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Preface

Advisories

Five types of advisories are used throughout this manual to provide helpful information, or to alert you to the potential for hardware damage or personal injury.

**NOTE**
Used to amplify or explain a comment related to procedural steps or text.

**IMPORTANT**
Used to indicate an important piece of information or special “tip” to help you

**CAUTION**
Used to indicate and prevent the following procedure or step from causing damage to the equipment.

**WARNING**
Used to indicate and prevent the following step from causing injury.

**DANGER or STOP**
Used to indicate and prevent the following step from causing serious injury or significant data loss

Disclaimer: We have attempted to identify most situations that may pose a danger, warning, or caution condition in this manual. However, One Stop Systems does not claim to have covered all situations that might require the use of a Caution, Warning, or Danger indicator.
Safety Instructions

Always use caution when servicing any electrical component. Before handling the One Stop Systems Expansion chassis, read the following instructions and safety guidelines to prevent damage to the product and to ensure your own personal safety. Refer to the “Advisories” section for advisory conventions used in this manual, including the distinction between Danger, Warning, Caution, Important, and Note.

Always use caution when handling/operating the computer. Only qualified, experienced, authorized electronics personnel should access the interior of the computer and expansion chassis.

**WARNING**

Never modify or remove the radio frequency interference shielding from your workstation or expansion unit. To do so may cause your installation to produce emissions that could interfere with other electronic equipment around your system.

When Working Inside a Computer

Before taking covers off a computer, perform the following steps:

- Turn off the computer and any peripheral devices.
- Disconnect the computer and peripheral power cords from their AC outlets or inlets to prevent electric shock or system board damage.

In addition, take note of these safety guidelines when appropriate:

- To help avoid possible damage to systems boards, wait five seconds after turning off the computer before removing a component, removing a system board, or disconnecting a peripheral device from the computer.
- When you disconnect a cable, pull on its connector or on its strain-relief loop, not on the cable itself. Some cables have a connector with locking tabs. If you are disconnecting this type of cable, press in on the locking tabs before disconnecting the cable. As you pull connectors apart, keep them evenly aligned to avoid bending any connector pins. Also, before connecting a cable, make sure both connectors are correctly oriented and aligned.

**CAUTION**

Do not attempt to service the system yourself except as explained in this manual. Follow installation instructions closely.
Protecting Against Electrostatic Discharge

Electrostatic Discharge (ESD) Warning

Electrostatic Discharge (ESD) is the enemy of semiconductor devices. You should always take precautions to eliminate any electrostatic charge from your body and clothing before touching any semiconductor device or card by using an electrostatic wrist strap and/or rubber mat.

Static electricity can harm system boards. Perform service at an ESD workstation and follow proper ESD procedures to reduce the risk of damage to components. One Stop Systems strongly encourages you to follow proper ESD procedures, which can include wrist straps and smocks, when servicing equipment.

You can also take the following steps to prevent damage from electrostatic discharge (ESD):

When unpacking a static-sensitive component from its shipping carton, do not remove the component’s anti-static packaging material until you are ready to install the component in a computer. Just before unwrapping the anti-static packaging, be sure you are at an ESD workstation or are grounded.

When transporting a sensitive component, first place it in an anti-static container or packaging.

Handle all sensitive components at an ESD workstation. If possible, use anti-static floor pads and workbench pads.

Handle components and boards with care. Do not touch the components or contacts on a board. Hold a board by its edges or by its metal mounting bracket.
1 Product Information

PCIe x16 Gen 4 add-in card supporting dual Gen 4 hot-swap M.2 drives in removable carriers and dual SFF-8643 connectors supporting additional NVMe expansion. The hot-swap removable carriers provide interchangeability and flexibility at Gen 4 M.2 speeds for edge applications while providing scalability through the additional SFF-8643 internal connections.

1.1 Removal Tray
1.2 PCIe M.2 Carrier Card

1.2.1 OSS-537 Board

1.2.2 OSS-568 Board
1.3 Features

- Quad PCIe 4.0 NVMe M.2 slots
- Hot-swap removable drive carriers
- Operates at up to 512Gb/s at PCIe 4.0 speeds
- Supports M.2 2242/2260/2280/22110/E1.S drives
- Supports PCIe 3.0 backward compatibility

