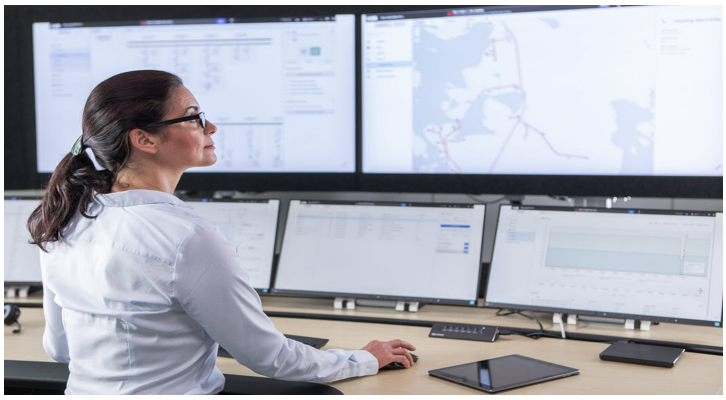
GRID AUTOMATION PRODUCTS

MicroSCADA X SYS600 10.2

DuoDriver 5.0 Installation Guide



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Product version: 10.2

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Section 1 About this Manual

1.1 Copyrights

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This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit. (https://www.openssl.org/). This product includes cryptographic software written by Eric Young (eay@cryptsoft.com). This product includes software written by Tim Hudson (tjh@cryptsoft.com).

1.2 General

This manual provides detailed information about the DuoDriver and how to connect and configure it by the user.

This manual is intended for the following audience:

- Technical staff, who are familiar with electronic devices and networking environment and are educated as technicians in electronics.
- System Administrators with networking experience without experience in the usage of DuoDriver.
- System Administrators, who are responsible for the installation and configuration of network equipment.

1.3 Document conventions

The following conventions are used for the presentation of material:

- The words in names of screen elements (for example, the title in the title bar of a dialog, the label for a field of a dialog box) are initially capitalized.
- Capital letters are used for file names.
- Capital letters are used for the name of a keyboard key if it is labeled on the keyboard. For example, press the CTRL key. Although the Enter and Shift keys are not labeled they are written in capital letters, e.g. press ENTER.
- Lowercase letters are used for the name of a keyboard key that is not labeled on the keyboard. For example, the space bar, comma key and so on.
- Press CTRL+C indicates that the user must hold down the CTRL key while pressing the C key (in this case, to copy a selected object).
- Press ALT E C indicates that the user presses and releases each key in sequence (in this case, to copy a selected object).
- The names of push and toggle buttons are boldfaced. For example, click **OK**.
- The names of menus and menu items are boldfaced. For example, the **File** menu.
    - The following convention is used for menu operations: **Menu Name/Menu Item/ Cascaded Menu Item**. For example: select **File/Open/New Project**.
    - The **Start** menu name always refers to the **Start** menu on the Windows Task Bar.
- System prompts/messages and user responses/input are shown in the Courier font. For example, if the user enters a value that is out of range, the following message is displayed: `Entered value is not valid`.
  The user may be told to enter the string MIF349 in a field. The string is shown as follows in the procedure: `MIF349`
- Variables are shown using lowercase letters: sequence name

1.4 Abbreviations

Abbreviation	Description
CE	Consumer Electronic Label by Consumer Electronic Association CEA
CLI	Command-Line interface
DANP	Double Attached Node implementing PRP
DHCP	Dynamic Host Configuration Protocol
FTP	File Transfer Protocol
HTML	Hypertext Markup Language
HW	Hardware
IP	Internet Protocol
LAN_A	Redundant network interface A
LAN_B	Redundant network interface B
LRE	Link Redundancy Entity
PC	Personal Computer
PRP-1	Parallel Redundancy Protocol Version 1
RCT	Redundancy Check Tag
SAN	Singly Attached Nodes
SW	Software
TCP	Transmission Control Protocol

Table continues on next page

Abbreviation	Description
TFTP	Trivial File Transfer Protocol
UDP	User Datagram Protocol
VDAN	Virtual Doubly Attached Node (SAN as visible through a RedBox)

1.5 Related documents

Name of the manual	Document ID
SYS600 10.2 IEC 61850 System Design	1MRK 511 475-UEN

1.6 Document revisions

Revision	Version number	Date	History
A	10.2	31.03.2021	New document for SYS600 10.2

Section 2 Network Operation and Installation

2.1 Operation

The DuoDriver implements the Parallel Redundancy Protocol (PRP) in version 0 and 1 as defined in document IEC 62439-3, Industrial communication networks - High availability automation networks - Part 3: Parallel Redundancy Protocol (PRP) and High-availability Seamless Redundancy (HSR).

Other Redundancy Protocols (HSR, SRP, MRP) are currently not supported.

2.2 Installation files

The installation media is located under <drive>:\sc\Setup\DuoDriver folder.

File name	Description
DuoDriverNotifyObj-{GUID}.dll	Notify Object 32bit This DLL implements the Protocol Bindings of the virtual adapter.
DuoDriverNotifyObj-{GUID}_x64.dll	Notify Object 64bit This DLL implements the Protocol Bindings of the virtual adapter.
DuoDriverMgmtGUI.exe	Management application
duodrv_mp.cat	Miniport catalogue file
duodrv_mp.inf	Miniport information file
duodrv_prot.cat	Protocol catalogue file
duodrv_prot.inf	Protocol information file
duodrvng.sys	DuoDriver v5.0 32bit NDIS6.4-Driver file.
duodrvng_x64.sys	DuoDriver v5.0 64bit NDIS6.4-Driver file.
iec62439_mgmt.dll	The DLL provides functionality to manage virtual adapters and to communicate with their associated physical adapters 32bit.
iec62439_mgmt_x64.dll	The DLL provides functionality to manage virtual adapters and to communicate with their associated physical adapters 64bit.
iec62439_snmp_agent.dll	The DLL provides support for IEC62439-3 MIB to the Microsoft SNMP service 32bit.
iec62439_snmp_agent_x64.dll	The DLL provides support for IEC62439-3 MIB to the Microsoft SNMP service 64bit.
ProtocolSetup.exe	Setup application to install the NDIS protocols. This is mainly a wrapper for the SetupGUI which is not running standalone 32bit.
ProtocolSetup_x64.exe	Setup application to install the NDIS protocols. This is mainly a wrapper for the SetupGUI which is not running standalone 64bit.
setup.exe	Setup application (NSIS based installer).
setup.ini	[optional] Template for command line based installation.
SetupGuiNG.exe	Setup application for PRP pairing GUI 32bit
Table continues on next page	

File name	Description
SetupGuiNG_x64.exe	Setup application for PRP pairing GUI 64bit
SnmpExtensionAgentSetup.exe	The SNMP Extension Agent Setup is a console mode helper executable that loads the SNMP Extension Agent DLL 32bit.
SnmpExtensionAgentSetup_x64.exe	The SNMP Extension Agent Setup is a console mode helper executable that loads the SNMP Extension Agent DLL 64bit.
vendor.cer	The file vendor.cer containing the vendor certificate (public key!) used to sign the driver package.
SYS600_DuoDriver Installation Guide.pdf	PDF manual is located in <drive>:\sc\Documentation \EN

