Emulex® Drivers for Windows

User Guide
Release 12.2

Table of Contents

Chapter 1: Introduction

This document explains how to install the Emulex® drivers for Windows on your system and configure the drivers' capabilities.

This product supports the following Emulex adapters:

- LPe12000-series adapters
- LPe16000-series adapters
- LPe31000-series adapters
- LPe32000-series adapters
- LPe35000-series adapters

1.1 Abbreviations

1GbE	1 Gigabit Ethernet
10GbE	10 Gigabit Ethernet
AL_PA	arbitrated loop physical address
APTS	
ARM	Advanced RISC Machines
BIOS	basic input-output system
CPU	central processing unit
CRC	cyclic redundancy check
DCBX	Data Center Bridging Capabilities Exchange
DHCP	Dynamic Host Control Protocol
DID	device ID
DIMM	dual inline memory module
DMA	direct memory access
DNS	Domain Name Server
DOS	disk operating system
DPC	deferred procedure call
ETS	Enhanced Transmission Selection
FA-PWWN	Fabric Assigned Port World Wide Name
FC	Fibre Channel
FC-AL	Fibre Channel Arbitrated Loop
FCP	Fibre Channel Protocol
FDMI	Fabric-Device Management Interface
FLOGI	fabric login
FSB	front-side bus
GB	gigabyte
Gb/s	gigabits per second
GUI	graphical user interface

HBA	host bus adapter
IEEE	Institution of Electrical and Electronics Engineers
IP	Internet Protocol
iSCSI	Internet Small Computer Systems Interface
I/O	input/output
IOMMU	input/output memory management unit
KB	Knowledge Base
LACP	Link Aggregation Control Protocol
LAN	local area network
LSO	large send offload
LUN	logical unit number
MAC	Media Access Control
MDS	Multilayer Director Switch
MSI	message signaled interrupts
MTU	maximum transmission unit
N/A	not applicable
NDIS	Network Driver Interface Specification
NPIV	N_Port ID virtualization
NTFS	New Technology File System
NUMA	non-uniform memory access
NVGRE	network virtualization using generic routing encapsulation
NVMe	nonvolatile memory express
OS	operating system
PCI	Peripheral Component Interconnect
PCIe	PCI Express
PF	PCI function
PFC	process flow control or priority flow control
PLOGI	port login
POST	power-on self-test
PT-PT	point-to-point
PXE	Preboot Execution Environment
QFE	Quick Fix Engineering
RAID	redundant array of independent disks
RCMD	Remote Command Service
ROM	read-only memory
RSC	receive segment coalescing
RSCN	registered state change notification
RSS	receive-side scaling
RX	receive

SACK	selective acknowledgement
SAN	storage area network
SCSI	Small Computer System Interface
SFP	small form-factor pluggable
SLI	Service Level Interface
SR-IOV	Single Root I/O Virtualization
TCP	Transmission Control Protocol
TCP/IP	Transmission Control Protocol/Internet Protocol
TX	transmit
UDP	User Datagram Protocol
UEFI	Unified Extensible Firmware Interface
ULP	unit of least precision
VF	virtual function
VHD	virtual hard disk
VLAN	virtual local area network
VLAN ID	VLAN identifier
VM	virtual machine
VMQ	virtual machine queue
WWN	World Wide Name
WWNN	World Wide Node Name
WWPN	World Wide Port Name
XRI	extensible resource indicator

Chapter 2: Installation

Install the Windows drivers in one of two ways:

- OneInstall Installer contains the Emulex Storport Miniport driver and the OneCommand® Manager application in a single download package.
- Driver kits and AutoPilot Installer provide installation options ranging from simple installations with a few mouse clicks to unattended installations that use predefined script files and text-only installations.

NOTE: Check www.broadcom.com for required updates to the Windows operating system or the Emulex drivers.

2.1 OneInstall Installer

OneInstall Installer can be run in Interactive mode or Silent mode.

NOTE: OneInstall Installer does not allow you to perform preinstallation tasks or text-only installations. For these tasks, use the driver kits.

OneInstall Installer is a self-extracting executable file that installs the following software on your system:

- FC driver
- OneCommand Manager application

NOTE: The enterprise kit for the OneCommand Manager application does not operate locally on Windows Server Core. You must install the OneCommand Manager core kit (command line interface only) on Windows Server Core. Refer to the *Emulex OneCommand Manager Application User Guide* for installation instructions.

2.1.1 Loading OneInstall Installer Using Interactive Mode

To install the drivers using Interactive mode, perform these steps:

1. Download OneInstall Installer from the Broadcom website.
2. Navigate to OneInstall Installer in Windows Explorer.
3. Double-click **OneInstall Installer**.

   The **Welcome** screen is displayed.
4. Click **Next**.

   The **Installation Options** screen is displayed.
5. Select the drivers and applications that you want to install and click **Next**.

   A progress screen is displayed while OneInstall installer loads the selected drivers and applications. After the drivers and application software are loaded, an **Installation completed** screen is displayed.
6. Click **Finish**.

2.1.2 Loading OneInstall Installer Using Silent Mode

Silent mode installation must be run from a batch file or from the command line.

If you run OneInstall Installer from a batch file or from a command line prompt, the default Windows behavior starts OneInstall, then immediately continues with the next command. It does not wait until OneInstall Installer has finished.

As a result, the value of `%ERRORLEVEL%` will always be `0` because Windows successfully started OneInstall Installer. It does *not* reflect an accurate OneInstall Installer exit code.

To remedy this problem, run OneInstall Installer setup as follows:

```
START /wait OneInstall-Setup-<version>.exe
echo %ERRORLEVEL%
```

The `START /wait` entry ensures that the command does not return until setup has exited. The value of `%ERRORLEVEL%` now accurately reflects the OneInstall Installer exit code.

2.1.2.1 Command Format

The format of the command is:

```
OneInstall-Setup-<version>.exe <install-mode> <options>
```

Where:

<version> is the version number of OneInstall Installer.

<*install-mode*> is one of the following:

`/q0` – (Interactive, non-silent install) This is the default.

`/q1` – (Non-interactive install) This option displays status pages.

`/q2` – (Silent install) This option is completely silent; no pages are displayed.

`/q` – This is the same as `/q1`.

<*options*> specify the kit, or kits, to install:

`ALL=1` – Installs the FC driver and the OneCommand Manager application (default).

NOTE: On a Windows Server Core system, this option installs all drivers and the OneCommand Manager core kit.

`ALLCORE=1` – Installs the FC driver and the OneCommand Manager core kit.

`FC=1` – Installs the FC driver only.

`OCM=1` – Installs the OneCommand Manager core kit only.

NOTE: On a Windows Server Core system, this option installs the OneCommand Manager core kit.

`OMCORE=1` – Installs the OneCommand Manager core kit only.

To install the drivers using Silent mode, perform these steps:

1. Download OneInstall Installer from the Broadcom website.
2. Open a DOS window.
3. Change the directory to the folder containing your OneInstall Installer package.

The following are examples of Silent mode commands:

```
Start /wait OneInstall-Setup-<version>.exe  /q2  ALL=1
Start /wait OneInstall-Setup-<version>.exe  /q2  FC=1
Start /wait OneInstall-Setup-<version>.exe  /q2  OCM=1
Start /wait OneInstall-Setup-<version>.exe  /q2  ALLCORE=1
Start /wait OneInstall-Setup-<version>.exe  /q2  OCMCORE=1
```

2.2 Driver Kit Installer

Each driver kit contains and loads the Windows driver package `elxdrvr-fc-<version>.exe)`.

2.2.1 Loading the Driver Kit

The driver kit copies the selected Emulex drivers and applications onto your computer.

NOTE: This procedure does not install drivers, and no driver changes are made until you run AutoPilot Installer.

To load the driver kit, perform these steps:

1. Download the driver kit from the Broadcom website to your system.
2. Double-click the driver kit to run it.

   The **Emulex Kit Welcome** page is displayed.
3. Click **Next**.

   The **Installation Options** window is displayed.
4. Select one or both of the following options:
   - **Perform Installation of Software** – Copies the driver kit for your operating system to your computer.
   - **Unpack All Drivers** – Extracts all drivers to the current user's `Documents` folder. Select this option to perform boot from SAN installations.

   The **Operation in progress** window shows the kit file-loading progress. After the kit files are loaded, the **Installation completed** window is displayed.
5. To continue with the installation, ensure that **Start AutoPilot Installer** is selected.

2.3 AutoPilot Installer

AutoPilot Installer runs after the driver kit is loaded and the OneCommand Manager application is installed. AutoPilot Installer can be installed at these times:

- Immediately after the driver kit has been loaded
- At a later time using an interactive installation
- Through an unattended installation

AutoPilot Installer provides the following functions:

- Command line functionality – Initiates an installation from a command prompt or script. Configuration settings can be specified in the command line.
- Compatibility verification – Verifies that the driver to be installed is compatible with the operating system and platform.
- Driver installation and update – Installs and updates drivers.
- Multiple adapter installation capability – Installs drivers on multiple adapters, alleviating the requirement to manually install the same driver on all adapters in the system.

NOTE: Refer to the *Emulex Software Kit Migration User Guide* for information about installing drivers on a system containing a mix of OneConnect® and LightPulse® adapters.

- Driver diagnostics – Determines whether the driver is operating properly.
- Silent installation mode – Suppresses all screen output (necessary for unattended installation).

NOTE: AutoPilot Installer does not allow you to install the driver if the minimum Windows service pack or Microsoft Storport driver update is not installed.

You can install the driver by using any of the following methods.

NOTE: These installation methods are not mutually exclusive.

- **Hardware-first installation**. At least one Emulex adapter must be installed before you can install the Emulex drivers and utilities.
- **Software-first installation**. You can install drivers and utilities using AutoPilot Installer prior to the installation of any adapters. You do not need to specify the adapter models to be installed later. The appropriate drivers and utilities automatically load when you install the adapters.
- **Utility-only installation**. If the drivers in the driver kit share the same version with those already installed on the system, you can reinstall or update the previously installed utility without reinstalling the drivers.
- **Text-only installation**. Text-based installation mode is used automatically when AutoPilot Installer is run on a Windows Server Core system.
- **Network installation.** You can place the driver kit installers on a shared network drive and install them across your local area network (LAN). Network-based installation is often used with unattended installation and scripting, which allows you to configure and install the same driver and utility versions on all the hosts in a storage area network (SAN).
- **Unattended installation**. You can run the driver kit installers and AutoPilot Installer with no user interaction from a command line or script. Unattended installation works for both hardware-first and software-first installations and all driver kits. An unattended installation operates in Silent mode (also referred to as Quiet mode) and creates an extensive report file with installation status.

NOTE: Complete driver and utilities documentation can be downloaded from the Broadcom website.

2.3.1 Starting Installers from a Command Prompt or Script

If a driver kit or AutoPilot Installer is run from a command prompt or command script (batch file), the Windows command processor does not wait for the installer to run to completion. As a result, you cannot check the exit code of the installer before the next command is executed. For command line invocation, always use the `START` command with the `/wait` option, which causes the command processor to wait for the installer to finish before the command processor continues.

For additional information on command line installation and configuration parameters, see Appendix B, AutoPilot Installer Command Line and Configuration File Parameters.

2.3.2 Running a Software Installation Interactively

Two options are available when performing an installation interactively. These options assume you have already downloaded the driver kit from the Broadcom website.

- Option 1 allows you to automatically run AutoPilot Installer, which completes the driver kit loading and installation with a few mouse clicks.
- Option 2 allows you to run AutoPilot Installer separately. Use this option to perform the following actions:
  - Changing installation settings for a limited number of systems
  - Familiarizing yourself with AutoPilot Installer configuration options

2.3.2.1 Option 1: Automatically Run AutoPilot Installer

Use this option unless you have specific configuration requirements.

