SEL-5815

PRP Driver for Windows

Instruction Manual

20250124

SCHWEITZER ENGINEERING LABORATORIES

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General Information

This manual is intended for the following audience:

- Technical staff, which are familiar with electronic devices and Networking environment and are educated as Technicians in Electronics.
- System Administrators with networking experience.
- System Administrators, who are responsible for the installation and configuration of network equipment.

This manual provides information and instructions for installing, configuring, and operating the SEL-5815 PRP Driver. Included are detailed technical descriptions of the driver and application examples.

Typographic Conventions

The instructions in this manual indicate these options with specific font and formatting attributes. The following table lists these conventions:

Example	Description
Cancel	PC software dialog boxes and menu selections.
Start > Settings	The > character indicates submenus.
`Windows IP`	Samples of text captured from a computer monitor.

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Legal Department
GPL Compliance
Schweitzer Engineering Laboratories, Inc.
One Schweitzer Drive
Pullman, WA 99163-5603 U.S.A.

Please include your return address, product number, and firmware revision.

IEC 62439

Introduction

The IEC 62439 standard series specifies relevant principles for high availability networks that meet the requirements for industrial automation networks.

In the fault-free state of the network, the protocols of the IEC 62439 series provide ISO/IEC 8802-3 (IEEE 802.3) compatible, reliable data communication, and preserve determinism of real-time data communication. In cases of fault, removal, and insertion of a component, they provide deterministic recovery times.

These protocols retain fully the typical Ethernet communication capabilities as used in standard Ethernet networks, so that the software involved remains applicable.

The market is in need of several network solutions, each with different performance characteristics and functional capabilities, matching diverse application requirements. These solutions support different redundancy topologies and mechanisms which are introduced in IEC 62439-1 and specified in the other parts of the IEC 62439 series. IEC 62439-1 also distinguishes between the different solutions, giving guidance to the user.

IEC 62439-3/PRP

The IEC 62439-3 Standard defines the PRP Protocol.

PRP is based on a completely redundant network. Devices provide two network interfaces, each connecting to a different network. Both networks are completely independent. This approach provides a bumpless redundancy with off-the shelf networking equipment.

A PRP network supports different type of attached devices:

- **DAN, Double Attached Node.** High available nodes are attached to both redundant networks via two separate network interfaces.
- **SAN, Singly Attached Node.** Standard node without PRP functionality connected to one of the redundant networks
- **VDAN, Virtual Doubly Attached Node.** SAN as visible through a RedBox.
- **RedBox, Redundancy Box.** Connects SANs to both redundant networks.

Here is a visual representation including the different device types:

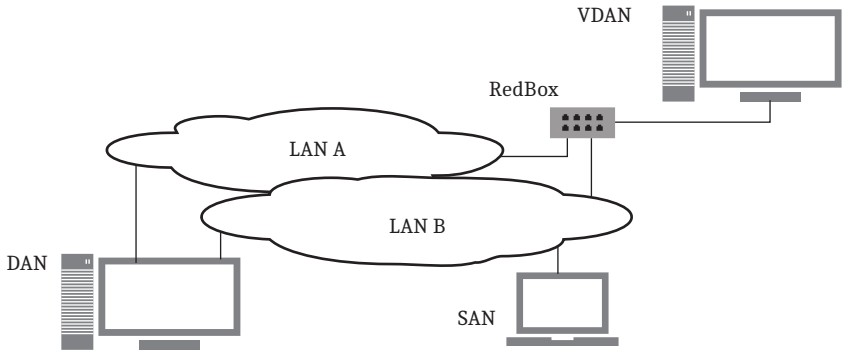

Figure 1 PRP-Network

The network stack of two connected DAN devices is shown in *Figure 1*:

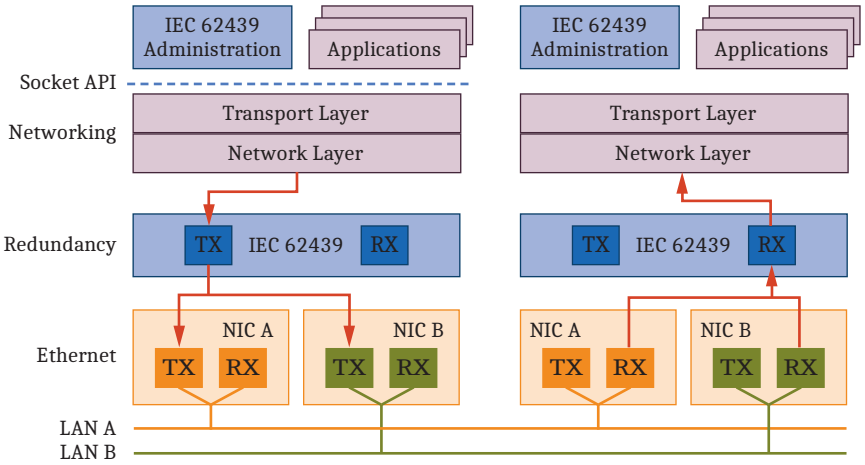

Figure 2 PRP Device Stack

Installation

System Requirements

- Microsoft Windows 10 x64 or Server 2016 or newer Operating System
- Two or more Ethernet network adapters

Networking

The system must have at least two physical network adapters available. For example running 'ipconfig' from a command prompt should produce a list with two Ethernet adapters as shown:

```
C:\Windows\System32>ipconfig <Enter>

Windows IP Configuration

Ethernet adapter LAN A1:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::df9:4f46:b0a8:eb4a%21
   Autoconfiguration IPv4 Address. . : 169.254.235.74
   Subnet Mask . . . . . . . . . . . : 255.255.0.0
   Default Gateway . . . . . . . . . :

Ethernet adapter LAN B1:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::6151:2007:9ab4:e96a%19
   Autoconfiguration IPv4 Address. . : 169.254.233.106
   Subnet Mask . . . . . . . . . . . : 255.255.0.0
   Default Gateway . . . . . . . . . :

...
```

Driver Installation and Removal

The SEL-5815 PRP Driver for Windows follows standard software installation and removal conventions typical for Windows operating systems. If you require guidance, the installation package will include a file named Readme.txt which includes installation instructions and system requirements.

Licensing

To purchase an SEL-5815 PRP Driver for Windows license, contact your local SEL sales representative. Once you have purchased a license, you can install and remove the license on a system by using these four functions of the SEL-5815 License Manager:

- *Internet Activate*
- *Internet Deactivate*
- *Manual Activate*
- *Manual Deactivate*

Systems that have internet access should use the Internet Activate and Internet Deactivate functions, while systems without internet access must use the Manual Activate and Deactivate functions. These four functions are initiated using the four buttons at the bottom-left corner of the SEL-5815 License Manager application, as shown in *Figure 3*.

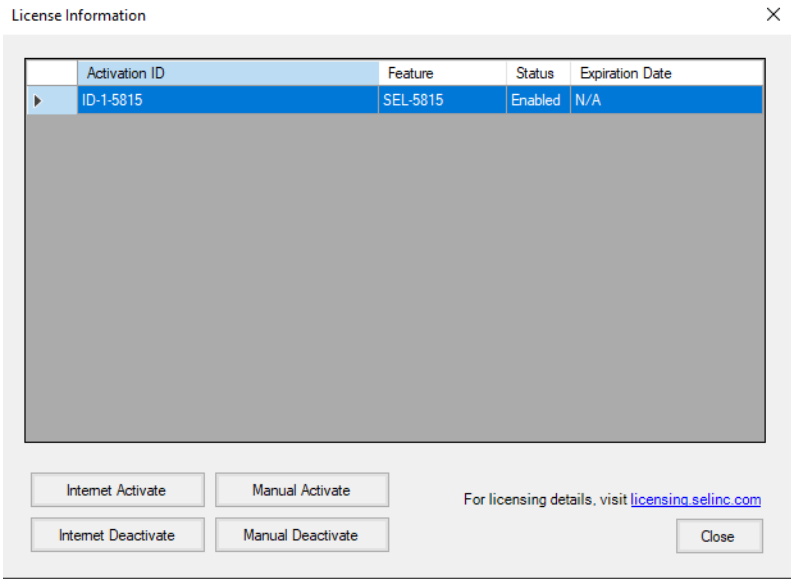

Figure 3 SEL-5815 License Manager

Internet Activate

Step 1. Open the SEL-5815 License Manager application under SEL-5815 PRP Driver for Windows from the Windows Start menu.

Step 2. From the License Information form, click **Internet Activate**.

Step 3. At the Enter Activation ID window, enter the Activation ID you received when you purchased your license.

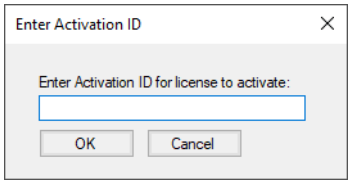

Figure 4 Enter Activation ID

Step 4. Click **OK**. When you successfully activate your license, the License Information window displays your active license information.

Internet Deactivate

Step 1. Open the SEL-5815 License Manager application under SEL-5815 PRP Driver for Windows from the Windows Start menu.

Step 2. From the License Information window, click **Internet Deactivate**.

Step 3. Click **OK** in the confirmation prompt. When you successfully deactivate your license, the License Information window no longer displays your active license for the deactivated Activation ID.

Manual Activate

Step 1. Open the SEL-5815 License Manager application under SEL-5815 PRP Driver for Windows from the Windows Start menu.

Step 2. From the License Information window, click **Manual Activate**.

Step 3. From the Manual Activate window, click **Generate Capability Request File**.

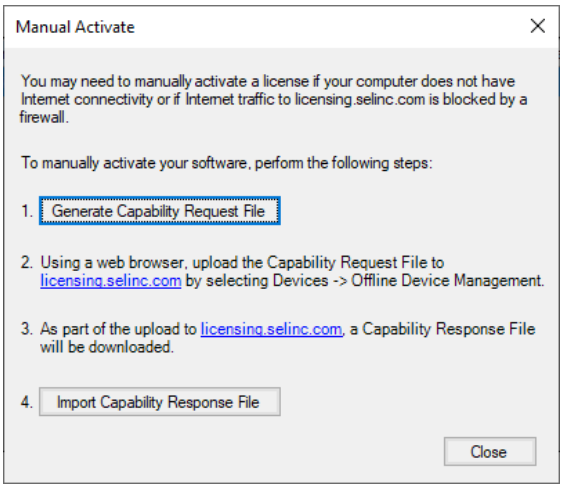

Figure 5 Generate Capability Request File for Manual Activation

Step 4. At the Enter Activation ID prompt, enter the Activation ID you received when you purchased your license and click **OK**.