2.3 Installation

2.3.1 Supported Hardware

The following network cards (NICs) are being supported by ABB DuoDriver v5.0 software

- Intel Pro/1000 PT Dual Port Server Adapter
- Intel Pro/1000 MT Dual Port Server Adapter
- Intel Pro/1000 GT Desktop Adapter
- Intel Gigabit CT Desktop Adapter
- Intel Ethernet Server Adapter I340-T4
- Intel I350-T2
- Broadcom BCM5720
- Broadcom BCM5719

2.3.2 Supported Operating Systems

The following operating systems are being supported by ABB DuoDriver v5.0 software

- Windows 8.1 32-bit and 64-bit (Minimum patch level March 2019 is required)
- Windows Server 2012 R2 (Minimum patch level March 2019 is required)
- Windows 10 Enterprise LTSB 2016 (32/64bit)
- Windows 10 Enterprise LTSC 2019 (32/64bit)
- Windows Server standard LTSB 2016 (64 Bit)
- Windows Server standard LTSC 2019 (64 Bit)

2.3.3 Labeling

For PRP two LANs create a single redundant network. For diagnostics purposes the used network adapters need to be identified and renamed using descriptive naming.

Identify and rename the network adapters to be used with DuoDriver. You can identify the adapters corresponding to physical adapters by connecting and disconnecting the LAN cables and observing status changes.

Supposed naming scheme: LAN A is the upper/leftmost and LAN B the lower/rightmost connector of the adapter. The networks should be named correspondingly (NET 1 is the upper/leftmost etc.).

Use only alphabets (a-z,A-Z), numbers (0-9), dash (-), underscore (_) and space ( ) in adapter names.

See an example of a system with three redundant networks: Networks are named NET1, NET2 and NET3. The adapters for NET1 are named NET1_A and NET1_B. Similarly for NET2 and NET3. NET0 is a non redundant single adapter for other purposes.

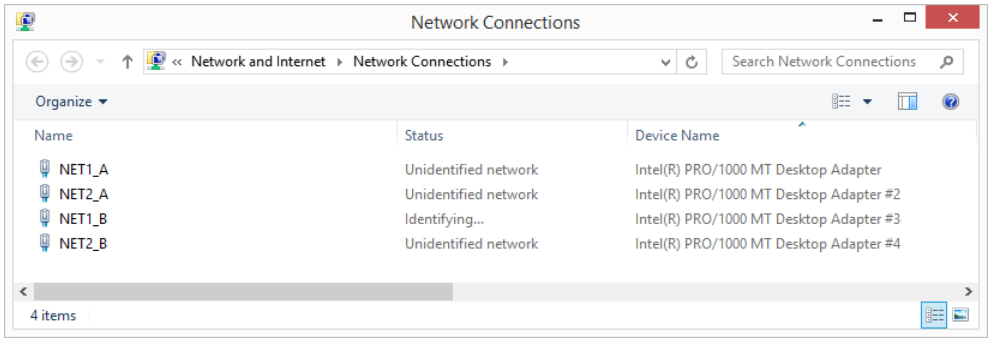


Figure 1: Network adapters before Installation

2.3.4 Physical adapter configuration

There is no special software configuration required before the DuoDriver installation. The hardware must have at least two physical network adapters available with same abilities.

Be aware that with Gigabit Ethernet, PRP-1 will send and receive a large amount of packets which leads to an interrupt load twice as with a single attached device. Ensure that both physical adapters are configured to use adaptive interrupt handling and the CPU performance can handle this amount of traffic.

2.3.5 Installing the Microsoft SNMP Service

Microsoft SNMP Service needs to be installed only if SNMP Agent feature of DuoDriver is used.

To install the SNMP Agent implementing the IEC62439-MIB, the Microsoft SNMP Service has to be enabled. The service can be installed within the “Control Panel” - “Program and Features” page as shown in Figure 2 and Figure 3.

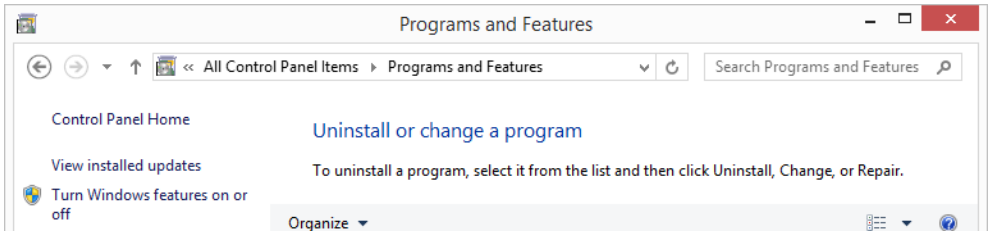


Figure 2: Turn Windows features on or off

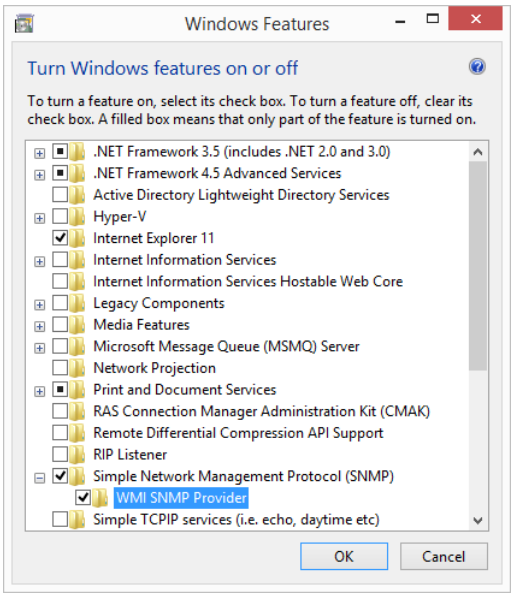


Figure 3: Windows Features: SNMP

Finally the service can be configured using the Computer Management Console (Computer > Manage > Services and Applications > Services). See Figure 4 for an example with low security requirements.