1. Double-click the driver kit or run it from a command line. The command line parameter `APargs` allows you to specify arguments that are automatically passed to the AutoPilot Installer command.

   A **Welcome** window is displayed with driver kit version information and Emulex contact information (see Appendix B, AutoPilot Installer Command Line and Configuration File Parameters, for additional information on command line installations).

2. Click **Next** to proceed to the **Installation Options** window.

   For each installation option, the default installation location for that option is displayed. Browse to a different location, if desired.

3. Click **Install** to continue the installation.

   The **Progress** dialog is displayed.

   After all tasks complete, a **Finish** window is displayed. The **Start AutoPilot Installer** check box is automatically selected.

4. Click **Finish**.

   AutoPilot Installer runs automatically and completes one of the following installations:
   - Section 2.3.3, Hardware-First Installation or Driver Update
   - Section 2.3.4, Software-First Installation

2.3.2.2 Option 2: Run AutoPilot Installer Separately

To access these options, run AutoPilot Installer after the driver kit loading has been completed, which allows you to change the configuration options supplied to AutoPilot Installer.

1. Perform Step 1 through Step 3 in Option 1: Automatically Run AutoPilot Installer.
2. Clear the **Run AutoPilot Installer** check box on the **Finish** dialog.
3. Click **Finish**.

   The driver kit installer exits.

   After the driver kit loading is complete, change the configuration in one of two ways:
   - Change the configuration file.
   - Supply parameters on the command line.

NOTE: See Appendix B, AutoPilot Installer Command Line and Configuration File Parameters, for additional information on either of these configuration methods.

After you have finished this step, you can run AutoPilot Installer at a later time.

4. Run AutoPilot Installer using the following command:

```
C:\Program Files\Emulex\AutoPilot Installer\APInstall.exe
```

NOTE: The location of `APInstall.exe` might differ on your system, depending on your system's Program Files location. You can also specify a different location when you install the driver package.

2.3.3 Hardware-First Installation or Driver Update

The driver kit installer must be downloaded from the Broadcom website and installed before performing this installation.

NOTE: To update the Emulex protocol drivers, begin this procedure at Step 2.

To perform a hardware-first installation, perform these steps:

1. Install a new Emulex adapter and power on the system. If the **Windows Found New Hardware** wizard is displayed, click **Cancel** to exit; AutoPilot Installer performs this function.

NOTE: If multiple adapters are in the system, the **Windows Found New Hardware** wizard is displayed multiple times. Click **Cancel** to exit the wizard each time it is displayed.

2. Run AutoPilot Installer using one of the two options listed in Section 2.3.2, Running a Software Installation Interactively.

   Consider the following items:
   - If you are updating the driver, the existing port settings are used, unless otherwise specified in the configuration file. These settings are preselected but can be changed. Set or change the settings, then click **Next**.
   - If you are initially installing a vendor-specific version of the Emulex driver installation program, a **Driver Configuration** window might be displayed. This window includes one or more windows with questions that you must answer before continuing the installation process. In this case, answer each question and click **Next** on each window to continue.
3. Click **Next**. The installation is completed automatically.

   A dialog is displayed if Windows requires a reboot. After the installation is successful, a **Finish** window is displayed.
4. View or print a report, if desired.
   - **View Installation Report** – The installation report is a text file with current Emulex adapter inventory, configuration information, and task results.
   - **Print Installation Report** – The Windows **Print** dialog is displayed to select options for printing the installation report.
5. Click **Finish** to exit AutoPilot Installer.
6. If the system must be rebooted, you are prompted to do so. You must reboot before using the drivers or utilities.

2.3.4 Software-First Installation

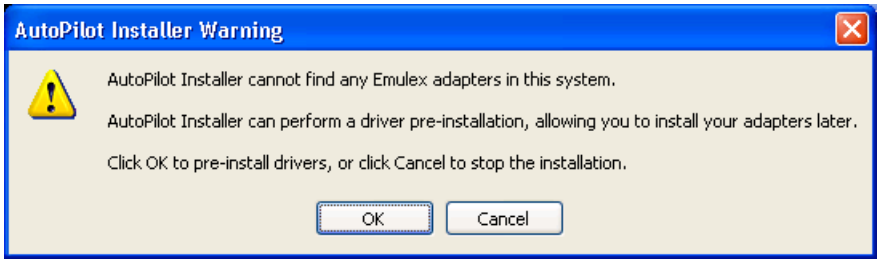
The driver kit must be downloaded from the Broadcom website and loaded.

To do a software-first installation, perform these steps:

1. Run AutoPilot Installer using one of the two options listed in Section 2.3.2, Running a Software Installation Interactively.

   Figure 1 is displayed.

Figure 1: AutoPilot Installer Warning (Software-First Installation)



2. Click **OK**.

   A **Welcome** window is displayed.

3. Click **Next**. The installation automatically progresses.

   After the installation is successful, the **Finish** window is displayed.

4. View or print a report, if desired.
   - **View Installation Report** – The installation report is a text file with the current Emulex adapter inventory, configuration information, and task results.
   - **Print Installation Report** – The Windows **Print** dialog is displayed to select options for printing the installation report.

5. Click **Finish** to exit AutoPilot Installer.

2.3.5 Text-Only Driver Installation

Text-based Installation mode is used automatically when the driver kit installer runs on a server with the Server Core installation option of Windows Server. During text-based installations, AutoPilot Installer uses a command prompt window. The driver kit installer notifies you when the driver is installed and also gives you an opportunity to stop the installation.

Whether AutoPilot Installer is launched from the command line or run as a program, Windows always starts AutoPilot Installer as a separate stand-alone task. This means that AutoPilot Installer has its own command prompt window and cannot access other windows.

2.3.6 Unattended Driver Installation

An unattended driver installation, sometimes referred to as a quiet or silent installation, requires no user input. This is useful for performing an installation remotely from a command script, or if you want to ensure that a custom configuration is not changed by a user during installation.

In unattended installation mode, AutoPilot Installer performs the following actions:

- Reads the configuration file
- Reads any options that might be specified on the command line, overriding the configuration file settings as appropriate
- Opens the installation report file
- Validates the operating system
- Discovers adapters and records the adapter inventory in the report file
- Verifies mandatory configuration file parameters
- Searches for drivers to install based on the LocalDriverLocation setting in the configuration file
- Verifies, if appropriate, that the selected driver is either a different type than the currently installed driver or a more recent version of the currently installed driver

- Copies the driver parameters from the configuration file into the registry for the driver's co-installer
- Installs or updates the driver
- Rediscovers adapters and records the updated adapter inventory in the report file
- Records the final results and closes the report file

An unattended installation can be performed in two ways:

- Installs the driver silently.
- Runs the driver kit installer separately.

2.3.6.1 Option 1: Install the Driver Silently

Run the driver kit from a command prompt or script. Specify the `/q` (quiet) command line option. For example:
`elxdrvr-fc<version>.exe /q`

NOTE: The name of the driver kit depends on the current version identifier. For other command line options, see Appendix B, AutoPilot Installer Command Line and Configuration File Parameters.

2.3.6.2 Option 2: Run the Driver Kit Installer Separately

To run the driver kit separately, perform these steps:

1. Follow Step 1 to Step 3 in Section 2.3.2, Running a Software Installation Interactively.
2. Clear the **Run AutoPilot Installer** check box on the **Finish** dialog.
3. Choose one of the following options:
   – Run AutoPilot Installer from a command prompt or script with the silent option:
   `APInstall.exe /silent`
   – Edit the AutoPilot Installer configuration file before running AutoPilot Installer. The configuration file is typically in the following location:
   `C:\Program Files\Emulex\AutoPilot Installer\<driver type>\APInstall.cfg`
   Uncomment the line that sets `SilentInstallEnable` to `True`. You may also want to edit other settings in the same section of the configuration file related to unattended installations. See Appendix B, AutoPilot Installer Command Line and Configuration File Parameters, for additional information. After editing the file, run AutoPilot Installer from the **Start** menu, a command prompt, or a script.

2.3.7 Installation Failure

The two possible installation failures are described in this section.

2.3.7.1 AutoPilot Installer Failure

If AutoPilot Installer fails, the **Diagnostics** window shows that the adapter failed. If the adapter fails, perform these steps:

1. Select the adapter to view the reason why the adapter failed. The reason and suggested corrective action are displayed.
2. Perform the suggested corrective action, and run AutoPilot Installer again.

NOTE: You can run `APInstall.exe` from a command prompt.

2.3.7.2 OneInstall Installer Failure

OneInstall Installer might fail for any of the following reasons:

- The operating system prerequisites have not been met.
- The individual kit installation failed. To check the installation, run the installation interactively. If you encounter error messages when you run the installation interactively, those issues would also apply to an unattended installation.
- If an individual package failed to install properly, run that package's installer directly. This method displays status and error messages that can be used to diagnose the issue. (OneInstall Installer does not provide this information because each package is installed silently.)

2.4 Manually Installing or Updating the Emulex Drivers

You can install or update the Emulex protocol drivers and utilities manually without using AutoPilot Installer.

2.4.1 Installing or Updating the Storport Miniport Drivers

To update or install the Storport Miniport driver from the desktop, perform these steps:

1. Select **Start > Settings > Control Panel > System**.
2. Select the **Hardware** tab.
3. Click **Device Manager.**
4. Open the **Storage Controllers** item.
5. Double-click the desired Emulex adapter.

NOTE: The driver affects only the selected adapter. If there are other adapters in the system, you must repeat this process for each adapter. All dual-channel adapter models are displayed in Device Manager as two adapters, and each adapter must be updated.

6. Select the **Driver** tab.
7. Click **Update Driver.** The **Update Driver** wizard starts.
8. Select **No, not this time**. Click **Next** on the **Welcome to the Hardware Update Wizard** window.
9. Select **Install from a list or specific location (Advanced)** and click **Next.**
10. Select **Don't search. I will choose the driver to install** and click **Next.**
11. Click **Have Disk** and direct the **Device Wizard** to the location of `oemsetup.inf`. If you have installed the driver installer kit in the default folder, the path is:
    `C:\Program Files\Emulex\AutoPilot Installer\FC\Drivers\Storport\x64\<OS>`
12. Click **OK**. Select **Emulex LightPulse LPX000, PCI Slot X, Storport Miniport Driver** (your adapter model is displayed here).
13. Click **Next**.
14. Click **Finish**.

    The driver installation has completed. The driver will start automatically. If the adapter is connected to a SAN or data storage device, a blinking yellow light on the back of the adapter indicates a linkup condition.

2.5 Removing the Emulex Driver Kits and Drivers

This section details procedures to uninstall the driver kits.

2.5.1 Uninstalling the Emulex Driver Kits

NOTE: If you uninstall the Emulex driver kit, AutoPilot Installer is automatically uninstalled.

2.5.1.1 Uninstalling an Emulex Driver Kit on Windows Server 2012, Windows Server 2016, and Windows Server 2019.

To uninstall a driver kit on a Windows Server 2012, Windows Server 2016, or Windows Server 2019 system, perform these steps:

1. Select **Start > Control Panel**.
2. From the Control Panel, select **Programs > Uninstall a Program**.
3. Select one of the following in the program list and click the **Uninstall** icon in the tool bar above the program list. If you have User Access Control enabled, click **Continue** when asked for permission.
   - `Emulex /FC kit-2.xx.xxx`
4. Click **Yes** when prompted to remove the driver kit. After the driver kit is removed from the system, click **OK**.

