on the switch case.

7.4.2.1.2 Insulation Resistance and Earth Continuity Checks

If the unit is disassembled to access the internal Micro SD card, then the following checks must be made after the unit is reassembled and before use.

⚠

Caution:
These tests must only be carried out by a maintenance operative having appropriate technical training and experience necessary to be aware of hazards to which that operative may be exposed in performing installation / maintenance and of measures to reduce the risks to that person or other persons.

The unit must be unpowered and electrically isolated from the installation wiring by removing **all connections** with the exception of the safety Protective Conductor Terminal (PCT) connection to the equipment case, which may be left in place.

Ensure that all case fixings have been reinserted and tightened to the correct torque.

Insulation Resistance Check

- Connect the following pins together to form isolation groups on the unit under test:

H49 Terminal Connections	Terminals	Isolation Group
Primary Power Supply Input – Slot C	23 and 24	1
Secondary Power Supply Input – Slot B	1 and 2	2
Alarm Relay – Slot A	1,2 and 3	3

- Using an insulation resistance tester and taking care to follow the manufacturer’s safety precautions, test between the following isolation groups with the output set to 500 V DC:

Test #	First Isolation Group	Second Isolation Group
1	Primary Power Supply Input – Group 1	Groups 2 and 3 connected to Case PCT
2	Secondary Power Supply Input – Group 2	Groups 1 and 3 connected to Case PCT
3	Alarm Relay – Group 3	Groups 1 and 2 connected to Case PCT

- Verify that the insulation resistance of each test is >100MΩ.
- If any of the test measurements are <100MΩ then the root cause must be identified and rectified before the unit can be returned to active service.

Earth Continuity Check

- Using a continuity tester or Digital Multimeter, check that the resistance from the PCT to all other conductive case components on the unit is <1Ω.
- If any of the test measurements are not <1Ω then the root cause must be identified and rectified before the unit can be returned to active service.

7.4.2.2 VLAN

A physical network can be split into logical segments to create multiple Virtual Local Area Networks (VLANs).

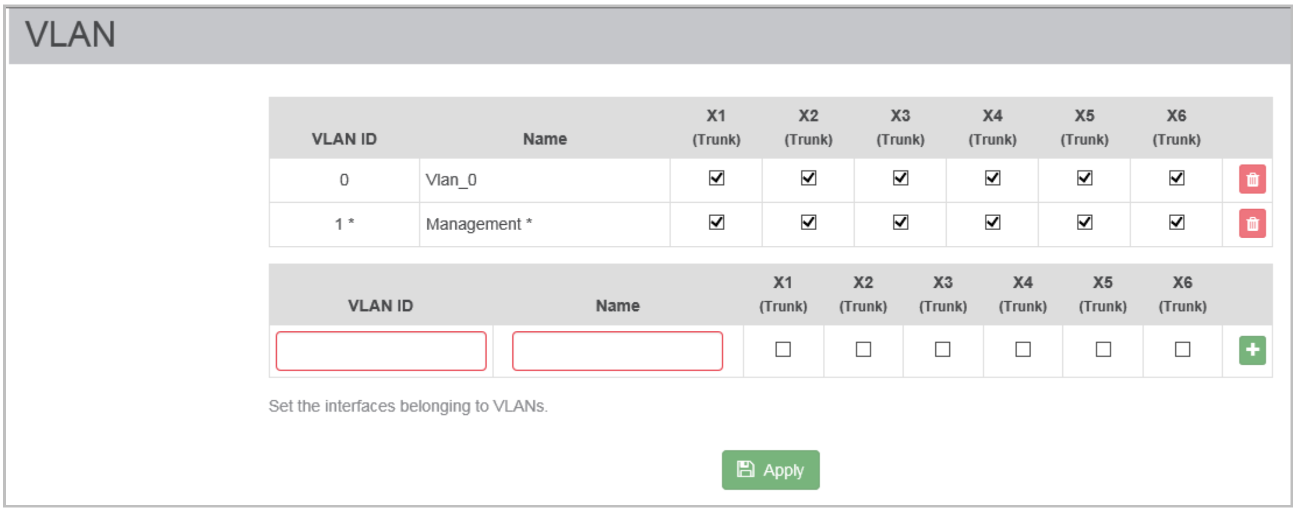
A VLAN gathers a group of devices that may be located anywhere on a network, but which communicate as if they were on the same physical network.

Setting up a Virtual Local Area Network (VLAN) is more flexible than traditional networks and easier to manage:

- Ease the relocation of devices on networks (no re-cabling)
- Extra security: devices within each VLAN can only communicate with other devices on the same VLAN. If a device on VLAN A needs to communicate with devices on VLAN B, the traffic must pass through a routing device.
- Restricted traffic: with traditional networks, traffic is directed to all network devices, regardless of whether or not they need it and may cause network congestion. VLANs are set up to contain only those devices that need to communicate with each other.

VLANs can manage traffic flow through Reason H49 to improve bandwidth utilization and security.

To configure virtual LANs in Reason H49, click **Network** > **VLAN**.



VLAN

VLAN ID	Name	X1 (Trunk)	X2 (Trunk)	X3 (Trunk)	X4 (Trunk)	X5 (Trunk)	X6 (Trunk)	
0	Vlan_0	☑	☑	☑	☑	☑	☑	🗑
1 *	Management *	☑	☑	☑	☑	☑	☑	🗑

VLAN ID	Name	X1 (Trunk)	X2 (Trunk)	X3 (Trunk)	X4 (Trunk)	X5 (Trunk)	X6 (Trunk)	
		☐	☐	☐	☐	☐	☐	+

Set the interfaces belonging to VLANs.

Figure 82: Reason H49 Web User Interface – VLAN Configuration

Reason H49 can manage up to 4096 configurable Virtual LANs. Each VLAN (starting from 2) can handle up to six VLAN ports.

Set the Virtual LAN attributes, as described below:

Attribute	Description
VLAN ID	For tag-based VLANs, this is the ID to look for in the tag. It identifies the individual VLANs you create on your network. The VLAN ID must be specified in the range from 1 to 4094. • VLAN 0 is not used for VLAN routing but only to carry priority information. • VLAN 4095 is not allowed by the 802.1Q standard. It is not displayed in the page.
VLAN Name	Enter a unique name to identify the VLAN. This is used for display purposes only.
X1 to X6	Check the box for each port you wish to include in this VLAN.

Note:
In QuadBox configuration, the ports 5 and 6 might be disabled. Thus, we highly recommend checking the interfaces implied in the VLAN configuration against the selected redundancy mode.

It is possible to remove a VLAN by clicking on the corresponding **Remove** icon.

7.4.2.3 Multicast Filtering

Ethernet protocol supports multicast messages.

A multicast is a packet sent by one host to multiples hosts.

The multicast filtering is a mechanism where information is filtered and then addressed to a group of destination hosts simultaneously.

Only those hosts that belong to a specific multicast group will receive the multicast message as show.

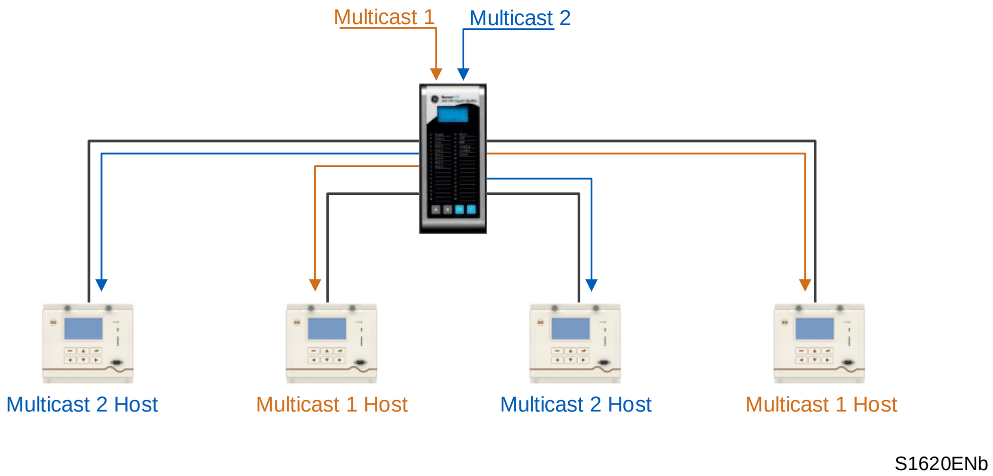
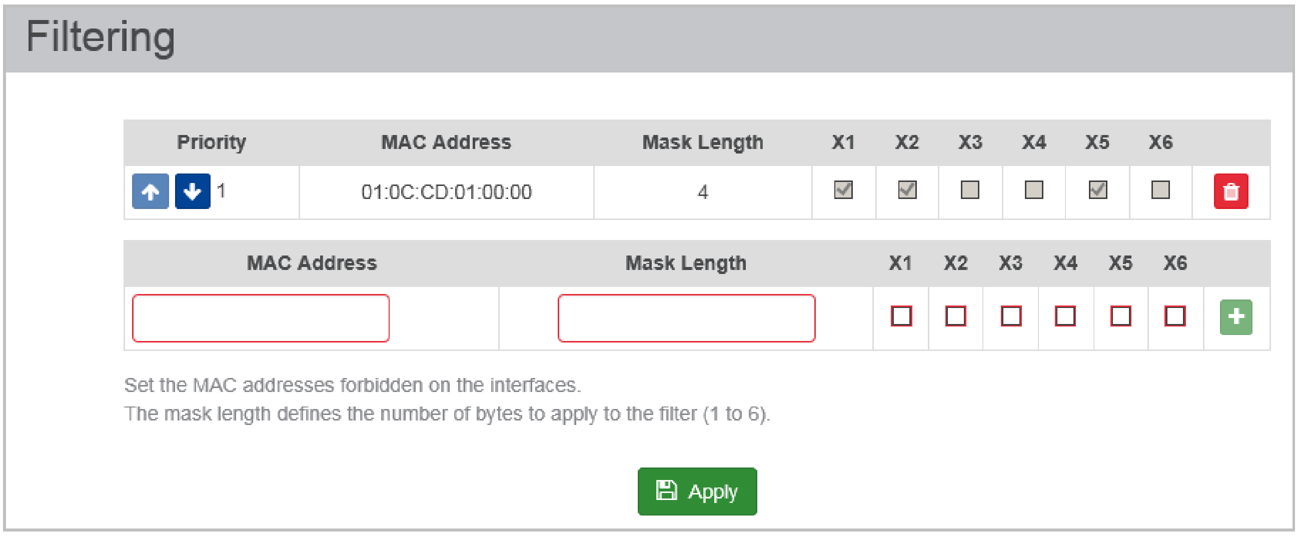


Figure 83: Multicast Filtering Principles

Reason H49 supports adding MAC addresses manually to restrict or filter multicast traffic automatically.

The filter relies on a range of MAC addresses applied to one or more device ports (interfaces).

To manage Multicast filtering rules, click **Network** > **Multicast Filtering**.



Filtering

Priority	MAC Address	Mask Length	X1	X2	X3	X4	X5	X6	
↑ ↓ 1	01:0C:CD:01:00:00	4	☑	☑	□	□	☑	□	🗑

MAC Address	Mask Length	X1	X2	X3	X4	X5	X6	
		□	□	□	□	□	□	+

Set the MAC addresses forbidden on the interfaces.
The mask length defines the number of bytes to apply to the filter (1 to 6).

Figure 84: Reason H49 Web User Interface – Multicast Filtering Configuration

Add multicast MAC addresses manually:

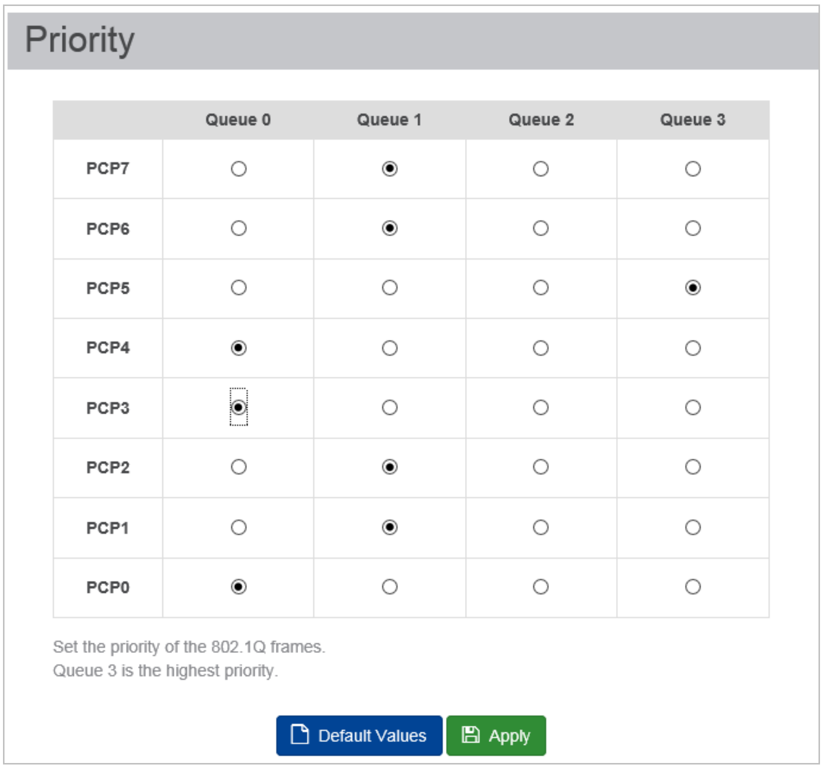
Attribute	Description
MAC Address	Set the forbidden MAC addresses for the selected port(s)
Mask Length	Number of bytes of the MAC Address to apply to the filter (1 to 6)
X1 to X6	Select the ports over which the **frame is allowed**.

7.4.2.4 Priority

Reason H49 provides a mechanism for priorizing Ethernet frames by using Priority Code Points.

Four priority queues (from 0 to 3) are present in Reason H49 (3 being the highest priority) and eight Priority Code Point (PCP) can be distributed among the queues.

- To configure priority queues, click **Network > Priority**.



Priority

	Queue 0	Queue 1	Queue 2	Queue 3
PCP7	○	●	○	○
PCP6	○	●	○	○
PCP5	○	○	○	●
PCP4	●	○	○	○
PCP3	●	○	○	○
PCP2	○	●	○	○
PCP1	○	●	○	○
PCP0	●	○	○	○

Set the priority of the 802.1Q frames.
Queue 3 is the highest priority.

Figure 85: Reason H49 Web User Interface – Priority Configuration

Set the priority mechanism as described below:

Attribute	Description
Queue 0 to Queue 3	Select the queue for which the PCP is set. A given queue can be associated with 0 or more PCPs
PCP0 to PCP7	Priority Code Point (PCP) Only one Queue can be selected for each row.