Step 5. Save the Capability Request File to a portable drive or a network drive that can be accessed by a separate computer that has internet access, or email the Capability Request File to SEL

Step 6. From a computer that has internet access, go to https://licensing.selinc.com and log in with the Activation ID you are activating.

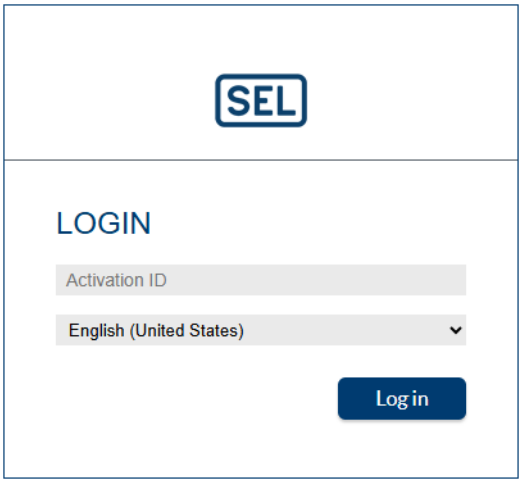

Figure 6 Log In With Activation ID

Step 7. From the License & Delivery Portal page, click the **Devices** tab and click **Offline Device Management**.

Step 8. From the **Offline Device Management** page, click **Choose File** and select the Capability Request File saved in *Step 5*. Click **Upload**.

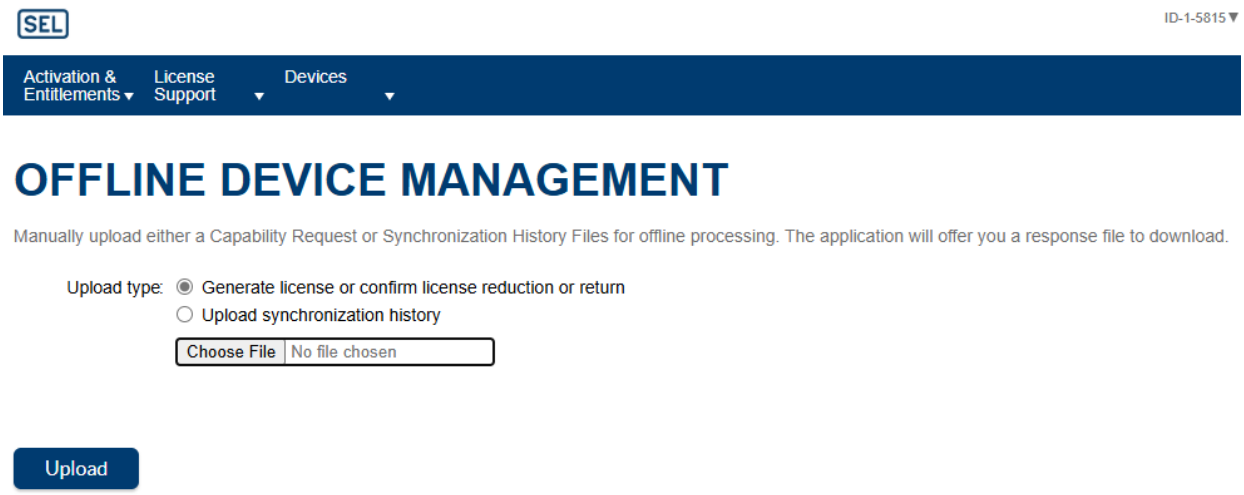

Figure 7 Upload Capability Request

Step 9. Click the link highlighted in *Figure 8* to download the Capability Response file.

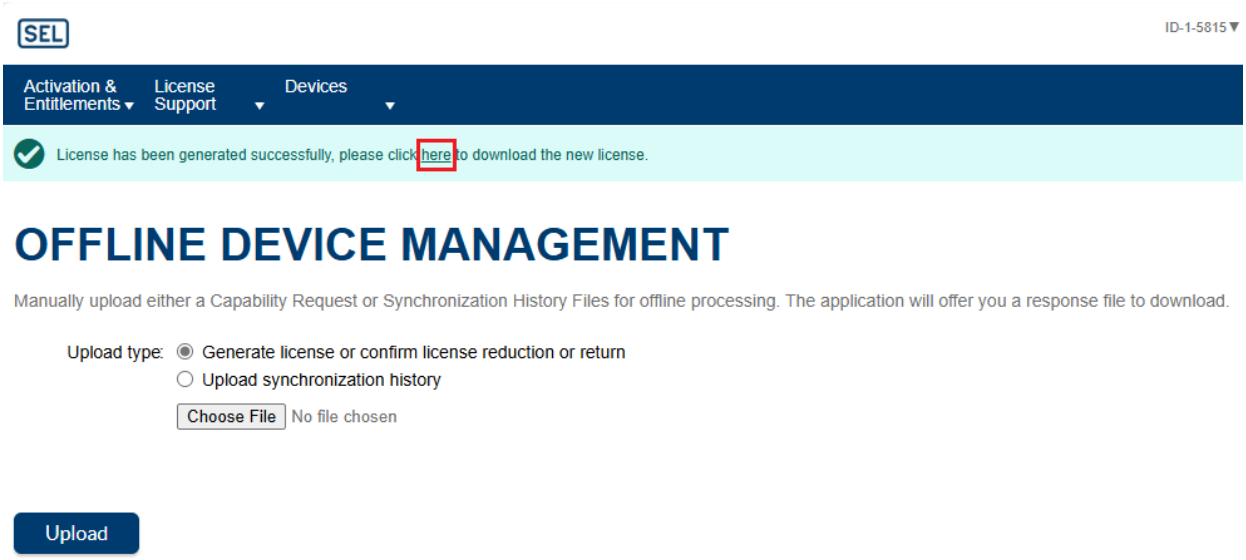

Figure 8 Download Capability Response File

Step 10. Save the downloaded Capability Response File to the portable drive or network drive used in *Step 5*.

Step 11. Return to the computer where the license is being activated.

Step 12. From the Manual Activate form, click **Import Capability Response File**.

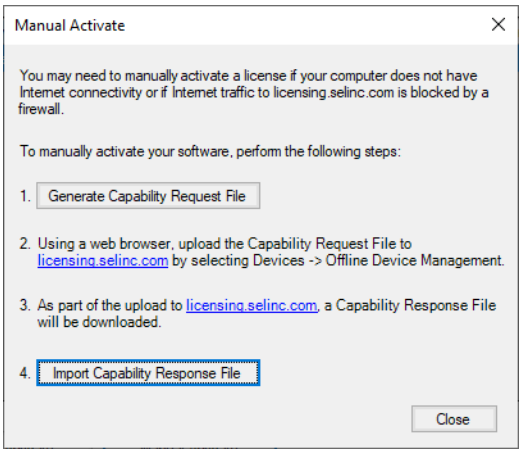

Figure 9 Import Capability Response File

Step 13. Navigate to the location of the Capability Response File created in *Step 10* and click **Open**.

Step 14. Click **Close** on the Manual Activate form. The License Information screen now displays the activated license.

Manual Deactivate

Step 1. Open the SEL-5815 License Manager application under SEL-5815 PRP Driver for Windows from the Windows Start menu.

Step 2. From the License Information form, click **Manual Deactivate**.

Step 3. From the Manual Deactivate screen, click **Generate Capability Request File**.

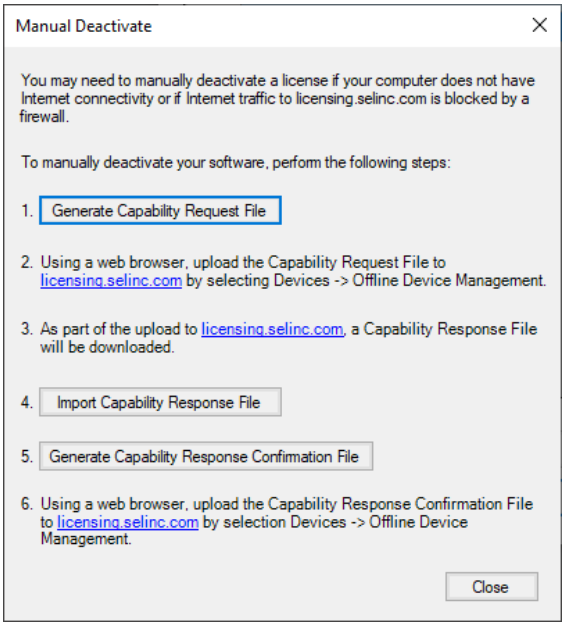

Figure 10 Generate Capability Request File for Manual Deactivation

Step 4. Save the Capability Request File to a portable drive or a network drive that can be accessed by a separate computer that has Internet access, or email the Capability Request File to SEL.

Step 5. From a computer that has internet access, go to https://licensing.selinc.com and sign in with the Activation ID you are deactivating.

Step 6. From the License & Delivery Portal page, click the **Devices** tab and click **Offline Device Management**.

Step 7. From the Upload Capability Request page shown in *Figure 7*, click **Choose a File**, and select the Capability Request File saved in *Step 4*. Click **Upload**.

Step 8. Click the link highlighted in *Figure 8* to download the Capability Response file.

Step 9. Click **Save**, then copy the saved Capability Response File to the portable drive or network drive used in *Step 4*.

Step 10. Return to the computer where the license is being deactivated.

Step 11. From the Manual Deactivate form, click **Import Capability Response File**.

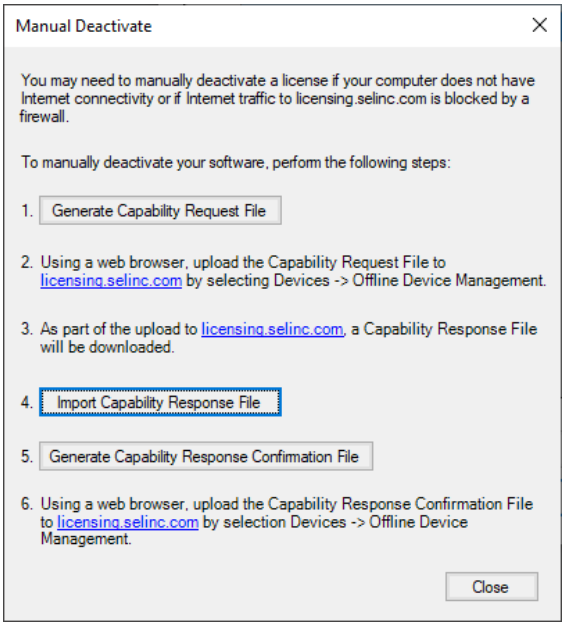

Figure 11 Import Capability Response File

Step 12. Browse to the location of the Capability Response File created in *Step 9* and click **Open**.