1.4 General Specification

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form Factor</td>
<td>PCIe 4.0 x16 dual-width add-in card</td>
</tr>
<tr>
<td>Dimensions</td>
<td>8.10” x 4.38” (20.6 x 11.1 cm)</td>
</tr>
<tr>
<td>Bandwidth</td>
<td>Up to 512Gb/s</td>
</tr>
<tr>
<td>Drive Form Factors</td>
<td>Drive form factors supported: o</td>
</tr>
<tr>
<td></td>
<td>• PCIe 4.0 NVMe M.2 2242, 2260, 2280, 22110</td>
</tr>
<tr>
<td></td>
<td>• PCIe 3.0 NVMe M.2 2242, 2260, 2280, 22110</td>
</tr>
<tr>
<td>Connectors</td>
<td>PCIe x16 card edge connector</td>
</tr>
<tr>
<td></td>
<td>Dual SFF-8643 internal connectors (per board)</td>
</tr>
<tr>
<td></td>
<td>Compliant to PCI-SIG PCI Express® External Cable Specification 4.0</td>
</tr>
<tr>
<td>Bracket</td>
<td>Standard full-height, dual-width</td>
</tr>
<tr>
<td>PCIe Switch</td>
<td>Broadcom PLX PEX 88032</td>
</tr>
<tr>
<td></td>
<td>16 GT/s 32-Lane PCIe 4.0 Switch</td>
</tr>
<tr>
<td></td>
<td>DMA controller</td>
</tr>
<tr>
<td></td>
<td>SSC Isolation</td>
</tr>
<tr>
<td>Power Consumption</td>
<td>60W</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>0°C to 40°C (200LFM airflow required) based on 1.7°C/W</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-40°C to 85°C</td>
</tr>
<tr>
<td>Operating Humidity</td>
<td>20% to 80% relative humidity non-condensing</td>
</tr>
<tr>
<td>Storage Humidity</td>
<td>20% to 80% non-condensing</td>
</tr>
<tr>
<td>Agency Compliance</td>
<td>Designed to meet the following agency standards:</td>
</tr>
<tr>
<td></td>
<td>• FCC – Part 15 Class A, 47CFR; Canada ICES-003, issue 4, Class A; Japan: VCCI, Class A’ CE Emissions 2004-108EC</td>
</tr>
<tr>
<td></td>
<td>• UL/IEC 60950-1; Canada: CSA C22.2 No. 60950-1; Argentina: IEC60950-1; IEC 60950-1 (CB Certificate and CB Test Report)</td>
</tr>
<tr>
<td></td>
<td>• CE Mark (EN55022 Class A, EN60950-1, EN55024, EN61000-3-2, EN61000-3-3)</td>
</tr>
<tr>
<td></td>
<td>• CISPR 22, CISPR 24, Class A; Australia/New Zealand AS/NZS CISPR 22, Class A</td>
</tr>
<tr>
<td></td>
<td>• RoHS 6 of 6 compliance (Directive 2002/95/EC)</td>
</tr>
<tr>
<td></td>
<td>• WEEE (EU 2012/19) &amp; RoHS 3 (EU 2015/863)</td>
</tr>
<tr>
<td>Supported Operating Systems</td>
<td>Windows 10 &amp; Windows 10 Pro</td>
</tr>
<tr>
<td></td>
<td>Windows 2012 Server</td>
</tr>
<tr>
<td></td>
<td>Ubuntu 16x</td>
</tr>
</tbody>
</table>
1.5 Block Diagram

1.6 Dimensions
1.7 M Key Connector

The OSS-537 and OSS-568 boards support M key edge connector.
2 Hardware Requirements

This section provides the hardware parts needed for the OSS-537 board to work. It is strictly recommended to follow and use the hardware requirements listed below for the board to operate properly.

1. M.2 NVME SSD (Gen 4)
2. Recommended: Server type computer
3. Optional: Standard workstation (with x16 Gen4 PCIe slot) with good air flow and cooling.

Your computer must have sufficient cooling and airflow to prevent overheating of the M.2 media.

<table>
<thead>
<tr>
<th>Operating Temperature</th>
<th>0°C to 40°C (200 LFM airflow required) based on 1.7°C/W.</th>
</tr>
</thead>
</table>

For standard workstation, it is highly recommended using 20 CFM Fan or higher.

You can measure the airflow by using an inexpensive gadget called “Anemometer Handheld Wind Speed Meter.”

3 Software Requirements

1. Computer running Windows Server or Windows 10 and Windows 10 Pro
   a. Windows Pro, driver is loaded automatically when card is installed and detected.
   b. On Windows Server, requires no driver. OS loads the driver automatically.
2. Centos 7
3. Ubuntu 16
4 Hardware Installation

The following steps will guide you through the installation of your M.2 PCIe carrier board.

4.1 Installation-Procedures Overview

Following steps provide the exact sequence that needs to be followed:

1. Set the Quad M.2 Carrier board on a sturdy surface
2. Remove the module canister
3. Install the M.2 onto the circuit board
4. Secure the M.2 onto the circuit board
5. Turn OFF computer before installation
6. Remove cover from the computer
7. Remove the corresponding slot cover from computer chassis
8. Configure SW1 Dipswitch
9. Plug-in PCIe carrier board and secure it.
10. Slide the canister back into the PCIe carrier board
11. Power ON the computer
12. Perform Hardware check (Verify LED indicators)
13. Verify device installation (i.e., Windows Device Manager or Linux lspci tree)
4.4  Prepare PCIe Carrier Card

Place the “Quad M.2 Carrier” board on a sturdy surface

4.5  Remove the canister

Remove the tray/canister from the carrier board by pulling the tab (lever or ejector handle) to disengage.

Flip the canister to access the circuit board
4.6 Install M.2 module

Align the M.2 Key edge connector to the M.2 key edge socket on the circuit board

Slowly insert the media at ~30-degree position into the connector socket until it is fully seated.