Click the **Default Values** button to reset the H49 to factory defaults:

- **Queue 3**: PCP6 ; PCP7
- **Queue 2**: PCP4 ; PCP5
- **Queue 1**: PCP2 ; PCP3
- **Queue 0**: PCP0 ; PCP1

7.4.3 Security

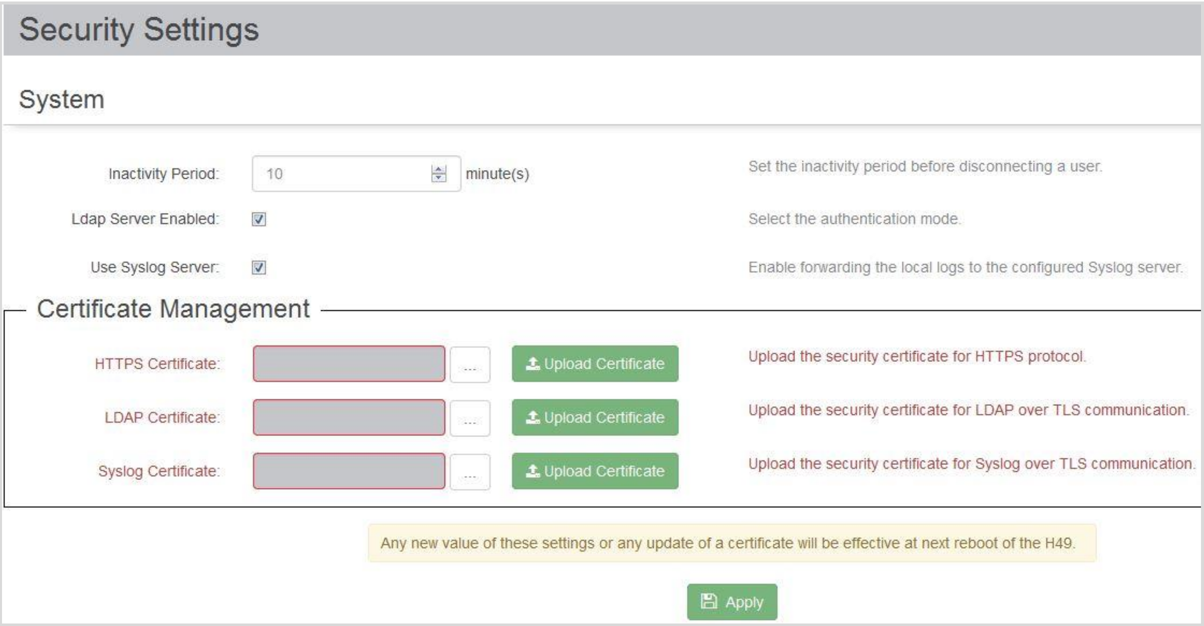
This section is divided into four pages:

- Security settings
- User Accounts
- LDAP Server
- Syslog server

7.4.3.1 Security Settings

To configure security settings, click **Security > Security Settings**.

From this page, you can set the user and system management parameters and manage TLS and trusted certificates.



Security Settings

System

Inactivity Period: 10 minute(s) — Set the inactivity period before disconnecting a user.

Ldap Server Enabled: ☑ — Select the authentication mode.

Use Syslog Server: ☑ — Enable forwarding the local logs to the configured Syslog server.

Certificate Management

HTTPS Certificate: ... Upload Certificate — Upload the security certificate for HTTPS protocol.

LDAP Certificate: ... Upload Certificate — Upload the security certificate for LDAP over TLS communication.

Syslog Certificate: ... Upload Certificate — Upload the security certificate for Syslog over TLS communication.

Any new value of these settings or any update of a certificate will be effective at next reboot of the H49.

Figure 86: Reason H49 Web User Interface – Security Configuration

System

Set the system security settings as described below:

Attribute	Description
Inactivity Period	Sets the inactivity period before disconnecting a user. If Period equals 0, then no disconnection time will be applied.

Attribute	Description
LDAP Server Enabled	Enables / disables the use of LDAP server Local authentication uses the set of user and roles defined in the **User Accounts** page while LDAP uses the configuration defined in LDAP page If LDAP server is enabled, then • the LDAP server provides both authentication and roles assigned to user accounts • if the roles assigned to a user change, the user needs to re-login to apply the new roles
Use Syslog Server	Reason H49 device keeps a local log file. This option makes it possible to forward the local logs to the configured Syslog server. Server attributes are configured in Syslog page.

Certificate Management

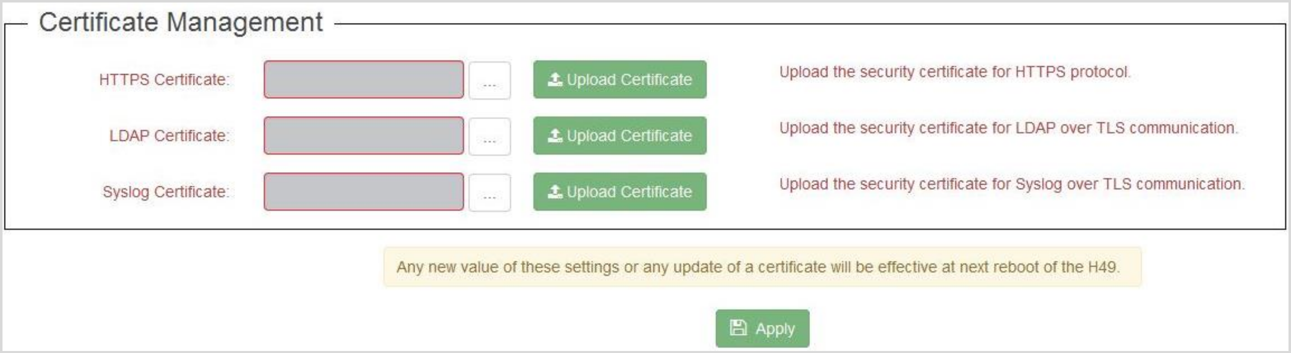
Certificates are used in a network to provide secure access. This is an electronic document that identifies an entity (machine, server or other) and associates that entity with a key.

Reason H49 uses certificates for communicating with external servers such as the syslog and LDAP server or upgrading HTTPS.

Caution:
To manage system certificates from the Security Settings page, you must be a Security Administrator.
Ensure that the certificate resides on the file system of the computer where your browser is running.

To upgrade certificates, perform the following steps:

- Click the "**...**" button to navigate to the folder that contains the desired certificate, then select the relevant certificate and click **Upload Certificate**.
- Click **Apply** to save the modifications



Upload the security certificate for HTTPS protocol.

Upload the security certificate for LDAP over TLS communication.

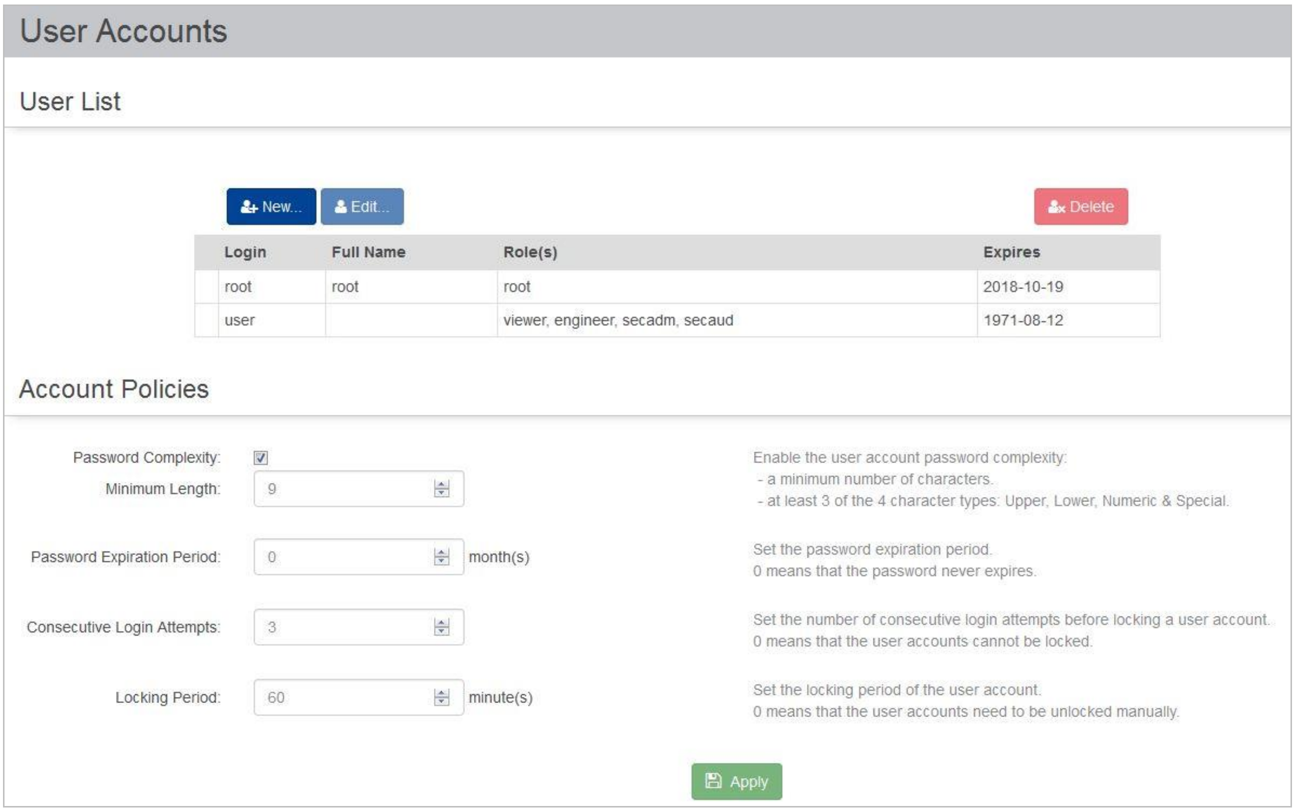
Upload the security certificate for Syslog over TLS communication.

Any new value of these settings or any update of a certificate will be effective at next reboot of the H49.

Figure 87: Reason H49 Web User Interface – Certificate Management

7.4.3.2 User Accounts

As an administrator, you can configure local user accounts and **local user account** policy from the **Security > User Accounts** menu.



Login	Full Name	Role(s)	Expires
root	root	root	2018-10-19
user		viewer, engineer, secadm, secaud	1971-08-12

Password Complexity: ☑

Minimum Length: 9

Enable the user account password complexity:
- a minimum number of characters.
- at least 3 of the 4 character types: Upper, Lower, Numeric & Special.

Password Expiration Period: 0 month(s)

Set the password expiration period.
0 means that the password never expires.

Consecutive Login Attempts: 3

Set the number of consecutive login attempts before locking a user account.
0 means that the user accounts cannot be locked.

Locking Period: 60 minute(s)

Set the locking period of the user account.
0 means that the user accounts need to be unlocked manually.

Figure 88: Reason H49 Web User Interface – Local User Account Configuration

Note 1:
Password Expiration Period setting is only used for new user accounts.

Note 2:
This page allows the user to create, edit and remove local user accounts. These user accounts are used only if no LDAP account management has been defined or if the LDAP server is not accessible. If local authentication is used, then its associated authorization will also be local.

⚠

Caution:
As a system administrator, you MUST NOT edit or change your own password from the Security > User Accounts menu as your new password will not be taken into account by the system.

To change your administrator password, click on the user icon in the top-right corner of the web application and then select Account Settings.

Set the user account properties as described below:

Attribute	Description
Password Complexity	Enables account password complexity. When checked, user's password shall fit the following restrictions: • Minimum length of password • At least 4 character types: Upper, Lower, Numeric & Special.
Minimum Length	Sets the minimum number of characters required when Password Complexity is checked. You can select a value between 3 and 20
Password Expiration Period	Password expiration period defined in months between 0 and 24. 0 means that the passwords never expire.
Consecutive Login Attempts	Number of consecutive login attempts before locking a user account. • 0 means that this policy is disabled. • The maximum number of attempts is 10.
Locking Period	Set the locking period of the user accounts. 0 means that the user account will be locked until a user with appropriate privileges manually unlock it.

The following data is displayed for the existing **local** accounts:

Attribute	Description
Status	Shows the current account's status • No icon shown: there is no special issue concerning the account • ⊘ The account has been disabled by the security administrator (see Edit User Account section) • 🔒 The account has been locked by the system after some login attempts. The user has to wait until the end of the security time (see Locking Period in Security Settings section) However, the security administrator can manually unlock the account (see Security Settings section).
Login	Account's login
Full Name	Account's name
Role(s)	Roles assigned to the corresponding account
Expires	Password expiration date

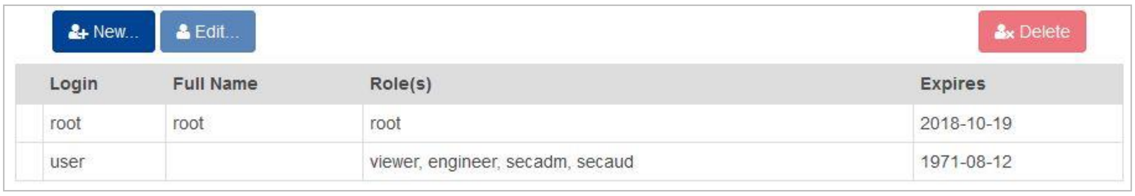
Three action buttons are also provided in this page allowing the following functions:

- **New**: creates a new local account
- **Edit**: modifies the selected account
- **Delete**: removes the selected account

Create a new user Account

The **User Accounts** window allows the user to create a new local user. Login and password are mandatory whereas the other fields are optional.

- To create a new local user account, click **New**:



Login	Full Name	Role(s)	Expires
root	root	root	2018-10-19
user		viewer, engineer, secadm, secaud	1971-08-12

Figure 93: Reason H49 Web User Interface – Create Local User Account

In the **Account Settings** popup, complete the following attributes:

Attribute	Description
Login	Unique login name
Full Name	User's name
Password	User's password. Automatic default password is generated when opening the New window. Special characters will not be accepted.
Roles	User's role • **Viewer** • **Engineer** • **Security Administrator** • **Security Auditor**
Disable the user account	A new disabled account can be generated by checking this option.

- Click **Save** to save the new user account. Modifications are immediately applied.
- Click **Cancel** to cancel the user account creation. The entries are lost and the window is closed.

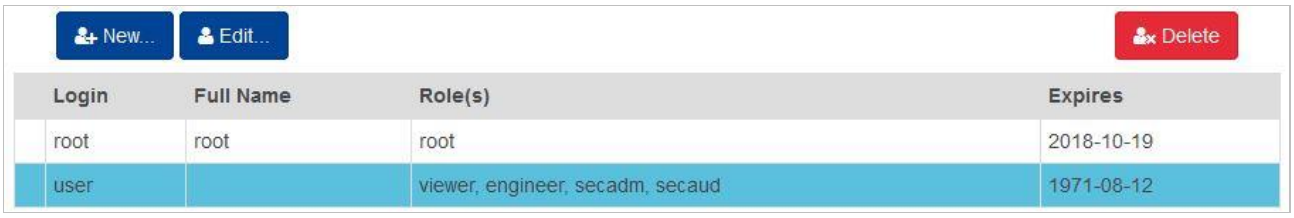
> *Note:*
> *Local accounts are accessible only if no LDAP server is defined or if it is disabled or unreachable.*

Edit a User Account

All user accounts are modifiable (name and password), including the default factory account.

To edit an existing local user account:

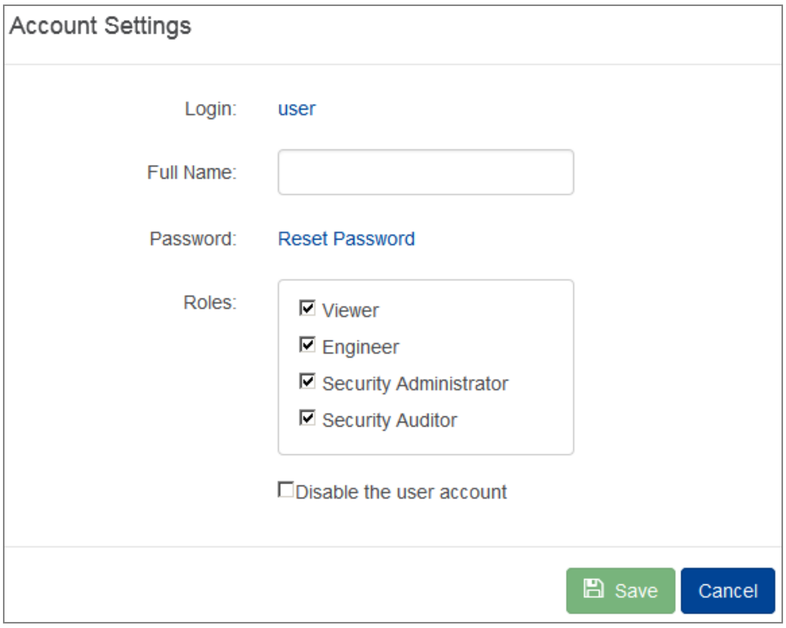
- Select the account to be modified and then, click **Edit**.