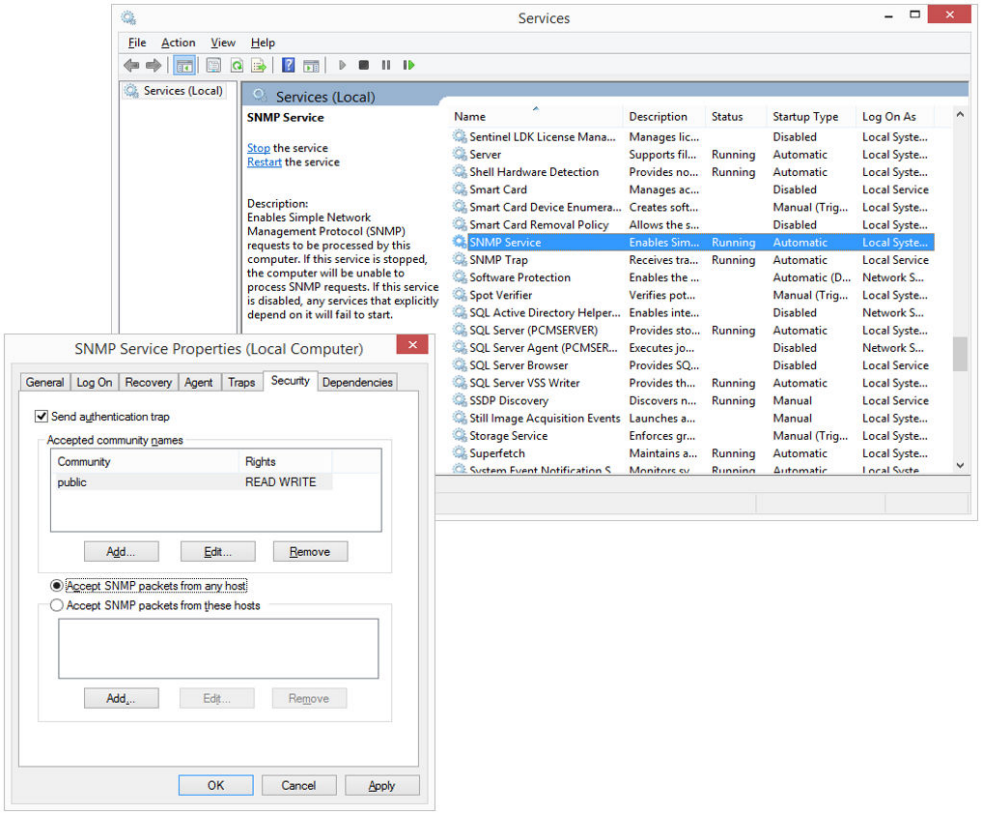


Figure 4: SNMP Service Security Properties - an example with low security requirements

2.3.6 Starting SETUP.EXE

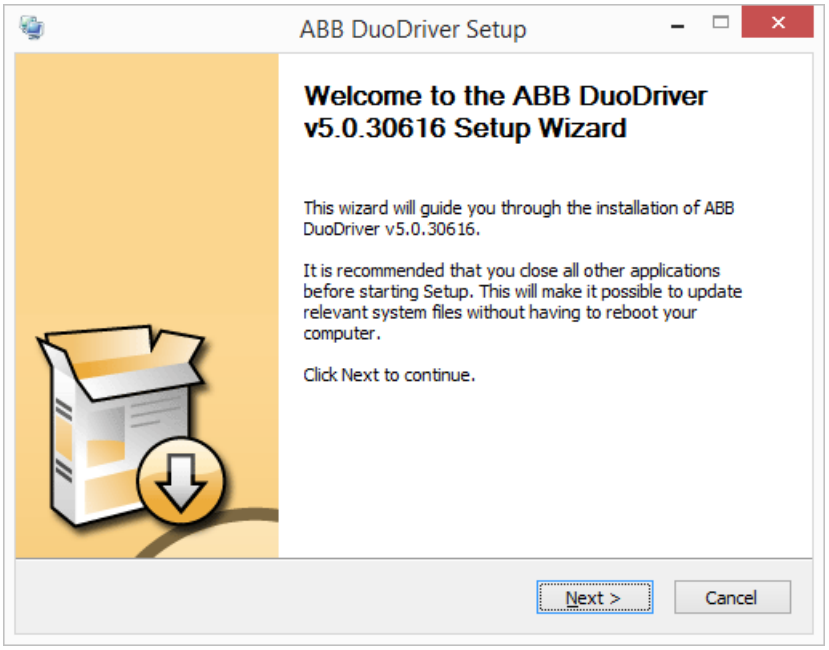


Figure 5: DuoDriver Setup Wizard - Welcome dialog

In case of updating older version, you may get notify to uninstall first.

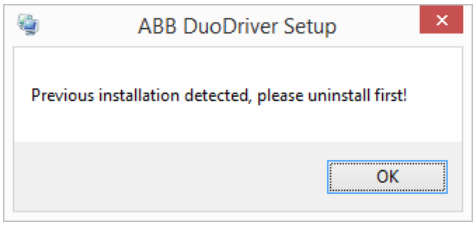


Figure 6: Uninstall Notification

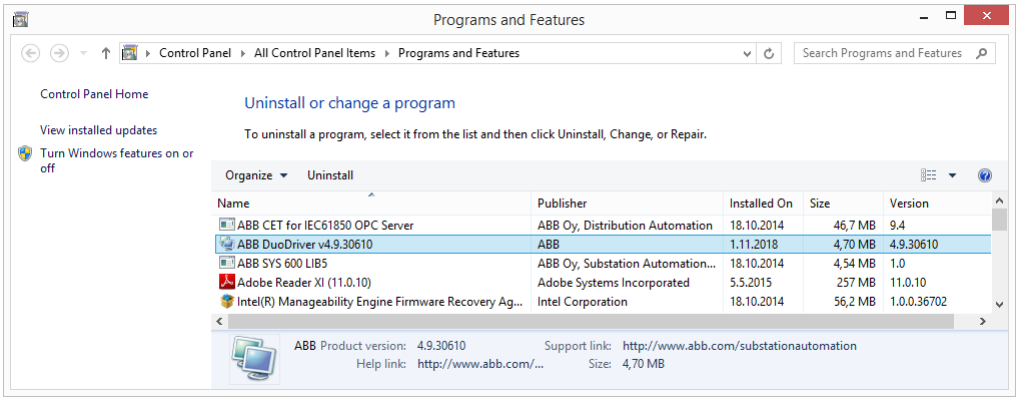


Figure 7: Uninstall old version

2.3.7 License check

The DuoDriver can only be used together with SYS600 holding a valid license for the DuoDriver. If this is not the case the installer will abort with an error message.