4.7 Secure the Media

Secure the M.2 media.

Follow the steps below on how to install the canister in the PCIe card carrier in the PCIe cards in the computer.

**IMPORTANT!** It is important to install the PCIe Quad M.2 Carrier first in the computer before installing the canister.
4.8 Configure SW1 Dipswitch

Set the SW1 Dipswitch using the settings below before you install the card in the computer. All toggle switches are set to OFF.

1 = OFF, 2 = OFF, 3 = OFF, 4 = OFF

4.8.1 SW1 Dipswitch

<table>
<thead>
<tr>
<th>Toggle Switch#</th>
<th>Description / Purpose</th>
<th>ON</th>
<th>OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Flash 0 or Flash 1 SBR select</td>
<td>Flash 1 (default)</td>
<td>Flash 0</td>
</tr>
<tr>
<td>2</td>
<td>Spare switch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Spare switch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>PCIe Switch Debug Serial Port select</td>
<td>UART port</td>
<td>SDB port</td>
</tr>
</tbody>
</table>

4.9 Connect Data Cables

Plug in the HD Mini SAS cables to the board.

Use two HD Mini SAS Cables.

- Plug in the first cable to the SFF 8643 connectors, see photos below.
- Pay attention to the orientation of the cable connector, it has a small plastic latch that snaps in place when you connect it to the 8643 connectors.
Plug in the second HD Mini SAS cable. Make sure both cables are firmly seated and latched in.

### 4.10 Plugin the PCIe carrier board

Plug-in the PCIe carrier board to an open / available x16 slot. You can install the PCIe carrier board in a computer (motherboard) or in an OSS compatible Gen4 expansion unit (i.e., 4UP or EB4400).

Align the x16 and x1 edge connectors on top of the x16 slot connectors on the motherboard and gently push it down until both card edge connectors are firmly seated.
Secure the bracket with two screws.

### 4.11 Connect Power to Mezzanine Card

Connect Power to the Mezzanine Card. Use available external “4pin ATX Molex Female” power cable from the power supply and connect that to the J2 connector on the mezzanine card (OSS-568 board).

**NOTE:**
The x1 card edge connector is mainly for power. If a PCIe card slot is not available to use for the x1 card edge connector, you must connect the external Aux power cable to J2 connector. Photos below show the x1 card edge connector plugged-in vs not plugged-in to a card slot.

If the x1 PCIe connector is already plugged-in to a card slot, the external power cable is no longer required.
4.13 Install Canister

- Slide the canister back into the enclosure of the PCIe carrier board.
- Push the lever forward to latch the canister in place.

4.14 Power ON the computer

Prior to powering ON the computer, verify that the PCIe card edge connector is fully seated as shown from the photos below.

Note:
When PCIe 4.0 Quad M.2 Carrier is installed in an OSS expansion unit or plugged-in to an OSS Gen4 expansion backplane, you must apply power to the OSS expansion unit or board first before powering on the host computer. See diagram below for supported expansion system setup.
5 Hardware Check

Once the host computer has booted up, verify that all LEDs are correctly illuminated on the carrier card. An operational PCIe board will show the following LEDs illuminated.

1. CE LINK, SSD RST and RESET LED
2. M.2 LINK LEDs
3. D2 LED

5.1 LED Definition

<table>
<thead>
<tr>
<th>LED Name</th>
<th>When ON</th>
<th>When OFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>A and B Stat</td>
<td>Swap status still in development.</td>
<td>Normal for now</td>
</tr>
<tr>
<td>Core Stat</td>
<td>ARM core running when flashing</td>
<td>ARM core not running</td>
</tr>
<tr>
<td>CE</td>
<td>Card edge link status: solid on when Gen4</td>
<td>Not linked</td>
</tr>
<tr>
<td></td>
<td>• On for Gen4,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Flashing fast for Gen3,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Flashing slow for Gen2</td>
<td></td>
</tr>
<tr>
<td>SSD RST</td>
<td>One or more M.2 is seated in the carrier</td>
<td>Stuck in reset</td>
</tr>
<tr>
<td>PWR GOOD</td>
<td>Power is present on the board</td>
<td>No Power</td>
</tr>
<tr>
<td>M.2 Link LED</td>
<td>M.2 media is present / detected can flash at different rates</td>
<td>M.2 media is missing / not detected. Data cables are not connected.</td>
</tr>
</tbody>
</table>
6 Verify OSS Device on Windows OS

6.1 Device Manager

Verify the hardware device in Windows Device Manager. As your Windows OS starts up, you will see a small message box popping-up in the lower-right corner of the screen to alert you that Windows has found new hardware.

Follow these steps on how to view and verify the OSS device via Windows Device Manager.

- Go to Device Manager
- Right Click on the Windows Logo on the left bottom of the system tray
- Click "View:
- Click "Devices by connection"

- Select and expand all the “PCI Express Root Complex”
- Select and expand "PCI Express Root Port"
- Select and expand "PCI Express Upstream Switch Port"
  - Four or five instances of "PCI Express Downstream Switch Port" will show up
  - Select and expand all "PCI Express Downstream Port"
  - Under each "PCI Express Downstream Port", you will see "Broadcom Synthetic Enabler Endpoint”.