Login	Full Name	Role(s)	Expires
root	root	root	2018-10-19
user		viewer, engineer, secadm, secaud	1971-08-12

Figure 94: Reason H49 Web User Interface – Edit a Local User Account

In the **Account Settings** popup, make the relevant changes:



Account Settings

Login: user

Full Name:

Password: Reset Password

Roles:
☑ Viewer
☑ Engineer
☑ Security Administrator
☑ Security Auditor

☐ Disable the user account

Figure 95: Reason H49 Web User Interface – Change Settings of a Local User Account

If the selected user's account is locked, an unlock button is available for users with **Security administrator** role.

A **Reset password** option is also available for users with **Security administrator** role. In this case, the system generates a new automatic password that the user can update.

It is highly recommended to change the reset password upon the first utilization of the user account.

If the roles assigned to a user change, the user will need to re-login in order to apply the new roles.

Account Settings

Users can update their own account settings. These attributes are accessible by clicking on the user icon in the top-right corner of the web server application:

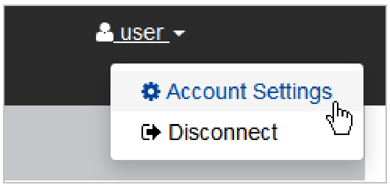
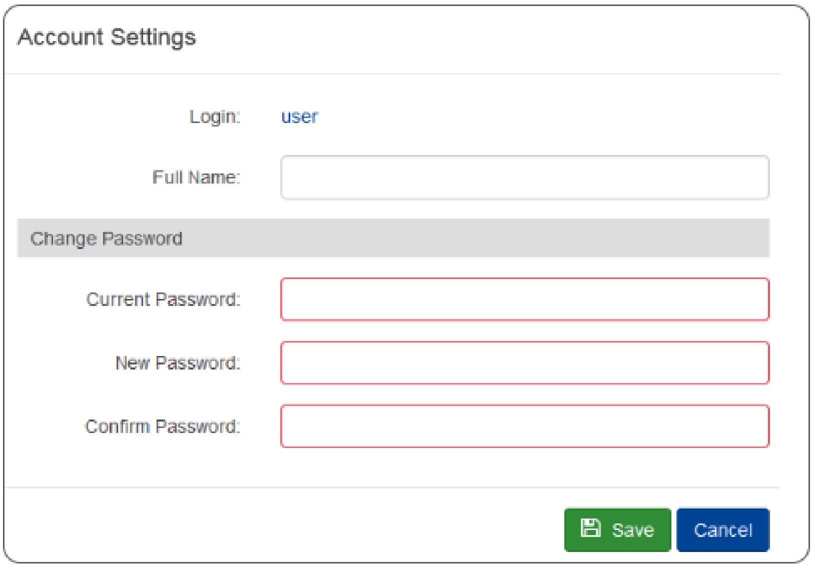


Figure 89: Reason H49 Web User Interface – User Account Settings Icon

The attributes displayed in the **Account Settings** window are:

- Login
- Full Name
- Current Password
- New Password
- Confirm Password



Account Settings

Login:	user
Full Name:	

Change Password

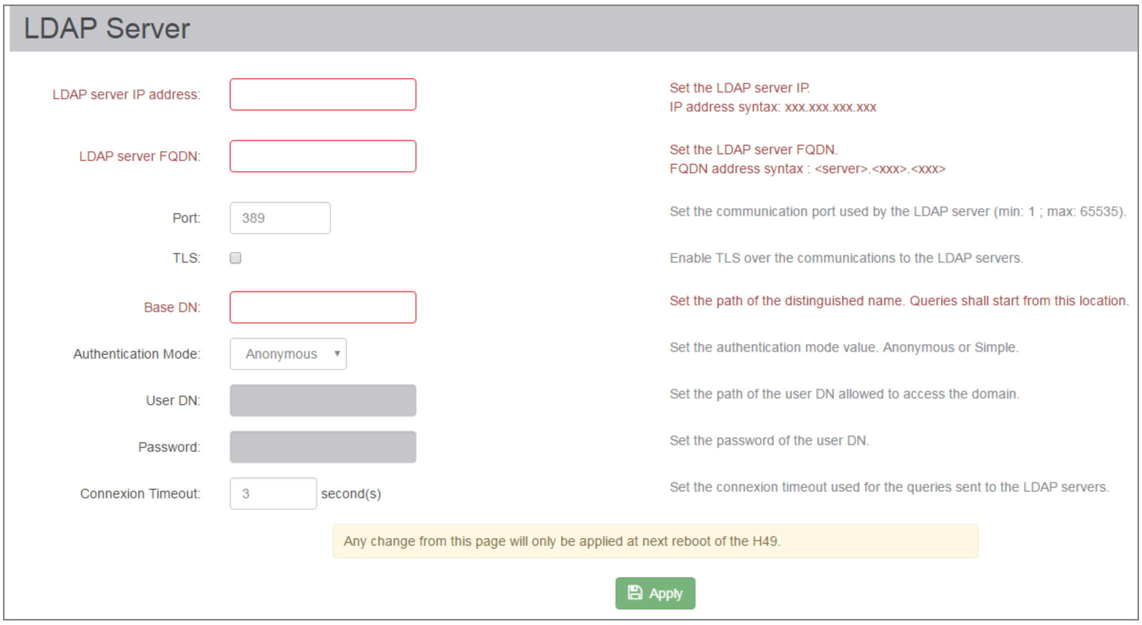
Current Password:	
New Password:	
Confirm Password:	

Figure 90: Reason H49 Web User Interface – Account Settings

7.4.3.3 LDAP Server

This page allows configuring the LDAP server for remote authentication.

The information in this page is used when the LDPA authentication mode is selected in the **Security > Security Settings** page (see Security Settings section).



LDAP Server

LDAP server IP address:		Set the LDAP server IP. IP address syntax: xxx.xxx.xxx.xxx
LDAP server FQDN:		Set the LDAP server FQDN. FQDN address syntax : <server>.<xxx>.<xxx>
Port:	389	Set the communication port used by the LDAP server (min: 1 ; max: 65535).
TLS:	□	Enable TLS over the communications to the LDAP servers.
Base DN:		Set the path of the distinguished name. Queries shall start from this location.
Authentication Mode:	Anonymous	Set the authentication mode value. Anonymous or Simple.
User DN:		Set the path of the user DN allowed to access the domain.
Password:		Set the password of the user DN.
Connexion Timeout:	3 second(s)	Set the connexion timeout used for the queries sent to the LDAP servers.

Any change from this page will only be applied at next reboot of the H49.

Figure 91: Reason H49 Web User Interface – LDAP Server Settings

Attribute	Description
LDAP Server IP address	LDAP Server's IP address (for instance *10.17.10.10)*
LDAP Server FQDN	Complete domain name of the LDAP Server using the Fully Qualified Domain Name (FQDN), for instance *kiwi.dsagile.intern*.
Port	Communication port used by the LDAP servers
TLS	Enables the TLS encryption over the LDAP communication channel
Base DN	Base Distinguished Name in the LDAP server
Authentication Mode	Authentication access mode to the LDAP server: • **Simple** • **Anonymous**
User DN	User account authorized to request data to the LDAP server. It shall be provided if the Simple Authentication Mode is selected.
Password	Password associated to User DN
Connection Timeout	Connection timeout in seconds used for the queries sent to the LDAP server. After timeout, the client considers that the requested server is out of service.

In any case, the Reason H49 switch cannot edit the passwords associated to LDAP-managed accounts.

Note:
If the LDAP server is temporarily unreachable, you may experience access issues to user management features (User Account creation...) from the H49. The operation can take time due to LDAP connection timeout.

7.4.3.4 Syslog Server

A Syslog server is used for logging any message of events that occur on the host.

The list of activities and operations, which are logged, is detailed below:

General	Authentication	Security	System
Startup log	Login failed (Invalid user account, wrong password, account Locked, session already active,	Security settings updated	System settings updated
Shutdown log	Login successful	User account changes (password reset, change of role), User account created, locked, unlocked, removed	Time/date change
	Logout (Timeout, User log off)	Role (assigned to and removed from user account)	Firmware/application update
		Certificate management	Database switch
		Central authentication server activity (reachable or not)	System stopped/rebooted
		Syslog server activity (reachable or not)	

This Syslog Server feature allows the user to configure a Syslog server.

Attributes in this page will be taken into account only if the Syslog server has been selected in the **Security > Security Settings** page (see Security Settings section).

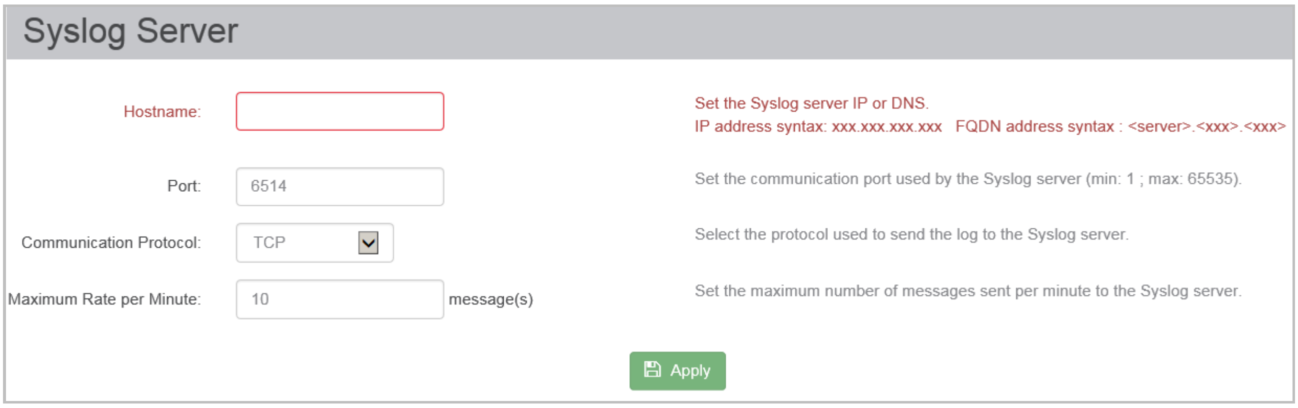
Attribute	Description
Hostname	Server's IP address or Fully Qualified Domain Name
Port	Communication port used by the Syslog server
Communication Protocol	Communication protocol used to send the logs to the Syslog server • UDP • TCP • TCP/TLS
Maximum Rate per Second	Maximum number of messages sent per minutes to the Syslog server

When UDP is used:

- If the log server is reachable, then the log messages are sent to the server “on-the-fly”; in other words, messages are not buffered and sent in batch to the server.

When TCP or TCP/TLS is used:

- If the log server is unavailable, the log messages are temporarily buffered and they are sent to the server upon service reestablishment.



Syslog Server

Hostname:		Set the Syslog server IP or DNS. IP address syntax: xxx.xxx.xxx.xxx FQDN address syntax : <server>.<xxx>.<xxx>
Port:	6514	Set the communication port used by the Syslog server (min: 1 ; max: 65535).
Communication Protocol:	TCP	Select the protocol used to send the log to the Syslog server.
Maximum Rate per Minute:	10 message(s)	Set the maximum number of messages sent per minute to the Syslog server.

Figure 92: Reason H49 Web User Interface – Syslog Server Settings

Chapter 8: Cyber Security

Cyber security has become an urgent matter in many industries where advanced automation and communications networks play a crucial role and where high reliability is of paramount importance.

Cyber security relies on processes and practices designed to protect networks, computers, programs and data from attack, damage, or unauthorized access.

Various standards and recommendations apply to substation cyber security and consist in maintaining the Availability, Integrity and Confidentiality of the substation data and automation processes.

8.1 Reason H49 Cyber Security Implementation

At the Reason H49 level, the following cyber security measures have been implemented:

- Encryption and Credential
- Secured File Transfer
- Authorization
- Authentication
- Password Management
- Security Log Management
- Other Security Measures

8.1.1 Encryption and Credentials

Usernames and passwords are secured and are NERC compliant.

8.1.2 Secured File Transfer

Files are exchanged through a secure file transfer protocol such as:

- **Secure Shell (SSH)**, provides confidentiality and integrity of data in client-server architectures by encrypting data
- **SSH File Transfer Protocol / Secure File Transfer Protocol (SFTP)**, provides secure file transfer capabilities. This is an extension of the Secure Shell protocol (SSH) protocol.
- **HyperText Transfer Protocol Secure (HTTPS)** for secure communication over a computer network widely used on the Internet. Connections are encrypted by Transport Layer Security (TLS) or Secure Sockets Layer (SSL)

Non-secured protocols are disabled.

8.1.3 Authorization

Authorization is both the process of a security administrator granting rights to users and the process of checking user account permissions for access to devices.

The permissions define both the environment the user sees and the way he/she can interact with it.

When successfully authenticated, the user can only perform actions for which privileges have been explicitly granted to him/her. These permissions are set by a security administrator and stored locally or on the authentication server.

8.1.3.1 Role-Based Access

Reason H49 uses the concept of Roles and Rights. This process consists in assigning local authorized users to one predefined roles and is known as Role-Based-Access Control (RBAC).

A role is a collection of privileges.   Different roles and different access rights can be associated with a user.

This action is done in the **Security > User Accounts** page of the web user interface:

The available roles are:

Attribute	Description
Viewer	A "Viewer" can only display data or read information. A "Viewer" is not authorized to change other passwords, nor to visualize the security logs.
Engineer	An "Engineer" can only access data useful to run the system. He/she works in the substation and can act on a sub-system. He/she has observer rights plus specific rights to trigger commands. The "Engineer" is not authorized to change other passwords, nor to visualize the security logs.

Attribute	Description
Security Administrator	The "Security Administrator" is responsible of the Security policy. He/she is ONLY allowed to reset passwords, define the security parameters, and visualize the security logs. The "Security Administrator" is not allowed to display any data of DS Agile system, load a database nor change a sub-system operating mode.
Security Auditor	A "Security Auditor" can only display data or read information. A "Security Auditor" is authorized to visualize the security logs.

Note:
If the roles assigned to a user change, the user must logout and log back in to exercise his/her privileges.

8.1.4 Authentication

User authentication is a process that verifies the identity of a user who connects to a device.

Any user interaction with Reason H49 requires authentication through a login and password, whatever the interaction service (protocol) and regardless of the interaction type (read, write).

8.1.4.1 Central Authentication

Reason H49 operates with LDAP for central authentication.

Centralized username/password management reduces the maintenance, as all user credentials are stored in a server and not in each individual device.

To use centralized accounts, check the **LDAP Server Enabled** option in the **Security > Security Settings** page.

When central authentication is used, then central authorization is applied. The central authorization service provides the list of user's roles.

The configuration of the LDPA server address, encryption mode, access account, etc. is done in the **Security** > **LDPA Server** page.

Redundant LDAP server can be configured to ensure system redundancy.

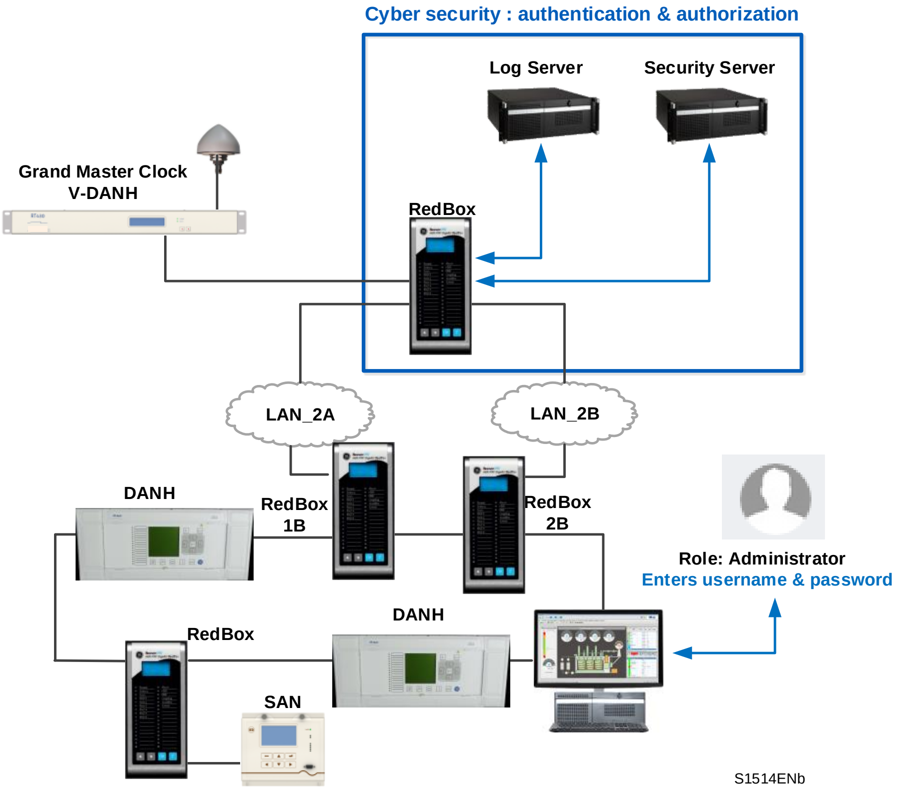


Figure 93: Network Architecture with Centralized Authentication

- The user authenticates on the device through the user interface
- The device checks the credentials provided by the user against the centralized security server that stores user account database.
- The centralized security server answers the device and confirms whether the user has the right to access the device or not (this is the authorization step).
  - Upon successful authentication, the user is granted authorization for access.
  - If an error occurs during the authentication process, a message appears as shown on the following figure.
- Then, the device gives access to the user and loads the user profile according to his/her role

8.1.4.2 Local Authentication

When the centralized authentication is not available or when the “LDAP Server Enabled” option is not selected in the **Security > Security settings** page, Reason H49 uses a local account service for local authentication.