2.3.8 Choose Install Location

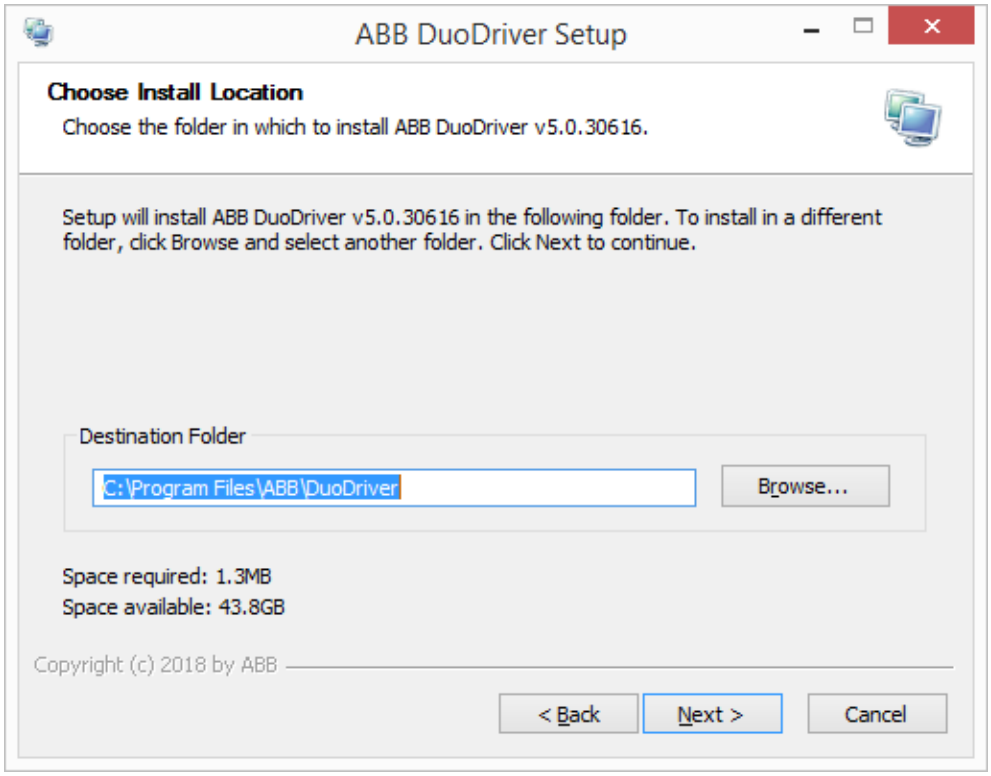


Figure 8: Installation Wizard - Install Location

2.3.9 Choose Components

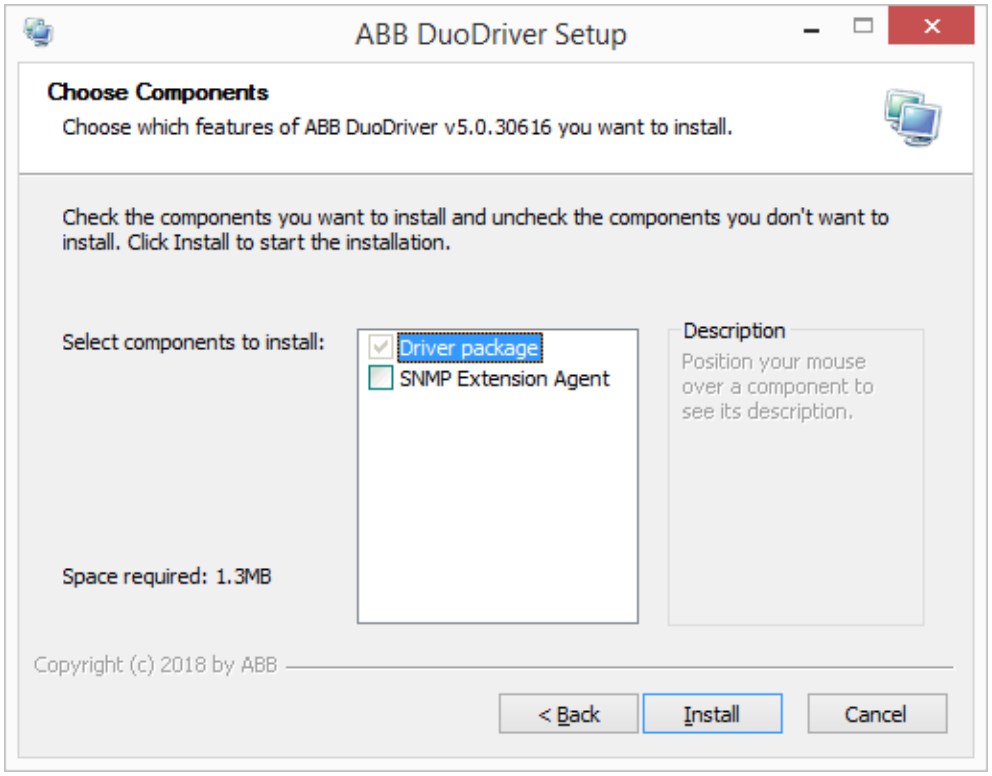


Figure 9: Installation Wizard - Choose components

For more information about the SNMP Extension installation please see Section 2.3.5.

2.3.10 Windows Security Warning for Signed Drivers

Windows Security may ask to install the device softwares "ABB Network adapters" and "ABB Network Protocol" from publisher "ABB Switzerland Ltd". Install the softwares.

2.3.11 Preinstallation Complete

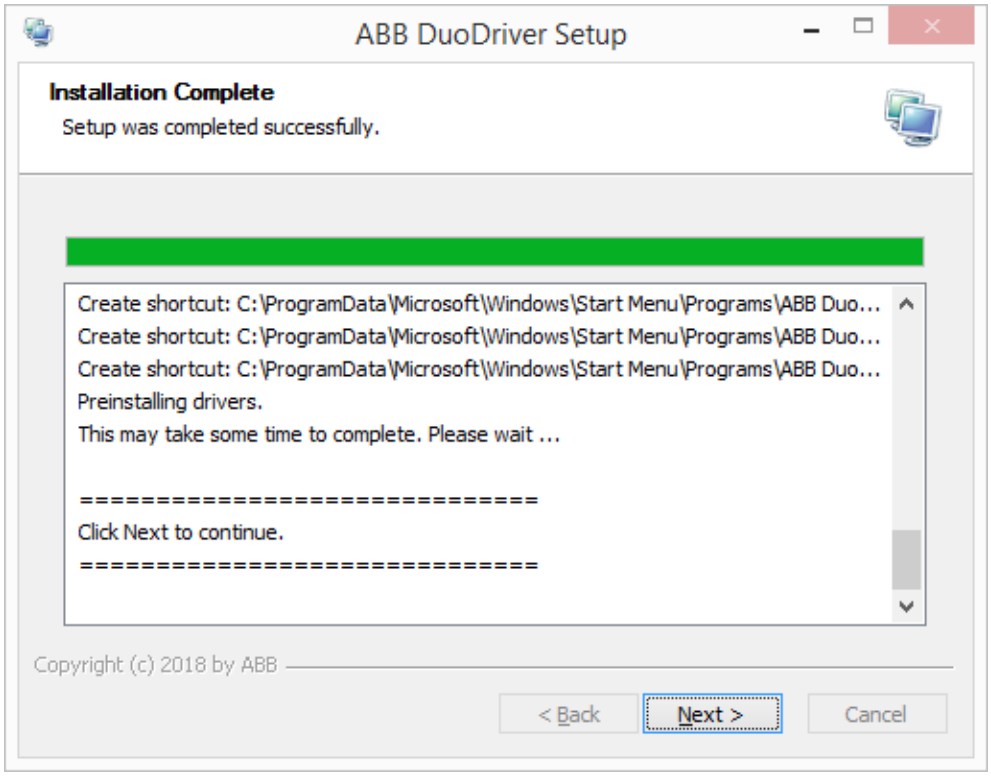


Figure 10: Installation Wizard - Preinstallation Complete

2.3.12 Setup Virtual Adapters (also known as “Pairing”)

To create redundant networks you have to pair two physical adapters to one virtual adapter. Rename the virtual adapter and select the physical adapters. Press 'Add Virtual Adapter' to pair the adapters.

Use only alphabets (a-z,A-Z), numbers (0-9), dash (-), underscore (_) and space ( ) in adapter names.