Step 13. From the Manual Deactivate screen, click **Generate Capability Response Confirmation File**.

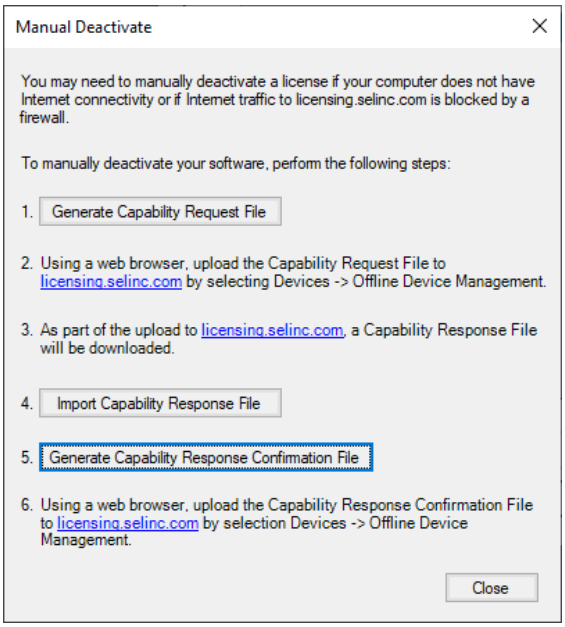

Figure 12 Generate Capability Response Confirmation File

Step 14. Provide a name and location to save the Capability Response Confirmation File to a removable drive or a network drive that you can access on a separate computer that has Internet access, then click **Save**. Do not close the Manual Deactivate form.

Step 15. From a computer that has internet access, go to https://licensing.selinc.com and log in with the Activation ID you are deactivating.

Step 16. From the License & Delivery Portal page, click the **Devices** tab and click **Offline Device Management**.

Step 17. From the Upload Capability Request page, click **Choose a File**, click the **Capability Response Confirmation File** saved in *Step 14*, and click **Upload**. After you upload the confirmation file, the FlexNet software generates another response file. This additional response file is not required and does not need to be downloaded.

Step 18. Return to the computer on which the license is being deactived and click **Close** on the Manual Deactivate form. The Activation ID that was deactivated no longer shows in the License Information screen.

Configuration

Creating Virtual Adapters

The SEL IEC 62439 Configuration application can be accessed from the Windows Start menu:

Start > SEL-5815 PRP Driver for Windows > IEC 62439-3 PRP Configuration

NOTE: The SEL-5815 PRP Driver for Windows must be licensed before you can begin configuration. If you are unable to run the configuration application, see *Licensing* to install the license and check the license status.

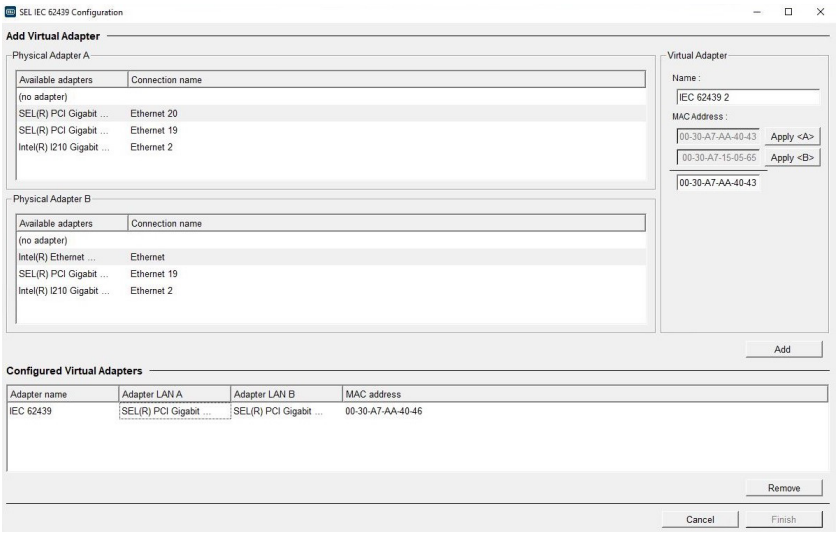

Figure 13 SEL IEC 62439 Configuration

The SEL IEC 62439 Configuration application shows all network physical adapters available on the system which can be "paired" to create PRP Virtual Adapters.

To create a new virtual adapter, first select one physical adapter from each Physical Adapter list. Enter a Name for the virtual adapter, then choose one of the physical MAC addresses, or type a valid unique MAC address. Click **Add** to confirm the selection. The new virtual adapter will be added to the Configured Virtual Adapters list, and the two physical adapters will disappear from the Physical Adapter lists.

NOTE: The IEC 62439-3 PRP Configuration application will check whether "global" and "local" bits of the MAC address are set correctly. Further MAC conflicts will not be detected.

To remove a virtual adapter, select the adapter in the Configured Virtual Adapters list and then click the **Remove** button. Once the virtual adapter is removed, the physical adapters that were part of that virtual adapter will reappear in the Physical Adapter lists.

Click **Finish** to complete the configuration and close the application, or **Cancel** to discard changes and close the application.

Using Virtual Adapters

Virtual Adapters can be configured through the OS the same as physical adapters. For example, running ipconfig from a command prompt will list all available Physical and PRP Virtual Adapters:

```
C:\Windows\System32>ipconfig /all <Enter>

Windows IP Configuration

...

Ethernet adapter Local Area Connection 3:

   Connection-specific DNS Suffix . :
   Description . . . . . . . . . . . : IEC 62439
   Physical Address. . . . . . . . . : 08-00-27-93-BA-CC
   DHCP Enabled. . . . . . . . . . . : Yes
   Autoconfiguration Enabled . . . . : Yes
   Link-local IPv6 Address . . . . . : fe80::c8b3:e362:74d0:22b9%35(Preferred)
   Autoconfiguration IPv4 Address. . : 169.254.34.185(Preferred)
   Subnet Mask . . . . . . . . . . . : 255.255.0.0
   Default Gateway . . . . . . . . . :

...
```

IP Settings

The settings for new Virtual Adapters is for the IP address to be automatically configured (DHCP) and have IPv4/IPv6 enabled. To change this behavior, go to Windows Network Settings and open the Properties window of the Virtual Adapter.

Maintenance

Driver Management

The SEL IEC 62439 PRP Management application can be accessed from the Windows Start menu:

Start > SEL-5815 PRP Driver for Windows > IEC 62439-3 PRP Management

Main features of the SEL IEC 62439 Management application are as follows:

- Surveillance — Overview of all Virtual Adapters
- Adapters — Details for each Virtual Adapter
  - Statistics
  - Node Table
  - Settings
- About — Version, End User License Agreement and Instruction Manual links

Surveillance

The Surveillance tab displays the operating state of each virtual adapter.

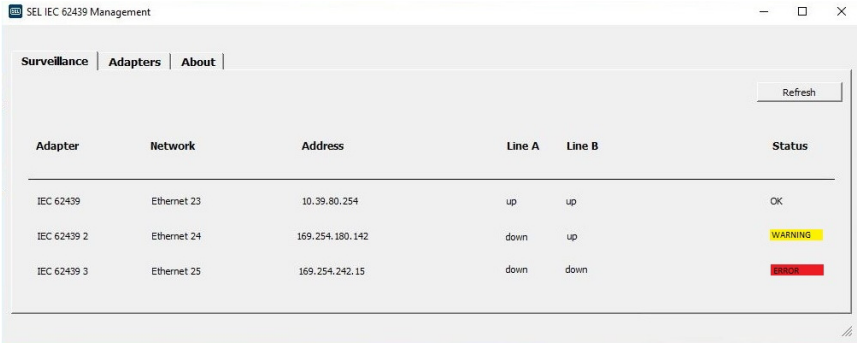

Figure 14 SEL IEC 62439 Management–Surveillance

The first column shows the virtual adapter names given during configuration. The Network column lists the name shown in the Windows Network Connections settings window. The Line A and Line B columns display either up (if the physical interface is ready) or down (if not ready). The Status column can show one of the following values:

- **OK**. Normal status, both physical adapters are up.
- **WARNING**. One physical adapter is down or Redundancy Status warning.
- **ERROR**. Both physical adapters are down or Redundancy Status error.

When the Status is WARNING or ERROR, position the mouse pointer over the status to display additional status information. Detailed status information is provided in *Table 1*:

Table 1 Status Information (Sheet 1 of 2)

Status	Status Information	Details
ERROR	Interface Down	Both physical lines are down. No network connection available.
	No Network Connection	No network data received on both lines. No network connection available.
	No Redundancy	No incoming supervision frames received. No network connection available.
	Erroneous Frames	Erroneous frames on any line detected. Erroneous frames are dropped and redundancy is not guaranteed.
WARNING	Duplicate Accept	This node has been configured to duplicate accept mode. All frames are passed twice to upper layer.
	Frames On Wrong Line	There are incoming frames on the wrong line. Most probably a configuration issue.
	Line Down	One physical line is down. Redundancy not available.
	Line Not Connected	No incoming packets on one line. Network connection loss on one line.

Table 1 Status Information (Sheet 2 of 2)

Status	Status Information	Details
	Node Table Overflow	The node table is full – there are too many nodes in the network. Nodes which are not stored in the node table are treated as DAN-P Duplicate Accept (keep both frames).
	Frames Removed From Duplicate Table	Frames have been removed from duplicate table because EntryForgetTime has elapsed. Those frames are passed twice to upper layer.
	Duplicate Table Overrun	Frames have been removed from the duplicate table because table is full. Those frames are not treated as duplicate candidates and are passed twice to upper layer.
	Invalid RCT	Incoming packets with invalid redundancy trailer detected. Those packets are sent to upper layer, because duplicate detection does not work on those frames.

Adapter Statistics

On the Adapters tab, click the Statistics button to view the statistics of each virtual adapter, including physical line related statistics and virtual adapter global values.