2.5.1.2 Uninstalling an Emulex Driver Kit on a Server Core System

To uninstall a driver kit on a Server Core system, perform these steps:

1. From the system prompt, navigate to the **Program Files** folder.
2. Navigate to **Emulex\AutoPilot Installer**.
3. Run the following batch file:
   - `Uninstall_fc_kit.bat`

The driver files are removed from the system.

On all platforms, the reports folder in the `Emulex\AutoPilot` Installer folder is not removed, so you can still view installation history and the drivers that have been installed on the system. You can delete the reports folder at any time.

2.5.2 Uninstalling the Emulex Drivers

The Emulex Storport Miniport driver is uninstalled using the Device Manager.

2.5.2.1 Uninstalling an Emulex Storport Miniport Driver

To uninstall the Emulex Storport Miniport driver, perform these steps:

1. Select **Start > All Programs > Administrative Tools > Computer Management**.
2. Click **Device Manager.**
3. Double-click the adapter from which you want to remove the Storport Miniport driver. A device-specific console window is displayed. Select the **Driver** tab.

4. Click **Uninstall** and click **OK** to uninstall.

2.5.2.2 Uninstalling the Emulex Storport Miniport Driver on Windows Server 2012, Windows Server 2016, and Windows Server 2019.

The Emulex Storport Miniport driver is uninstalled using the Device Manager.

NOTE: On Windows Server 2012, Windows Server 2016, and Windows Server 2019, after the message `Warning – you are about to uninstall this device from your system` is displayed, you must select the check box **Delete the software for this device** to uninstall the driver.

To uninstall the Emulex Storport Miniport driver in Windows Server 2012, Windows Server 2016, or Windows Server 2019, perform these steps:

1. Select **Server Manager > Dashboard > Tools > Computer Management > Device Manager**.
2. Double-click the adapter from which you want to remove the Storport Miniport driver. A device-specific console window is displayed.
3. Select the **Driver** tab.
4. Click **Uninstall** and click **OK** to uninstall.

Chapter 3: Configuration

3.1 Driver Configuration

The Emulex Storport Miniport driver has many options that you can modify to provide different behavior. You can set Storport Miniport driver parameters using the OneCommand Manager application. Refer to the *Emulex OneCommand Manager Application User Guide* for information on using this utility to configure the driver.

3.1.1 Configuring Driver Parameters

Table 1, provides information, such as the range of permissible values and the factory defaults. Parameters can be entered in either decimal or hexadecimal format.

A parameter has one of the following activation requirements:

- Dynamic – The change takes effect while the system is running.
- Reset – An adapter reset from the utility is required before the change takes effect.
- Reboot – A reboot of the entire machine is required before the change takes effect. In this case, you are prompted to perform a reboot when you exit the utility.

NOTE: If you are creating custom unattended installation scripts, any driver parameter can be modified and included in the script.

NOTE: When a new WWPN is assigned using FA-PWWN, persistently stored configuration information associated with the original WWPN, such as driver parameters and LUN frame priority settings, is not applied to the newly assigned WWPN. The configuration information associated with the original WWPN must be reconfigured for the new WWPN.

Most parameters default to a setting that optimizes adapter performance.

3.1.1.1 Enabling and Configuring NVMe over FC on an Initiator

You can configure NVMe driver parameters using the OneCommand Manager GUI or the OneCommand Manager CLI.

- Refer to the *Emulex OneCommand Manager Application for LightPulse Adapters User Guide* for detailed information on starting the OneCommand Manager GUI and navigating to the **Driver Parameters** tab.
- Refer to the *Emulex OneCommand Manager Command Line Interface for LightPulse Adapters User Guide* for detailed information on using the `SetDriverParam` command.

NOTE: Using the OneCommand Manager CLI, you can use the `GetDriverParam` command to view the current settings for the parameters.

Table 1: Storport Miniport Driver Parameters

Parameter	Definitions	Activation Requirement	Notes
AutoMap	AutoMap controls the way targets are assigned SCSI IDs. Discovered targets are assigned persistent SCSI IDs according to the selected binding method. Persistent bindings do not take effect with the driver in stand-alone mode. ■ 0 = Automap is disabled. The OneCommand Manager application persistently sets the SCSI address of a discovered FCP-capable FC node (target). ■ 1 = Automap by WWNN. ■ 2 =Automap by WWPN. ■ 3 = Automap by DID. Values: 0 to 3 Default: 2 **NOTE:** If the EnableNVME parameter is set to 1, the driver automatically sets the AutoMap parameter to the default value of 2, automap by WWPN.	Reboot	—
BBCRecovery	If set to 1, BBCRRecovery enables buffer-to-buffer credit recovery. Buffer-to-buffer credit recovery also requires adapter firmware and switch firmware support. Values: 0 to 1 Default: 1	Reset	LPe16000-series and LPe32000-series adapters only.
Class	Class selects the class of service on FCP commands. ■ If set to 2, class of service is 2. ■ If set to 3, class of service is 3. Values: 2 to 3 Default: 3	Dynamic	Supported on LPe12000-series adapters only.
CoalesceMsCnt	CoalesceMsCnt specifies wait time in milliseconds to generate an interrupt response if CoalesceRspCnt has not been satisfied. Zero specifies an immediate interrupt response notification. A nonzero value enables response coalescing at the specified interval in milliseconds. Value: 0 to 63 (decimal) or 0x0 to 0x3F (hexadecimal) Default: 0 (0x0)	Reset	Supported on LPe12000-series adapters only.
CoalesceRspCnt	CoalesceRspCnt specifies the number of response entries that trigger an interrupt response. Values: 0 to 255 (decimal) or 0x1 to 0xff (hexadecimal) Default: 8 (0x8)	Reset	Supported on LPe12000-series adapters only.
ConfigScale	ConfigScale sets the memory footprint profile in accord with the anticipated use case on a per-port basis. ConfigScale is always set at 4. The maximum transfer size is set according to the value of the ExtTransferSize parameter. Default: 4	Reboot	Not supported on LPe12000-series adapters.

Table 1: Storport Miniport Driver Parameters (Continued)

Parameter	Definitions	Activation Requirement	Notes
DriverTraceMask	The DriverTraceMask parameter is only available on operating systems that support extended system event logging. ■ If set to 0 = The parameter is disabled. ■ If set to 1 = Error events logging is enabled. ■ If set to 4 = Warning events logging is enabled. ■ If set to 8 = Informational events logging is enabled. The values can be masked to generate multiple levels of event logging. Values: 0, 1, 4, and 8 Default: 0	Dynamic	—
EnableAck0	Set to 1 to force sequence rather than frame level acknowledgment for class 2 traffic over an exchange. This applies to FCP data exchanges on IREAD and IWRITE commands. Values: 0 to 1 (decimal) Default: 1	Reset	Supported on LPe12000-series adapters only.
EnableAUTH	EnableAUTH enables DHCHAP fabric authentication. This parameter requires the authentication to be supported by the fabric. Authentication is enabled if this value is set to 1. Values: 0 to 1 Default: 0	Reboot	EnableAuth must be disabled before deleting authentication for all ports.
EnableFDMI	If set to 1, enables management server logon on fabric discovery, which allows FDMI to operate on switches that have FDMI-capable firmware. FDMI operates as FDMI-1. If set to 2, FDMI operates as FDMI-2. If set to 0, FDMI is disabled. Values: 0 to 2 (decimal) Default: 2	Reset	—
EnableMDSD	If set to 1, Cisco Multilayer Director Switch (MDS) diagnostics are enabled. Values: 0 to 1 Default: 0 The parameter should be disabled (set to 0) after diagnostics are complete.	Reset	—
EnableNVMe	EnableNVMe enables or disables driver NVMe over FC functionality. ■ 0 = Disable NVMe ■ 1 = Enable NVMe Values: 0 or 1 Default: 0	Reboot	Enabling NVME causes the driver to allocate more memory resources to support NVMe over FC. It also activates NVMe discovery in addition to FCP discovery, which allows the driver to discover both FCP targets and NVMe over FC targets. The driver runs in either FCP mode or in FCP+NVMe mode. NVMe-only mode is not supported.

Table 1: Storport Miniport Driver Parameters (Continued)

Parameter	Definitions	Activation Requirement	Notes
EnableXLane	EnableXLane enables ExpressLane™ If set to 1, enables the driver to set the CS_CTL priority according to the value of XLanePriority driver parameter. Values: 0 or 1 Default: 0 **NOTE:** If the EnableXLane parameter is set to 1, ExpressLane functionality is applied only to FCP LUNs, and not to NVMe namespaces.	Reboot	Not supported on LPe12000-series adapters.
ExtTransferSize	ExtTransferSize is an initialization-time parameter that affects the maximum SGL that the driver can handle, which determines the maximum I/O size that a port will support. ■ If set to 0 = The maximum default transfer size is 512 KB for all controller models. ■ If set to 1= The maximum transfer size is 1 MB. ■ If set to 2 = The maximum transfer size is 2 MB. ■ If set to 3 = The maximum transfer size is 4 MB. Values: 0 to 3 Default: 0 (disabled)	Reboot	—
FrameSizeMSB	FrameSizeMSB controls the upper byte of receive FrameSize if issued in PLOGI. This allows the FrameSize to be constrained on 256-byte increments from 256 (1) to 2048 (8). Values: 0 to 8 Default: 0	Reset	—
FwLogBufferCnt	FwLogBufferCnt enables firmware logging and sets the log buffer size in multiples of 256 KB. ■ If set to 0 = Firmware logging is disabled. ■ If set to 1 = Firmware logging is enabled with 256-KB log buffer allocated. ■ If set to 2 = Firmware logging is enabled with 512-KB log buffer allocated. ■ If set to 3 = Firmware logging is enabled with 768-KB log buffer allocated. ■ If set to 4= Firmware logging is enabled with 1-MB log buffer allocated. Values: 0 to 4 Default: 0 (disabled)	Reboot	Not supported on LPe12000, LPe15000, or LPe16000-series adapters.
InitTimeout	Determines the number of timeout seconds during driver initialization for the link to come up. If the link fails to come up by the InitTimeout, driver initialization exits but is still successful. If the link comes up before the value specified by InitTimeout, the driver sets double the amount for discovery to complete. Values: 5 to 30 seconds or 0x5 to 0x1E (hexadecimal) Default: 15 seconds (0xF)	Reboot	—

Table 1: Storport Miniport Driver Parameters (Continued)

Parameter	Definitions	Activation Requirement	Notes
LimTransferSize	Limits the maximum transfer size to selectable values if this parameter is nonzero. Values: ■ 0 = Port ■ 1 = 64 KB ■ 2 = 128 KB ■ 3 = 256 KB Default: 0	Reboot	—
LinkSpeed	LinkSpeed has significance only if the adapter supports speeds other than 1 Gb/s. Value: Auto-select, 2 Gb/s, 4 Gb/s, and 8 Gb/s Default: Auto-select **NOTE:** Setting this option incorrectly can cause the adapter to fail to initialize. **NOTE:** If you configure the link speed in a BIOS utility, the link speed might be overridden by the Emulex driver for Windows according to its LinkSpeed setting. To avoid this issue, configure the link speed in both the Emulex driver for Windows and the Boot BIOS or UEFI driver.	Reset	Supported on LPe12000-series adapters only.
LinkTimeOut	A timer is started on all mapped targets using the LinkTimeOut value when a link-down event is detected. If the timer expires before link-up discovery is resolved, commands issued to timed-out devices return a SELECTION_TIMEOUT. The Storport driver is notified of a bus change event, which leads to the removal of all LUNs on the timed-out devices. Value: 2 to 255 seconds or 0x0 to 0xFF (hexadecimal) Default: 30 (0x1E)	Dynamic	—
LogErrors	LogErrors determine the minimum severity level required to enable entry of a logged error into the system event log. Errors are classified as severe, malfunction, or command level. A severe error requires user intervention to correct a firmware or adapter issue. An invalid link speed selection is an example of a severe error. A malfunction error indicates a system problem, but user intervention is not required. An invalid fabric command type is an example of a malfunction error. An object allocation failure is an example of a command error. ■ If set to 0 = All errors are logged. ■ If set to 1 = Command level errors are logged. ■ If set to 2 = Malfunction errors are logged. ■ If set to 3 = Severe errors are logged. Values: 0 to 3 Default: 3	Dynamic	—