Be careful, the undo functionality of the selection is inactive if “Add Virtual Adapter" is pressed. If the adapter configuration needs to be changed the product must be reinstalled.

See an example of a system with three redundant networks: Networks are named NET1 and NET2. The physical adapters for NET1 are named NET1_A and NET1_B. Similarly for NET2. NET1 is paired and NET2 is configured to be paired.

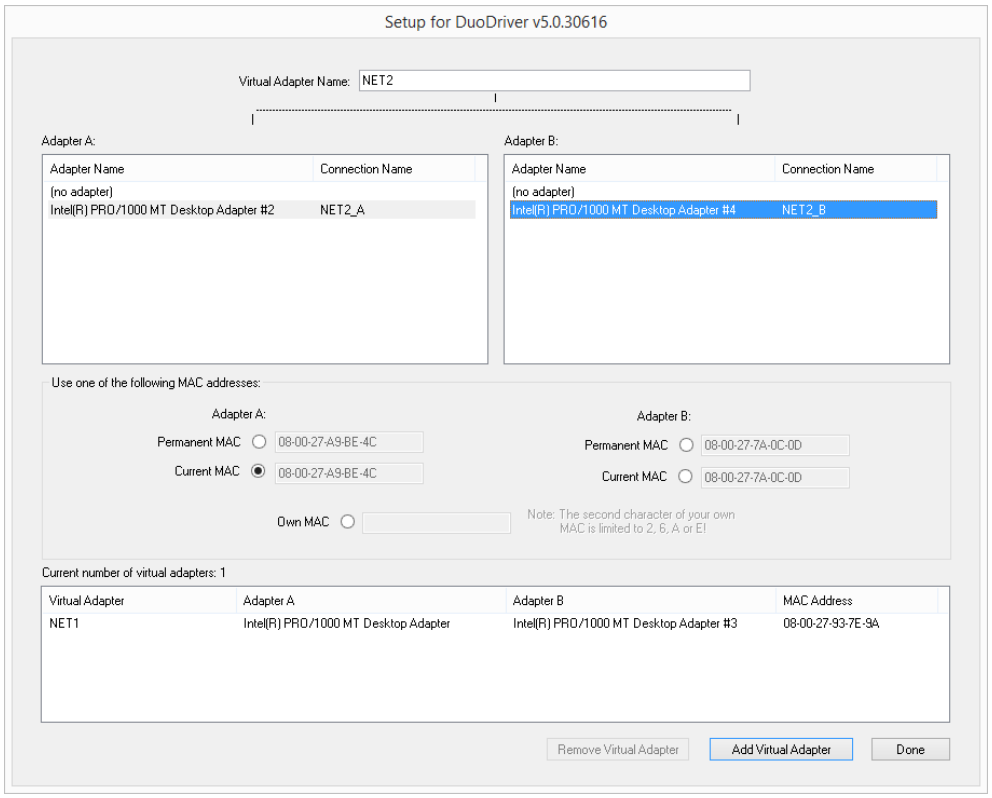


Figure 11: Virtual Adapter Setup

2.3.13 Completing installation

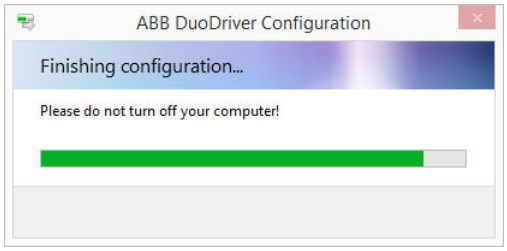


Figure 12: Installation Wizard - Completing the installation

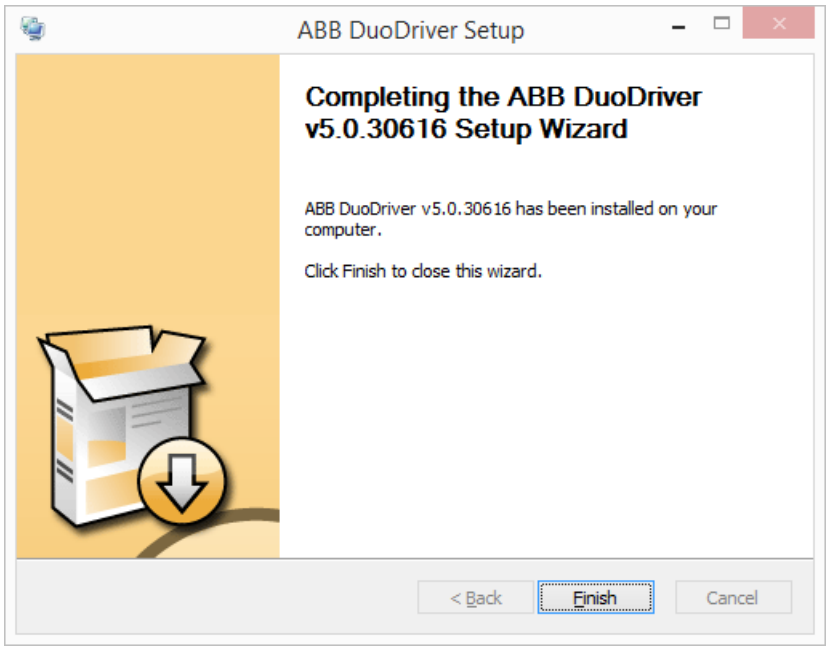


Figure 13: Installation Wizard - Installation Completed

You have successfully installed the DuoDriver.

2.3.14 Verify DuoDriver Installation

The new DuoDriver virtual adapters can be seen and renamed in Windows Network Connections.

E.g. a system with three redundant networks: Networks are named NET1, NET2 and NET3.

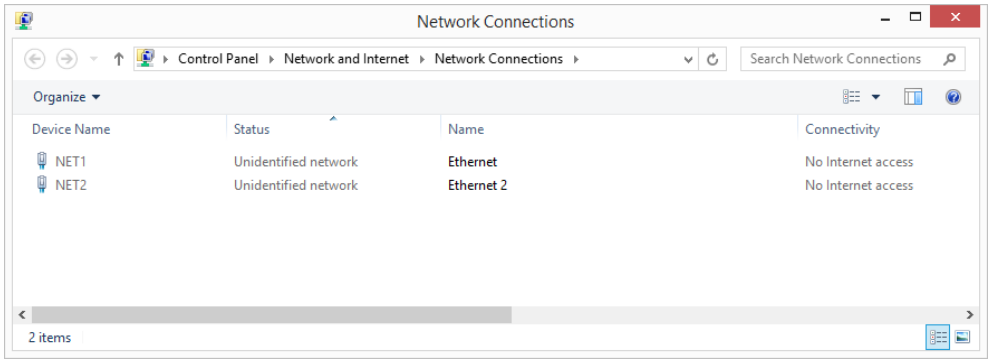


Figure 14: Virtual Adapters

If installation was succesful a management program for DuoDriver is installed. Diagnostics for DuoDriver can be viewed with DuoDriver Management and Configuration GUI. It can be started from **Start > ABB > DuoDriver > DuoDriverMgmtGUI**. See Section 4.1 for details.