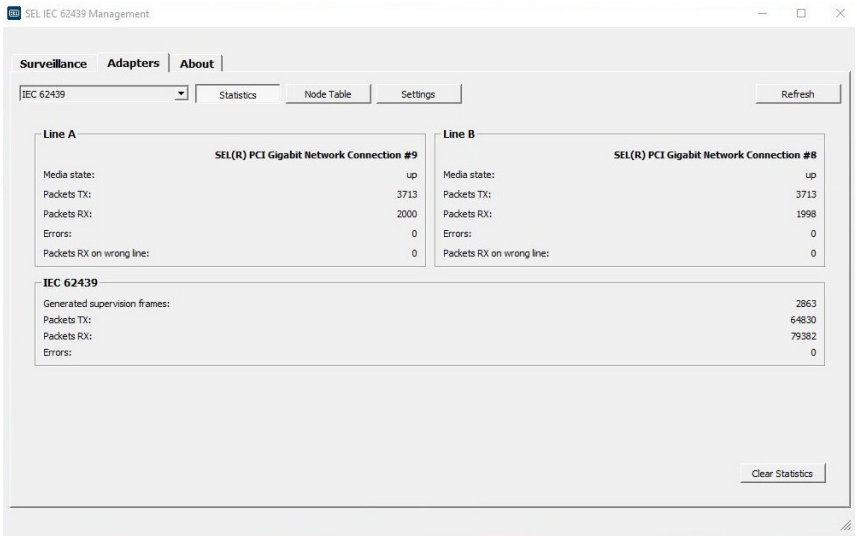

Figure 15 SEL IEC 62439 Management—Adapter Statistics

For each physical line the following values are reported:

Table 2 SEL IEC 62439 Management—Adapter Statistic Values

Media state	Displays whether the physical line is up or down.
Packets TX	The count of redundancy packets transmitted through the underling physical line.
Packets RX	The count of redundancy packets received by underling physical line.
Errors	The count of redundancy errors coming from the underling physical line.
Packets RX on wrong line	The count of packets received on the wrong line. This is an indicator that a physical line is connected to the wrong redundant network!

The global statistics gives the following information:

Table 3 SEL IEC 62439 Management—Global Statistic Values

Generated supervision on frames	Number of supervision frames injected from the virtual adapter.
Packets TX	Number of packets sent by the application interface.
Packets RX	Number of packets the adapter received for processing from the underling lines.
Errors	Generic errors like node table error. Zero for proper operation.

Adapter Node Table

The Adapter Node Table displays a list of all remote nodes (network devices) that the virtual adapter has discovered, in order to track packet redundancy. *Figure 16* shows an example node table.

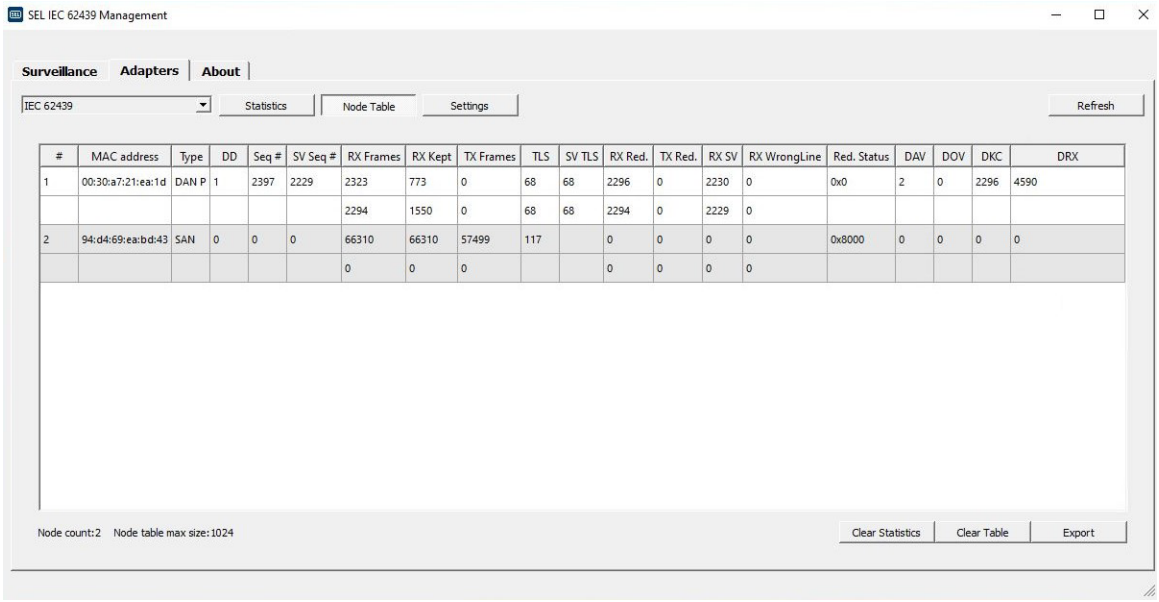

Figure 16 SEL IEC 62439 Management—Adapter Node Table

Table 4 Description of Adapter Node Table Fields (Sheet 1 of 2)

#	Number of the entry.
MAC address	Ethernet address (MAC). Shows the MAC address of the remote node. This field is the unique primary key of the node table entry.

Table 4 Description of Adapter Node Table Fields (Sheet 2 of 2)

Type	Node Type (SAN A, SAN B, SAN AB, DAN, VDAN, RedBox). The additional letter is for the redundancy protocol (P: PRP, H: HSR).
DD	Duplicate Discard. Shows if duplicates will be discarded by this given remote node. If DD is set to 1 Duplicate Discard is enabled. 0 means that this node is a SAN, a DAN with incompatible algorithm (e.g. PRP v0 or HSR), configured to Duplicate Accept mode or supervision frames are lost.
Seq #	Frame Sequence Number. Shows the frame sequence number of the last received frame from this node. This sequence number is part of the Redundancy Control Trailer (RCT) of each frame.
SV Seq #	Supervision Frame Sequence Number. Shows the sequence number of the last received supervision frame from this node. This sequence number is part of the supervision frame format (not in RCT).
RX Frames	Incoming Frames. Shows the total number of received frames per line (including non-redundant frames).
RX Kept	Kept Incoming Frames. Shows the number of incoming frames per line passed to the upper layer. Those frames may be non-redundant frames (DD set to 0) or redundant frames which are not duplicates (e.g. the first arrived frame). In a proper Duplicate Discard setup the sum of both RX Kept counters should match RX Frames per line.
TX Frames	Outgoing Frames. Shows the total number of sent frames per line (including non-redundant frames).
TLS	Time Last Seen. Shows the elapsed time in ms since reception of the latest packet.
SV TLS	Supervision Time Last Seen. Shows the elapsed time in ms since reception of the latest supervision frame. This time must not exceed Life Check Interval.
RX Red.	Incoming Redundant Frames. Shows the number of received frames with a valid redundancy trailer (= number of PRP frames).
TX Red.	Outgoing Redundant Frames. Shows the number of sent frames with a valid redundancy trailer (= number of PRP frames).
RX SV	Incoming Supervision Frames. Shows the number of received supervision frames from this node.
RX WrongLine	Incoming Frames on wrong line (error counter). Shows how many frames have been received on the wrong line (e.g. line identifier in the RCT was wrong). If this counter is continuously increasing, the redundancy behavior is critical and needs to be reviewed!
Red. Status	Redundancy Status. Shows an Error code if something on the connected node may be wrong. This field is not “self-healing”. Errors don’t disappear until the node table is cleared. Error numbers can be shown as combined errors. See table below for redundancy status error numbers.
DAV	Duplicates Aged. No duplicate received within aging time-out period. This may happen if a duplicate is lost or if the delay between line A and line B exceeds the aging time-out, which is configured to 400ms by default. If this counter is continuously increasing, the redundancy behavior is critical and needs to be reviewed!
DOV	Duplicates Overwritten. Duplicate detection failure caused by ring-buffer overflow. This may happen if the driver receives a burst of packets on one line before they arrive on the other line. If this counter is continuously increasing, the redundancy behavior is critical and needs to be reviewed!
DKC	Duplicates Kept. Duplicates which have not been discarded (incl. DAV & DOV frames). As long as DAV and DOV counters are set to 0, this counter should match the sum of RX Kept frames.
DRX	Duplicates Received. Frames which have passed the Duplicate Discard algorithm includes all discarded frames.

Table 5 Redundancy Status Error Numbers

Error	Short Name	Description
0x1	TLS_A	Supervision Time last seen on Line A is higher than the live check interval.
0x2	TLS_B	Supervision Time last seen on Line B is higher than the live check interval.
0xC	PDIFF_AB	There is a difference > 16 between the received supervision frames from line A and B.
0x30	TDIFF_AB	There is a time difference between the last received packet on line A and B which is more than 400 ms.
0x40	DOWN_A	Line A is down.
0x80	DOWN_B	Line B is down.
0x100	WLINE_A	There are Packets from Line B on Line A (Packets on wrong line).
0x200	WLINE_B	There are Packets from Line A on Line B (Packets on wrong line).
0x8000	SAN	This node is a SAN.

Adapter Settings

The virtual adapter settings can be viewed by any user. To modify settings, run the SEL IEC 62439 Management application as an Administrator, then click the **Edit** button on the Adapter Settings screen.

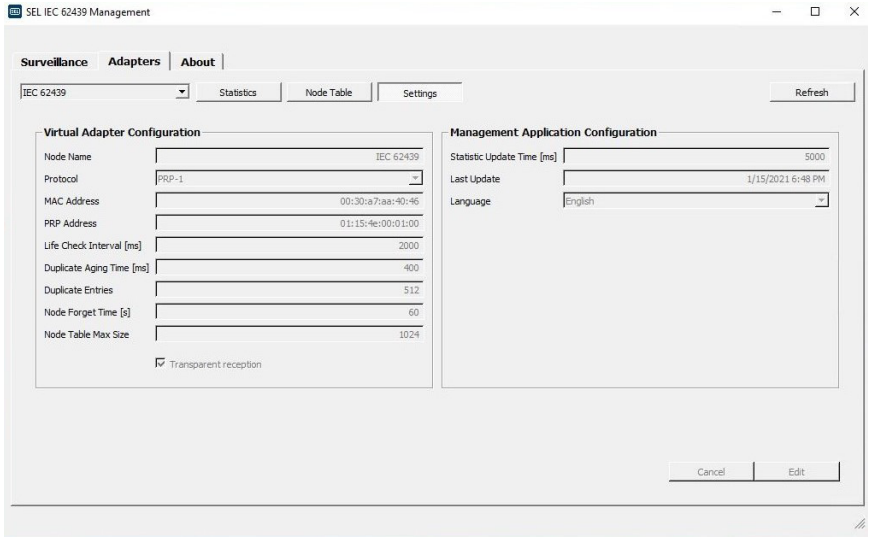

Figure 17 SEL IEC 62439 Management—Adapter Settings

Table 6 Description of Adapter Settings Fields (Sheet 1 of 2)

Node Name	The node name assigned to this virtual adapter. Maximum 32 characters.
Protocol	The protocol version to be used. Currently only PRP-1 is supported.
MAC Address	The MAC-address of the virtual adapter (READ ONLY).
PRP Address	The PRP-address of the virtual adapter. Only the last two digits can be changed. Range: 00–FF (hex).
Life Check Interval [ms]	The time period between each supervision frame. Range: 500–3,600,000 ms.