It means that information about user(s) is stored on the system.

Note:
Local user accounts are applied only if no LDAP account management has been defined or if the LDAP server is not accessible. If local authentication is used, then its associated authorization will also be local.

Local account management (creation, deletion, edition, etc.) is accessible from the **Security > User Accounts** page.

Default User

By default, Reason H49 is delivered with a default administrator account.

When connecting to Reason H49 for the very first time via the web server, the user shall use the following default authentication information:

- Login: **user**
- Password: **user**

Then, once connected to the Reason H49 switch, he/she will be invited to enter his/her password in order access the services provided by the device.

Note:
This default account is modifiable by the customer.

8.1.5 Password Management

One of the fundamental principles of cyber security consists in combining a user ID with a password.

For Reason H49, password policy is implemented in compliance with IEEE 1686 recommendations.

Password Complexity

The password policy is implemented for all local users.

This action is done in the **Security > User Accounts** page.

The security administrator can increment here the user's account password complexity by defining restrictions according to the NERC CIP and IEEE 1686-2013 standards:

- Minimum number of characters:
    - 9 with 4 character types: Uppercase, Lowercase, Numeric and special non-alphanumeric {such as @,!,#,{, etc.} !

> *Note:*
> *password complexity can be disabled to accommodate customers that do not require complex passwords.*

Password Expiration Period

The security administrator can force users to change regularly their password. He/she can set the password lifetime after which it expires.

Consecutive Login Attempts

The security administrator can set the number of consecutive login attempts before locking a user account and the locking period.

Inactivity Period

The security administrator can set the inactivity period before disconnecting a user. This avoids leaving the device accidentally open to access by authorized persons.

Thus, when the user does not perform an action within the pre-defined interval, he/she will automatically log off.

Locking Period

After a fixed number of login attempts, the user account is locked out. The system tags it with the 🔒 icon.

The user will have to wait until the end of the security time (see **Locking period** in section Security Settings).

However, the security administrator can manually unlock the account (see **Unlock** in section Security Settings).

Change User Password

Users and system administrator can update their own account settings by clicking on the user icon, in the top-right corner of the web application:

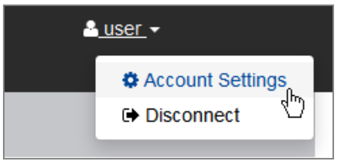


Figure 94: Reason H49 Web User Interface – User Account Settings Icon

The following attributes can be modified:

- Full name
- Current password
- New password
- Confirm password

Caution:
As a system administrator, use this menu to edit or change your own password.

Reset a Password

To reset a password, the old and new passwords are required.

Only a user with **Security Administrator** privileges can reset a user's password by clicking **Reset password**, in the user **Security > User Account > Account Setting** page.

In this case, the system will automatically generate a new password that can be changed by the user.

The new password is then used to connect to the device web application.

Note:
When a user has lost a password, the password cannot be recovered due to the one-way password encryption algorithm.

8.1.6 Security Logs

Any user activity or login attempts whether successful or failed is logged:

- Startup log and Shutdown log
- Successful and failed login attempts
- User account (local) changes (password reset, change of role)
- Database switch
- Firmware / application update
- Manual logout
- Time out logout
- Alarm incident
- Time/date change
- Configuration change

8.1.7 Local Logs

Reason H49 keeps a local log file.

Sensitive information such as passwords is not logged.

8.1.8 Remote Logs

Reason H49 supports logging to a remote Syslog server. Refer to the Security Settings section for more details

At any time, the security administrator can enable/disable logging to a central syslog server.

Syslog implementation supports UDP, TCP and TCP over TLS.

- If the log server is reachable, then the log messages are sent to the server “on-the-fly”; in other words, messages are not buffered and sent in batch to the server.
- If the log server is unavailable, the log messages are temporarily buffered and they are sent to the server upon service reestablishment.

Moreover, the bandwidth used for accessing the log server has been configured in order to avoid flooding the network.

8.1.9 Other Security Measures

Hardening

Hardening is the process of securing a system by reducing its surface of vulnerability.

This includes the removal of unnecessary software, unnecessary usernames or logins and the disabling or removal of unnecessary services.

By default, Reason H49 configuration is hardened according to CIS (Center for Internet Security) recommendations.

Disabling Ports

The availability of unused ports could provide a security risk.

An authorized user with Engineer role can disable unused physical ports.

This action is done from the **Network > Interface** page.

Every interface is represented by a row in the table.

Note: When the device is configured in QuadBox mode, ports 5 and 6 are deactivated, thus they are not displayed in the list.

Firmware Update

Reason H49 firmware is digitally signed.

When uploading and installing a new firmware version on the device, the package signature is verified before allowing the firmware to be installed.

Cyber security certificates and public and private keys used for the authentication process are stored in the local hardware.

The engineer user can update the device firmware as described in the Management section.

Configuration Update

The engineer user can update the device by downloading a **Running** and a **Startup** configuration as described in the Management section.

Chapter 9: Maintenance

Caution:
Before carrying out any work on this product you should study the contents of the safety and technical data of the GE Grid Solutions Safety Guide SFTY/4L M/H11 (or later issue) and the ratings on the equipment rating label.
You should also read the Safety Information section of this document before carrying out work on this product.

9.1 Maintenance period

Deterioration may occur over time. Because of the electrical and heavy-interference environment, the device should be checked at regular intervals to confirm that it is operating correctly.

The device is self-supervising and so requires less maintenance than earlier devices. Most problems will result in a reboot. However, some periodic tests should be carried out to ensure that they are functioning correctly and that the external wiring is intact. It is the responsibility of the customer to define the interval between maintenance periods. If your organization has a Preventative Maintenance Policy, the recommended product checks should be included in the regular program. Maintenance periods depend on many factors, such as:

- The operating environment
- The accessibility of the site
- The amount of available manpower
- The importance of the installation in the power system
- The consequences of failure

9.2 Product checks

9.2.1 Visual checks

These checks should be performed during maintenance operations:

- Check that no components look damaged.
- Check that the RJ45 and optical SFP modules are firmly held in place.

9.2.2 Functional checks

Check that the LEDs in the front panel give correct indications (see the Hardware section).

- Check that the network connectors are correctly fitted

9.3 Firmware Upgrade

Follow the procedure described in the Management section.

9.4 Error detection

Most of the faults are indicated through the LEDs in the front panel.

See the Hardware section for more details on LEDs indication.

Reason H49 supports monitoring access through SNMP. It is the responsibility of the maintenance procedure to regularly monitor the device in order to verify it healthy functioning.

9.5 Testing the LEDs

Reason H49 provides a mechanism allowing us to test the correct functioning of the LEDs present in the front panel.

- Press "OK" + "C" buttons: all LEDs turn RED,
- Message "LED test / press OK" is displayed on the LCD
- Press "UP" button: all LEDs turn AMBER
- Press "DOWN" button: all LEDs turn GREEN
- Press "OK" button in order to set the device to its normal (LED + LCD)

9.6 Method of Repair

This product cannot be repaired on-site. Should the product fail, then it will need to be replaced with an equivalent device.

9.6.1 Replacing Reason H49

The case and connectors have been designed for ease of use, so removing Reason H49 is very simple.

9.6.1.1 Removing Reason H49

Before disconnecting, check that labels correctly identify the connections, and match the descriptions.

Note the IP Address, Subnet settings, etc., to configure the replacement.

Proceed by:

1. Disconnecting all the power supply connectors.
2. Disconnecting the alarm contacts connectors.
3. Disconnecting the Ethernet RJ45 connectors.
4. Disconnecting the Ethernet optical connectors.
5. Disconnecting the protective earth connection.
6. Removing the H49 from the DIN rail carefully, paying attention to its weight.

9.6.1.2 Installing a replacement product

To reinstall a replacement product:

1. Attach the product to the DIN rail
2. Connect the protective earth connection
3. Connect the power supply connection(s)
4. Establish an HTTPS connection and set the IP Address, etc.
5. Restore the other connections

9.6.2 Repair and Modification Procedure

In case of equipment malfunction, the customer shall get in contact with GE's Contact Centre and never attempt to repair the device by own.

Please follow these steps to return the product to us:

1. Get the Repair and Modification Return Authorization (RMA) form.
   An electronic version of the RMA form is available upon request from the GE contact Center web page: **https://www.gegridsolutions.com/contact.htm**
2. Fill in the RMA form.
   Fill in only the white part of the form.
   Please ensure that all fields marked **(M)** are completed such as:
   - Equipment model
   - Model No. and Serial No.
   - Description of failure or modification required (please be specific)
   - Value for customs (in case the product requires export)
   - Delivery and invoice addresses
   - Contact details
3. Send the RMA form to your local contact.
   For a list of local service contacts worldwide, visit the following web page:
   https://www.gegridsolutions.com/contact.htm
4. The local service contact provides the shipping information.
   Your local service contact provides you with all the information needed to ship the product:
   - Pricing details
   - RMA number
   - Repair center address
   - If required, an acceptance of the quote must be delivered before going to the next stage.

5 Send the product to the repair center:

- Address the shipment to the repair center specified by your local contact
- Make sure all items are packaged in an anti-static bag and foam protection
- Make sure a copy of the import invoice is attached with the returned unit
- Make sure a copy of the RMA form is attached with the returned unit
- E-mail or fax a copy of the import invoice and airway bill document to your local contact.

Chapter 10: Technical Data

10.1 Conformity

Reason H49 has been designed, manufactured, and certified fully compliant with the generally applicable environmental standards such as:

- IEC 60255-27:2013
- IEEE 1613: 2009, IEEE 1613a:2011, IEEE 1613-1:2013
- IEC 61850-3 ed2.0:2013

10.2 Environmental conditions

In power plant and substation environments, Reason H49 is intended to be used in the normal service conditions listed below:

Item	Operating conditions	Storage conditions
Ambient Air Temperature[5]	-25°C/+55°C	-40°C/+70°C[1]
Solar radiation	Negligible	
Altitude	≤ 2 000 m	
Relative humidity (24 h average)	From 5 % to 95 % RH[2]	
Atmospheric pressure	86kPa to 106kPa	
Air pollution by dust, salt, smoke, corrosive/flammable gas, vapours	No significant air pollution[4]	
Vibration, earth tremors	Class 1[3]	

Note 1: The GE Reason H49 should be stored in its supplied packaging.

Note 2: No condensation or ice is considered.

Note 3: According to IEC 60255-21 series

Note 4: These conditions correspond to maximum values given for classes 3C1 and 3S1 in IEC 60721-3-3.

Note 5: The ambient air temperature is the maximum or minimum temperature around the enclosure of Reason H49

10.3 IEC61850-3 Certification

10.3.1 Dielectric

Description	Test Standard	Mode	Group	Test Level
Impulse voltage	IEC 60255-27:2013 IEC 61180-1:1992		DC and AC Power ports Binary input/output Alarm output	5kV+0%,-10% - 1.2/50µs impulse
			Signal ports (RJ45 + serial com)	1kV 1.2/50µs impulse
Dielectric voltage	IEC 60255-27:2013		DC and AC Power ports Binary input/output Alarm output	2kV rms. 50Hz for 1 minute
			Signal ports (RJ45 + serial com)	0,5kV rms. 50Hz for 1 minute
Insulation resistance	IEC 60255-27:2013	Earth and all others	Power, input/output, Alarm and serial ports	Test voltage 500Vdc
Protective bonding resistance	IEC 60255-27:2013		Mechanical ports	60s, Test voltage < 12Vdc or 12 Vrms ac

10.3.2 Electromagnetic Compatibility

10.3.2.1 Standard compliance

Reason H49 is compliant with European Commission Directive on EMC (IEC 61000-5 standard).

10.3.2.2 DC Auxiliary supply

Description	Test Standard	Group	Test Level
DC voltage interruptions	IEC 61000-4-29:2000 IEC 60255-26:2013	DC Power port	Supply Interruptions ΔU 100% for 50ms
DC voltage dips	IEC 61000-4-29:2000 IEC 60255-26:2013	DC Power port	ΔU 30% for 100ms, ΔU 60% @ 100ms
Voltage ripple on DC Power Supply voltage	IEC 61000-4-17:2009 IEC 60255-26:2013	DC Power port	AC 100Hz ripple superimposed on DC max. and min. auxiliary supply at 10% of rated DC value.
Burden for DC Power supply		DC Power port	PSU 110Vdc/load = Max 16,79VA PSU 220Vdc/load = Max 16,79VA
Inrush current and power-up duration		DC Power port	PSU 50Vdc = 9.7 A (100 – 150 ms) PSU 110Vdc = 19,4A (110 ms) PSU 220Vdc = 43,8A (92 ms)

10.3.2.3 AC Auxiliary Supply

Description	Test Standard	Group	Test Level
AC voltage interruptions	IEC 61000-4-11:2004 IEC 60255-26:2013	AC Power ports	Supply Interruptions ΔU 100% for 5 periods, 50 periods
AC voltage dip	IEC 61000-4-11:2004 IEC 60255-26:2013	AC Power ports	ΔU 30% for 1 period ΔU 60% for 50 periods
Burden for AC Power supply		AC Power ports	PSU 110Vac/load = Max 33,42VA PSU 230Vac/Load = Max 33,42VA
Inrush current and power-up duration		AC Power ports	PSU 110Vac = 12,84A (126ms) PSU 220Vac = 14,8A (109ms)

10.3.2.4 Auxiliary Supply

Description	Test Standard	Group	Test Level
Gradual shut down/start-up	IEC 60255-26:2013	AC/DC Power port	Shut-down ramp 60s Power off 5 min Start-up ramp 60s
Reversal of DC Power Supply	IEC 60255-27:2013-10.6.6	AC/DC Power port	Duration = 60s
Burden for binary input		Binary inputs	PSU 110Vdc/load = Max 1VA PSU 220Vdc/load = Max 1VA

10.3.2.5 Fast Transient

Description	Test Standard	Mode	Group	Test Level
Fast Transient	IEC 61000-4-4:2012 IEC 60255-26:2013	CDN	DC and AC Power and Earth ports	Level 4: 4kV peak voltage at 5-kHz and 100-kHz repetition freq.
	IEC 61000-4-4:2012 IEC 60255-26:2013	Clamp	Signal ports	Level 4: 2kV peak voltage at 5-kHz and 100-kHz repetition freq.