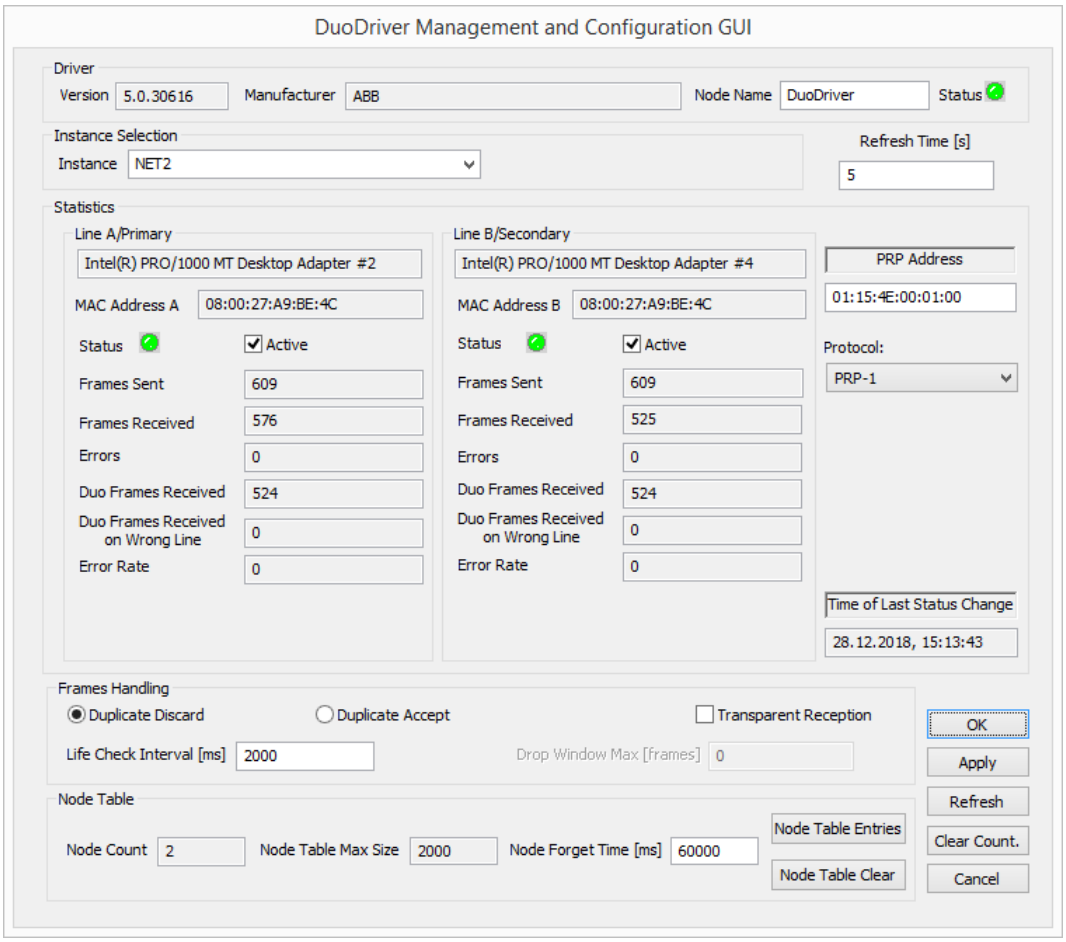


Figure 15: DuoDriver Management GUI

Section 3 IP Configuration

All new Virtual Adapters are automatically configured (DHCP) and have IPv4 and IPv6 enabled. Open the Virtual Adapter Connection Properties to change this behavior.

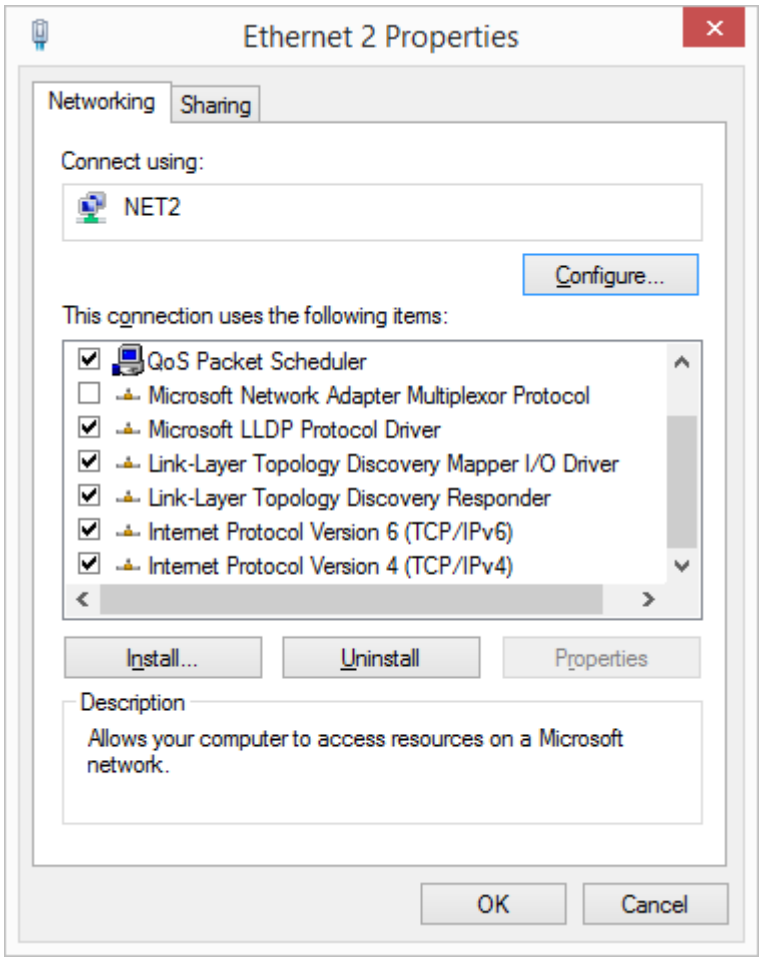
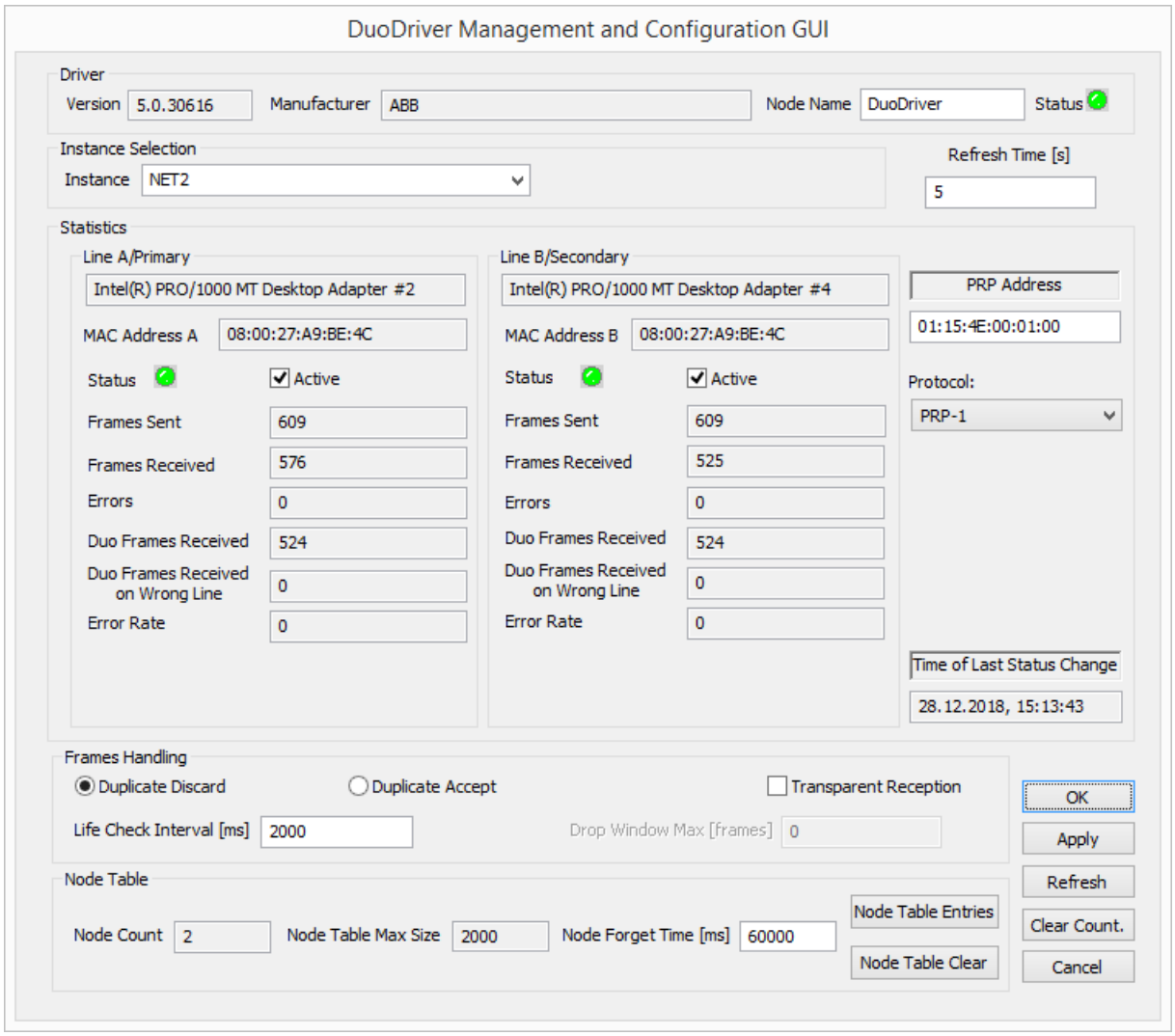