Note:
The "Broadcom Synthetic Enabler Endpoint" "PCI Vendor ID 1000, Device ID 02B2" will appear when no M.2 module is inserted or installed.
7 Verify M.2 Media on Windows OS

7.1 Device Manager

When installed properly, you will see the four M.2 media devices and Standard NVM Express Controllers. The screenshots below represent the hierarchy of a single “OSS PCIe 4.0 Quad M.2 Carrier” board with four M.2 media devices detected on Windows 10 host computer.
7.2 Disk Management

You can check and verify the M.2 media by using the Disk Management on Windows OS (i.e., Windows 10 Pro), see photo below.

7.3 Storage Spaces

You can verify and manage the disk and create storage pool by using Microsoft “Storage Spaces” tool, see screenshot below.
7.4 Check Temperature

You can check the temperature of the M.2 media via "Windows PowerShell," see screenshot below.

```
Get-PhysicalDisk | Get-StorageReliabilityCounter | Sort-Object DeviceId | ft DeviceId, Temp
```

```
DeviceId Temperature TemperatureMax
------------- ----------- -----------
1             29          90
2             34          90

Get-PhysicalDisk | select DeviceID, FriendlyName, SerialNumber
```

```
DeviceID FriendlyName          SerialNumber
---------- ---------------------- ------------------
2          Sabrent Rocket 4.0 2TB 6479-A731_F300_2E78.
0          SMI-ICDH-018T-A142  A8517535
1          Sabrent Rocket 4.0 2TB 6479-A731_F300_2D39.
```
8 Verify OSS Device on Linux OS

To check and verify if the OSS PCIe 4.0 Quad M.2 Carrier card is properly detected, use the following command lines.

# lspci -vvt | grep Broadcom, see output below

```
root@Support:-# lspci -vvt | grep Broadcom
 | \02.0-[17-1d]----00.0-[18-1d]----00.0 [19]----00.0 Broadcom / LSI Device 02b2
 | +01.0-[1a]----00.0 Broadcom / LSI Device 02b2
 | +02.0-[1b]----00.0 Broadcom / LSI Device 02b2
 | +03.0-[1c]----00.0 Broadcom / LSI Device 02b2
 | \-1f.0-[1d]----00.0 Broadcom / LSI Device 00b2
```

# lspci -vvv | grep 02b2, see output below.

```
root@Support:-# lspci -vvv | grep 02b2
19:00.0 System peripheral: Broadcom / LSI Device 02b2 (rev b0)
1a:00.0 System peripheral: Broadcom / LSI Device 02b2 (rev b0)
1b:00.0 System peripheral: Broadcom / LSI Device 02b2 (rev b0)
1c:00.0 System peripheral: Broadcom / LSI Device 02b2 (rev b0)
```

# lspci -vvt | grep 02b2, see output below.

```
root@Support:-# lspci -vvt | grep 02b2
 | \02.0-[17-1d]----00.0-[18-1d]----00.0 [19]----00.0 Broadcom / LSI Device 02b2
 | +01.0-[1a]----00.0 Broadcom / LSI Device 02b2
 | +02.0-[1b]----00.0 Broadcom / LSI Device 02b2
 | +03.0-[1c]----00.0 Broadcom / LSI Device 02b2
```

# lspci -vvv | grep c010, see output below

```
root@Support:-# lspci -vvv | grep c010
17:00.0 PCI bridge: Broadcom / LSI Device c010 (rev b0) (prog-id 00 [Normal decode])
18:00.0 PCI bridge: Broadcom / LSI Device c010 (rev b0) (prog-id 00 [Normal decode])
18:01.0 PCI bridge: Broadcom / LSI Device c010 (rev b0) (prog-id 00 [Normal decode])
18:02.0 PCI bridge: Broadcom / LSI Device c010 (rev b0) (prog-id 00 [Normal decode])
18:03.0 PCI bridge: Broadcom / LSI Device c010 (rev b0) (prog-id 00 [Normal decode])
18:1f.0 PCI bridge: Broadcom / LSI Device c010 (rev b0) (prog-id 00 [Normal decode])
```
9 Verify M.2 Media on Linux OS

The M.2 storage device can be verified by typing the following command lines:

# nvme -list

```
root@Support:~# nvme list

<table>
<thead>
<tr>
<th>Node</th>
<th>SN</th>
<th>Model</th>
<th>Namespace</th>
<th>Usage</th>
<th>Format</th>
<th>FW Rev</th>
</tr>
</thead>
<tbody>
<tr>
<td>./dev/nvme0n1</td>
<td>774B68BKA20S</td>
<td>KXC102N5102</td>
<td>TOSHIBA</td>
<td>1</td>
<td>1.02 TB / 1.02 TB</td>
<td>S12</td>
</tr>
<tr>
<td>./dev/nvme0n2</td>
<td>774E09BPAK05S</td>
<td>KXC102N5102</td>
<td>TOSHIBA</td>
<td>1</td>
<td>1.02 TB / 1.02 TB</td>
<td>S12</td>
</tr>
<tr>
<td>./dev/nvme0n3</td>
<td>388F7877F128P</td>
<td>KXC102N5102</td>
<td>TOSHIBA</td>
<td>1</td>
<td>1.02 TB / 1.02 TB</td>
<td>S12</td>
</tr>
<tr>
<td>./dev/nvme0n4</td>
<td>11F6A88B1148</td>
<td>KXC102N5102</td>
<td>TOSHIBA</td>
<td>1</td>
<td>1.02 TB / 1.02 TB</td>
<td>S12</td>
</tr>
</tbody>
</table>
```