10.3.2.6 Emissions

Description	Test Standard	Group	Test Level
Conducted Emissions	IEC 61000-6-4:2011 IEC 60255-26:2013	AC and DC Power Supply	0,15 MHz to 0,50 MHz: 79 dB(µV) quasi peak & 66 dB(µV) average 0,5 MHz to 30 MHz: 73 dB(µV) quasi peak & 60 dB(µV) average

Description	Test Standard	Group	Test Level
	IEC 61000-6-4:2011 IEC 60255-26:2013	Com, RJ45 ports	0,15 MHz to 0,5 MHz: 97 dB(µV) to 87 dB(µV) quasi-peak 84 dB(µV) to 74 dB(µV) average 53 dB(µA) to 43 dB(µA) quasi-peak 40 dB(µA) to 30 dB(µA) average 0,5 MHz to 30 MHz: 87 dB(µV) quasi-peak 74 dB(µV) average 43 dB(µA) quasi-peak 30 dB(µA) average
Radiated Emissions	IEC 61000-6-4:2011 IEC 60255-26:2013	Enclosure port	30 - 230MHz: 40dB(µV/m) quasi-peak at 10m and 3m measuring distances. 230 - 1000MHz: 47dB(µV/m) quasi-peak at 10m and 3m measuring distances. 1 GHz to 3 GHz: 56dB(µV/m) average at 3m measuring distance. 76dB(µV/m) peak at 3m measuring distance. 3 GHz to 6 GHz: 60dB(µV/m) average at 3m measuring distance. 80dB(µV/m) peak at 3m measuring distance.

10.3.2.7 Immunity

Description	Test Standard	Mode	Group	Test Level
Conduced disturbances, induced by radiofrequency fields	IEC 61000-4-6:2013 IEC 60255-26:2013		DC and AC Power ports, earth port, signal ports	Level 3 : 10V (rms) Disturbance signal 80% AM with a 1KHz sine wave, 150Ω Frequency sweep from 150kHz to 80MHz Spot frequencies: 27 MHz ±0,5% & 68 MHz ±0,5%
Radiated, radio-frequency electromagnetic field	IEC 61000-4-3:2010 IEC 60255-26:2013	6 Faces	Enclosure ports	Level 3 : 10V/m (rms) Frequency sweep: from 80MHz to 3000MHz Spot frequencies: 80 MHz ± 0,5 % 160 MHz ± 0,5 % 380 MHz± 0,5 % 450 MHz ± 0,5 % 900 ± 5 MHz 1 850 ± 5 MHz 2 150 ± 5 MHz

Description	Test Standard	Mode	Group	Test Level

	IEC 61000-4-3:2010	6 Faces	Enclosure ports	Level 4 : 30V/m (rms)
				Frequency sweep:
				from 800MHz to 960MHz
				from 1400MHz to 2000MHz

Electrostatic Discharge	IEC 61000-4-2:2008 IEC 60255-26:2013		Enclosure ports	Level 4: 15kV air discharge. 8kV contact discharge.
Surge Immunity	IEC 61000-4-5:2014 IEC 60255-26:2013	DM	AC/DC Power, Alarm, binary Input/Output Ports	Level 3: Source impedance 2Ω, Line-to-line 2kV, coupling resistor 0Ω, coupling capacitance 18 µF
		CM		Level 4: Source impedance 2Ω, Line-to-earth 4kV, coupling resistor 10Ω, coupling capacitance 9 µF
		DM	Signal ports	Level 4: Source impedance 2Ω, Line-to-ground 4kV, coupling resistor 40Ω, coupling capacitance 0,5 µF
Power frequency magnetic field	IEC 61000-4-8:2009 IEC 60255-26:2013		Enclosure port	Level 5: 100A/m continuous (≥60s) 1000A/m for 1s
Pulsed magnetic field immunity	IEC 61000-4-9:2001		Enclosure port	Level 5: 1000A/m peak Applied 6.4/16µs magnetic field pulses in all planes for the EUT in a quiescent state.
Damped oscillatory magnetic field immunity	IEC 61000-4-10:2001 - 11		Enclosure port	Level 5: 100A/m peak Applied in all planes at: 100kHz, repetition rate ≥ 40Hz, during 60s 1MHz, repetition rate ≥ 400Hz, during 60s
Slow damped oscillatory wave	IEC 61000-4-18:2011 IEC 60255-26:2013	CM	DC and AC Power	Level 3: 2.5kV @100kHz and 1MHz
		DM	DC and AC Power	Level 3: 1kV peak voltage @100kHz and 1MHz
		CM	Ethernet ports	Level 3: 2.5kV @100kHz and 1MHz

Main frequency voltage	IEC 61000-4-16-compil:2011 IEC 60255-26:2013		DC Power port, Signal ports	Level 4: 30 Vrms cont. 300 Vrms for 1 s Coupling resistor 200Ω and coupling capacitor 1uF - DC and inputs Coupling resistor 50Ω - Ethernet ports

10.3.3 Safety tests

Description	Test Standard	Test Level
Functional performance requirements	IEC 62439-1:2010 IEC 62439-3:2016 IEC 61850-8-1:2011 IEC 61850-90-4:2013 IEC 61850-9-3:2016 IEC 61588:2009	PRP, HSR and PTP functional features
Clearance and creepage distances		Pollution degree= 2 Overvoltage category = III
IP Rating	IEC 60529: 2013	IP2x for each face
Flammability of insulation materials, components and fire enclosure	IEC 60695-11-10	UL94V-0

10.3.4 Environmental tests

10.3.4.1 Dielectric

Description	Mode	Group	Test Level
Insulation resistance	Earth and all others	Power, Input / output, Alarm and serial ports	Test voltage 500Vdc
Dielectric type test	Earth and all others	AC/DC Power, binary input/output, alarm ports	2kV - before and after environmental tests
	Earth and all others	Serial and internet ports	0,5kV - before and after environmental tests
Protective bonding resistance		Mechanical ports	60s, Test voltage < 12Vdc or 12 Vrms ac before and after environmental tests

10.3.4.2 Climatic

Description	Test Standard	Test Level
Dry heat - Max operating temp	IEC 60068-2-2:2007	Test Bd: 55°C - 96 hours
Cold - Min operating temp	IEC 60068-2-1:2007	Test Ad: -25°C - 96 hours
Dry heat – Max storage temperature	IEC 60068-2-2:2007	Test Bd: 70°C - 96 hours Power on @55°C
Cold - Min storage temperature	IEC 60068-2-1:2007	Test Ab: -40°C - 96 hours Power on @-25°C
Change of temperature	IEC 60068-2-14:2009	Test Nb: Start = 20°C for 1h Lower temperature = -25°C Higher temperature = 55°C
Damp heat - steady state	IEC 60068-2-78:2012	Test Cab: 40°C ±2 °C - RH 93% ± 3% - 10 days

Description	Test Standard	Test Level
Damp heat cyclic (12 h+12 h)	IEC 60068-2-30:2005	Test Db: +25 °C ± 3 °C - 97 % −2 %+3 % RH +55 °C ± 2 °C - 93 % ± 3 % RH 6 of 24 hours (12 h + 12 h) cycles

10.3.4.3 Mechanical

Description	Test Standard	Test Level
Vibration response	IEC 60255-21-1:1988	Class 2
Vibration endurance (sinusoidal)	IEC 60255-21-1:1988	Class 1
Shock response	IEC 60255-21-2:1988	Class 2
Shock withstand and bump	IEC 60255-21-2:1988	Class 1
Seismic	IEC 60255-21-3:1993	Class 2
Enclosure protection	IEC 60529:2013	IP2x

10.4 IEEE1613 Certification

Description	Test Standard	Mode	Group	Test Level
Service conditions	IEEE C37.90:2007 - B8		Device	Installation Zone A
Operational temperature range	IEEE C37.90:2007 - B8		Device	Operating temperature: -25°C to 55°C Storage temperature: -40°C to 70°C
Relative humidity			Device	55% (for op and no-op temperature) with excursions up to 95% without internal condensation for a maximum of 96 h
Allowable ac component in dc control voltage supply			DC Power port	Alternating component (ripple) of 5% peak or less in the dc control voltage supply, provided the minimum instantaneous voltage is not less than 80% of rated voltage
DC rated control power inputs			DC Power port	Operating successfully over a minimum range of 85% to 110% of rated voltage at rated frequency
AC rated control power inputs			AC Power port	Operating successfully over a minimum range of 85% to 110% of rated voltage at rated frequency
Dielectric power frequency			DC and AC Power ports Binary input/output Alarm output	2kV, AC between 45Hz and 65Hz, 1min
			Signal ports (RJ45 + serial com)	500V, AC between 45Hz and 65Hz, 1min
Impulse voltage			DC and AC Power ports Binary input/output Alarm output	a) Waveform polarity: Positive and negative b) Rise Time: 1.2 µs ± 30% c) Magnitude: 5 kV +0/−10% (circuit rated upper 50V) d) Time to half value: 50 µs ± 20% e) Source impedance: 500 Ω ± 10% f) Output energy: 0.5 joules ± 10%
Fast transient waveform	IEEE C37.90:2007 - B8	CM	Power, Input / output, Data com and signal ports	4kV crest value (tolerance ± 10%)
	IEEE C37.90:2007 - B8	TM	Power and output ports	4kV crest value (tolerance ± 10%)
	IEEE C37.90:2007 - B8	TM	Watchdog	4kV crest value (tolerance ± 10%)

Surge withstand capability (SWC)	IEEE C37.90:2007 - B8	CM	Power, Input/output, Data com and signal ports	2,5kV crest value (tolerance +0/–10%.)
	IEEE C37.90:2007 - B8	TM	Power and output ports	2,5kV crest value (tolerance +0/–10%.)
Surge Immunity	IEC 61000-4-5:2005	DM	AC/DC Power, Alarm, binary Input/Output Ports	Level 4: Source impedance 2Ω, Line-to-line 2kV, coupling resistor 0Ω, coupling capacitance 18 μF
		CM		Level 4: Source impedance 2Ω, Line-to-earth 4kV, coupling resistor 10Ω, coupling capacitance 9 μF
		CM	Signal ports	Level 4: Source impedance 2Ω, Line-to-ground 4kV, coupling resistor 40Ω, coupling capacitance 0,5 μF
RF susceptibility tests	IEEE C37.90.2:2004 - B10	6 faces	Enclosure ports	a) Field strength = 20 V/m (–0 to +6 dB) un-modulated b) Sine wave amplitude modulation, 80 % AM at 1 kHz rate c) Range of 80 MHz to 1000 MHz. d) Spot frequency tests: - 80, 160 and 450MHz ±0.5% - 900MHz ±5 MHz e) Dwell time >0,5s
		6 faces	Enclosure ports	a) Field strength = 10 V/m (–0 to +6 dB) un-modulated b) Sine wave amplitude modulation, 80 % AM at 1 kHz rate; c) Range of 1000 MHz to 3800 MHz with dwell time >0,5s and frequency sweep test: 1% d) Spot frequency tests: - 1,6GHz and 3,8GHz with dwell time >1s
		6 faces	Enclosure ports	a) Pulse modulated (50% duty cycle) 8,5 V/m (–0 to +6 dB) b) Range of 1000 MHz to 6000 MHz d) Spot frequency tests: - 1,732GHz - 1,8GHz - 2,31GHz - 2,45GHz and 5,8GHz e) Dwell time >1s

Electrostatic discharge tests	IEEE Std C37.90.3:2012 - B4		Enclosure port	a) Contact discharge (direct/indirect) = 8 kV b) Air discharge (direct) = 15 kV
Immunity to conducted disturbances induced by RF fields	IEC 61000-4-6:2003 - 5		DC and AC Power ports, earth port, signal ports	Level 3: 10Vemf
Power frequency magnetic field immunity tests	IEC 61000-4-8:1993		Enclosure port	Zone A: 100A/m continuous (≥60s) 1000A/m - 3s
Damped oscillatory magnetic field tests	IEC 61000-4-10:2001		Enclosure port	Level 5: 100A/m peak Applied in all planes at: 100kHz, repetition rate ≥ 40Hz, during 60s 1MHz, repetition rate ≥ 400Hz, during 60s
Immunity to common-mode disturbances	IEC 61000-4-16:2002		DC/AC Power port, Signal ports	Level 4: 30 Vrms cont. 300 Vrms for 1 s Frequency range = 0Hz to 150kHz Coupling resistor 200Ω and coupling capacitor 1uF - DC and inputs Coupling resistor 50Ω - Ethernet ports AC main frequencies - 50 Hz and 60 Hz.
Vibration			Enclosure port	Class: V.S.2 Velocity: <10mm/s Freq range 1Hz to 150Hz
Shock			Enclosure port	Height of fall : 100mm
Device cooling				Device shall be convection cooled and shall not include internal fans or any other means of forced air circulation.

10.5 General Characteristics

Item	Description
Rated Insulation Voltage	300V
Pollution degree	2
Overvoltage category	III

10.5.1 Mechanical

Item	Description
Dimensions	W x H x D = 165 mm x 176 mm x 75 mm
Weight	1.3 kg
Mounting	DIN Rail EN50022

10.5.2 Auxiliary Power Supply

Item	Description
Supply voltage range	48 – 220 Vdc 85 – 230 Vac
Power consumption	10 W
Input Frequency voltage	The nominal frequency (fn) for the AC auxiliary voltage is dual rated at 50/60 Hz, the operating range is 44 Hz to 66 Hz

10.5.3 Auxiliary Fault Relays (Optical Port Alarm)

Item	Description
Connector	NC contact potential free
Max. switching voltage	33 VAC; 30 VDC
Max. switching current	5 A
Max. switching power	165 VA; 150 W

10.5.4 BIU261D

10.5.4.1 Power supply input voltage operative range

Nominal ranges	Operative DC range	Operative AC range
48 – 220 V_{DC}	38.4 (48-20%) – 280 V_{DC}	
85 – 230V_{AC}		72.3 (85-15%) – 253 V_{AC} (230+10%)

10.5.4.2 Maximum measured burden in Volt-ampere (VA)

Item	Power supply voltage	VA
Maximum burden AC powered on main power supply	110 Vac	23.19
Maximum burden DC powered on main power supply	110 Vdc	16,16
Maximum burden DC powered on secondary power supply	110 Vdc	16,13
Maximum burden for binary input	110,4 Vdc 220,76 Vdc	0,16 0,69

10.5.4.3 Maximum measured inrush current (Vdc)

Power input voltage (Vdc)	Measured peak current (A)	Power-up duration (ms)
110	19,4	110
220	43,8	92
50	9.7	100 - 150

10.5.4.4 Maximum measured inrush current (Vac)

Power input voltage (Vac)	Measured peak current (A)	Power-up duration (ms)
110	12,84	126
230	14,8	109

10.6 Ethernet Management

Item	Description
Standards	IEEE802.3, 802.3u, 802.3x
Forwarding mode	Store and forward
Memory bandwidth	800 Mbps
MAC Address	512
Address learning	Automatic
Illegal frame	Dropped per 802.3
Late collision	Dropped after 512 bit times
Latency	20 µs measured at 75 % load with frames length of 64 bytes between the device ports and the redundant ports. 250 µs measured at 75 % load with frames length of 1518 bytes between the device ports and the redundant ports.