Figure 16: Virtual Adapter properties

Section 4 Management Application

4.1 Interface Configuration and Statistics



Field Name	Description	Limits
Driver Version	Version of the actual Kernel Driver	Read-only
Driver Manufacturer	Manufacturer name of this Software.	Read-only
Node Name	Name of this LRE	String (32 Bytes)
Instance Selection	Selection of LRE (= Virtual Adapter)	-
Refresh Time	Refresh interval of driver statistics.	0 = disable refresh timer
MAC Address [A/B]	MAC address of this physical adapter.	Read-only
Status	Indication if the physical link is up (green) or down (red).	Read-only
Active	Enable or disable this line (aka Port Admin State).	Boolean

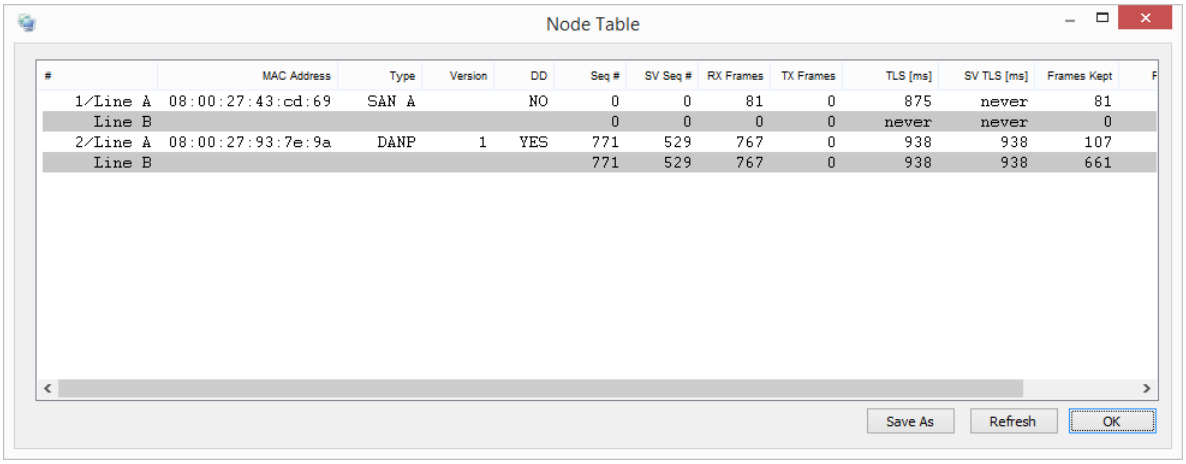
Table continues on next page

Field Name	Description	Limits
Frames Sent	Total Frames sent over this line.	Read-only
Frames Received	Total Frames received over this line.	Read-only
Errors	Total Frames received with errors over this line.	Read-only
Duo Frames Received	Total Frames received with a valid redundancy trailer.	Read-only
Duo Frames Received on Wrong Line	Total Frames received with a valid redundancy trailer, but on the wrong line.	Read-only
ErrorRate	Difference between Total Kept Frames and received Duo Frames on this line. The error rate is re-calculated for every 1000 kept packets.	Read-only
PRP Address	Supervision address.	00:15:4e:00:01:xx
Protocol	Selection of the redundancy protocol.	PRP-0 or PRP-1
Time of Last Status Change	Time of the last statistic update.	Read-only.
Duplicate Discard	Enable Duplicate Discard algorithm.	Boolean
Duplicate Accept	Disable Duplicate Discard algorithm (this mode is for test purposes only).	Boolean
Transparent Reception	Flag whether to pass or remove the redundancy trailer when passing the frame to upper layers.	Boolean.
Life Check interval	Time interval in milliseconds to send supervision frames.	Max value: 60’000 [ms]
Drop Window Max	Drop Window size used for Drop Window Algorithm in PRP version 0.	For PRP-0 only.
Node Count	Current entries in the Node Table	Read-only
Node Table Max Size	Max. entries in Node Table.	Read-only
Node Forget Time	Time after which an entry is marked as “deprecated” when no more frames have been received.	Min value: 10’000 [ms]
Node Table Entries	Opens the Node Table View (see section)	-
Node Table Clear	Removes all entries in the Node Table	-

4.1.1 Protocol Switching

If you switch from PRP-0 to PRP-1 (or vice versa) all statistics and NodeTable contents are cleared. The new protocol is starting seamless (no reboot required anymore). There are some statistics and fields available only in one version of the protocol (e.g. DropWindow Max is disabled when PRP-1 is configured).