# lsblk -a

```
root@Support:~# lsblk -a

```

# lspci -vtt | grep NameOfM.2

Output below shows four Toshiba M.2 storage devices. You can replace the "NameofM.2" with your preferred M.2 device brand name.

```
root@Support:~# lspci -vtt | grep Toshiba

```

OSS-PCle4-ADP-x16-M.2-4

26
# lshw -short -class storage

```
# lshw -short -class storage

<table>
<thead>
<tr>
<th>H/W path</th>
<th>Device</th>
<th>Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>/sys/class/scsi/fff</td>
<td></td>
<td>storage</td>
<td>C620 Series Chipset Family SATA Controller [AHCI mode]</td>
</tr>
<tr>
<td>/sys/class/scsi/fff</td>
<td></td>
<td>storage</td>
<td>C620 Series Chipset Family SATA Controller [AHCI mode]</td>
</tr>
<tr>
<td>/sys/class/scsi/fff</td>
<td></td>
<td>storage</td>
<td>Toshiba Corporation</td>
</tr>
<tr>
<td>/sys/class/scsi/fff</td>
<td></td>
<td>storage</td>
<td>Toshiba Corporation</td>
</tr>
<tr>
<td>/sys/class/scsi/fff</td>
<td></td>
<td>storage</td>
<td>Toshiba Corporation</td>
</tr>
<tr>
<td>/sys/class/scsi/fff</td>
<td></td>
<td>storage</td>
<td>Toshiba Corporation</td>
</tr>
<tr>
<td>/sys/class/scsi/fff</td>
<td></td>
<td>storage</td>
<td>Toshiba Corporation</td>
</tr>
<tr>
<td>/sys/class/scsi/fff</td>
<td></td>
<td>storage</td>
<td>Toshiba Corporation</td>
</tr>
<tr>
<td>/sys/class/scsi/fff</td>
<td></td>
<td>storage</td>
<td>Toshiba Corporation</td>
</tr>
<tr>
<td>/sys/class/scsi/fff</td>
<td></td>
<td>storage</td>
<td>Toshiba Corporation</td>
</tr>
</tbody>
</table>

root@Support:~# lshw -short -class storage
```

# lsblk -f

```
# lsblk -f

```

# fdisk -l | grep nvme

```
# fdisk -l | grep nvme

```

```
root@Support:~# fdisk -l | grep nvme

Disk /dev/nvme0n1: 953.89 Gb, 1024200563040 bytes, 2000480264 sectors, 512 byte/dev/nvme0n1: 953.89 Gb, 1024200563040 bytes, 2000480264 sectors
/dev/nvme1n1: 1.17 TiB, 17078006873600 bytes, 3333999800 sectors
/dev/nvme2n1: 1.17 TiB, 17078006873600 bytes, 3333999800 sectors
/dev/nvme3n1: 1.17 TiB, 17078006873600 bytes, 3333999800 sectors
/dev/nvme4n1: 1.17 TiB, 17078006873600 bytes, 3333999800 sectors
/dev/nvme0n1: 953.89 Gb, 1024200563040 bytes, 2000480264 sectors
/dev/nvme1n1: 1.17 TiB, 17078006873600 bytes, 3333999800 sectors
/dev/nvme2n1: 1.17 TiB, 17078006873600 bytes, 3333999800 sectors
/dev/nvme3n1: 1.17 TiB, 17078006873600 bytes, 3333999800 sectors
/dev/nvme4n1: 1.17 TiB, 17078006873600 bytes, 3333999800 sectors
```
# blkid

```
# blkid

/dev/mdev/mnp2: UUID="a2021cb5-b175-4cf2-b65d-928256f8ea0b" TYPE="ext4" PARTUUID="de8e726a-8812-4922-ab89-7375f7cb3adb"
/dev/mdev/mnp1: TYPE="squashfs"
/dev/mdev/mnp1: TYPE="squashfs"
/dev/mdev/mnp1: TYPE="squashfs"
/dev/mdev/mnp1: TYPE="squashfs"
/dev/mdev/mnp1: TYPE="squashfs"
/dev/mdev/mnp1: TYPE="squashfs"
/dev/mdev/mnp1: PARTLABEL="Microsoft reserved partition" PARTUUID="c6103456-33c0-11ec-83c0-b03af3b0809f"
/dev/mdev/mnp1: PARTLABEL="Microsoft reserved partition" PARTUUID="c6103456-33c0-11ec-83c0-b03af3b0809f"
/dev/mdev/mnp1: PARTLABEL="Microsoft reserved partition" PARTUUID="c6103456-33c0-11ec-83c0-b03af3b0809f"
/dev/mdev/mnp1: PARTLABEL="Microsoft reserved partition" PARTUUID="c6103456-33c0-11ec-83c0-b03af3b0809f"
/dev/mdev/mnp1: UUID="85574e00-40d0" TYPE="vfat" PARTLABEL="EFI System Partition" PARTUUID="87583d2a-3ebe-44c9-8804-6946e94e8800"
/dev/mdev/mnp0: TYPE="squashfs"
/dev/mdev/mnp0: TYPE="squashfs"
/dev/mdev/mnp0: TYPE="squashfs"
/dev/mdev/mnp0: TYPE="squashfs"
/dev/mdev/mnp0: TYPE="squashfs"
/dev/mdev/mnp0: TYPE="squashfs"
```