Table 1: Storport Miniport Driver Parameters (Continued)

Parameter	Definitions	Activation Requirement	Notes
MaxIODepth	MaxIODepth limits the maximum number of outstanding I/Os handled by the driver. MaxIODepth allows the maximum number of outstanding I/Os to be constrained by increments of 256 from 256 (1) to 4096 (16) if the value is smaller than the driver limit. (The driver limit is derived from the adapter and driver resources.) If MaxIODepth is set to 0, the maximum number of outstanding I/Os is the driver limit. Values: 0 to 16 Default: 0	Reboot	LPe16000-series and LPe32000-series adapters only.
NodeTimeout	The node timer starts when a node (that is, a discovered target or adapter) becomes unavailable. If the node fails to become available before the NodeTimeout interval expires, the operating system is notified so that any associated devices (if the node is a target) can be removed. If the node becomes available before the NodeTimeout interval expires, the timer is canceled and no notification is made. Values: 1 to 255 seconds or 0x0 to 0xFF (hexadecimal) Default: 30 (0x1E)	Dynamic	—
NumNVMEIOQ	NumNVMEIOQ specifies the maximum number of NVMe I/O queues supported by the driver within an NVMe subsystem. Values: 4 to 255 (decimal) or 0x4 to 0xFF (hexadecimal)	Reboot	The NumNVMEIOQ parameter caps the maximum number of IOQs supported by the driver. The driver allocates resources based on this setting. However, the following conditions apply: ■ The number of IOQs created on the subsystem also depends on the maximum number of IOQs that the subsystem supports. ■ The number of IOQs created is the minimum value of NumNVMEIOQ and the maximum number of IOQs supported by the subsystem. For best performance and to avoid wasting resources, verify the subsystem capabilities before setting this value. Issue the nvme-get-feature command, with the FeatureID parameter set to 0x7, to read the number of supported queues.

Table 1: Storport Miniport Driver Parameters (Continued)

Parameter	Definitions	Activation Requirement	Notes
NumNVMENode	NumNVMENode specifies the maximum number of NVMe nodes supported by the driver. An NVMe node is either an NVMe discovery service or an NVMe subsystem. Values: 8 to 512 (decimal) or 0x8 to 0x200 (hexadecimal) Default: 16	Reboot	—
NumNVMENS	NumNVMENS specifies the maximum number of NVMe namespaces supported by the driver within an NVMe subsystem. Value: 8 to 255 (decimal) or 0x8 to 0xFF (hexadecimal) Default = 8	Reboot	—
NVMEKATimeInt	NVMEKATimeInt specifies the number of 5-second time intervals that the NVMe Keep Alive command is sent for each NVMe subsystem association. The Keep Alive timeout is set to three times the value of NVMEKATimeInt, in seconds. Values: 1 to 12 Default: 3	Reboot	For example, if NVMEKATimeInt is set to 2: ■ The Keep Alive command is sent every 10 seconds (2 × 5). ■ The Keep Alive timeout is set to 30 seconds (10 × 3).
NvmeMode	The NVMe configuration bitmask. Bit 0: 1 to disable ANA support Bit 1 to 7: Reserved Default: 0	Reset	—
QueueDepth	QueueDepth requests per LUN/target (see the QueueTarget parameter). If you expect the number of outstanding I/Os per device to exceed 32, you must increase to a value greater than the number of expected I/Os per device (up to a value of 254). If the QueueDepth value is set too low, a performance degradation can occur due to driver throttling of its device queue. QueueDepth supports more than 1000 outstanding commands per port. Value: 1 to 254 or 0x1 to 0xFE (hexadecimal) Default = 32 (0x20)	Dynamic	—
QueueTarget	QueueTarget controls I/O depth limiting on a per-target or per-LUN basis. ■ If set to 0 = Depth limitation is applied to individual LUNs. ■ If set to 1 = Depth limitation is applied across the entire target. Values: 0 to 1 or 0x0 to 0x1 (hexadecimal) Default: 0 (0x0)	Dynamic	—

Table 1: Storport Miniport Driver Parameters (Continued)

Parameter	Definitions	Activation Requirement	Notes
RmaDepth	RmaDepth sets the remote management buffer queue depth. The greater the depth, the more concurrent management controls can be handled by the local node. Value: 8 to 64 or 0x8 to 0x40 (hexadecimal) Default: 16 (0x10) **NOTE:** The RmaDepth driver parameter pertains to the functionality of the OneCommand Manager application.	Reboot	—
ScanDown	■ If set to 0 (= lowest AL_PA) = Lowest physical disk (ascending AL_PA order). ■ If set to 1 (= highest AL_PA) = Lowest physical disk (ascending SEL_ID order). Values: 0 to 1 Default: 1 **NOTE:** This option applies to private loop only in DID mode.	Reboot	—
SLIMode	■ If set to 0 = Autoselect firmware, use the latest firmware installed. ■ If set to 2 = Implies running the adapter firmware in SLI-2 mode. ■ If set to 3 = Implies running the adapter firmware in SLI-3 mode. Values: 0, 2, and 3 Default: 0	Reboot	Supported on LPe12000-series adapters only.
Topology	■ If set to 0 (0x0) = FC-AL. ■ If set to 1 (0x1) = PT-PT fabric. ■ If set to 2 (0x2) = *FC-AL first, then attempt PT-PT. ■ If set to 3 (0x3) = *PT-PT fabric first, then attempt FC-AL. **NOTE:** Topology failover requires firmware version v3.20 or higher. If the firmware does not support topology failover, options 0, 2 and 1, 3 are analogous. Values: 0 to 3 Default: 2 (0x3)	Reset	—
TraceBufSiz	TraceBufSiz sets the size in bytes for the internal driver trace buffer, which acts as an internal log of the driver's activity. Values: 250000 to 2000000 or 0x3D090 to 0x1E8480 (hexadecimal). Default: 250000 (0x3D090)	Reboot	—
XLanePriority	XLanePriority sets the frame priority level for the LUN. Refer to the switch vendor administration guide to set the value. Values: 0 to 7F (hexadecimal) Default: 0	Dynamic	Not supported on LPe12000-series adapters.

3.1.2 Server Performance with LPe12000-Series Adapters

3.1.2.1 I/O Coalescing

I/O Coalescing is enabled and controlled by two driver parameters: `CoalesceMsCnt` and `CoalesceRspCnt`. The effect of I/O Coalescing depends on the CPU resources available on the server. With I/O Coalescing turned on, interrupts are batched, which reduces the number of interrupts and maximizes the number of commands processed with each interrupt. For heavily loaded systems, this setting provides better throughput.

With I/O Coalescing turned off (the default setting), each I/O processes immediately, one CPU interrupt per I/O. For systems with light loads, the default setting provides better throughput. Table 2 shows recommendations based upon the number of I/Os per adapter.

Table 2: Recommended Settings for I/O Coalescing

I/Os per Second	Suggested `CoalesceMsCnt`	Suggested `CoalesceRspCnt`
I/Os < 10,000	0	8
10,000 < I/Os < 18,000	1	8
18,000 < I/Os < 26,000	1	16
I/Os > 26,000	1	24

3.1.2.1.1 CoalesceMsCnt

The `CoalesceMsCnt` parameter controls the maximum elapsed time in milliseconds that the adapter waits before it generates a CPU interrupt. The value range is `0` to `63` (decimal) or `0x0` to `0x3F` (hexadecimal). The default is `0` and disables I/O Coalescing.

NOTE: A port reset is required to make changes to `CoalesceMsCnt` and `CoalesceRspCnt`.

3.1.2.1.2 CoalesceRspCnt

The `CoalesceRspCnt` parameter controls the maximum number of responses to batch before an interrupt generates. If `CoalesceRspCnt` expires, an interrupt generates for all responses collected up to that point. With `CoalesceRspCnt` set to less than `2`, response coalescing is disabled, and an interrupt triggers for each response. The value range for `CoalesceRspCnt` is `1` to `255` (decimal) or `0x1` to `0xFF` (hexadecimal). The default value is `8`.

NOTE: A port reset is required to make changes to `CoalesceMsCnt` and `CoalesceRspCnt`.

3.1.2.2 Performance Testing

Three driver parameters must be considered (and perhaps changed from the default) for better performance testing: `QueueDepth`, `CoalesceMsCnt`, and `CoalesceRspCnt`.

3.1.2.2.1 QueueDepth

If the number of outstanding I/Os per device is expected to exceed 32, increase this parameter to a value greater than the number of expected I/Os per device, to a maximum of `254`. The `QueueDepth` parameter defaults to `32`. If the default setting is not a high enough value, performance degradation might occur due to Storport throttling its device queue.

3.1.2.2.2 CoalesceMsCnt

`CoalesceMsCnt` defaults to `0`. If you are using a performance evaluation tool, such as IOMETER, and if you expect the I/O activity to be greater than 8000 I/Os per second, set `CoalesceMsCnt` to `1` and reset the adapter or reboot the system.

3.1.2.2.3 CoalesceRspCnt

`CoalesceRspCnt` defaults to `8`. For all other values up to the maximum of `63`, the adapter does not interrupt the host with a completion until either `CoalesceMsCnt` milliseconds has elapsed or `CoalesceRspCnt` responses are pending. The values of these two driver parameters reduces the number of interrupts per second, which improves overall CPU utilization. However, a point exists where the number of I/Os per second is small relative to `CoalesceMsCnt`, and this situation will slow down the completion process, causing performance degradation.

3.1.2.2.4 Examples

Test scenario 1:

- IOMETER runs with an I/O depth of `1` I/O per device in a small-scale configuration (16 devices). In this case, the test does not exceed the adapter's performance limits, and the number of I/Os per second are in the low thousands.
- Recommendation: Set `CoalesceMsCnt` to `0` (or use the default value).

Test scenario 2:

- IOMETER runs with an I/O depth of 48 I/Os per device in a small-scale configuration (16 devices).
- Recommendation: Set `QueueDepth` to be greater than `48` (for example, `64`).

3.1.3 Server Performance with FC Drivers

3.1.3.1 Performance Testing

The `QueueDepth` parameter must be considered (and perhaps changed from the default) for better performance testing.

If the number of outstanding I/Os per device is expected to exceed 32, increase this parameter to a value greater than the number of expected I/Os per device, to a maximum of `254`. The `QueueDepth` parameter defaults to `32`. If the default setting is not a high enough value, performance degradation might occur due to Storport throttling its device queue.

Test scenario:

- IOMETER is running with an I/O depth of 48 I/Os per device in a small-scale configuration (16 devices).
- Recommendation: Set `QueueDepth` to be greater than `48` (for example, `64`).

Chapter 4: Troubleshooting

Your system may operate in an unexpected manner in certain circumstances. This section contains reference tables on event codes and error messages and provides information regarding unusual situations.

4.1 General Troubleshooting

The following table describes issues you may encounter and their solutions.