Table 6 Description of Adapter Settings Fields (Sheet 2 of 2)

Duplicate Aging Time [ms]	Time period for a packet to age out of the duplicate discard algorithm. Range: 16–4095 ms.
Duplicate Entries	Number of packets tracked by the duplicate discard algorithm. Range: 32–1024.
Node Forget Time [s]	Time period of inactivity for a node to age out of the node table. Range: 10–3600 s.
Node Table Max Size	Number of nodes stored in the node table. Range: 64–2048.
Transparent Reception	When enabled, the virtual adapter will not remove the PRP header from received packets.
Statistic Update Time [ms]	Update interval of the statistic in the Management application. Range: 0 (off); 100–3,600,000 ms.
Last Update	Time of the last statistic update (READ ONLY)
Language	Language of the Management application.

About

The About Tab displays the version information, a link to the End User License Agreement, and a link to the Instruction Manual.

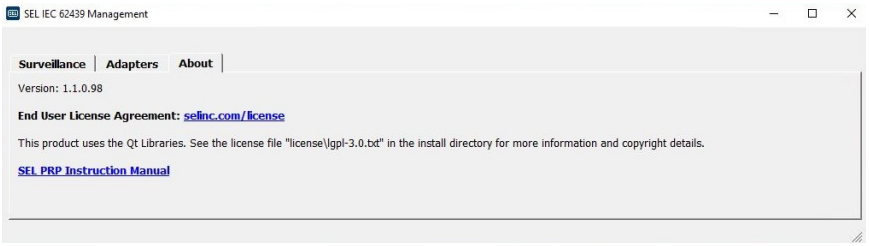

Figure 18 SEL IEC 62439 Management—Info

SNMP Extension

The SEL-5815 PRP Driver for Windows can be managed using the SNMP extension. This extension can be enabled during the software installation process, or it can also be enabled and disabled by clicking the IEC 62439-3 SNMP Enable/Disable items in the Windows Start Menu under SEL-5815 PRP Driver for Windows > SNMP Extension Agent.

Refer to *Appendix B: IEC 62439 MIB* on page 22 for the Root OID.

Troubleshooting

Health Check

Use of the SEL IEC 62439 Management application or SNMP Extension helps to detect problems. Below is a list of statistics that provide an overview of the redundancy health:

1. Media State for Line A / B should be “up”
2. TX and RX Counters for Line A / B should increment, but not necessarily symmetrically.
3. Errors Counters for Line A / B should be zero

4. Wrong LAN Counters for Line A / B should be zero
5. Node Table count should reflect at least the number of Duplicate Attached Nodes.

Common Operation Oversights

Table 7 Troubleshooting—Common Problems and Solutions (Sheet 1 of 2)

Problem	Solution
There is no communication	Use classical approach as for any network interface: ➤ Check the link LEDs ➤ Check the network configuration (IP, etc.) ➤ Test the connection running a “ping” If the problem cannot be determined, contact your network administrator or SEL support.
The Wrong Line counters are incrementing	Some redundant devices are attached on the wrong LAN. To identify the device, look at the Node Table.
The Wrong Line counters are incremented as fast as the RX counters	The physical line/adapter is attached to the wrong LAN.
Media State of Line A or B is “down”	The physical line/adapter is not attached to the LAN.
Line A/B has “up” link, but the RX counters are not increasing	The RX counters increment even if there is no application specific network traffic through the supervision frames. This situation means that link is down on LAN A/B or the traffic is blocked.
The Device does not appear as “DANP” in the node table of other devices	Supervision frames are sent on both interfaces, so even if one interface is “down”, the device should be recognized as DANP. Verify the following settings on all nodes: ➤ Correct PRP Address ➤ Life Check Interval is greater than the Node Forget Time of the other nodes Furthermore, the Sent Supervision frame counter should increment at Life check interval rate.
The Line A/B Error counters are incremented	Theses counters are incremented by: ➤ Reception of an illegal supervision frame ➤ Reception of a packet with illegal Redundancy Control Trailer (RCT) This means that a noncompliant Redundant Device is present on LAN A/B. In such a case, try to determine the device which is noncompliant using a network traffic capture application.
The Node Table contains fewer nodes than expected	Only Redundant Devices (DAN, etc.) should be persistent in the node table. Other devices (SAN) appear only when they generate traffic for this node. If some Redundant Devices are not listed, check if the Node Forget Time setting is appropriate.
The Node Table contains too many nodes	Check if the Node Forget Time setting is appropriate.

Table 7 Troubleshooting—Common Problems and Solutions (Sheet 2 of 2)

Problem	Solution
Some Duplicate packets are visible on the virtual interface	Duplicate frames are tolerated from the PRP-1 Standard in the following case: ➤ Packet with illegal RCT ➤ Packet Delay between LAN A and LAN B is too great. The frames are only kept for duplicate testing for about ~400 ms or until the buffer size limit is reached at high load. If a duplicate frame is received after this delay it will be treated as new. This is a valid situation respecting the IEC 62439 standard and not an error. Duplicates may be passed to upper layer.
All packets are duplicated on the virtual interface	Check the Duplicate Aging Time and Duplicate Entries settings in the SEL IEC 62439 Management application.

Technical Support

We appreciate your interest in SEL products and services. If you have questions or comments, please contact us at:

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Pullman, WA 99163-5603 U.S.A.
Tel: +1.509.338.3838
Fax: +1.509.332.7990
Internet: selinc.com/support
Email: info@selinc.com

Protocol Implementation Conformance Statement

The Protocol Implementation Conformance Statement (PICS) indicates which options listed in IEC 62439-3 are supported.

Table 8 Protocol Conformance Statement

Option	Description	Status
SNMP_MIB	Ability to support the SNMP MIB	2.0
NTAB_SIZ	Number of entries in the Nodes Table (0 = no Nodes Table)	64–2048
PRIO_QTY	Number of supported priorities	
VLAN_QTY	Number of supported VLANS	
MULT_QTY	Number of filtered multicast addresses	
CLK_1588	Support of IEC61588 synchronization	
PRP_SRP	Ability to perform as a non-bridging node with no PRP	
PRP_RSTP	Ability to perform as a RSTP bridge element with designated port role	
PRP_MRP	Ability to perform as a MRP bridge element (client or master)	
HSR_H	Ability to support HSR mode H (default)	
HSR_N	Ability to support HSR mode N	
HSR_M	Ability to support HSR mode M	
HSR_T	Ability to support HSR mode T	
HSR_U	Ability to support HSR mode U	
HSR_X	Ability to support HSR mode X	
RBX_PRP	RedBox with PRP ports	Yes
RBX_HSR	RedBox with HSR ports	
QBX_HSR	QuadBox integrating two RedBoxes	
RBX_PNT	Number of entries in the ProxyNodeTable	

Appendix A: Manual Versions

Instruction Manual

The date code at the bottom of each page of this manual reflects the creation or revision date.

Table 9 lists the instruction manual versions and revision descriptions. The most recent instruction manual version is listed first.

Table 9 Instruction Manual Revision History

Date Code	Summary of Revisions
20250124	➤ Added *Licensing*.
20240918	➤ Removed the part number from the cover. The manual is available from the SEL website only.
20210426	➤ Initial version.