9.1 Check Temperature

To check on the temperature of the M.2 storage devices on Linux (i.e., Ubuntu 18x), use the command line "nvme smart-log /dev/nvme. You would need to identify the storage device name first, use the command line "nvme list".

```
# nvme list

Node  SN  Model  Namespace Usage  Format  FW Rev
/dev/nvme0n1  7744600b4d0  K1G0SNV1T02  1  1.82 TB / 1.82 TB  512 B + 8 B  AAG4108
/dev/nvme0n2  38K7R8F3j3p  K1G0SPW1T04  1  1.71 TB / 1.71 TB  512 B + 8 B  AAG4108
/dev/nvme0n3  38K7R8F3j3p  K1G0SPW1T04  1  1.71 TB / 1.71 TB  512 B + 8 B  AAG4108
/dev/nvme0n4  11f9a00574x  KED16U19792  1  41.58 GB / 1.92 GB  512 B + 8 B  0102
```

```
# nvme smart-log /dev/nvme0n1

Smart Log for NVME Device: nvme0n1 Namespace id: ffffffff
Critical warning:
  temperature: 46 C
  available spare: 100%
  available_spare_threshold: 100%
  percentage_used: 33%
  data_units_read: 1,308,293,316
  data_units_written: 359,469,447
  host_read_commands: 1,862,769,712
  host_write_commands: 868,385,204
  power_cycle: 241
  power_on_hours: 15,125
  unsafe_shutdowns: 219
  multi_errors: 0
  num_err_log_entries: 0
  Warning Temperature Time: 0
  Critical Composite Temperature Time: 0
  Temperature sensor 1: 46 C
  Thermal Management T1 Trans Count: 0
  Thermal Management T2 Trans Count: 0
  Thermal Management T1 Total Time: 0
  Thermal Management T2 Total Time: 0

root@support: #
```
9.2 Check OSS Device Speed and Linkwidth

To check the "Speed and Linkwidth" of the OSS devices use the command lines below.

First, you need to identify the bus address, type "lspci -vtt | grep Broadcom". See output below

Once you have identified the bus number, use the command lines below to retrieve the "Link Status and Link Capability"

# lspci -vvv 1d:00.0 | grep 'LnkSta\|LnkCap'

If you need to retrieve the full detail, use "lspci -vvv 1d:00.0"
9.3 Check M.2 Speed and Linkwidth

Type `lspci -vtt | grep VendorName`. Replace “Toshiba” with the vendor’s name of your M.2 media.

```
root@Support:--# lspci -vtt | grep Toshiba
| -0.0-[17-16]----0.0-[18-16]----0.0 Toshiba Corporation Device 0116
  +0.0-[19]----0.0 Toshiba Corporation Device 0116
  +0.1-[1a]----0.0 Toshiba Corporation Device 0116
  +0.2-[1b]----0.0 Toshiba Corporation Device 0116
  +0.3-[1c]----0.0 Toshiba Corporation Device 0116
```

Then type `lspci -vvv -s 19:00.0 | grep 'LnkSta\|LnkCap'`

```
root@Support:--# lspci -vvv -s 19:00.0 | grep 'LnkSta\|LnkCap'

LnkCap: Port #0, Speed 8Gt/s, Width x4, ASPM not supported
LnkSt2: Current De-emphasis Level: -6dB, EqualizationComplete, EqualizationPhase1
```

To retrieve the detailed info, use `lspci -vvvv -s 19:00.0`. Replace the 19:00.00 with the bus number of your M.2 device (XX:XX.X)
9.4 PCIe Device Detailed Info

You can view and capture the detailed information of the device by using the command line "lspci -vvv -s XX:xx.x" (see screenshot below).
9.5 Smartctl

Smartctl (Self-Monitoring, Analysis and Reporting Technology) is a command line utility or a tool that performs SMART tasks such as printing the SMART self-test and error logs, enabling, and disabling SMART automatic testing, and initiating device self-tests.