Table 3: General Troubleshooting

Issue	Answer/Solution
The operating system fails to install or does not successfully install the driver.	Verify that the driver supports the operating system.
AutoPilot Installer fails.	If the AutoPilot Installer fails, the **Diagnostics** window shows that the adapter failed. If the adapter fails, perform these steps: 1. Select the adapter to view the reason why the adapter failed. The reason and suggested corrective action are displayed. 2. Perform the suggested corrective action and run AutoPilot Installer again. **NOTE:** You can run AutoPilot Installer again from the **Start** menu (**Programs > Emulex > AutoPilot Installer**), or you can run `APInstall.exe` from a command prompt.
OneInstall Installer fails.	If OneInstall Installer fails, it may be because of one of the following reasons: ■ The operating system prerequisites have not been met. ■ The individual kit installation failed. To check, run the installation interactively. If you encounter error messages when you run the installation interactively, those issues would also apply to an unattended installation. ■ If an individual package failed to install properly, run that package's installer directly. This method displays status and error messages that can be used to diagnose the issue. (The OneInstall Installer does not provide these displays because each package is installed silently.)
Windows Device Manager shows a code 10 or code 39 with a yellow or red exclamation point on the device.	The firmware image does not match the installed device drivers, or the firmware is corrupt. Using the OneCommand Manager application or one of the Windows PE offline or online utilities, install a version of firmware that is compatible with the driver.
The firmware is corrupt or non-responsive.	Using the OneCommand Manager application or one of the Windows PE offline or online utilities, install a version of firmware that is compatible with the driver.
Port names might differ for adapter ports, although they are running the same driver binary.	This is a display issue that does not affect functionality. Run the AutoPilot Installer to correct this issue. Example: Run `elxdrvr-fc-12.x.xxx.xx.exe` and reinstall the driver kit. **NOTE:** A reboot may be required after the installation to view the correct names in Device Manager.

Appendix A: Error and Event Log Information

A.1 Error and Event Logs

A.1.1 Viewing the Error Log

The system event log is a standard feature of Windows Server software. All events logged by the Emulex Storport Miniport will be Event ID 11 with source `ELXFC`.

To view the error log:

1. Open the **Event Viewer** window by doing one of the following:
   – Click **Start > Programs > Administrative Tools > Event Viewer**.
   – Right-click **My Computer > Manage and Event Viewer** in Computer Management.

   The **Event Viewer** window is displayed.
2. Double-click any event with the source name `ELXFC`.
3. Examine the entry at offset 0x10 and Event ID 11. The Emulex event code is found in byte 0x10, and supplementary data is in the byte offsets 0x11 through 0x13.

For example, Figure 2 shows the following information:

byte 0x10 = 9b, byte 0x11 = 00, byte 0x12 = 29, and byte 0x13 = 00

Figure 2: Event Properties

A.1.1.1 Severity Scheme

When the Event Viewer is launched, there are three branches: Application, Security, and System. All ELXFC/LP error log entries are found under the System branch, and all ELXFC/LP error log entries have the Event Viewer severity level of *error*.

- A severe error code indicates that the driver, firmware, or adapter is behaving abnormally, and your intervention is required to correct the issue.
- A malfunction error code indicates that there is an issue with the system, but your intervention is not required.
- A command error code indicates that an event has transpired, but does not require your intervention. An event may be issue-oriented, such as an invalid fabric command sub-type. An event may not be issue-oriented, such as exhausted retries on PLOGI or PDISC.

A.1.1.2 Related Driver Parameter: LogError

The `LogError` driver parameter determines the minimum severity level to enable entry of a logged error into the system. See Chapter 3, Configuration, for instructions on how to set driver parameters.

- If set to `0` = All errors regardless of severity are logged.
- If set to `1` = Severe, malfunction, and command level errors are logged.
- If set to `2` = Both severe and malfunction errors are logged.
- If set to `3` = Only severe errors are logged.

NOTE: Set `LogError` to `1` if you are troubleshooting SAN connectivity or device discovery issues.

A.1.1.3 Format of an Error Log Entry

An error log entry takes the form of an event. This event is described by the following items:

- Date (date entry was logged)
- Source (`elxfc/elxcna`)
- Time (time entry was logged)
- Category (none)
- Type (error)
- Event ID (0)
- User (N/A)
- Computer (name of computer)

A.1.1.4 Error Codes Tables

This section provides tables listing error codes and their descriptions.

A.1.1.4.1 Severe Errors

Table 4 lists severe errors and their codes.

Table 4: Severe Errors

Byte 0x10	Interpretation
0x00	Invalid link speed selection (SLI2-3 mode)
0x01	READ_REV failed (SLI2-3 mode)
0x02	Invalid adapter type (SLI2-3 mode)
0x03	Invalid adapter type (SLI2-3 mode)
0x04	CONFIG_PORT failed

Table 4: Severe Errors (Continued)

Byte 0x10	Interpretation
0x06	READ_CONFIG_failed
0x07	CONFIG_RING 0 failed
0x08	CONFIG_RING 2 failed
0x09	CONFIG_RING 1 failed
0x0A	CONFIG_RING 3 failed
0x0B	INIT_LINK failed (SLI2-3 mode)
0x0C	INIT_LINK failed (SLI2-3 mode)
0x0D	READ_REV failed (SLI2-3 mode)
0x0E	Invalid adapter type (SLI2-3 mode)
0x0F	Invalid adapter type (SLI2-3 mode)
0x10	CONFIG_PORT failed (reinitialization)
0x12	READ_CONFIG command failed (reinitialization)
0x13	CONFIG_RING 0 failed (reinitialization)
0x14	CONFIG_RING 1 failed (reinitialization)
0x15	CONFIG_RING 2 failed (reinitialization)
0x16	CONFIG_RING 3 failed (reinitialization)
0x17	Unresponsive adapter port (SLI2-3 mode)
0x1C	Firmware trap: info1 (SLI2-3 mode)
0x1D	Firmware trap: info2 (SLI2-3 mode)
0x1E	Overtemperature error condition (SLI2-3 mode)
0x1F	Firmware-initiated adapter port reset (SLI2-3 mode)
0x20	Adapter port error attention (SLI2-3 mode)
0x22	Overtemperature warning (SLI2-3 mode)
0x23	Returned to safe temperature (SLI2-3 mode)
0x24	Invalid response tag (SLI2-3 mode)
0x25	Invalid response tag (SLI2-3 mode)
0x26	Invalid response tag (SLI2-3 mode)
0x27	Invalid response sequence (SLI2-3 mode)
0x28	Failure on REG_LOGIN mailbox command
0x29	Unable to initiate fabric binding operation
0x2A	Attempted ADISC to nonexistent node
0x2B	Failure on iocb context allocation
0x2C	Unable to initiate nport unbinding operation
0x2D	Unable to initiate nport binding operation
0x2E	Failed to allocate resources for ExpressLane
0x2F	Cisco MDSD ACQE received (SLI4 mode) ■ 0x13: Shared Link Status values ■ 0x12: LB_Level_BitMask values ■ 0x11: Attention Type
0x30	Failure on mailbox context allocation
0x38	Link down due to unexpected FA-PWWN WWPN change

Table 4: Severe Errors (Continued)

Byte 0x10	Interpretation
0x39	Trunking ACQE received ■ 0x11: Trunk status ■ 0x12 to 0x13: Logical speed
0X3A	Trunking error detected ■ 0x11: Port fault value
0x42	Re-simulate FCF after exhausted retries on FLOGI
0x51	ABTS timeout on path and target ■ 0x11: Path id ■ 0x12: Target id
0x7C	Menlo initialization error
0x7D	Menlo initialization error
0x7E	Menlo initialization error
0x80	NVMe Keep Alive feature failure ■ 0x12: Target id ■ 0x11: Path id
0xA0	Failed to initialize adapter port (OneConnect)
0xA1	Failed to initialize adapter port (SLI2-3 mode)
0xC1	Failed to allocate miniport uncached extension
0xC2	Insufficient uncached extension space
0xC3	Port initialization failure (OneConnect)
0xC4	Port initialization failure (SLI2-3 mode)
0xC5	Utility mailbox command error
0xC6	SLI4 preinitialization failure
0xC7	UNREG_VPI failure requiring reset
0xC8	Invalid FLOGI response failure requiring reset
0xC9	REG_FCFI failure requiring resolicitation (SLI4 mode)
0xCA	Invalid scatter gather list size
0xCB	Unsupported IFType (SLI4 mode)
0xD3	NPIV memory allocation failure
0xE0	Unable to allocate exchange for an unsolicited ELS command

Table 4: Severe Errors (Continued)

Byte 0x10	Interpretation
0xE1	Misconfigured port event on indicated port. Not supported on LPe12000-series adapters. Link Effect and Link State (SLI4 mode) ■ 0x13: Port name ■ 0x12: Link effect ■ 0x11: Link state Link State Values – 0x11 ■ 0x0: Physical Link is functional ■ 0x1: Optics faulted/incorrectly installed/not installed – Reseat optics. If the issue is not resolved, replace. ■ 0x2: Optics of two types installed – Remove one optic or install a matching pair of optics. ■ 0x3: Incompatible optics – Replace with compatible optics for card to function. ■ 0x4: Unqualified optics – Replace with Broadcom optics for warranty and technical support. See Link Effect. ■ 0x5 Uncertified optics – Replace with Broadcom-certified optics to enable link operation. See Link Effect. Link Effect – 0x12 ■ Bit 0 set: Link is nonoperational. ■ Bit 0 clear: Link is operational.
0xF0	Unresponsive adapter port (SLI4 mode)
0xF4	ULP unrecoverable error: low part (SLI4 mode)
0xF5	ULP unrecoverable error: high part (SLI4 mode)
0xF6	ARM unrecoverable error (SLI4 mode)
0xF7	READ_NV failed (SLI4 mode)
0xF8	READ_NV failed (SLI4 mode)
0xF9	READ_REV failed (SLI4 mode)
0xFA	READ_CONFIG failed (SLI4 mode)
0xFB	Failed to post header templates (SLI4 mode)
0xFC	Invalid completion queue entry (SLI4 mode)
0xFD	Invalid completion queue entry (SLI4 mode)
0xFE	Invalid completion queue entry (SLI4 mode)
0xFF	Unrecoverable error (SLI4 mode)

A.1.1.4.2 Malfunction Errors

Table 5 lists malfunction errors and their codes.

Table 5: Malfunction Errors

Byte 0x10	Interpretation
0x05	SET_VAR command failed
0x11	SET_VAR command failed (reinitialization)
0x21	Spurious mailbox command interrupt
0x31	Unrecognized mailbox command completion
0x32	Duplicate link attention: event tag unchanged
0x33	Invalid link attention: no link state indicated
0x34	Duplicate link attention: link state unchanged
0x35	Error reading common service parameters for port
0x36	Error reading common service parameters for fabric

Table 5: Malfunction Errors (Continued)

Byte 0x10	Interpretation
0x37	Error reading common service parameters for nport
0x39	Trunking ACQE received ■ 0x13 to 0x12: Logical speed ■ 0x11: Trunk status
0x81	NVMe IOQ not available ■ 0x11: Driver stage
0xB1	Write check error
0x3B	Failed to create node object
0x3C	PRLI initiation failure
0x3D	Recoverable UNREG base VPI error ■ 0x11: Mailbox status
0x3E	Recoverable UNREG VPI error ■ 0x11: Mailbox status
0x42	Exhausted retries on FLOGI
0x45	ELS command rejected
0x49	Exhausted retries on PLOGI
0x4E	World Wide Port Name mismatch on ADISC
0x4F	World Wide Node Name mismatch on ADISC
0x50	ADISC response failure
0x55	LOGO response failure
0x57	PRLI to nonexistent node
0x5A	PRLI response error
0x5F	CT command error
0x62	Name server response error
0x66	State Change Notification registration failure
0x6A	Unrecognized ELS command received
0x6F	Received PRLI from un-typed source
0x73	Failed to pend PRLI for authentication
0x77	Failed to allocate node object
0x7A	REG_VPI failed
0x82	IOQ creation failure. Byte 0x11 indicates the number of IOQs created. Byte 0x12 indicates the expected number of IOQs to be created.
0xA3	Command context allocation failure
0xAB	SCSI command error
0xAC	Read check error
0xB0	Node timeout: device removal signaled to Storport
0xB1	FCP_RSP short frame received

Table 5: Malfunction Errors (Continued)

Byte 0x10	Interpretation
0xE1	Misconfigured port event on indicated port. Not supported on LPe12000-series adapters. Link Effect and Link State (SLI4 mode) ■ 0x13: Port name ■ 0x12: Link effect ■ 0x11: Link state Link State Values – 0x11 ■ 0x0: Physical Link is functional ■ 0x1: Optics faulted/incorrectly installed/not installed – Reseat optics. If the issue not resolved, replace. ■ 0x2 Optics of two types installed – Remove one optic or install matching pair of optics. ■ 0x3: Incompatible optics – Replace with compatible optics for card to function. ■ 0x4: Unqualified optics – Replace with Broadcom optics for warranty and technical support. See Link Effect. ■ 0x5: Uncertified optics – Replace with Broadcom-certified optics to enable link operation. See Link Effect. Link Effect – 0x12 ■ Bit 0 set: Link is nonoperational. ■ Bit 0 clear: Link is operational.