10.7 Manufacturer

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Chapter 11: Glossary

100 Base-FX	The fiber optic ports are full duplex at 100 Mbps only.
10Base-T; 100Base-T and 1000Base-T	The copper ports are full/half duplex and auto-sense the transmission speed. They will auto-negotiate with the connected device to determine the optimal speed. When the connected device is only capable of transmitting at 10 Mbps, the switch makes a 10 Mbps connection.
Cat. 5, 5e and 6	Category 5, 5e and 6 unshielded twisted pair (UTP) cabling. An Ethernet network operating at 10 Mbits/second (10Base-T) will often tolerate low quality cables, but at 100 Mbits/second (10Base-T) the cable must be rated as Category 5, or Cat 5 or Cat V, by the Electronic Industry Association (EIA). This rating is printed on the cable jacket. These cables contain eight conductors, arranged in four twisted pairs, and terminated with an RJ45 type connector. In addition, there are restrictions on maximum cable length for both 10 and 100 Mbits/second networks.
CIS	Center for Internet Security The Centre for Internet Security mobilizes a broad community of stakeholders to contribute their knowledge, experience, and expertise to identify, validate, promote, and sustain the adoption of cybersecurity's best practices.
CoS	Class of Service defined in IEEE 802.1Q -17.2 (2014) Class of service (CoS), is a 3-bit field called the Priority Code Point (PCP) within an Ethernet frame header when using VLAN tagged frames as defined by IEEE 802.1Q -17.2 (2014).
DANP	Doubly attached node for Parallel Redundancy Protocol (PRP).
DANH	Double attached node for High-availability Seamless Redundancy.
Fast Ethernet	An Ethernet system that is designed to operate at 100 Mbps.
FQDN	A fully Qualified Domain Name (FQDN), sometimes also referred to as an absolute domain name, is a domain name that specifies its exact location in the tree hierarchy of the Domain Name System (DNS). It specifies all domain levels, including the top-level domain and the root zone.
Half-duplex	A system that allows packets to be transmitted and received, but not at the same time. Contrast with full-duplex.
HSR	High-availability Seamless Redundancy HSR provides zero recovery time in case of failure of one component. It is suited for applications that demand high availability and very short switch over time. Such applications are protection for electrical substation automation and controllers for synchronized drives, for instance in printing machines. For such applications, the recovery time of commonly used protocols like the Rapid Spanning Tree Protocol (RSTP) is not acceptable. HSR was standardized by the International Electrotechnical Commission, Geneva, as IEC 62439-3 (2016) Clause 5. It is one of the redundancy protocols selected for substation automation in the IEC 61850 standard. HSR is application-protocol independent and can be used by most Industrial Ethernet implementations that use the IEC 61784 suite.
HSR frame	Frame that carries as EtherType the HSR_Ethertype.
Interlink	Link that connects two network hierarchies.
LAN	Local area network.
LDAP	The Lightweight Directory Access Protocol (LDAP) is a directory service protocol that runs on a layer above the TCP/IP stack. It provides a mechanism used to connect to, search, and modify Internet directories. The LDAP directory service is based on a client-server model.
MAC address	The Media Access Control address is a unique 48-bit hardware address assigned to every network interface card. Usually written in the form 01:23:45:67:89:ab.
MIB	See “Management Information Base” in the SNMP section.

NTP	Network Time Protocol.
PHY	The OSI physical layer: The physical layer provides for transmission of cells over a physical medium.
Power management	If there is no cable on a port, most of the circuitry for that port is disabled to save power.
PRP	Parallel redundancy protocol. The redundancy protocol implement redundancy in the nodes rather than in the network, using doubly attached nodes obeying too PRP (DANPs). Achieving bumpless Ethernet connectivity using redundancy in accordance with IEC 62439-3 (2016) Clause 4.
PTP	Precision Time Protocol. Achieving highly accurate time synchronization over Ethernet in accordance with IEEE 1588/IEC 61588 (2009).
QuadBox	Quadruple port device connecting two peer HSR rings, which behave as an HSR node in each ring and is able to filter the traffic and forward it from ring to ring.
RedBox	Redundant Ethernet box. A device attaching single attached nodes to a redundant network.
RCT	Redundancy check trailer.
RMON	Remote monitoring. A network management protocol that allows network information to be gathered at a single workstation. Whereas SNMP gathers network data from a single type of Management Information Base (MIB), RMON 1 defines nine additional MIBs that provide a much richer set of data about network usage. For RMON to work, network devices, such as hubs and switches, must be designed to support it. The newest version of RMON, RMON 2, provides data about traffic at the network layer in addition to the physical layer. This allows administrators to analyze traffic by protocol.
SSH	Secured Shell. A secured encrypted network protocol for remote administration of computers.
SSL	Secured Socket Layer.
SNMP	Simple Network Management Protocol is the protocol governing network management and the monitoring of network devices and their functions.
SNTP	Simple Network Time Protocol.
Switching logic	Hardware that transmits a frame from one port to another port, possibly providing cut through.
TLS	Transport Layer Security framework provides encryption capabilities over a communication.
VDAN	Virtual doubly attached node (SAN as visible through a RedBox).
VLAN	A virtual LAN (VLAN) is any broadcast domain that is partitioned and isolated in a computer network at the data link layer (OSI layer 2). LAN is an abbreviation of local area network. To subdivide a network into virtual LANs, one configures a network switch or router.
SRP	Switch Redundant Protocol.

Chapter 12: Appendices

12.1 Appendix 1 Configuring Reason H49 from command lines

The Command Line Interface enables users to configure and manage the features of the Reason H49 switch.

The user (or client) issues commands to the program in the form of successive lines of text (command lines) through a Secure Shell (SSH) console.

12.1.1 Prerequisites

To be able to access the H49 functions from an SSH console, make sure that the PC host and the switch are connected to the same LAN on the same logical subnet.

By default, the H49's IP address is **192.168.254.254** and the H49's subnet mask is **255.255.0.0**.

To do so:

1. Open the **Control Panel** on your computer
2. Go to **Network Connections**
3. Right-click **Local Area Connection** and select **Properties**
4. Select **Internet Protocol Version 4 (TCP/IP)** and click **Properties**
5. Select **Use the following IP address** and type a compatible IP address and a sub mask of 255.255.0.0
6. Click **OK** to save the change. Reboot your PC if prompted.
7. Connect an Ethernet cable between your PC and any port on the Reason H49 switch.

Note:
The device connects to the network through a Small Form-factor Pluggable module (SFP). Refer to the Ethernet Connections section to see the references of the supported RJ45-type SFP module.

12.1.2 Accessing the SSH configuration interface

You may use any SSH tool to access the H49's configuration console.

In our example, one way of accessing the H49 through a Secure Shell (SSH) console is by using the **PuTTY** program, which can be downloaded free of charge from http://www.putty.org/.

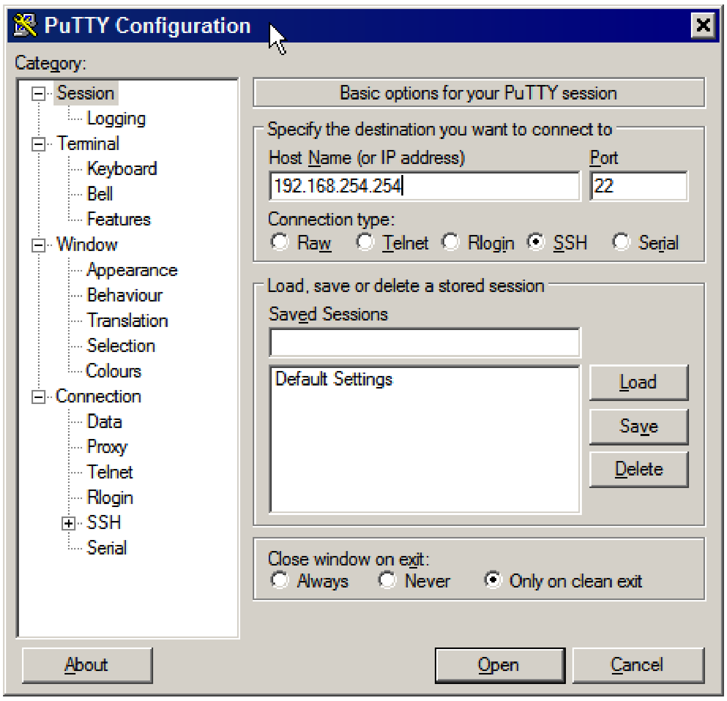
1 Start the **PuTTY** console

2 Click the **Session** menu from the tree-view on the left-side of the window

3 In the **Host Name (or IP address)** entry field, type the IP address of the switch **192.168.254.254**

4 Set the port to **22**

5 Check the **SSH** connection type and click **Open** to establish the connection:

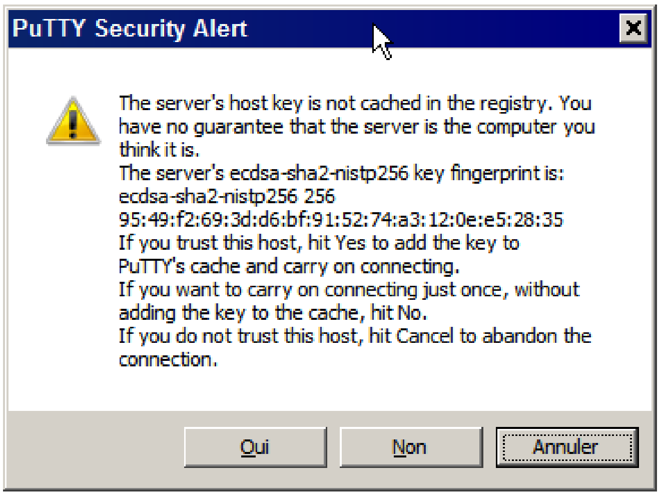


Host Name (or IP address): 192.168.254.254
Port: 22
Connection type: ○ Raw ○ Telnet ○ Rlogin ● SSH ○ Serial

Figure 95: SSH Console – Establish the connection with the H49

When starting the SSH console for the first time, a security popup window appears on screen.

6 Click **Yes** to accept the SSH key and carry on connecting:



The server's host key is not cached in the registry. You have no guarantee that the server is the computer you think it is.
The server's ecdsa-sha2-nistp256 key fingerprint is:
ecdsa-sha2-nistp256 256
95:49:f2:69:3d:d6:bf:91:52:74:a3:12:0e:e5:28:35
If you trust this host, hit Yes to add the key to PuTTY's cache and carry on connecting.
If you want to carry on connecting just once, without adding the key to the cache, hit No.
If you do not trust this host, hit Cancel to abandon the connection.

Figure 96: SSH Console – Add the SSH Key

12.1.3 Login to the H49

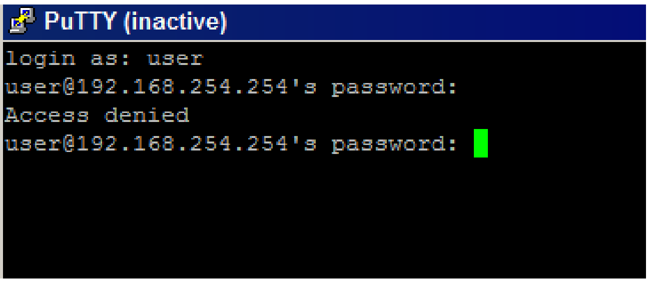
The console login screen appears. It prompts you for a login name and password.

Use the following default values:

- **Login as:** type **user** and press **Enter**
- **Password:** type **user** and press **Enter**

Note:
Login and password are case-sensitive. You can change the user name and the password later in the Command Line Interface.

If an error occurs during the authentication process, an information message appears on screen, as shown in the following figure.

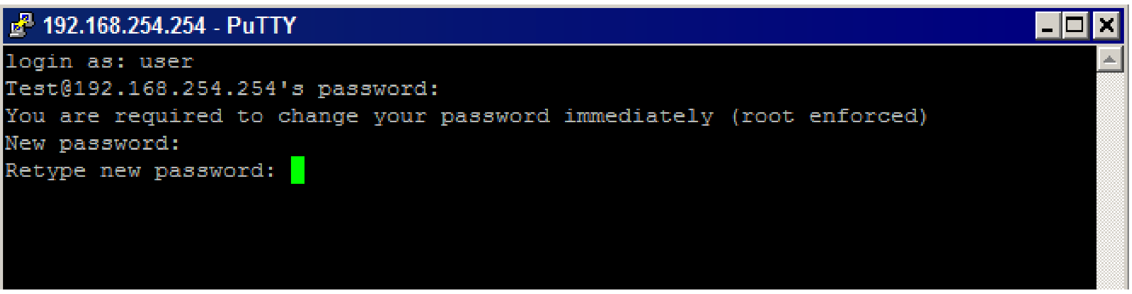


```
login as: user
user@192.168.254.254's password:
Access denied
user@192.168.254.254's password:
```

Figure 97: SSH Console – Error during the Login Process

When connecting to Reason H49 for the first time, the system prompts the user to change the default password.

- Enter a new password and confirm:

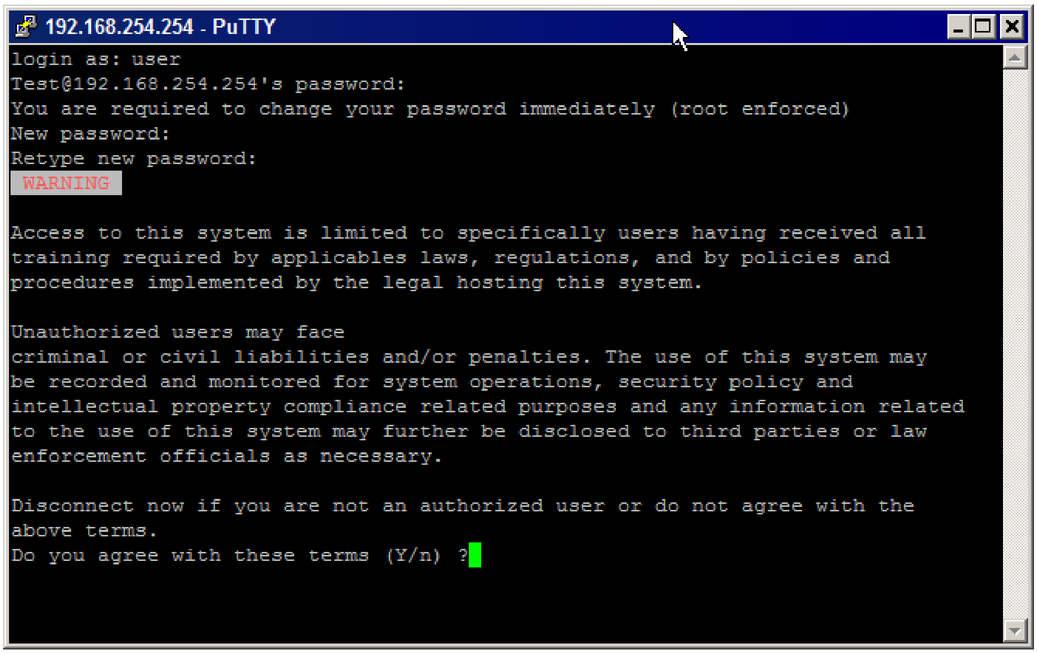


```
login as: user
Test@192.168.254.254's password:
You are required to change your password immediately (root enforced)
New password:
Retype new password:
```

Figure 98: SSH Console – Enforced Password Policy

Upon successful authentication, you are granted authorization for access.