4.2 Node Table View



Field Name	Description
#	Iteration of Node table entries. Each entry is shown as two lines in the table.
MAC Address	MAC address of the foreign node. This is the primary key of the table. • *If running PRP version 0, the local MAC address is also shown and used as primary key.*
Type	Type of the foreign node (DANP, REDBOXP, VDANP or SAN)
DD	Has the foreign node duplicate discard algorithm enabled?
Seq #	Last received PRP sequence number (found in RCT) on this line.
SV Seq #	Last received Supervision sequence number on this line.
RX Frames	Number of received frames on this line.
TX Frames	Number of sent frames on this line.
TLS	Time in milliseconds since the last frame has been received on this line.
SV TLS	Time in milliseconds since the last supervision frame has been received on this line.
Frames Kept	Number of frames passed to the upper layer.
RX SV	Number of supervision frames on this line.
RX Wrong Line	Number of received redundancy frames on the wrong line.

In addition to this NodeTable view, there is an export function (Save As) to write the current values into a comma separated values (CSV) file.

Section 5 SNMP Agent

The virtual adapter of the DuoDriver includes an optional SNMP Agent, which can be selected during the installation process. The SNMP Agent is based on Microsoft's SNMP Service – thus it provides SNMPv2c protocol.

The DuoDriver SNMP Agent implements the PRP MIB defined in the standard paper (OID=.1.0.62439.3). The following section is a summary of the most important SNMP values.

5.1 IEC62439-3-MIB (PRP)

The "LRE" shortcut is used for Link Redundancy Entity. The ProxyTable is not implemented.

5.1.1 LRE Configuration

Configuration items available per system:

Name	Description	Values
lreManufacturerName	Specifies the name of the LRE device manufacturer	*Plain text*
lreInterfaceCount	total number of LREs present in this system (= number of virtual adapters).	*Integer value*

Configuration items available per LRE:

Name	Description	Values
lreInterfaceConfigIndex	A unique value for each LRE	*Integer number*
lreRowStatus	Indicates the status of the LRE table entry.	*active(1), notInService(2), notReady(3), createAndGo(4), createAndWait(5), destroy(6)*
lreNodeType	Specifies the operation mode of the LRE	*PRP-1 (1), HSR (2)*
lreNodeName	Specifies this LRE's node name	*Plain text*
lreVersionName	Specifies the version of this LRE's software	*Plain text*
lreMacAddress	Specifies the MAC address to be used by this LRE. MAC addresses are identical for all ports of a single LRE	*MAC address*
lrePortAdminStateA[B]	Specifies whether the port shall be active or not Active through administrative action.	*notActive (1), active (2)* *Not supported (always active)*
lreLinkStatusA[B]	Shows the actual link status of the LRE's port	*up (1), down (2)*
lreDuplicateDiscard	Specifies whether a duplicate discard algorithm is used at reception.	*doNotDiscard (1), discard (2)*
lreTransparentReception	If removeRCT is configured, the RCT is removed when forwarding to the upper layers, only applicable for PRP LRE	*removeRCT (1), passRCT (2)*

Table continues on next page

Name	Description	Values
lreHsrLREMode	This enumeration is only applicable if the LRE is an HSR bridging node or RedBox.	***Not supported (RedBox only)***
lreSwitchingEndNode	This enumeration shows which feature is enabled in this particular LRE.	*(3): a PRP node/RedBox.*
lreRedBoxIdentity	Applicable to RedBox HSR-PRP A and RedBox HSR-PRP B.	***Not supported (RedBox only)***
lreEvaluateSupervision	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.*	*Always TRUE*
lreNodesTableClear	Specifies that the Node Table is to be cleared	*Set to 1 clears the Node Table*
lreProxyNodeTableClear	Specifies that the Proxy Node Table is to be cleared	***Not supported (RedBox only)***

5.1.2 LRE Statistics

Per Interface statistics:

Name	Description	Values
lreInterfaceStatsIndex	A unique value for each LRE	*Integer number*
lreCntTxA	Number of frames with RCT send on Port A	*Integer number*
lreCntTxB	Number of frames with RCT send on Port B	*Integer number*
lreCntTxC	Number of frames sent towards the application interface	***Not supported***
lreCntErrWrongLanA	Number of frames with the wrong LAN identifier received on LRE port A	*Integer number*
lreCntErrWrongLanB	Number of frames with the wrong LAN identifier received on LRE port B	*Integer number*
lreCntErrWrongLanC	Number of frames with the wrong LAN identifier received on the interlink of a RedBox	***Not supported (RedBox only)***
lreCntRxA	Number of frames with RCT received on Port A	*Integer number*
lreCntRxB	Number of frames with RCT received on Port B	*Integer number*
lreCntRxC	Number of frames received from the application interface. All frames (with our without RCT) are counted	***Not supported***
lreCntErrorsA	Number of frames with errors received on this LRE port A	*Integer number*
lreCntErrorsB	Number of frames with errors received on this LRE port B	*Integer number*
lreCntErrorsC	Number of frames with errors received on the application interface	***Not supported***
lreCntNodes	Number of nodes in the Nodes Table	*Integer number*
lreCntProxyNodes	Number of nodes in the Proxy Node Table	***Not supported (RedBox only)***

Table continues on next page

Name	Description	Values
lreCntUniqueRxA	Number of entries in the duplicate detection mechanism on port A for which no duplicate was received	***Not supported***
lreCntUniqueRxB	Number of entries in the duplicate detection mechanism on port B for which no duplicate was received	***Not supported***
lreCntUniqueRxC	Number of entries in the duplicate detection mechanism on the application interface for which no duplicate was received	***Not supported***
lreCntDuplicateRxA	Number of entries in the duplicate detection mechanism on port A for which one single duplicate was received	***Not supported***
lreCntDuplicateRxB	Number of entries in the duplicate detection mechanism on port B for which one single duplicate was received	***Not supported***
lreCntDuplicateRxC	Number of entries in the duplicate detection mechanism on the application interface for which one single duplicate was received	***Not supported***
lreCntMultiRxA	Number of entries in the duplicate detection mechanism on port A for which more than one duplicate was received	***Not supported***
lreCntMultiRxB	Number of entries in the duplicate detection mechanism on port B for which more than one duplicate was received	***Not supported***
lreCntMultiRxC	Number of entries in the duplicate detection mechanism on the application interface for which more than one duplicate was received	***Not supported***

Per Node statistics:

Name	Description	Values
lreNodesIndex	Unique value for each node in the LRE's node table."	*Integer number*
lreNodesMacAddress	MAC Address of the remote Node	*MAC Address*
lreTimeLastSeenA	Time since the last packet arrived on Port A	*Integer number [time in 1/100s]*
lreTimeLastSeenB	Time since the last packet arrived on Port B	*Integer number [time in 1/100s]*
lreRemNodeType	Remote Node type	*danp(0), redboxp(1), vdanp(2), danh(3), redboxh(4), vdanh(5)*

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