A.1.1.4.3 Command Errors

Table 6 lists command errors and their codes.

Table 6: Command Errors

Byte 0x10	Interpretation
0x43	Fabric logon succeeded
0x46	ELS command failed
0x47	Exhausted retries on ELS command
0x4A	PLOGI accepted
0x56	LOGO accepted
0x59	PRLI accepted
0x63	Fabric name server response
0x6B	ELS RSCN processed
0x71	LOGO received from fabric
0x79	FDISC accepted
0x81	The indicated IOQ is not available.
0xA2	SCSI address is assigned to discovered target
0xA4	Report LUNs error (initial I/O to discovered target)
0xA5	Local error indication on FCP command
0xA6	FCP command error
0xA8	Data overrun
0xA9	FCP command error
0xAA	SCSI check condition
0xAD	Local reject indication on FCP command
0xAE	Error on SCSI passthrough command
0xAF	Error on Menlo CT command

Table 6: Command Errors (Continued)

Byte 0x10	Interpretation
0xE1	Misconfigured port event on indicated port. Not supported on LPe12000-series adapters. Link Effect and Link State (SLI4 mode) ■ 0x13: Port name ■ 0x12: Link effect ■ 0x11: Link state Link State Values – 0x11 ■ 0x0: Physical Link is functional ■ 0x1: Optics faulted/incorrectly installed/not installed – Reseat optics. If the issue not resolved, replace. ■ 0x2: Optics of two types installed – Remove one optic or install matching pair of optics. ■ 0x3: Incompatible optics – Replace with compatible optics for card to function. ■ 0x4: Unqualified optics – Replace with Broadcom optics for warranty and technical support. See Link Effect. ■ 0x5: Uncertified optics – Replace with Broadcom-certified optics to enable link operation. See Link Effect. Link Effect – 0x12 ■ Bit 0 set: Link is nonoperational. ■ Bit 0 clear: Link is operational.

A.1.1.4.4 Event Indicators

Table 7 lists event indications and their codes.

Table 7: Event Indicators

Byte 0x10	Interpretation
0x18	Port shutdown event (SLI2 to SLI3 mode)
0x19	Port in offline state (SLI2 to SLI3 mode)
0x1A	Port in online state (SLI2 to SLI3 mode)
0x1B	Port in offline state (SLI2 to SLI3 mode)
0xA7	Data underrun
0xD0	NPIV Virtual Port creation success (Virtual Port DID 0x11 to 0x13)
0xD1	NPIV Virtual Port creation failed (Virtual Port index 0x11 to 0x13)
0xD2	NPIV Virtual Port FDISC failed (Virtual Port index 0x11to 0x13)
0xD4	Exceeded maximum Virtual Ports supported (Virtual Port index 0x11 to 0x13)
0xD5	NPIV Virtual Port removal (Virtual Port DID 0x11 to 0x13)
0xE2	Authentication not support (remote DID 0x11 to 0x13)
0xE3	Authentication ELS command timeout (remote DID 0x11 to 0x13)
0xE4	Authentication transaction timeout (remote DID 0x11 to 0x13)
0xE5	LS_RJT other than Logical Busy received for Authentication transaction (remote DID 0x11 to 0x13)
0xE6	LS_RJT Logical Busy received for Authentication Transaction (remote DID 0x11 to 0x13)
0xE7	Received Authentication Reject other than Restart (remote DID 0x11 to 0x13)
0xE8	Received Authentication Reject Restart (remote DID 0x11 to 0x13)
0xE9	Received Authentication Negotiate (remote DID 0x11 to 0x13)
0xEA	Authentication spurious traffic (remote DID 0x11 to 0x13)
0xEB	Authentication policy has been changed (remote DID 0x11 to 0x13)
0xED	Same passed values were set for both local and remote entities (remote DID 0x11 to 0x13)
0xEE	Authenticated successfully (remote DID 0x11 to 0x13)

Table 7: Event Indicators (Continued)

Byte 0x10	Interpretation
0xEF	Failed to authenticate (remote Did 0x11–0x13)
0xF1	Port shutdown event (SLI4 mode)
0xF2	Port in offline state (SLI4 mode)
0xF3	Port in online state (SLI4 mode)
0x18	Port shutdown event (SLI2 to SLI3 modes)
0x19	Port in offline state (SLI2 to SLI3 modes)
0x1A	Port in online state (SLI2 to SLI3 modes)
0x1B	Port in offline state (SLI2 to SLI3 modes)
0xA7	Data underrun
0xD0	NPIV Virtual Port creation success (Virtual Port Did 0x11 to 0x13)
0xD1	NPIV Virtual Port creation failed (Virtual Port index 0x11 to 0x13)
0xD2	NPIV Virtual Port FDISC failed (Virtual Port index 0x11 to 0x13)
0xD4	Exceeded maximum Virtual Ports supported (Virtual Port index 0x11 to 0x13)
0xD5	NPIV Virtual Port removal (Virtual Port Did 0x11 to 0x13)
0xE2	Authentication not supported (remote Did 0x11 to 0x13)
0xE3	Authentication ELS command timeout (remote Did 0x11 to 0x13)
0xE4	Authentication transaction timeout (remote Did 0x11 to 0x13)
0xE5	LS_RJT other than Logical Busy received for Authentication transaction (remote Did 0x11 to 0x13)
0xE6	LS_RJT Logical Busy received for Authentication Transaction (remote Did 0x11 to 0x13)
0xE7	Received Authentication Reject other than Restart (remote Did 0x11 to 0x13)
0xE8	Received Authentication Reject Restart (remote Did 0x11 to 0x13)
0xE9	Received Authentication Negotiate (remote Did 0x11 to 0x13)
0xEA	Authentication spurious traffic (remote Did 0x11 to 0x13)
0xEB	Authentication policy has been changed (remote Did 0x11 to 0x13)
0xED	Same passed were set for both local and remote entities (remote Did 0x11 to 0x13)
0xEE	Authenticated successfully (remote Did 0x11 to 0x13)
0xEF	Failed to authenticate (remote Did 0x11 to 0x13)
0xF1	Port shutdown event (SLI4 mode)
0xF2	Port in offline state (SLI4 mode)
0xF3	Port in online state (SLI4 mode)

A.1.2 Viewing the Event Log

This section provides information on the event logs.

A.1.2.1 Event Log Interpretation

- All events logged by Emulex Storport Miniport are in Event ID 11 with source `elxfc`.
- The Storport Miniport driver parameter `LogErrors` determines what type of events are logged by the driver; the default setting is `3`, which logs only events of a SEVERE nature; the optional setting of `2` logs events of both SEVERE and MALFUNCTION types; and the optional setting of `1` logs events of SEVERE, MALFUNCTION, and COMMAND type.

NOTE: For troubleshooting SAN connectivity or device discovery issues, set the `LogErrors` to `1`.

- The Emulex event code is found in byte 0010, and supplementary data is in byte offsets 0011 through 0013.

A.1.2.2 Additional Event Log Information

The following tables are not comprehensive but do include the codes that are most likely to appear in SAN environments in which issues occur.

A.1.2.2.1 ELS/FCP Command Error Status Codes

Table 8 lists the internal firmware codes posted by the adapter firmware that explain why a particular ELS or FCP command failed at the FC level.

Table 8: ELS/FCP Command Error Status Codes

Code	Explanation
0x2	Remote Stop – Remote port sent an ABTS
0x3	Local Reject – Local Reject error detail
0x9	LS_RJT Received – Remote port sent LS_RJT
0xA	A_RJT Received – Remote port sent BA_RJT

A.1.2.2.2 CT Command Response Codes

Table 9 lists the codes that indicate the response to a FC Common Transport protocol command.

Table 9: CT Command Response Codes

Code	Explanation
0x8001	FC Common Transport reject
0x8002	FC Common Transport accept

A.1.2.2.3 FC-CT Reject Reason Codes

Table 10 lists the codes that indicate the reason a CT command was rejected.

Table 10: FC-CT Reject Reason Codes

Code	Explanation
0x01	Invalid command code
0x02	Invalid version level
0x05	Logical busy
0x07	Protocol error

A.1.2.2.4 ELS Command Codes

Table 11 lists the FC protocol codes that describe the Extended Link Services commands that were sent.

Table 11: ELS Command Codes

Code	Explanation
0x01	Link Service Reject (LS_RJT)
0x02	Accept (ACC)
0x03	N_Port Login (PLOGI)
0x04	Fabric Login (FLOGI
0x05	N_Port Logout (LOGO)
0x20	Process Login (PRLI)
0x21	Process Logout (PRLO)
0x51	Discover F_Port Service Params (FDISC)
0x52	Discover Address (ADISC)
0x61	Register State Change Notify (RSCN)

A.1.2.2.5 SCSI Status Codes

Table 12 lists the SCSI status codes returned from a SCSI device that receives a SCSI command.

Table 12: SCSI Status Codes

Code	Explanation
0x00	Good
0x02	Check condition
0x08	Busy
0x18	Reservation conflict
0x28	Queue full

A.1.2.2.6 Local Reject Status Codes

Table 13 list the codes supplied by the Emulex adapter firmware that indicate why a command was failed by the adapter.

Table 13: Local Reject Status Codes

Code	Explanation
0x02	Sequence timeout – Possible bad cable/link noise
0x04	Invalid RPI – Occurs if the link goes down
0x05	NO XRI – Possible host or SAN problem
0x0D	TX DMA failed – Possible host system issue
0x0E	RX DMA failed – Possible host system issue
0x0F	Illegal frame – Possible bad cable or link noise
0x11	No resources – Port out of exchanges or logons
0x18	Loop open failure – FC_AL port not responding
0x1A	Link down – Queued cmds returned at link down
0x1D	Out of order data – Possible bad cable or noise

A.1.2.2.7 SRB Status Codes

Table 14 lists the SCSI Request Block status codes provided by the driver to the operating system based upon the response from a SCSI device in the SAN.

Table 14: SRB Status Codes

Code	Explanation
0x04	Error
0x05	Busy
0x09	Timeout
0x0A	Selection timeout
0x0B	Command timeout
0x0E	BUS reset
0x12	Data overun

A.1.2.3 ASC/ASCQ

Additional Sense Code/Additional Sense Code Qualifier information can be found in any SCSI specification document; these codes contain detailed information about the status or condition of the SCSI device in question.

A.1.2.4 Additional Notes on Selected Error Codes

These error codes might be seen more frequently than others, or that indicate conditions that you might be able to solve by investigation and correction of issues in the SAN configuration.