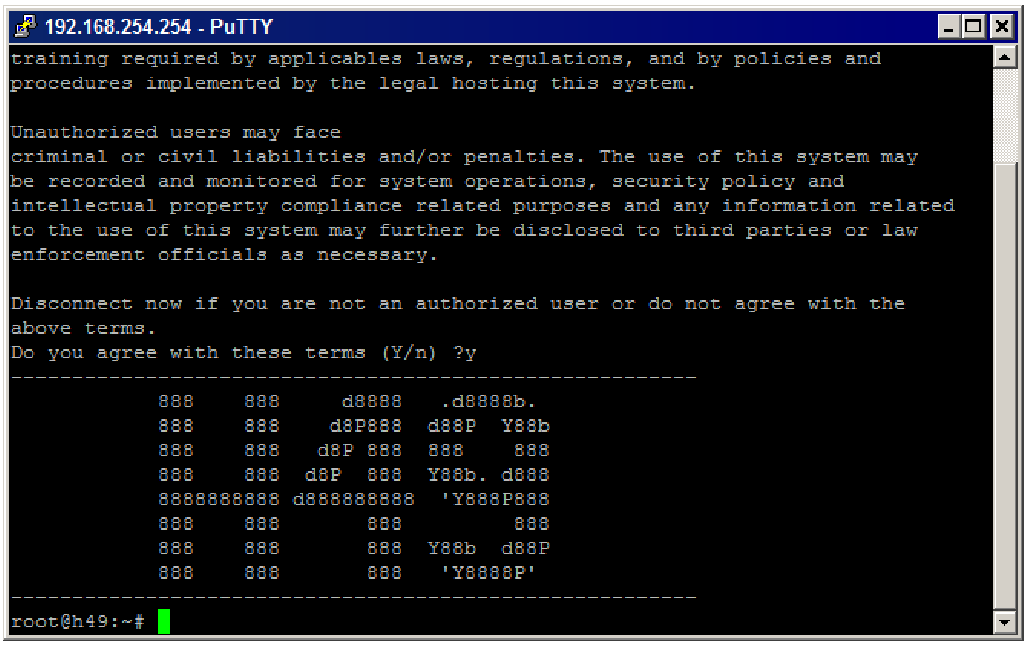
Read the License agreement and type **Y** (for yes) to agree to the terms:



```
login as: user
Test@192.168.254.254's password:
You are required to change your password immediately (root enforced)
New password:
Retype new password:
 WARNING

Access to this system is limited to specifically users having received all
training required by applicables laws, regulations, and by policies and
procedures implemented by the legal hosting this system.

Unauthorized users may face
criminal or civil liabilities and/or penalties. The use of this system may
be recorded and monitored for system operations, security policy and
intellectual property compliance related purposes and any information related
to the use of this system may further be disclosed to third parties or law
enforcement officials as necessary.

Disconnect now if you are not an authorized user or do not agree with the
above terms.
Do you agree with these terms (Y/n) ?
```

Figure 99: SSH Console – Agreement Conditions

The Reason H49's start screen appears:



```
training required by applicables laws, regulations, and by policies and
procedures implemented by the legal hosting this system.

Unauthorized users may face
criminal or civil liabilities and/or penalties. The use of this system may
be recorded and monitored for system operations, security policy and
intellectual property compliance related purposes and any information related
to the use of this system may further be disclosed to third parties or law
enforcement officials as necessary.

Disconnect now if you are not an authorized user or do not agree with the
above terms.
Do you agree with these terms (Y/n) ?y
--------------------------------------------------------
            888    888     d8888   .d8888b.
            888    888    d8P888  d88P  Y88b
            888    888   d8P 888  888    888
            888    888  d8P  888  Y88b. d888
            8888888888 d888888888  'Y888P888
            888    888       888         888
            888    888       888  Y88b  d88P
            888    888       888   'Y8888P'
--------------------------------------------------------
root@h49:~#
```

Figure 100: SSH Console – H49 Main Menu

Note:
*To modify the appearance of the SSH console, select **Appearance** under the **Window** menu and change the desired formatting options, or go to **Colours** to change the use of Foreground and Background colours.*

12.1.4 CLI Commands

This section gathers the list of command lines that can be used to configure the Reason H49 switch.

A command line is a combination of a command name, a parameter name and a parameter value:

The general format is:

- `command -parameter value`

Example: to set the H49 sub mask, you can type: `system -n 255.255.0.32`

> *Note:*
> *Command parameters are case-sensitive (for example –S has not the same effect as –s).*

12.1.4.1 Common parameters

All commands support the following parameters:

Parameter	Effect
-d	Displays the command description
-i	Displays information about the configuration
-h	Displays all parameters and values valid for the command
-v	Displays the command version
-S	Saves the settings (make the modifications permanent)
-D	Enables debugging mode.
-iy	Displays the configuration in YAML format

12.1.4.2 H49 System Commands

Switch

The `switch` command allows setting the switching mode of the device:

```
switch [-m <mode>] -S -i
```

command	parameter	Description	Values
switch	**-m**	Sets the switching mode	StoreAndForward, adaptative
	-i	Displays configuration	

Front Panel

The `frontpanel` command allows interacting with the front panel:

`frontpanel -a <ip address> -l <state>`

command	parameter	Description	Values
`frontpanel`	**`-a`**	Sets the device IP address on the front panel	xxx.xxx.xxx.xxx
	`-c`	Updates LEDs on the front panel	
	`-l`	Enables/disables led chaser	enable, disable
	`-y`	Copies the command information in a YAML format	

AlarmContact

The `alarmContact` command allows you to configure the behaviour of the alarm relay:

`alarmContact [-c <contact>] [-f <state>] -S -i`

command	parameter	Description	Values
`alarmContact`	**`-c`**	Contact number	1,2
	`-f`	Force Logic Output State	unforced, energized, unenergized

Global Status

The `system` command allows you to configure the global settings of the system.

`system [-a <IP Address>] [-n <netmask>] [-g <gateway>] [-s <DNS IP Address>] [-m <MAC Address>] [-t<name>] -S -i`

command	parameter	Description	Values	Default
`system`	**`-a`**	Sets the Reason H49 IP Address		**192.168.254.254**
	`-n`	Sets the Reason H49 net mask	0 to 32	**16**
	`-m`	Sets MAC Address. Restart is needed		
	`-c`	Sets the Reason H49 name		
	`-g`	Sets Gateway IP address		**0.0.0.0**
	`-s`	Sets DNS Server IP Address		**10.18.0.134**
	`-t`	Sets synchronization time	local, ntp, ptp	**ptp**

The following values can be set the Time zone of the Reason H49:

command	parameter	Description	Values
`timezone`	**`-z`**	Sets the time zone	

NTP

The following values can be set in the NTP configuration:

command	parameter	Description	Values
ntp	**-a**	Sets the IP address of remote NTP server	
	-c	Disables or enables the NTP client	enable, disable
	-p	Sets the poll rate of NTP client	
	-s	Disables or enables the local NTP server	enable, disable

PTP

The following values can be set in the IEEE1588-v2 PTP configuration (VLAN, PCP, Mode).

```
ptp [-m <mode>] [-s <steps>] [-p1 <priority1>] [-p2
<priority2>] [-a <domain>] -o -S -i
```

command	parameter	Description	Values
ptp	**-m**	Sets the IEEE1588-v2 operating mode	disable, ordinary, boundary
	-f	Sets the IEEE1588-v2 profile	power_2011, default_12
	-l	Sets the IEEE1588-v2 delay	disabled, <p2p> TC peer-to-peer, <e2e> TC end-to-end
	-s	Sets the IEEE1588-v2 steps	1, 2
	-p1	Sets the IEEE1588-v2 prority1	0 to 255
	-p2	Sets the IEEE1588-v2 priority2	0 to 255
	-a	Sets the IEEE1588-v2 domain	0 to 255
	-n	Sets VLAN used for PTP	0 to 4094
	-c	Sets PCP used for PTP	0 to 7
	-o	Sets the PTP synchronization to slave mode.	

Redundancy Mode

The following values can be set to configure the Reason H49 Redundancy function:

command	parameter	Description	Values
redundancy	**-l**	Sets the interlink ID	HSR-PRP-A, HSR-PRP-B
	-n	Sets the network ID	1 to 6
	-a	Sets redundancy supervision MAC address	

SNMP

SNMP is configured by manually editing the file **/etc/snmp/snmpd.conf**

command	parameter	Description	Values
snmp	**-s**	Sets the single-quoted 'configuration_line' string into the configuration. The associated line is either added or modified if already existing. The line must NOT contain single-quote characters.	See "Supported SNMP settings"
	-d	Deletes the specified item (Unique ID, see -i) where ID is of the form CLASS.id as displayed by the -i listing (eg: snmp -d ACCESS@RWGroup/usm/authPriv) or an administration command (**Great care shall be exercised in using such commands**).	
	-P	Prepares a new configuration from scratch	
	-C	Copies the current configuration to a new configuration	
	-L	Adds the single-quoted 'configuration_line' to the new configuration. The line must be valid, as it is not checked prior to being inserted in the new configuration... The line must NOT contain single-quote characters.	
	-A	Applies the new configuration after editing the config file (restarts the snmp service)	

SNMP Setting Details

Use the *snmp -s <setting>* command to get more information about the given setting.

Supported SNMP Settings

The following configuration items are currently supported (parsed):

- access
- agentAddress
- agentGroup
- agentSecName
- agentuser
- com2sec
- createUser
- disk
- engineID
- engineIDType

- group
- includeAllDisks
- iquerySecName
- load
- monitor
- proc
- rocommunity
- rouser
- rwcommunity
- rwuser
- sysContact
- sysLocation
- sysName
- sysServices
- trap2sink
- trapsink
- view

Note:
Unsupported settings are passed directly to the SNMP configuration without further checking. In the same manner, unsupported settings cannot be modified by using the **`set`** *command; they shall be deleted prior to being re-set.*
The list of currently supported settings may evolve over time. Use the **`snmp -i`** *command to see which settings are currently supported. For further detail, please refer to http://www.net-snmp.org/docs/man/snmpd.conf.html.*

Management

The following values can be set to save the Reason H49 configuration into the startup configuration file. It also makes it possible to load a new configuration without reboot.

```
configuration [-p <configuration>] [-l <filename>] -S
```

command	parameter	Description	Values
`configuration`	`-p`	Displays the running or startup configuration settings	running, startup
	`-l`	Loads the running configuration file (.YAML)	/path/file
	`-S`	Saves the settings in the startup configuration (running to startup)	
	`-f`	Sets the network-related settings to the factory default	

The following values can be set to update the firmware of Reason H49 or change the general configuration for the redundancy mode:

command	parameter	Description	Values
`firmware`	`-f`	Updates the firmware with a file (.bin)	
	`-r`	Changes the redundancy operating mode. You must restart Reason H49 to apply changes.	HSR, HSR_PRP, PRP, NONE, QUADBOX
	`-U`	Upgrades the firmware from a **.tar.gz** file. Restart is needed	
	`-u`	Url of the upgrade file (**.tar.gz** file)	

12.1.4.3 Network Commands

VLAN

The following values can be set to configure the Reason H49 VLANs:

```
vlan [-c <vlan name>] [-l <vlan Id>] [-r <vlan Id>] [-p <port
1>:<port2>...] -S -i
```

command	parameter	Description	Values
`vlan`	`-c`	Specifies the name of the VLAN to be created	
	`-l`	Specifies the VLAN ID (to be used with the –c parameter)	2 to 4094
	`-r`	Removes a port from a VLAN (can be used with the –p parameter) or deletes the VLAN. To delete a VLAN, the command has to be run into two steps: 1 Remove the related port(s) using **`vlan -r <VLAN id> -p <port01>`**. This will only delete the specified port(s), not the VLAN ID. 2 Then, run **`vlan -r <VLAN id>`** to permanently delete the VLAN (ID and Name),	
	`-s`	Specifies the VLAN name to set the port list (to be used with the –p parameter)	
	`-p`	List of ports to add, remove or set	CE01:CE02…

Interface

The following values can be set to configure the Reason H49 interfaces.

```
interface <ifname> [-D] [-d] [-h] [-i] [-v] [-y]
```

command	parameter	Description	Values
`interface`	**`ifname`**	Interface name	CE01 to CE06
	`-s`	Sets interface state	Enable, disable
	`-m`	Sets interface mode	Trunk, access
	`-k`	Sets link mode	Autoneg, 1000full, 100full, 10full
	`-l`	Sets default VLAN	1 to 4095
	`-n`	Sets default PCP	0 to 7
	`-t`	Sets VLAN tagging	Enable, disable
	`-o`	Sets default VLAN for VLAN0	0 to 4095
	`-0`	Sets priority for PCP 0	0 to 3
	`-1`	Sets priority for PCP 1	0 to 3
	`-2`	Sets priority for PCP 2	0 to 3
	`-3`	Sets priority for PCP 3	0 to 3
	`-4`	Sets priority for PCP 4	0 to 3
	`-5`	Sets priority for PCP 5	0 to 3
	`-6`	Sets priority for PCP 6	0 to 3
	`-7`	Sets priority for PCP 7	0 to 3
	`-c`	Displays port counters (to be used with –i)	
	`-f`	Displays SFP Status (to be used with –i)	

12.1.4.3.1 MAC Address Table

This command configures the MAC Address table behaviour.

```
macAddressTable [-a <Aging Time>] -S -i
```

command	parameter	Description	Values
macAddressTable	**-a**	Sets the Address Lifetime	
	-b	Sets the **Aging Base Time** i.e how long MAC addresses remain in the Ethernet switching table. Reason H49 uses a mechanism called aging to store MAC addresses in the Ethernet switching table (the MAC table). When the aging time for a MAC address in the table expires, the address is removed. For each MAC address in the Ethernet switching table, the switch records a timestamp of when the information about the network node was learned. Each time the switch detects traffic from a MAC address that is in its Ethernet switching table, it updates the timestamp of that MAC address. A timer on the switch periodically checks the timestamp, and if it is older than the value set for mac-table-aging-time, the switch removes the node's MAC address from the Ethernet switching table.	
	-f	Sets the HSR entryForgetTime	10, 20, 40, 80, 160, 320, 640, 1280

12.1.4.3.2 Filtering

The following values can be set to configure filtering and redirection policy.

This command is also used to create rules to perform specific actions on specific Mac addresses.

```
filtering <interface> -e <entry> -s <state> -a <MAC
address> -l <length> -t <type> -f <interfaces list> -p
<priority> -S -i
```

command	parameter	Description	Values
filtering	**-e**	Sets the filter entry	4 to 9
	-s	Sets the filter entry state	enable, disable
	-a	Sets the filter MAC Address	xx:xx:xx:xx:xx:xx
	-f	Sets the filter ports allowed (interfaces into which the matching frame can be forwarded).	None SE01 CE01 CE02 CE03 CE04 CE05 CE06
	-l	Sets the filter length (mask length from the start of the MAC addresses for incoming frame)	0 to 48
	-t	Sets the filter type (the source or the destination MAC address to compare).	scr, dst
	-p	Sets the priority queue	0 to 3
	-r	Displays reserved filter fields (to be used with –i)	

12.1.4.4 Security Commands

Security Settings

The following values can be set in the Security configuration to setup security options about user session and user password policy.

```
security [-d] [-h] [-v] [-I <minutes>] [-l <minutes>] [-a
<nb_max_attempts>] [-P] [-L <length>] [-i] [-f]
```

command	parameter	Description	Values
security	**-f**	Reverts the switch to factory settings (Need reboot)	
	-i	Displays information about user login and password policy	User name, <null>
	-l	Lock period in minutes	1 to 999
	-a	Maximum login attempts	3 to 10
	-I	Inactivity period to log off users	1 to 999
	-L	Minimum user's password length	
	-P	Enables / Disables password policy	Enable, Disable
	-c	sets a new LDAP certificate	
	-s	sets a new syslog certificate	
	-k	sets a new key store for Reason web user interface	

User Account

The following values can be set to configure and manage all user accounts (create, modify or delete user or user group…).

command	parameter	Description	Values
account	**-c**	Creates a new user	
	-g	Adds user role	Viewer, engineer, secadm, secaud
	-m	Modifies group GID	
	-u	Sets the user login name	
	-n	Modifies the user login name	
	-f	Modifies the user full name	
	-p	Sets a new password for a user	
	-r	Removes a user	
	-s	Enables / Disables a user account	Enable, Disable
	-R	Removes role from a user	
	-U	Unlocks user account	
	-e	Sets the expiration period for the specified user account	

LDAP Server

The following values can be set in the LDAP configuration to use Central Authentication:

command	parameter	Description	Values
`ldap`	`-a`	Sets the LDAP server's address or FQDN	
	`-p`	Sets the TCP/IP port	
	`-b`	Sets the base dn of LDAP Server Organizational Unit (ou) Domain component (dc)	
	`-r`	Sets the bind domain name to dialog with the LDAP server Common name (cn) Domain component (dc)	
	`-P`	Sets the bind domain name password	
	`-t`	Specifies a timeout after which calls to synchronous LDAP APIs will abort if no response is received	In seconds
	`-s`	Turns SSL on	
	`-e`	Turns LDAP on	
	`-x`	Turns LDAP off	

Note:
Refer to Appendix 2 for additional information about use cases of LDAP configurations.