Appendix B: IEC 62439 MIB

```
-- ************************************************************************
IEC-62439-3-MIB DEFINITIONS::= BEGIN
-- ************************************************************************
-- Imports
-- ************************************************************************
IMPORTS

  MODULE-IDENTITY, OBJECT-TYPE,
  Counter32, TimeTicks, Integer32, Unsigned32                FROM SNMPv2-SMI
  OBJECT-GROUP,
  MODULE-COMPLIANCE                                          FROM SNMPv2-CONF
  TruthValue, RowStatus, MacAddress, DisplayString,
  TEXTUAL-CONVENTION                                         FROM SNMPv2-TC;

-- ************************************************************************
-- Root OID
-- ************************************************************************

iec62439 MODULE-IDENTITY

  LAST-UPDATED "201604270000Z" -- 2016, April 27
  ORGANIZATION "IEC/SC 65C"
  CONTACT-INFO "
                International Electrotechnical Commission
                IEC Central Office
                3, rue de Varembe
                P.O. Box 131
                CH - 1211 GENEVA 20
                Switzerland
                Phone: +41 22 919 02 11
                Fax: +41 22 919 03 00
                email: info@iec.ch
               "
  DESCRIPTION "
                This MIB module defines the Network Management interfaces
                for the redundancy protocols defined by the IEC 62439 suite.
                This MIB exposes the IEC62439-3 objects (PRP + HSR)
               "

  REVISION "201604270000Z" -- 2016, April 27
  DESCRIPTION "

                NetModule customized version
                added HSR modex type
               "

  REVISION "201405220000Z" -- 2014, May 22
  DESCRIPTION "
                added reference to ptp MIB and lreDupListResideMaxTime and type
                SecondFraction
               "

  REVISION "201202170000Z" -- February 17, 2012
  DESCRIPTION "
                Consistency brought into line to mrp, crp, brp MIBs
               "

  REVISION "201108260000Z" -- August 26, 2011
  DESCRIPTION "
                This MIB is aligned with the changes to PRP and HSR as defined in the
                Amendment to IEC 62439-3
               "

  REVISION "200811100000Z" -- November 10, 2008
  DESCRIPTION "
                Separation of IEC 62439 into a suite of documents.
                This MIB applies to IEC 62439-3, added HSR functionality
               "

  REVISION "200612160000Z" -- December 16, 2006
  DESCRIPTION "
                Initial version of the Network Management interface for the
                Parallel Redundancy Protocol
               "

::= {iso std(0) 62439 }

-- ************************************************************************
-- Redundancy Protocols
-- ************************************************************************

mrp OBJECT IDENTIFIER::= { iec62439 1 }
prp OBJECT IDENTIFIER::= { iec62439 2 }
crp OBJECT IDENTIFIER::= { iec62439 3 }
brp OBJECT IDENTIFIER::= { iec62439 4 }
drp OBJECT IDENTIFIER::= { iec62439 5 }
```

```
rrp OBJECT IDENTIFIER::= { iec62439 6 }
ptp OBJECT IDENTIFIER::= { iec62439 7 }

-- ****************************************************************************
-- Textual conventions
-- ****************************************************************************

SecondFraction::= TEXTUAL-CONVENTION
  DISPLAY-HINT"d"
  STATUS current
  DESCRIPTION
          "time interval expressed in multiple of 2**-16 = 15,7 microseconds
          this corresponds to the fraction of seconds in the NTP time representation
          the minimum time is 0 microseconds, the maximum 18 hours
          "
  REFERENCE "IEC 62439-3"
  SYNTAX Integer32

-- ****************************************************************************
-- Objects of the PRP Network Management
-- ****************************************************************************

linkRedundancyEntityNotifications OBJECT IDENTIFIER::= { prp 20 }
linkRedundancyEntityObjects OBJECT IDENTIFIER::= { prp 21 }
linkRedundancyEntityConformance OBJECT IDENTIFIER::= { prp 22 }

-- ****************************************************************************
lreConfiguration OBJECT IDENTIFIER::= { linkRedundancyEntityObjects 0 }
lreStatistics OBJECT IDENTIFIER::= { linkRedundancyEntityObjects 1 }
lreConfigurationGeneralGroup OBJECT IDENTIFIER::= { lreConfiguration 0 }
lreConfigurationInterfaceGroup OBJECT IDENTIFIER::= { lreConfiguration 1 }
lreStatisticsInterfaceGroup OBJECT IDENTIFIER::= { lreStatistics 1 }

-- ****************************************************************************
-- Objects for lreConfigurationGeneralGroup
-- ****************************************************************************

lreManufacturerName OBJECT-TYPE
  SYNTAX DisplayString
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "specifies the name of the LRE device manufacturer"
  ::= { lreConfigurationGeneralGroup 1 }

lreInterfaceCount OBJECT-TYPE
  SYNTAX Integer32
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "total number of LREs present in this system."
  ::= { lreConfigurationGeneralGroup 2 }

-- ****************************************************************************
-- Objects for lreConfigurationInterfacesGroup
-- ****************************************************************************

lreConfigurationInterfaces OBJECT IDENTIFIER
::= { lreConfigurationInterfaceGroup 0 }

-- ************************************
-- ***Begin LRE InterfacesConfigTable***
-- ************************************

lreInterfaceConfigTable OBJECT-TYPE
  SYNTAX SEQUENCE OF LREInterfaceConfigEntry
  MAX-ACCESS not-accessible
  STATUS current
  DESCRIPTION "
                list of PRP/HSR LREs. Each entry corresponds
                to one PRP/HSR Link Redundancy Entity (LRE), each representing a
                pair of LAN ports A and B. Basic devices supporting PRP/HSR may
                have only one LRE and thus one entry in the table, while more complex
                devices may have several entries for multiple LREs.
              "
::= { lreConfigurationInterfaces 1 }

lreInterfaceConfigEntry OBJECT-TYPE
  SYNTAX LREInterfaceConfigEntry
  MAX-ACCESS not-accessible
  STATUS current
  DESCRIPTION "
                each entry contains management information applicable to a
                particular LRE.
              "
  INDEX { lreInterfaceConfigIndex }
::= { lreInterfaceConfigTable 1 }


LREInterfaceConfigEntry::=
  SEQUENCE {
  lreInterfaceConfigIndex Unsigned32,
  lreRowStatus RowStatus,
```

```
  lreNodeType INTEGER,
  lreNodeName DisplayString,
  lreVersionName OCTET STRING,
  lreMacAddress MacAddress,
  lrePortAdminStateA INTEGER,
  lrePortAdminStateB INTEGER,
  lreLinkStatusA INTEGER,
  lreLinkStatusB INTEGER,
  lreDuplicateDiscard INTEGER,
  lreTransparentReception INTEGER,
  lreHsrLREMode INTEGER,
  lreSwitchingEndNode INTEGER,
  lreRedBoxIdentity INTEGER,
  lreEvaluateSupervision TruthValue,
  lreNodesTableClear INTEGER,
  lreProxyNodeTableClear INTEGER,
 lreDupListResideMaxTime SecondFraction
  }

lreInterfaceConfigIndex OBJECT-TYPE
  SYNTAX Unsigned32
  MAX-ACCESS not-accessible
  STATUS current
  DESCRIPTION "A unique value for each LRE."
::= { lreInterfaceConfigEntry 1 }

lreRowStatus OBJECT-TYPE
  SYNTAX RowStatus
  MAX-ACCESS read-create
  STATUS current
  DESCRIPTION "indicates the status of the LRE table entry"
::= { lreInterfaceConfigEntry 2 }

lreNodeType OBJECT-TYPE
  SYNTAX INTEGER
  {
    prpmode1 (1),
    hsr (2)
  }
  MAX-ACCESS read-write
  STATUS current
  DESCRIPTION "
               specifies the operation mode of the LRE:
               PRP mode 1 (1)
               HSR mode (2)
               Note: PRP mode 0 is considered deprecated and is not supported by this
               revision of the MIB
             "
::= { lreInterfaceConfigEntry 3 }

lreNodeName OBJECT-TYPE
  SYNTAX DisplayString
  MAX-ACCESS read-write
  STATUS current
  DESCRIPTION "specifies this LRE's node name"
::= { lreInterfaceConfigEntry 4 }

lreVersionName OBJECT-TYPE
  SYNTAX OCTET STRING (SIZE(1..32))
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "specifies the version of this LRE's software"
::= { lreInterfaceConfigEntry 5 }

lreMacAddress OBJECT-TYPE
  SYNTAX MacAddress
  MAX-ACCESS read-write
  STATUS current
  DESCRIPTION "
               Specifies the MAC address to be used by this LRE. MAC
               addresses are
               identical for all ports of a single LRE
             "
::= { lreInterfaceConfigEntry 6 }

lrePortAdminStateA OBJECT-TYPE
  SYNTAX INTEGER
  {
    notActive (1),
    active (2)
  }
  MAX-ACCESS read-write
  STATUS current
  DESCRIPTION "
               Specifies whether the port A shall be active or not Active
               through
               administrative action (Default: active).
             "
::= { lreInterfaceConfigEntry 7 }
```

```
lrePortAdminStateB OBJECT-TYPE
  SYNTAX INTEGER
  {
    notActive (1),
    active (2)
  }
  MAX-ACCESS read-write
  STATUS current
  DESCRIPTION "
                Specifies whether the port B shall be active or not Active
                through
                administrative action (Default: active).
              "
::= { lreInterfaceConfigEntry 8 }

lreLinkStatusA OBJECT-TYPE
  SYNTAX INTEGER
  {
    Up (1),
    down (2)
  }
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "shows the actual link status of the LRE's port A"
::= { lreInterfaceConfigEntry 9 }

lreLinkStatusB OBJECT-TYPE
  SYNTAX INTEGER
  {
    up (1),
    down (2)
  }
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "shows the actual link status of the LRE's port B"
::= { lreInterfaceConfigEntry 10 }

lreDuplicateDiscard OBJECT-TYPE
  SYNTAX INTEGER
  {
    doNotDiscard (1),
    discard (2)
  }
  MAX-ACCESS read-write
  STATUS current
  DESCRIPTION "
                specifies whether a duplicate discard algorithm is used at
                reception
                (Default: discard).
              "
::= { lreInterfaceConfigEntry 11 }

lreTransparentReception OBJECT-TYPE
  SYNTAX INTEGER
  {
    removeRCT (1),
    passRCT (2)
  }
  MAX-ACCESS read-write
  STATUS current
  DESCRIPTION "
                if removeRCT is configured, the RCT is removed when
                forwarding to the upper
                layers, only applicable for PRP LRE (Default: removeRCT).
              "
::= { lreInterfaceConfigEntry 12 }

lreHsrLREMode OBJECT-TYPE
  SYNTAX INTEGER
  {
    modeh (1),
    moden (2),
    modet (3),
    modeu (4),
    modem (5),
    modex (6)
  }
  MAX-ACCESS read-write
  STATUS current
  DESCRIPTION "
                This enumeration is only applicable if the LRE is an HSR
                bridging node or RedBox.
                It shows the mode of the HSR LRE:
                (1) Default mode: The HSR LRE is in mode h and bridges tagged HSR traffic
                (2) Optional mode: The HSR LRE is in mode n and bridging between its HSR ports
                Is disabled.
                Traffic is HSR tagged.
                (3) Optional mode: The HSR LRE is in mode t and bridges non-tagged HSR traffic
                between its HSR ports