NOTE: The nomenclature of *0x* is used as the prefix for the byte code fields because those are hexadecimal values.

A.1.2.4.1 Node Timeout (Code 0xBO)

This event code indicates that a particular device has not been found (if the message is logged during device discovery) or that a particular device has been removed from the fabric. If this message appears, determine if there is something wrong with the connection of that device to the SAN (cables, switches or switch ports, or status of the target device itself).

A.1.2.4.2 SCSI Command Error (Code 0x9A) and SCSI Check Condition (Code 0x9B)

Code 0x9A indicates that the SCSI command to a particular device was responded to with an error condition (the target and LUN information, along with the SCSI status, are provided).

In the specific case of code 0x9B, this code indicates that the device responded with the specific status of Check Condition – the ASC/ASCQ information provided in bytes 0x12 and 0x13 allows you to find out the status being reported by the target and to determine if an action can be performed to return the device to functional status.

A.1.2.4.3 Name Server Response (Code 0x63)

This code is useful in determining if the expected number of targets in a SAN configuration are being presented by the name server to the requesting adapter. The number in byte 0x11 is the number of targets returned to the name server query made by the adapter. If the number of targets does not match expectations, examine the SAN configuration found in the switch tables and if that information shows targets or devices still missing, check the connections between the switch ports and those devices.

A.1.2.4.4 Context Allocation Failures

A number of event codes for which the interpretation contains the phrase *context allocation failure* exist. These types of events refer to the internal memory constructs of the Emulex Storport Miniport driver and, as such, are intended information for Broadcom design engineers. If you encounter this type of code, contact Broadcom Technical Support for assistance.

NOTE: Context allocation failures are rare.

Appendix B: AutoPilot Installer Command Line and Configuration File Parameters

AutoPilot Installer can initiate an installation from a command prompt or script. You can run the AutoPilot Installer manually from the command line or a script, or you can run it automatically through the driver kit. When run manually from the command line or script, the command line parameters can be passed.

If you specify the `/q` switch with the driver kit installer command, the driver kit installer runs in unattended mode and automatically invokes `APInstall.exe` with its `/silent` switch. See Section 2.3.6, Unattended Driver Installation, for additional information.

B.1 AParg Driver Kit Parameter and Appending to the APInstall.exe File

If you specify a value for the `APargs` driver kit parameter, this value is appended to the `APInstall.exe` command line. For example, if you execute this installer file as:

```
elxdrv-fc-<version>.exe /q APargs=SilentRebootEnable=True
```

After installing the AutoPilot Installer, the driver kit automatically executes it as:

```
APInstall.exe /silent SilentRebootEnable=True
```

To specify more than one parameter, separate the settings by one or more spaces and put quotes around the entire `APargs` expression. For example, type the following command on one line:

```
elxdrv-fc-<version>.exe "APargs=SilentRebootEnable=True localDriverLocation =
"d:\drivers\new\Storport"
```

This results in the AutoPilot Installer being run as:

```
APInstall.exe SilentRebootEnable=True localDriverLocation = "d:\drivers\new\Storport"
```

Parameter values that contain spaces, such as path names, must be enclosed in double quotation marks. To add such a setting to `APargs`, you must insert backslashes before the quotes around the value, and then add double quotation marks around the entire `APargs` expression. For example, the command line (all on one line):

```
elxdrv-fc-<version>.exe "APargs=ReportLocation=\"C:\Documents and Settings\Administrator\My
Documents\reports\""
```

This results in AutoPilot Installer being run as:

```
APInstall.exe ReportLocation="C:\Documents and Settings\Administrator\My Documents\reports"
```

To pass multiple parameters to the AutoPilot Installer and to minimize errors, you can run the utility kit installer interactively, delay AutoPilot Installer execution, and then run the AutoPilot Installer command. The procedure is described in Section 2.3.2.2, Option 2: Run AutoPilot Installer Separately, and Section 2.3.6, Unattended Driver Installation.

You can specify a nondefault directory for the driver kit by specifying an installation folder on the command line. For example:

```
elxdrv-fc-<version>.exe install:"C:\Emulex"
```

This option can be used with the `APArgs` directive.

B.2 AutoPilot Installer Syntax

The syntax used to run AutoPilot Installer silently from a command line or script is:

`APInstall [/silent] [parameter setting][parameter setting...]`

The /`silent` switch and parameter settings can occur in any order. One or more spaces must separate the switch and each parameter setting.

The syntax of a parameter setting is:

`parameter_name =["]value["]`

Double quotation marks are required only around values that contain spaces. Spaces can separate parameters, equal signs, and values. Parameter names and values are not case-sensitive.

The `APInstall` command can contain the settings listed below. Each setting, except `ConfigFileLocation`, can also be specified in the AutoPilot configuration file. For descriptions of each parameter, see Section B.2.3, Software Configuration Parameters.

Settings specified in the `APInstall` command override those specified in the configuration file.

```
ConfigFileLocation = path-specifier
NoSoftwareFirstInstalls = { TRUE | FALSE }
SilentRebootEnable = { TRUE | FALSE }
ForceDriverUpdate = { TRUE | FALSE }
ForceDriverTypeChange = { TRUE | FALSE }
SkipDriverInstall = { TRUE | FALSE }
InstallWithoutQFE = { TRUE | FALSE }
ForceRegUpdate = { TRUE | FALSE }
LocalDriverLocation = path-specifier
ReportLocation = path-specifier
```

B.2.1 Path Specifiers

Paths can be specified as:

- An explicit path:

  `ReportLocation="C:\Program Files\Emulex\AutoPilot Installer\Reports"`
- A relative path:

  LocalDriverLocation="Drivers\Storport Miniport\"

  (assuming installation into `C:\Program Files\Emulex\AutoPilot Installer\`, this path would logically become `C:\Program Files\Emulex\AutoPilot Installer\Drivers\Storport Miniport\`)
- With the `%ProgramFiles%` environment variable:

  `LocalDriverLocation = "%ProgramFiles%\Emulex\AutoPilot Installer\Driver"`

B.2.2 Configuration File Location

The optional `ConfigFileLocation` setting contains the path to the configuration file that should be used. If this parameter is not specified, AutoPilot Installer uses the file named `APInstall.cfg` in the same folder as `APInstall.exe`.

The format is the same as that of the other path settings.

Example:

```
APInstall /silent SkipDriverInstall=True configFileLocation=MyConfiguration.cfg
```

B.2.3 Software Configuration Parameters

B.2.3.1 DiagEnable (Running Diagnostics)

NOTE: The `DiagEnable` parameter cannot be specified on the command line; it must be specified within the configuration file.

Default: True

By default, AutoPilot Installer runs its diagnostics after all driver installation tasks have been completed. To disable this function, set this parameter to False.

B.2.3.2 ForceDriverTypeChange (Forcing a Driver Type Change)

Default: False

When installing a driver, set this parameter to True to cause Silent mode installations to update or install the Storport Miniport driver on each adapter in the system, without regard for the currently installed driver type (replacing any installation of the SCSIport Miniport or FC Port driver).

B.2.3.3 ForceDriverUpdate (Forcing a Driver Version Update)

Default: False

By default, if the same version of the driver is already installed, an unattended installation proceeds with installing only the utilities. To force a driver update even if the same version of the driver is installed, set this parameter to True.

NOTE: `ForceDriverUpdate` applies only to unattended installations; in interactive installations, this parameter is ignored and you are asked if the driver should be updated.

B.2.3.4 ForceRegUpdate (Forcing an Update of an Existing Driver Parameter Value)

Default: False

The `ForceRegUpdate` driver parameter setting determines whether existing driver parameters are retained or changed when you update the driver. By default, all existing driver parameter settings are retained. The `ForceRegUpdate` parameter does not affect any existing persistent bindings. To set up an installation to remove the existing driver parameters from the registry and replace them with parameters specified in the AutoPilot configuration file, set this parameter to True.

NOTE: You can use this setting for attended installations with the **AutoPilot Installer** wizard if you modify the AutoPilot configuration file in AutoPilot Installer.

B.2.3.5 LocalDriverLocation (Specifying Location to Search for Drivers)

Default: Drivers (The default `Drivers` folder is located in the same folder as AutoPilot Installer.)

You can specify a local location that is to be searched for drivers during unattended installations. The location can be a local hard drive or a network shared drive. Removable media are not searched.

Example:

```
LocalDriverLocation = "d:\drivers\new\Storport"
```

NOTE: On x64 and 32-bit systems, the path specified by `LocalDriverLocation` must contain at least one instance of an FC driver. AutoPilot Installer automatically selects the most recent revisions that it finds.

B.2.3.6 NoSoftwareFirstInstalls (Prohibiting Software First Installations)

Default: False

If this parameter is set to True, AutoPilot Installer prevents unattended installations from performing software-first installations. This way you can run an automated installation on multiple machines in your network, but only machines with Emulex adapters actually have Emulex drivers updated or installed.

If this parameter is omitted from the configuration file or explicitly set to True, the page is not displayed. AutoPilot Installer uses configuration file parameters to determine the appropriate management mode.

B.2.3.7 ReportLocation (Setting Up an Installation Report Title and Location)

The automatically generated file name for this report is:
"report_*mm*-*dd*-*yy*.txt"

where *mm* is the month number, *dd* is the day, and *yy* indicates the year.

You can change only the installation report folder; the file name is auto-generated. In the following example, *x* could be any available drive:

```
ReportLocation = "x:\autopilot\reports\installs\"
```

B.2.3.8 SilentInstallEnable (Enabling Unattended Installation)

NOTE: Setting the `SilentInstallEnable` parameter to True in the configuration file is functionally equivalent to supplying the `/silent` switch on the command line. You cannot specify the `SilentInstallEnable` parameter on the command line.

Default: False

Setting this parameter to True causes AutoPilot Installer to operate with no user interaction.

B.2.3.9 SilentRebootEnable (Enabling Silent Reboot)

Default: False

AutoPilot Installer's default behavior in unattended installations does not restart the system. AutoPilot Installer continues with the installation. Restarts often require you to log on as part of the Windows startup process. If there is no logon, the installation process stops if the system is restarted. However, Windows can be configured to start up without requiring you to log on. You must ensure that it is safe to restart the system during unattended installations if you set this parameter to True.

B.2.3.10 InstallWithoutQFE (Enabling Installation if a QFE Check Fails)

Default: False

AutoPilot Installer checks for Microsoft's QFEs, also known as KB updates, based on the checks you have specified in the [`STORPORT.QFES`] section. By default, the installation terminates if the QFE check fails. To enable a driver installation to proceed even if a check for QFEs fails, set this parameter to True.

B.3 AutoPilot Configuration File

The AutoPilot configuration file is organized into sections, grouped according to related commands. Six main sections exist:

- [AUTOPILOT.ID] – Configuration Identification
- [AUTOPILOT.CONFIG] – Software Configuration
- [STORPORT.CONFIGURATION] – Configuration Prompts and Vendor-Specific Questions
- [STORPORT.QFES] – QFE Checks
- [STORPORT.PARAMS] – Setting Up FC Driver Parameters
- [SYSTEM.PARAMS] – Setting Up System Parameters

Each section begins with a heading. The heading is required even if there are no settings in the section. The only section not required is the Configuration Prompts section, which has the heading [STORPORT.CONFIGURATION]. That section cannot exist if AutoPilot Installer runs in Silent mode. You must delete or comment-out that entire section for unattended installation.

Lines that begin with a semicolon (;) are comments. Some of the comments are sample settings. To use the setting, remove the semicolon.