Smartctl command allows you to check for errors and extract info regarding the disks that are used, see example below

```
[root@localhost etc]# smartctl -a /dev/nvme0n1
smartctl 7.0 2016-11-09 r5093 [x86_64-linux-3.10.0-1062.1.2.el7.x86_64] (local build)
Copyright (C) 2002-17, H. P. Allen, C. C. Fung, M. A. Scott, P. Stein, F. Zanetti

== START OF INFORMATION SECTION ==

Model Number:                           SUSE4 Rocket 4.0 1TB
Serial Number:                          7F097031339D0911888
Firmware Version:                      HRT011.2
PCI Vendor/Subsystem ID:               0x1097
SATA ID Identifier:                    0X8479A7
Total RAW Capacity:                    2,000,399,994,016 [2.00 TB]
Unallocated RAW Capacity:              0
Controller ID:                         1
Number of Namespaces:                  1
Namespace Size/Capacity:               2,000,399,994,016 [2.00 TB]
Namespace 1 Formatted LBA Size:        512
Namespace 1 Hbuffer Size:              9472a7 3123832670
Local Time Is:                         Mon Aug 10 21:17:56 2020 EDT
Firmware Updates (0x12):               1 81ot, no Reset required
Optional Admin Commands (0x0017):       Security Format Front 0L Self-Test
Optional NVR Commands (0x0020):        Comp Rsk Engage Rsk_CE self Test Time.stamp
Maximum Data Transfer Size:            512 Pages
Warning Comp. Temp. Threshold:         90 Celsius
Critical Comp. Temp. Threshold:         95 Celsius

== START OF SMART DATA SECTION ==

SMART/Health Information (NVMe Log OX02)
Critical Warning:                      0x00
Temperature:                          28 Celsius
Available Spare:                      100%
Available Spare Threshold:            8%
Percentage Used:                      0%
Data Units Read:                      13,608,596 [6.96 TB]
Data Units Written:                   12,949,704 [6.63 TB]
Host Read Commands:                   221,957,584
Host Write Commands:                  221,957,584
Controller Busy Time:                 61
Power Cycles:                         206
Power On Hours:                       294
Disable Shutdowns:                    0%
Media and Data Integrity Errors:      0
Error Information Log Entries:        188
Warning Comp. Temperature Timer:      0
Critical Comp. Temperature Timer:      0
Error Information (NVMe Log OX02, max 64 entries)
No Errors Logged
```

OSS-PCIe4-ADP-x16-M.2-4
### 10 Benchmark Performance (Read & Write)

Performance read and write test results of FOUR M.2 modules mounted on the OSS card carrier.

- Computer and OS: SuperMicro X12DPG-QT6 running Windows 10 Pro
- Benchmark Software: CrystalDisk Mark 8.0.1 x6 2007-2021
- M.2 Module: 4 Sabrent Rocket 4.0 1TB

#### 10.1 Disk Management Tool

Windows 10 Disk Management is a built-in utility that allows you to see and manage any internal and external hard drives connected to your computer.

<table>
<thead>
<tr>
<th>1st Test</th>
<th>SEQ READ</th>
<th>SEQ WRITE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume: Striped (all four M.2), NTFS</td>
<td>11 GB/s</td>
<td>12 GB/s</td>
</tr>
</tbody>
</table>

**Stripped Volume:** A striped volume (RAID 0) combines areas of free space from multiple hard disks (anywhere from 2 to 32) into one logical volume.

<table>
<thead>
<tr>
<th>2nd Test</th>
<th>SEQ READ</th>
<th>SEQ WRITE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spanned Volume (all four M.2), NTFS</td>
<td>5 GB/s</td>
<td>4 GB/s</td>
</tr>
</tbody>
</table>

**Spanned Volume:** A spanned volume combines areas of unallocated space from multiple disks into one logical volume.

<table>
<thead>
<tr>
<th>3rd Test</th>
<th>SEQ READ</th>
<th>SEQ WRITE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mirrored Volume (You can only setup two M2 devices for Mirrored Volume), NTFS</td>
<td>9 GB/s</td>
<td>4 GB/s</td>
</tr>
</tbody>
</table>

**Mirrored Volume:** is a fault-tolerant dynamic volume. It provides data redundancy by using two copies of volume or copying data stored on the volume.
<table>
<thead>
<tr>
<th>Test</th>
<th>SEQ READ</th>
<th>SEQ WRITE</th>
</tr>
</thead>
<tbody>
<tr>
<td>4th</td>
<td>5.009 GB/s</td>
<td>4.251 GB/s</td>
</tr>
<tr>
<td>Test</td>
<td>Testing single M.2, installed directly on the Supermicro motherboard. NTFS.</td>
<td></td>
</tr>
<tr>
<td>5th</td>
<td>5.006 GB/s</td>
<td>4.244 GB/s</td>
</tr>
<tr>
<td>Test</td>
<td>Testing single M.2, installed directly on the PCIe carrier card.</td>
<td></td>
</tr>
</tbody>
</table>
11 FAQ’s

Q: Do I need to plug in the external AUX power cable to the mezzanine card (OSS-568)?
A: Yes, if the x1 card edge connector on the mezzanine card is not plugged-in to a card slot. The mezzanine card requires power.