                (4) Optional mode: The HSR LRE is in mode u and behaves like in mode h, except it
                does not remove unicast messages
```

```
                (5) Optional mode: The HSR LRE is configured in mixed mode. HSR frames are handled
                according to mode h. Non-HSR frames are handled according to
                802.1D bridging rules.
                (6) Optional mode: The HSR LRE is in mode x and behaves like in mode h, except it
                does not send a frame that is a duplicate of a frame that is received completely
                and correctly from the opposite direction.
              "
::= { lreInterfaceConfigEntry 13}

lreSwitchingEndNode OBJECT-TYPE
  SYNTAX INTEGER
  {
    nonbridgingnode(1),
    bridgingunspecified(2),
    prpnode(3),
    hsrredboxsan(4),
    hsrnode(5),
    hsrredboxhsr(6),
    hsrredboxprpa(7),
    hsrredboxprpb(8)
  }
  MAX-ACCESS read-write
  STATUS current
  DESCRIPTION "
                This enumeration shows which feature is enabled in this
                particular LRE:
                (1): an unspecified non-bridging node, e.g. SRP.
                (2): an unspecified bridging node, e.g. RSTP.
                (3): a PRP node/RedBox.
                (4): an HSR RedBox with regular Ethernet traffic on its interlink.
                (5): an HSR switching node.
                (6): an HSR RedBox with HSR tagged traffic on its interlink.
                (7): an HSR RedBox with PRP traffic for LAN A on its interlink.
                (8): an HSR RedBox with PRP traffic for LAN B on its interlink.
              "
::= { lreInterfaceConfigEntry 14 }

lreRedBoxIdentity OBJECT-TYPE
  SYNTAX INTEGER
  {
    id1a (2),
    id1b (3),
    id2a (4),
    id2b (5),
    id3a (6),
    id3b (7),
    id4a (8),
    id4b (9),
    id5a (10),
    id5b (11),
    id6a (12),
    id6b (13),
    id7a (14),
    id7b (15)
  }
  MAX-ACCESS read-write
  STATUS current
  DESCRIPTION "
                Applicable to RedBox HSR-PRP A and RedBox HSR-PRP B. One ID
                is used by
                one pair of RedBoxes (one configured to A and one configured to B)
                coupling an HSR ring to a PRP network. The integer value states the value
                of the path field a RedBox inserts into each frame it receives from its
                interlink and injects into the HSR ring. When interpreted as binary values,
                the LSB denotes the configuration of the RedBox (A or B), and the following
                3 bits denote the identifier of a RedBox pair.
              "
::= {lreInterfaceConfigEntry 15}

lreEvaluateSupervision OBJECT-TYPE
  SYNTAX TruthValue
  MAX-ACCESS read-write
  STATUS current
  DESCRIPTION "
                True if the LRE evaluates received supervision frames. False
                if it
                drops the supervision frames without evaluating. Note: LREs are required
                to send supervision frames, but reception is optional. Default value is dependent
                on implementation.
              "
::= { lreInterfaceConfigEntry 16}

lreNodesTableClear OBJECT-TYPE
  SYNTAX INTEGER
  {
    noOp (0),
    clearNodeTable (1)
  }
  MAX-ACCESS read-write
  STATUS current
  DESCRIPTION "specifies that the Node Table is to be cleared"
```

```
::= { lreInterfaceConfigEntry 17}

lreProxyNodeTableClear OBJECT-TYPE
  SYNTAX INTEGER
  {
    noOp (0),
    clearProxyNodeTable (1)
  }
  MAX-ACCESS read-write
  STATUS current
  DESCRIPTION "specifies that the Proxy Node Table is to be cleared"
::= { lreInterfaceConfigEntry 18}

lreDupListResideMaxTime OBJECT-TYPE
  SYNTAX SecondFraction
  UNITS "binaryFractionOfSecond"
  MAX-ACCESS read-write
  STATUS current
  DESCRIPTION "the longest time an entry may reside in the duplicates list,
              expressed as the number of seconds multiplied by 65536;
              the default value is 26214 x 15 us, or 400 ms; too low a value can
              cause broadcast storms"
  DEFVAL {26214}
::= { lreInterfaceConfigEntry 19}

-- ************************************
-- *** End lreInterfaceConfigTable ***
-- ************************************
-- ****************************************************************************
-- Objects for lreStatisticsInterfacesGroup
-- ****************************************************************************

lreStatisticsInterfaces OBJECT IDENTIFIER
::= { lreStatisticsInterfaceGroup 0 }


-- ************************************
-- ***Begin LRE InterfacesStatsTable ***
-- ************************************


lreInterfaceStatsTable OBJECT-TYPE
  SYNTAX SEQUENCE OF LREInterfaceStatsEntry
  MAX-ACCESS not-accessible
  STATUS current
  DESCRIPTION "
                list of PRP/HSR LREs. Each entry corresponds
                to one PRP/HSR Link Redundancy Entity (LRE), each representing a
                pair of LAN ports A and B and a port C towards the application/interlink.
                Basic devices supporting PRP/HSR may have only one LRE and thus one entry in
                the table, while more complex devices may have several
                entries for multiple LREs.
              "
::= { lreStatisticsInterfaces 1 }

lreInterfaceStatsEntry OBJECT-TYPE
  SYNTAX LREInterfaceStatsEntry
  MAX-ACCESS not-accessible
  STATUS current
  DESCRIPTION "
                An entry containing management information applicable to a
                particular LRE.
              "
  INDEX { lreInterfaceStatsIndex }
::= { lreInterfaceStatsTable 1 }

LREInterfaceStatsEntry::=
  SEQUENCE {
  lreInterfaceStatsIndex Unsigned32,
  lreCntTxA Counter32,
  lreCntTxB Counter32,
  lreCntTxC Counter32,
  lreCntErrWrongLanA Counter32,
  lreCntErrWrongLanB Counter32,
  lreCntErrWrongLanC Counter32,
  lreCntRxA Counter32,
  lreCntRxB Counter32,
  lreCntRxC Counter32,
  lreCntErrorsA Counter32,
  lreCntErrorsB Counter32,
  lreCntErrorsC Counter32,
  lreCntNodes Integer32,
  lreCntProxyNodes Integer32,
  lreCntUniqueA Counter32,
  lreCntUniqueB Counter32,
  lreCntUniqueC Counter32,
  lreCntDuplicateA Counter32,
  lreCntDuplicateB Counter32,
  lreCntDuplicateC Counter32,
  lreCntMultiA Counter32,
  lreCntMultiB Counter32,
```

```
  lreCntMultiC Counter32,
  lreCntOwnRxA Counter32,
  lreCntOwnRxB Counter32
  }

lreInterfaceStatsIndex OBJECT-TYPE
  SYNTAX Unsigned32
  MAX-ACCESS not-accessible
  STATUS current
  DESCRIPTION "A unique value for each LRE."
::= { lreInterfaceStatsEntry 1 }

lreCntTxA OBJECT-TYPE
  SYNTAX Counter32
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "
                number of frames sent over port A that are HSR tagged or
                fitted with a PRP
                Redundancy Control Trailer.
                Only frames that are HSR tagged or do have a PRP RCT are counted.
                A frame aborted during the transmission is not counted.
                Initial value = 0.
              "
::= { lreInterfaceStatsEntry 2 }

lreCntTxB OBJECT-TYPE
  SYNTAX Counter32
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "
                number of frames sent over port B that are HSR tagged or
                fitted with a PRP
                Redundancy Control Trailer.
                Only frames that are HSR tagged or do have a PRP RCT are counted.
                A frame aborted during the transmission is not counted.
                Initial value = 0.
              "
::= { lreInterfaceStatsEntry 3 }

lreCntTxC OBJECT-TYPE
  SYNTAX Counter32
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "
                number of frames sent towards the application interface of
                the DANP or DANH
                or over the interlink of the RedBox. Frames with and without PRP RCT or HSR
                tag are counted, but not link-local frames.
                A frame aborted during the transmission is not counted.
                Initial value = 0.
              "
::= { lreInterfaceStatsEntry 4 }

lreCntErrWrongLanA OBJECT-TYPE
  SYNTAX Counter32
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "
                number of frames with the wrong LAN identifier received on
                LRE port A.
                Initial value = 0. Only applicable to PRP ports.
              "
::= { lreInterfaceStatsEntry 5 }

lreCntErrWrongLanB OBJECT-TYPE
  SYNTAX Counter32
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "
                number of frames with the wrong LAN identifier received on
                LRE port B
                Initial value = 0. Only applicable to PRP ports.
              "
::= { lreInterfaceStatsEntry 6 }

lreCntErrWrongLanC OBJECT-TYPE
  SYNTAX Counter32
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "
                number of frames with the wrong LAN identifier received on
                the interlink of
                a RedBox. Only applicable to HSR RedBoxes in HSR-PRP configuration
                (hsrredboxprpa and hsrredboxprpb).
              "
::= { lreInterfaceStatsEntry 7 }

lreCntRxA OBJECT-TYPE
  SYNTAX Counter32
  MAX-ACCESS read-only
```

```
  STATUS current
  DESCRIPTION "
                number of frames received on a LRE port A. Only frames that
                are HSR tagged
                or fitted with a PRP Redundancy Control Trailer are counted. Frames that are
                not forwarded anywhere (e.g. because the sender of the frame is in the proxy
                node table) are counted, too. Only frames received completely and without
                error are counted.
                Initial value = 0.
              "
::= { lreInterfaceStatsEntry 8 }

lreCntRxB OBJECT-TYPE
  SYNTAX Counter32
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "
                number of frames received on a LRE port B. Only frames that
                are HSR tagged
                or fitted with a PRP Redundancy Control Trailer are counted. Frames that are
                not forwarded anywhere (e.g. because the sender of the frame is in the proxy
                node table) are counted, too. Only frames received completely and without
                error are counted.
                Initial value = 0.
              "
::= { lreInterfaceStatsEntry 9 }

lreCntRxC OBJECT-TYPE
  SYNTAX Counter32
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "
  number of frames received from the application interface of a
  DANP or DANH or
  the number of number of frames received on the interlink of a RedBox. Frames
  with and without PRP RCT or HSR tag are counted, but not link-local frames.
  Only frames received completely and without error are counted.
  Initial value = 0.
  "
::= { lreInterfaceStatsEntry 10 }

lreCntErrorsA OBJECT-TYPE
  SYNTAX Counter32
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "
  number of frames with errors received on this LRE port A.
  Initial value = 0.
  "
::= { lreInterfaceStatsEntry 11 }

lreCntErrorsB OBJECT-TYPE
  SYNTAX Counter32
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "
  number of frames with errors received on this LRE port B.
  Initial value = 0.
  "
::= { lreInterfaceStatsEntry 12 }

lreCntErrorsC OBJECT-TYPE
  SYNTAX Counter32
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "
  number of frames with errors received on the application
  interface of a DANP or
  DANH or on the interlink of a RedBox.
  Initial value = 0.
  "
::= { lreInterfaceStatsEntry 13 }

lreCntNodes OBJECT-TYPE
  SYNTAX Integer32
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "number of nodes in the Nodes Table."
::= { lreInterfaceStatsEntry 14 }

lreCntProxyNodes OBJECT-TYPE
  SYNTAX Integer32
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "
  number of nodes in the Proxy Node Table. Only applicable to
  RedBox.
  Initial value = 0.
                "
::= { lreInterfaceStatsEntry 15 }
```

```
lreCntUniqueA OBJECT-TYPE
  SYNTAX Counter32
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "
  number of entries in the duplicate detection mechanism on
  port A for which
  no duplicate was received.
  Initial value = 0.
  "
::= { lreInterfaceStatsEntry 16 }

lreCntUniqueB OBJECT-TYPE
  SYNTAX Counter32
  MAX-ACCESS read-only

  STATUS current
  DESCRIPTION "
  number of entries in the duplicate detection mechanism on
  port B for which
  no duplicate was received.
  Initial value = 0.
  "
::= { lreInterfaceStatsEntry 17 }

lreCntUniqueC OBJECT-TYPE
  SYNTAX Counter32
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "
  number of entries in the duplicate detection mechanism on the
  application interface
  of the DAN or the interlink of the RedBox for which no duplicate was received.
  Initial value = 0.
  "
::= { lreInterfaceStatsEntry 18 }

lreCntDuplicateA OBJECT-TYPE
  SYNTAX Counter32
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "
  number of entries in the duplicate detection mechanism on
  port A for which
  one single duplicate was received.
  Initial value = 0.
  "
::= { lreInterfaceStatsEntry 19 }

lreCntDuplicateB OBJECT-TYPE
  SYNTAX Counter32
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "
  number of entries in the duplicate detection mechanism on
  port B for which
  one single duplicate was received.
  Initial value = 0.
  "
::= { lreInterfaceStatsEntry 20 }

lreCntDuplicateC OBJECT-TYPE
  SYNTAX Counter32
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "
  number of entries in the duplicate detection mechanism on the
  application interface
  of the DAN or the interlink of the RedBox for which one single duplicate was
  received.
  Initial value = 0.
  "
::= { lreInterfaceStatsEntry 21 }

lreCntMultiA OBJECT-TYPE
  SYNTAX Counter32
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "
  number of entries in the duplicate detection mechanism on
  port A for which
  more than one duplicate was received.
  Initial value = 0.
  "
::= { lreInterfaceStatsEntry 22 }

lreCntMultiB OBJECT-TYPE
  SYNTAX Counter32
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "
```

```
  number of entries in the duplicate detection mechanism on
  port B for which
  more than one duplicate was received.
  Initial value = 0.
  "
::= { lreInterfaceStatsEntry 23 }

lreCntMultiC OBJECT-TYPE
  SYNTAX Counter32
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "
  number of entries in the duplicate detection mechanism on the
  application interface
  of the DAN or the interlink of the RedBox for which more than one duplicate was
  received.
  Initial value = 0.
  "
::= { lreInterfaceStatsEntry 24 }

lreCntOwnRxA OBJECT-TYPE
  SYNTAX Counter32
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "
  number of HSR tagged frames received on Port A that
  originated from this
  device. Frames originate from this device if the source MAC matches the
  MAC of the LRE, or if the source MAC appears in the proxy node table (if
  implemented). Applicable only to HSR.
  Initial value = 0.
  "
::= { lreInterfaceStatsEntry 25 }

lreCntOwnRxB OBJECT-TYPE
  SYNTAX Counter32
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "
  number of HSR tagged frames received on Port B that
  originated from this
  device. Frames originate from this device if the source MAC matches the
  MAC of the LRE, or if the source MAC appears in the proxy node table (if
  implemented). Applicable only to HSR.
  Initial value = 0.
  "
::= { lreInterfaceStatsEntry 26 }

-- ************************************
-- *** End LRE InterfacesStatsTable ***
-- ************************************


-- ***************************
-- ***Begin LRE NodesTable ***
-- ***************************

lreNodesTable OBJECT-TYPE
  SYNTAX SEQUENCE OF LRENodesEntry
  MAX-ACCESS not-accessible
  STATUS current
  DESCRIPTION "
                The node table (if it exists on that node) contains
                information about
                all remote LRE, which advertised themselves through
                supervision frames
              "
::= { lreStatisticsInterfaces 2 }

lreNodesEntry OBJECT-TYPE
  SYNTAX LRENodesEntry
  MAX-ACCESS not-accessible
  STATUS current
  DESCRIPTION "
  Each entry in the node table (if it exists) contains
  information about
  a particular remote LRE registered in the node table, which advertised itself
  through supervision frames.
  "
  INDEX { lreInterfaceStatsIndex,lreNodesIndex }
::= { lreNodesTable 1 }

LRENodesEntry::=
  SEQUENCE {
    lreNodesIndex Unsigned32,
    lreNodesMacAddress MacAddress,
    lreTimeLastSeenA TimeTicks,
    lreTimeLastSeenB TimeTicks,
    lreRemNodeType INTEGER
  }
  lreNodesIndex OBJECT-TYPE
```

```
  SYNTAX Unsigned32
  MAX-ACCESS not-accessible
  STATUS current
  DESCRIPTION "Unique value for each node in the LRE's node table."
::= { lreNodesEntry 1 }

lreNodesMacAddress OBJECT-TYPE
  SYNTAX MacAddress
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "Each MAC address corresponds to a single Doubly Attached Node"
::= { lreNodesEntry 2 }

lreTimeLastSeenA OBJECT-TYPE
  SYNTAX TimeTicks
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "
  Time in TimeTicks (1/100s) since the last frame from this
  remote LRE was
  received over LAN A. Initialized with a value of 0 upon node registration
  in the node table.
  "
::= { lreNodesEntry 3 }

lreTimeLastSeenB OBJECT-TYPE
  SYNTAX TimeTicks
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "
  Time in TimeTicks (1/100s) since the last frame from this
  remote LRE was
  received over LAN B. Initialized with a value of 0 upon node registration
  in the node table.
  "
::= { lreNodesEntry 4 }

lreRemNodeType OBJECT-TYPE
  SYNTAX INTEGER
  {
    danp (0),
    redboxp (1),
    vdanp (2),
    danh (3),
    redboxh (4),
    vdanh (5)
  }
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "DAN type, as indicated in the received supervision frame"
::= { lreNodesEntry 5 }

-- ***************************
-- *** End LRE NodesTable ***
-- ***************************


-- *********************************
-- *** Begin LRE ProxyNodeTable ***
-- *********************************

lreProxyNodeTable OBJECT-TYPE
  SYNTAX SEQUENCE OF LREProxyNodeEntry
  MAX-ACCESS not-accessible
  STATUS current
  DESCRIPTION "
                The proxy node table (if implemented) contains information
                about all
                nodes, for which the LRE acts as a connection to the HSR/PRP
                network.
              "
::= { lreStatisticsInterfaces 3 }

lreProxyNodeEntry OBJECT-TYPE
  SYNTAX LREProxyNodeEntry
  MAX-ACCESS not-accessible
  STATUS current
                  DESCRIPTION "
                Each entry in the proxy node table contains information about
                a particular nodefor
                which the LRE acts as a connection to the HSR/PRP network.
              "
  INDEX { lreInterfaceStatsIndex,lreProxyNodeIndex }
::= { lreProxyNodeTable 1 }

LREProxyNodeEntry::=
  SEQUENCE {
    lreProxyNodeIndex Unsigned32,
    lreProxyNodeMacAddress MacAddress
  }
  lreProxyNodeIndex OBJECT-TYPE
```

```
  SYNTAX Unsigned32
  MAX-ACCESS not-accessible
  STATUS current
  DESCRIPTION "A unique value for each node in the LRE's proxy node table."
::= { lreProxyNodeEntry 1 }

lreProxyNodeMacAddress OBJECT-TYPE
  SYNTAX MacAddress
  MAX-ACCESS read-only
  STATUS current
  DESCRIPTION "
  Each entry contains information about a particular node
  for which the LRE acts as a proxy for the HSR/PRP network.
  "
::= { lreProxyNodeEntry 2 }

-- ********************************
-- *** End LRE ProxyNodeTable ***
-- ********************************


--=================================================================
-- Conformance Information
--=================================================================

linkRedundancyConformance OBJECT IDENTIFIER::= { linkRedundancyEntityConformance 1 }
lreGroups OBJECT IDENTIFIER::= { linkRedundancyConformance 1}
lreDefaultGrp OBJECT-GROUP
  OBJECTS {
    lreManufacturerName,
    lreInterfaceCount,
    lreRowStatus,
    lreNodeType,
    lreNodeName,
    lreVersionName,
    lreMacAddress,
    lrePortAdminStateA,
    lrePortAdminStateB,
    lreLinkStatusA,
    lreLinkStatusB,
    lreDuplicateDiscard,
    lreTransparentReception,
    lreHsrLREMode,
    lreSwitchingEndNode,
    lreRedBoxIdentity,
    lreEvaluateSupervision,
    lreNodesTableClear,
    lreProxyNodeTableClear,
    lreDupListResideMaxTime,
    lreCntTxA,
    lreCntTxB,
    lreCntTxC,
    lreCntErrWrongLanA,
    lreCntErrWrongLanB,
    lreCntErrWrongLanC,
    lreCntRxA,
    lreCntRxB,
    lreCntRxC,
    lreCntErrorsA,
    lreCntErrorsB,
    lreCntErrorsC,
    lreCntNodes,
    lreCntProxyNodes,
    lreCntUniqueA,
    lreCntUniqueB,
    lreCntUniqueC,
    lreCntDuplicateA,
    lreCntDuplicateB,
    lreCntDuplicateC,
    lreCntMultiA,
    lreCntMultiB,
    lreCntMultiC,
    lreCntOwnRxA,
    lreCntOwnRxB,
    lreNodesMacAddress,
    lreTimeLastSeenA,
    lreTimeLastSeenB,
    lreRemNodeType,
    lreProxyNodeMacAddress
  }
  STATUS current
  DESCRIPTION
  "Objects in the default group"
::= {lreGroups 1}

-- ********************************************************************
```

```
--=====================================================================
-- MIB module Compliance statements
--=====================================================================

linkRedundancyCompliances OBJECT IDENTIFIER::= { linkRedundancyEntityConformance 2 }
linkRedundancyCompliance MODULE-COMPLIANCE
STATUS current
DESCRIPTION "Compliance for support by IEC 62439-3 module"
MODULE
MANDATORY-GROUPS {
  lreDefaultGrp
  }
::= { linkRedundancyCompliances 1 }

END
```

Glossary

DANP	Double Attached Node implementing PRP (IEC 62439).
DHCP	Dynamic Host Configuration Protocol.
IP	Internet Protocol.
LAN_A	Redundant network interface A (IEC 62439).
LAN_B	Redundant network interface B (IEC 62439).
MIB	Management Information Base.
OID	Object Identifier.
PC.	Personal Computer.
PRP-1	Parallel Redundancy Protocol Version 1. IEC Part 3: Parallel Redundancy Protocol (PRP) and High-availability Seamless Redundancy (HSR). [IEC 62439-3 Edition 3.0:2016].
RCT	Redundancy Check Tag (IEC 62439).
SAN	Singly Attached Nodes (IEC 62439).
TCP	Transmission Control Protocol.
UDP	User Datagram Protocol.
VDAN	Virtual Doubly Attached Node (SAN as visible through a RedBox) (IEC 62439).

Technical Support

We appreciate your interest in SEL products and services. If you have questions or comments, please contact us at:

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