B.3.1 Using the Windows Environment Variable (%ProgramFiles%)

You can use the Windows %ProgramFiles% environment variable in the LocalDriverLocation and ReportLocation strings within the configuration file. This variable allows you to specify strings in a driver-independent manner, allowing the same configuration file to be used on different systems where Windows may have been installed on different drives. To use this option, %ProgramFiles% must be the first component specified in the string. The portion of the string that follows is appended to the contents of the %ProgramFiles% environment variable. For example:

```
ReportLocation = "%ProgramFiles%\my company\reports"
```

NOTE: The contents of the %ProgramFiles% environment variable is not terminated with a slash, so you must provide one in the string. Windows environment variables are not case-sensitive.

B.3.2 Configuration Identification [AUTOPILOT.ID]

This section appears at the beginning of every AutoPilot configuration file and contains revision and label information. The revision entry identifies the file's version number and the date on which it was produced. The label entry identifies the configuration that the file supports. This section may appear only once in the APInstall.cfg file.

B.3.3 Software Configuration [AUTOPILOT.CONFIG]

This section contains settings that control and configure AutoPilot Installer and the OneCommand Manager application operation. This section can appear only once in the AutoPilot configuration file. See Section B.2.3, Software Configuration Parameters, for information about settings that can be specified in this section.

B.3.4 Configuration Prompts and Vendor-Specific Questions [STORPORT.CONFIGURATION]

NOTE: You must remove or comment-out the entire [STORPORT.CONFIGURATION] section for an unattended installation.

A [STORPORT.CONFIGURATION] section can exist in the AutoPilot configuration file. The first items in this section are the driver parameters to be used regardless of how the questions are answered. These items are followed by a subsection that contains questions (these may be vendor-specific questions). A line containing [QUESTIONS] marks the start of the subsection, and the end of it is marked by a line containing [ENDQUESTIONS]. Within the question subsection there can be as many questions as needed. Each question uses the format:

question= "*question?*", "*explanation*", "*answer0*", "*answer1*", "*answer2*",.... , "*answern*"

Where:

- "question?" contains the text of the question to be asked.
- "explanation" contains brief text to help explain the question. The explanation displays below the question in a smaller font. If there is no explanatory text, empty quotation marks must be used in its place.
- "answer0" contains the first answer to be displayed in the drop-down list.
- "answer1" contains the second answer to be displayed in the drop-down list.
- "answern" contains the nth answer to be displayed in the drop-down list.

For each question there can be as many answers as needed. For each answer, there must be a corresponding "answer =" section with its corresponding driver parameters listed beneath it. The answer uses the format:

```
answer = 0
DriverParameter="Param1=value; Param2=value;"
answer = 1
DriverParameter="Param1=value; Param2=value;"
....
answer = n
DriverParameter="Param1=value; Param2=value;"
```

B.3.4.1 Example of [STORPORT.CONFIGURATION] Section

The following is an example of STORPORT.CONFIGURATION.

```
[STORPORT.CONFIGURATION]
;The first section contains the driver parameters common to all configurations, no matter what answers
are given.
DriverParameter="EmulexOption=0;"
[QUESTIONS]
question = "What is your link speed?", "Note: select 'Auto-detect' if you are unsure about the answer.",
"4GB", "2GB", "1GB", "Auto-detect"
ANSWER = 0
DriverParameter = "LinkSpeed=4;"  ;4 GB
ANSWER = 1
DriverParameter = "LinkSpeed=2;"  ;2 GB
ANSWER = 2
DriverParameter = "LinkSpeed=1;"  ;1 GB
ANSWER = 3
DriverParameter = "LinkSpeed=0;"  ;Auto-detect question = "Describe the topology of your storage
network.", "Note: Select 'Arbitrated Loop' when directly connected to the array (no fibre switch).
Select 'Point-to-Point' when connected to a SAN (fibre switch).", "Arbitrated Loop", "Point-to-Point"
ANSWER = 0
DriverParameter = "Topology=2;"
```

```
ANSWER = 1
DriverParameter = "Topology=3;"
[ENDQUESTIONS]
[END.STORPORT.CONFIGURATION]
```

B.3.5 QFE Checks [STORPORT.QFES]

This section specifies an additional QFE check, also known as KB updates, during installation. To add a Windows QFE check to the configuration file, edit the [STORPORT.QFES] section in the AutoPilot configuration file. You can place this section anywhere within the file as long as it is not contained within another section. This section contains a single line for each QFE that is to be checked. Up to 10 lines are checked; more than that can exist, but they are ignored. All parameters in each line must be specified. These lines have the following format:

qfe = "*qfe name*", "*path and file name*", "*file version*", "*applicable OS*"

qfe name	The name of the item being checked; for example, QFE 2846340. The name should facilitate searching Microsoft's website for any required code updates.
path and file name	This string identifies the file to be checked and its location relative to the Windows home folder. In most cases, the file to check is the Microsoft Storport driver; for example: "\system32\drivers\storport.sys". This string is also used in dialogs and log file messages.
file version	This version is the minimum version that the file to be checked must have for the QFE to be considered installed. It is specified as a text string using the same format as is used when displaying the files property sheet; for example: "5.2.1390.176".
applicable OS	This parameter is used to determine if the QFE applies to the operating system platform present.

For example:

```
[STORPORT.QFES]
qfe = "QFE 83896", "\system32\drivers\storport.sys", "5.2.1390.176","Win2012"
```

B.3.6 Setting Up FC Driver Parameters [STORPORT.PARAMS]

This section specifies driver parameters. Parameters are read exactly as they are entered and are written to the registry. To change driver parameters, modify this section of the AutoPilot configuration file. Locate the [STORPORT.PARAMS] section in the AutoPilot configuration file. This section follows Optional Configuration File Changes. Under the [STORPORT.PARAMS] heading, list the driver parameters and new values for the driver to use.

For example:

```
Driver Parameter = "LinkTimeout = 45"
```

See Table 1, for a listing of driver parameters, defaults, and valid values.

B.3.7 Setting Up System Parameters [SYSTEM.PARAMS]

To change the system parameters, create a [SYSTEM.PARAMS] section in the APInstall.cfg file. Create this section under the Optional Configuration File Changes heading in the [AUTOPILOT.CONFIG] section.

For example, you can adjust the operating system's global disk timeout. The timeout is stored in the registry under the key HKML\CurrentControlSet\Services\disk and is specified with the following string:

```
TimeOutValue = 0x3C
```

where the number is the timeout value in seconds.

B.4 AutoPilot Installer Exit Codes

AutoPilot Installer sets an exit code to indicate whether an installation was successful or an error occurred. These exit codes allow AutoPilot Installer to be used in scripts with error handling. In unattended installations, AutoPilot Installer sets the following exit codes listed in Table 15.

Table 15: Unattended Installation Error Codes

Error Code	Hex	Description
0	0x00000000	No errors are reported.
2399141889	0x8F000001	An unsupported operating system detected.
2399141890	0x8F000002	The AutoPilot configuration file is not found.
2399141891	0x8F000003	Disabled adapters are detected in the system.
2399141892	0x8F000004	The selected driver is 64 bit and this system is 32 bit.
2399141893	0x8F000005	The selected driver is 32 bit and this system is 64 bit.
2399141894	0x8F000006	Installation activity is pending. AutoPilot Installer cannot run until it is resolved.
2399141895	0x8F000007	(GUI mode only) You canceled execution because you did not want to perform a software-first install.
2399141896	0x8F000008	No drivers are found.
2399141897	0x8F000009	One or more adapters failed diagnostics.
2399141904	0x8F000010	(GUI mode only) You chose to install drivers even though a recommended QFE or Service Pack was not installed.
2399141920	0x8F000020	(GUI mode only) You chose to stop installation because a recommended QFE or Service Pack was not installed.
2399141899	0x8F00000B	Unattended installation did not find any drivers of the type specified in the configuration file.
2399141900	0x8F00000C	A silent reboot was attempted, but, according to the operating system, a reboot is not possible.
2399141901	0x8F00000D	(GUI mode only) A driver package download was canceled.
2399141902	0x8F00000E	(Non-enterprise) No adapters were found in the system.
2399141903	0x8F00000F	A required QFE or service pack was not detected on the system.
2399141836	0x8F000030	AutoPilot Installer was not invoked from an account with administrator-level privileges.
2391419952	0x8F000040	AutoPilot Installer has detected unsupported adapters on the system.
2399141968	0x8F000050	Unattended software-first installations were disallowed.
2399141984	0x8F000060	You cancelled AutoPilot Installer before any driver or utility installation occurred.
2399142000	0x8F000070	You cancelled AutoPilot Installer after driver or utility installation occurred.
2399142032	0x8F000090	AutoPilot Installer encountered an error while parsing the command line (the report file contains the details).

B.5 AutoPilot Installer Installation Reports

During each installation, AutoPilot Installer produces a report describing events that occurred during the installation. This report contains the following sections:

- The first section provides basic information including the time and date of the installation, the name of the machine on which the installation was performed, the version number of AutoPilot Installer, and the identification of the configuration file that was used.
- The second section provides an inventory of the Emulex adapters as they were before AutoPilot Installer performed any actions.
- The third section lists the tasks that AutoPilot Installer performs in the order that they are completed.
- The fourth section records the results of each task. When all driver installation tasks are completed, an updated adapter inventory is recorded.

NOTE: If you cancel AutoPilot Installer, that fact is recorded along with the time you canceled the installation. The contents of any error dialogs that are displayed are also recorded.

B.6 Command Script Example

Modify the configuration file to script the installation of a system's driver. The following example command script (batch file) assumes that you have made mandatory changes to the AutoPilot configuration file, as well as any desired optional changes. If your systems were set up with a service that supports remote execution, you can create a command script to remotely update drivers for all of the systems on the storage network. If Microsoft's RCMD service was installed, a script similar to the following would run remote execution.

```
rcmd \\server1 g:\emulex\autopilot installer\fc\apinstall.exe
if errorlevel 1 goto server1ok
echo AutoPilot reported an error upgrading Server 1.
if not errorlevel 2147483650 goto unsupported
  echo Configuration file missing.
goto server1ok
 :unsupported
if not errorlevel 2147483649 goto older
echo Unsupported operating system detected.
 :older
if not errorlevel 2001 goto none
   echo The driver found is the same or older than the existing driver.
   goto server1ok
:none
if not errorlevel 1248 goto noreport
   echo No Emulex adapter found.
goto server1ok
:noreport
 if not errorlevel 110 goto nocfg
   echo Could not open installation report file.
 goto server1ok
:nocfg
 if not errorlevel 87 goto badcfg
   echo Invalid configuration file parameters.
   goto server1ok
:badcfg
   if not errorlevel 2 goto server1ok
   echo No appropriate driver found.
server1ok
rcmd \\server2 g:\autopilot\ApInstall   ConfigFileLocation=g:\autopilot\mysetup\apinstall.cfg
if errorlevel 1 goto server2ok
```

```
echo AutoPilot reported an error upgrading Server 2.
if not errorlevel 2147483650 goto unsupported
   echo Configuration file missing.
goto server2ok
 :unsupported
 if not errorlevel 2147483649 goto older
   echo Unsupported operating system detected.
 :older2
 if not errorlevel 2001 goto none2
   echo The driver found is the same or older than the existing driver.
   goto server2ok
:none2
 if not errorlevel 1248 goto noreport2
   echo No adapter found.
goto server2ok
:noreport
 if not errorlevel 110 goto nocfg2
   echo Could not open installation report file.
 goto server2ok
:nocfg2
 if not errorlevel 87 goto badcfg2
   echo Invalid configuration file parameters.
   goto server2ok
:badcfg2
   if not errorlevel 2 goto server2ok
   echo No appropriate driver found.
server2ok
```

Appendix C: License Notices

C.1 Secure Hash Algorithm (SHA-1) Notice


BROADCOM®