Q: Is it OK to have both external Aux power cable and the x1 card edge connected? Will this damage the card?
A: Yes, it is OK. It will cause no electrical failure and will not damage the card.

Q: Can I mix and match different M2 brand / vendor?
A: Not recommended, as this can affect the performance of the card and some M2 media may not initialize properly.

Q: Do I need to install driver for the PCIe M.2 carrier card on Windows OS (i.e., Windows 10 and or Server)?
A: No, driver is automatically loaded by the OS when the PCIe carrier card is detected.

Q: Can I hot-plug or remove the canister (containing M.2 module) while the computer is ON (Windows)?
A: Yes, you can hot-plug the canister if there is no activity running (i.e., moving files in and out).

Q: Do I need to install driver for the M.2 module / media?
A: There are few M.2 module / media will require driver to achieve full performance and for proper operation. Please consult the manual associated with the M.2 module that you are using.

Q: Will the M.2 PCIe carrier card works on Linux based OS?
A: Yes, the card will work on Ubuntu and Centos.

Q: Only two out of four M.2 modules are detected. What should I check?
A: Check the data cables, make sure both data cables are connected between the primary card and the mezzanine card.

Q: The OS is not recognizing the other two M.2 modules that are mounted on the mezzanine card. What should I check?
A: Check the external power cable is attached to the mezzanine card or the x1 card edge connector is plugged-in to a PCIe slot.

Q: Can I remove the PCIe card carrier from the PCIe card slot while computer is running?
A: No, do not remove the PCIe card carries while the computer is ON. You must power down the computer first before removing it from the motherboard.
12   Contacting Technical Support

Our support department can be reached by fax at (858) 530-2733 or by phone at (858) 530-2511. Support is available Monday through Friday, 8:00 AM to 5:00 PM PT. When contacting One Stop Systems Technical Support, please be sure to include the following information:

1) Name  
2) Company Name  
3) Phone Number  
4) Fax Number  
5) Email Address  
6) Model Number  
7) Serial Number  
8) Computer Make  
9) Computer Model  
10) Operating System and Version  
11) Make/Model of PCI cards in expansion chassis  
12) Detailed description of the problem

You can also visit our web site at: https://www.onestopsystems.com/support-0  
To submit a support ticket or case, use our OSS Online Support portal:  https://onestopsystems.desk.com/customer/portal/emails/new

For a quick response, use the Technical Support and RMA Request Form available in the Support Section of the website. Simply complete the form with all required information. Please make sure that your problem description is sufficiently detailed to help us understand your problem.  
For example: Do not say “Won’t boot up.” Do say “Tried all the steps in the Troubleshooting Section and it still won’t boot up.”

For faster diagnosis of your problem, please run the two utility programs described in the following sections and include the diagnostic files they generate with your email.

11   Returning Merchandise to One Stop Systems

If factory service is required, you must contact OSS Service Representative to obtain a Return Merchandise Authorization (RMA) number. Put this number and your return address on the shipping label when you return the item(s) for service.  
**One Stop Systems will return any product that is not accompanied by an RMA number.** Please note that One Stop Systems WILL NOT accept COD packages, so be sure to return the product freight and duties paid.

Ship the well-packaged product to the address below:

RMA # ________
One Stop Systems  
2235 Enterprise Street, Suite#110  
Escondido, CA 92029  
USA

It is not required, though highly recommended, that you keep the packaging from the original shipment of your One Stop Systems product. However, if you return a product to One Stop Systems for warranty repair/ replacement or take advantage of the 30-day money back guarantee, you will need to package the product in a manner like the way it was received from our plant. One Stop Systems cannot be responsible for any physical damage to the product or component pieces of the product (such as the host or expansion interfaces for the PCIe expansion chassis) that are damaged due to inadequate packing. Physical damage sustained in such a situation will be repaired at the owner’s expense in accordance with Out of Warranty Procedures. Please, protect your investment, a bit more padding in a good box will go a long way to ensuring the device is returned to use in the same condition you shipped it in. Please call for an RMA number first.
12 Shipping / transporting the card

Use appropriate packaging materials.

**IMPORTANT**

PCIe cards should be removed (or not to be installed) prior to shipping to avoid or prevent possible damage, failure to do so, will void the warranty of the unit.

11 APPENDIX A Compliance

**FCC**

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the service personnel will be required to correct the interference at his own expense.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received including interference that may cause undesired operation. Changes or modifications not expressly approved by the party responsible for compliance could void the service personnel’s authority to operate the equipment.

**NOTE**

The assembler of a personal computer system may be required to test the system and/or make necessary modifications if a system is found to cause harmful interferences or to be noncompliant with the appropriate standards for its intended use.

**Industry Canada**

This Class A digital apparatus complies with Canadian ICES-003. Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada

**CE**

The product(s) described in this manual complies with all applicable European Union (CE) directives. One Stop Systems will not retest or recertify systems or components that have been reconfigured by customers.
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Toll-Free: +1(800)285-8900 US • Main: +1 (760) 745-9883 • Fax: +1 (760) 745-9824

www.onestopystems.com