SysLog Server

The Log command allows you to manage the log feature such as configuring the remote syslog information, enabling / disabling central logs:

command	parameter	Description	Values
`log`	`-e`	Enables central log	
	`-D`	Disables central log	
	`-S`	Sets the remote log server IP or FQDN	<server_ip_address><port>
	`-P`	Sets the TCP/IP port	
	`-p`	Sets the IP protocol for the remote log server	udp, tcp, tcp/tls
	`-r`	Sets the maximum of messages/second sent to the remote log server.	
	`-s`	Shows local log file	

Banner Text

The following values can be set to configure the login banner text to be displayed at user log on:

command	parameter	Description	Values
`bannertext`	`-a`	IP address of the remote FTP/SFTP server	
	`-D`	Enables the debug mode	
	`-f`	Path / Filename to be used	
	`-l`	Updates the banner text using a local file	/path/filename
	`-n`	User name for the remote FTP/SFTP server	
	`-m`	Updates the banner text with a message	"text"
	`-p`	Protocol to be used for the remote FTP/SFTP server	
	`-r`	Sets the banner text with a remote file.	
	`-s`	Enables/disables the banner	enable, disable

Communication Protocol

The following values can be set in the Communication Protocol configuration:

command	parameter	Description	Values
`Communicationprotocol`	`-f`	Sets the port for the FTP protocol	
	`-u`	Defines the insecure protocols (Telnet, ftp)	
	`-S`	Defines the secure protocols (SSH, SFTP)	
	`-p`	Sets the port for secure protocols	
	`-s`	Enables or disables the secure or insecure protocol	
	`-t`	Sets the port for the Telnet protocol	

12.2 Appendix 2 Command Line Use Cases

This section figures out the usage of the H49 command lines with simple examples.

> *Note:*
> *All variable parameters and values used in this section are chosen arbitrary and only for description purposes.*

12.2.1 System Commands

12.2.1.1 Redundancy

The example below shows the use of the `redundany` command line:

Command	Description
`redundany -l -n -a`	Sets the Reason H49 redundancy mode, the network ID and the redundancy supervision MAC address

Example:

```
redundancy -l HSR-PRP-A -n 2 -a 01:15:4E:00:01:00
```

12.2.1.2 System

The example below shows the use of the `system` command line:

Command	Description
`system -a -n -g -c -t`	Sets the switch IP address, netmask, name and synchronization type together with the gateway IP address

Example:

```
system -a 192.168.254.254 -n 16 -g 0.0.0.0 -c SWH49 -t ptp
```

12.2.1.3 Switch

The example below shows the use of the `switch` command line:

Command	Description
`switch -m`	Sets the switching mode

Example:

```
switch -m adaptative
```

12.2.1.4 Alarm Contact

The example below shows the use of the `alarmContact` command line:

Command	Description
`alarmContact -c -f -c -f`	Sets the Logic Output State of each contact

Example:

```
alarmContact -c 1 -f unforced -c 2 -f unforced
```

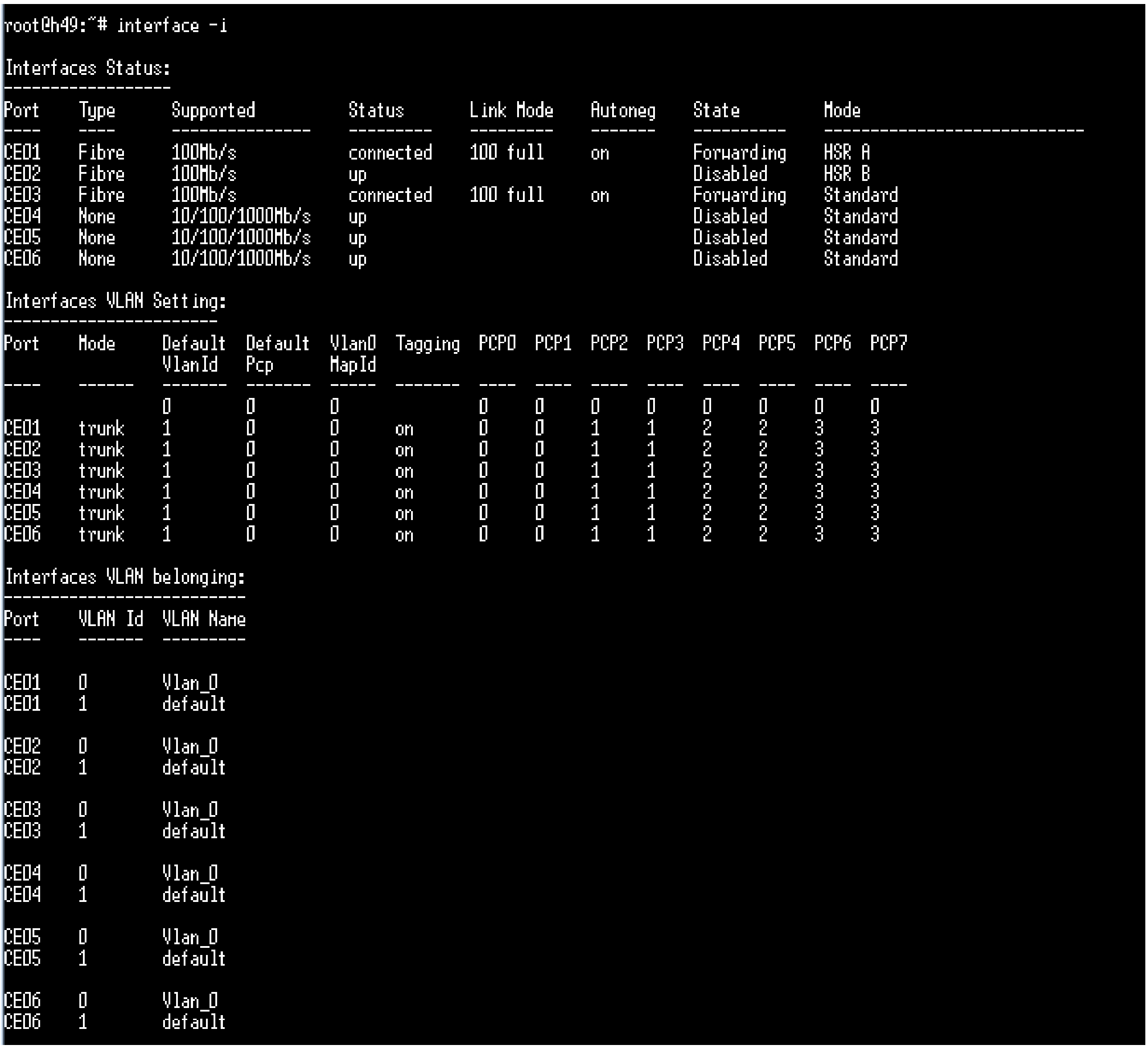
12.2.2 Networks Commands

12.2.2.1 Interface

The example below shows the use of the **`interface`** command line:

Command	Description
`Interface -i`	Shows the interface status, VLAN settings

Example:



```
root@h49:~# interface -i

Interfaces Status:
------------------
Port    Type      Supported          Status       Link Mode    Autoneg    State         Mode
----    ----      ---------------    ---------    ---------    -------    ----------    -----------------------------
CE01    Fibre     100Mb/s            connected    100 full     on         Forwarding    HSR A
CE02    Fibre     100Mb/s            up                                   Disabled      HSR B
CE03    Fibre     100Mb/s            connected    100 full     on         Forwarding    Standard
CE04    None      10/100/1000Mb/s    up                                   Disabled      Standard
CE05    None      10/100/1000Mb/s    up                                   Disabled      Standard
CE06    None      10/100/1000Mb/s    up                                   Disabled      Standard

Interfaces VLAN Setting:
------------------------
Port    Mode     Default  Default  Vlan0  Tagging  PCP0  PCP1  PCP2  PCP3  PCP4  PCP5  PCP6  PCP7
                 VlanId   Pcp      MapId
----    ------   -------  -------  -----  -------  ----  ----  ----  ----  ----  ----  ----  ----
                 0        0        0               0     0     0     0     0     0     0     0
CE01    trunk    1        0        0      on       0     0     1     1     2     2     3     3
CE02    trunk    1        0        0      on       0     0     1     1     2     2     3     3
CE03    trunk    1        0        0      on       0     0     1     1     2     2     3     3
CE04    trunk    1        0        0      on       0     0     1     1     2     2     3     3
CE05    trunk    1        0        0      on       0     0     1     1     2     2     3     3
CE06    trunk    1        0        0      on       0     0     1     1     2     2     3     3

Interfaces VLAN belonging:
--------------------------
Port    VLAN Id  VLAN Name
----    -------  ---------

CE01    0        Vlan_0
CE01    1        default

CE02    0        Vlan_0
CE02    1        default

CE03    0        Vlan_0
CE03    1        default

CE04    0        Vlan_0
CE04    1        default

CE05    0        Vlan_0
CE05    1        default

CE06    0        Vlan_0
CE06    1        default
```

12.2.2.2 VLAN

The example below shows the use of the **`vlan`** command line:

Command	Description
`vlan -c -l -p`	Sets the name of the VLAN, its ID and the ports to be added

Example:

```
vlan -c test -l 5 -s test -p CE01:CE02:CE03:CE04:CE05
```

12.2.2.3 MacAddress Table

The example below shows the use of the **`macAdressTable`** command line:

Command	Description
`macAddressTable -a -b -f`	Sets the MAC address lifetime, aging base time and HSR entry forgetTime

Example:

```
macAddressTable -a 48 -b4 -f 10
```

12.2.2.4 NTP

The example below shows the use of the **`ntp`** command line:

Command	Description
`ntp -s -c -a -p`	Disables or enables the local NTP server and client and sets the IP address of remote NTP server together with the poll rate of NTP client

Example:

```
ntp -s disable -c disable -a 127.0.0.1 -p 3
```

12.2.2.5 PTP

The example below shows the use of the **`ptp`** command line:

Command	Description
`ptp -m -l -f -p1 -p2 -a -s -c -n -S`	Sets the IEEE1588-v2 PTP configuration i.e. the operating mode, delay, profile, domain, and step together with the IEEE1588-v2 prority1 and 2, the priority code point (PCP) of the PTP frames and the VLAN used.

Example:

```
ptp -m ordinary -l p2p -f power_2011 -p1 128 -p2 128 -a 0 -s 2 -c 4 -n 0 -s 1
```

12.2.2.6 Timezone

The examples below show the use of the **`timezone`** command line:

Example of command	Description
`timezone -z <time zone>`	Sets the H49 time zone

Example:

```
timezone -z/Europe/Andorra
```

12.2.2.7 Banner Text

The examples below show the use of the **`bannertext`** command line:

12.2.2.7.1 Change Banner Text

Example of command	Description
`bannertext -M “message”`	Updates the banner text with a message

Example:

```
bannertext -M “This is a banner text“
```

12.2.3 Security Commands

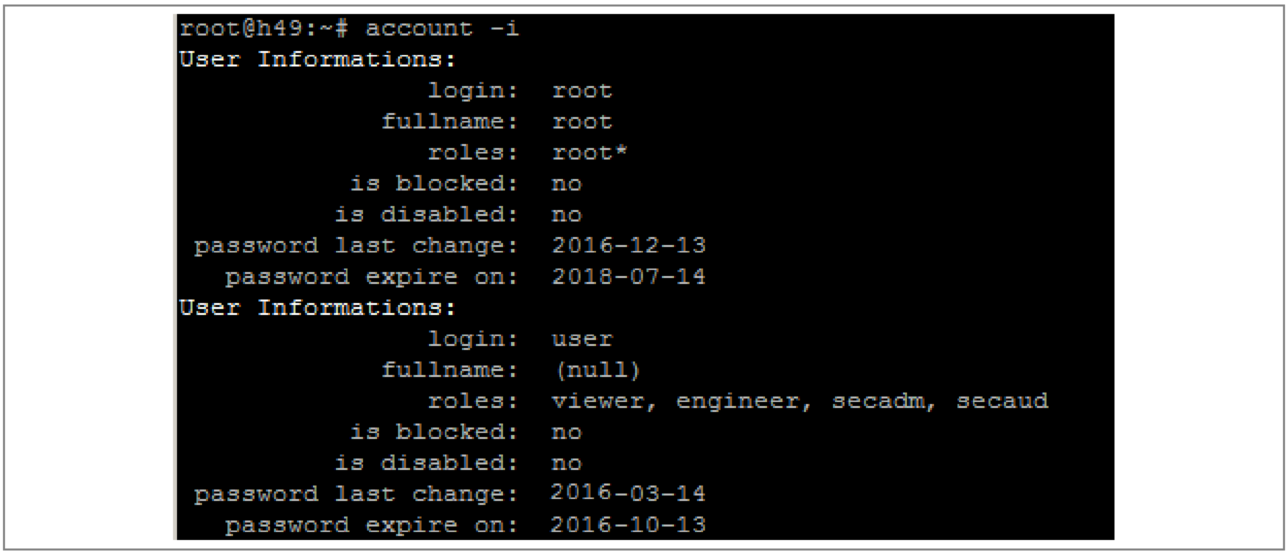
12.2.3.1 Account

The examples below show the use of the **account** command line:

Information

Example of command	Description
`account -i`	Displays information about account configuration

Example:



```
root@h49:~# account -i
User Informations:
                login:  root
             fullname:  root
                roles:  root*
           is blocked:  no
          is disabled:  no
 password last change:  2016-12-13
   password expire on:  2018-07-14
User Informations:
                login:  user
             fullname:  (null)
                roles:  viewer, engineer, secadm, secaud
           is blocked:  no
          is disabled:  no
 password last change:  2016-03-14
   password expire on:  2016-10-13
```

Figure 101: SSH Console – Information about the account configuration

Create a new user

Example of command	Description
`account -u <user_name> -c <user_group> -p <password>`	Creates a new user with a user group and a password

Example:

```
account -u JohnDoe -c secadm -p General
```

12.2.3.2 LDAP

The examples below show the use of the **`ldap`** command line:

Configure LDAP Server

Example of command	Description
`ldap -a <FQDN>,<IP_address> -p <Port_number>`	Sets the LDAP server address with an FQDN, an IP address and the port of connection

Example:

```
ldap –a kiwi.dsagile.intern,192.168.7.10 –p 389
```

Configure LDAP Base DN

Example of command	Description
`ldap -b <ou>,<dc>,<dc>`	Sets the base DN for the LDAP connection

Example:

```
ldap –b ou=DSAGILE,dc=VMADSYSLOGRADIUS,DC=DSAGILE
```

Configure User DN and Password and Timeout

Example of command	Description
`ldap -r <cn>,<cn>,<dc>,<dc> -P -t`	Sets the user DN to connect to the LDAP database, then configures the password of the user DN and the connection timeout.

Example:

```
ldap –r cn=Administrator,cn=Users,dc=VMADSYSLOGRADIOUS,dc=DSAGILE –P passAdm123 –t 2
```

> *Note:*
> *Special characters in LDAP passwords require to be written with " ” for instance ldap -P abc'**!**'xyz*

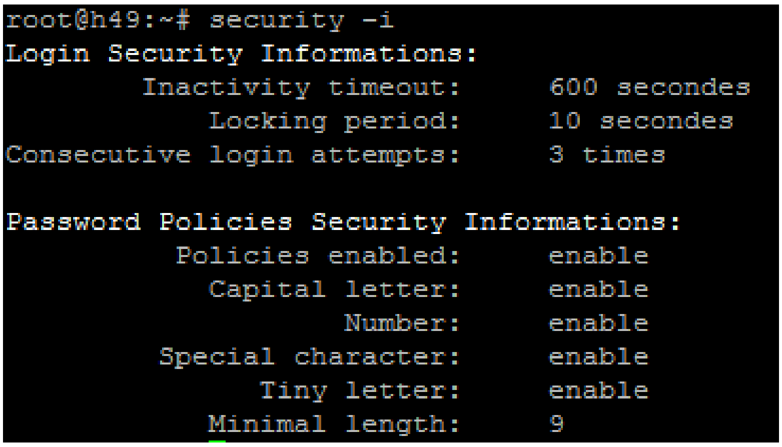
12.2.3.3 Security

The examples below show the use of the **security** command line:

Information

Example of command	Description
`security -i`	Displays information about security configuration

Example:



```
root@h49:~# security -i
Login Security Informations:
        Inactivity timeout:     600 secondes
            Locking period:     10 secondes
Consecutive login attempts:     3 times

Password Policies Security Informations:
          Policies enabled:     enable
            Capital letter:     enable
                    Number:     enable
         Special character:     enable
              Tiny letter:      enable
            Minimal length:     9
```

Figure 102: SSH Console – Information about the security configuration

Lock Period

Example of command	Description
`security -l 10`	Sets the lock period to 10 minutes

Example:

```
root@h49:~# security -l 10
```