



# Benchmark Report

Server: *FLEX 3134-SX+*

Family: *FLEX 3100-SX+*

Labs Partner: Molex

Product: BittWare XUP-VV8 FPGA Card

| Release Date | Revision | Notes         |
|--------------|----------|---------------|
| 01-OCT-2026  | 1.0      | First Release |

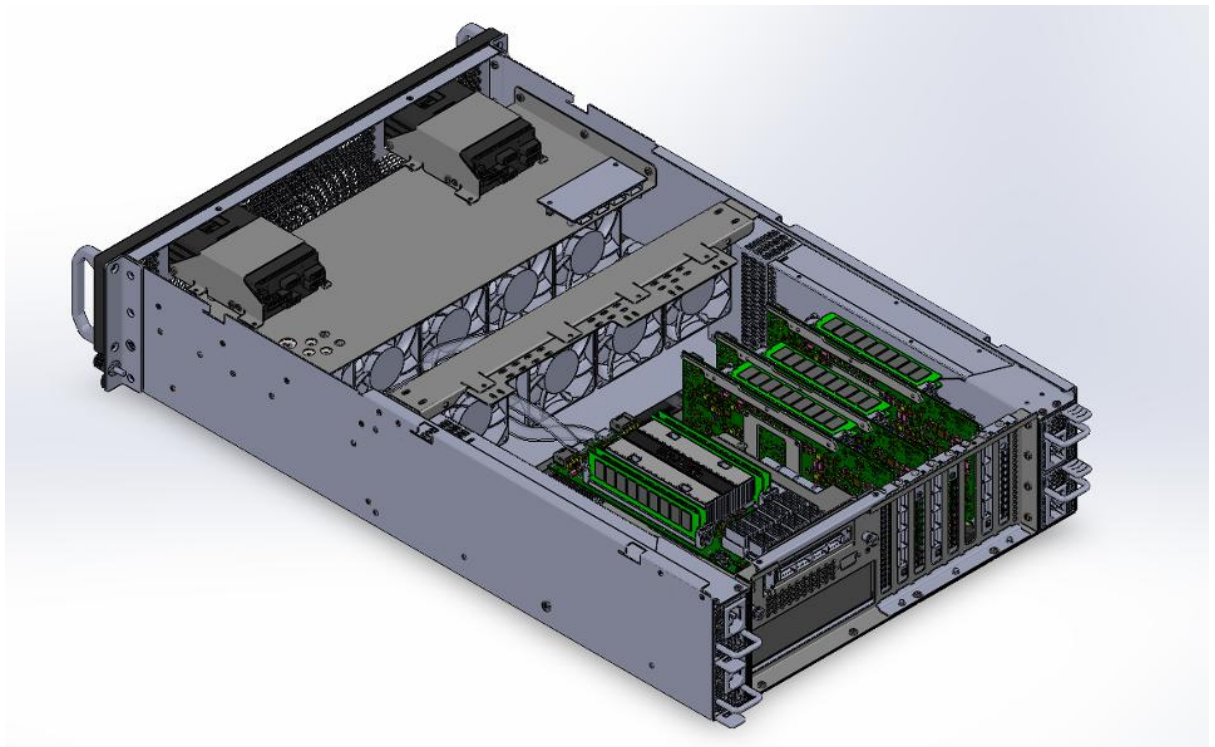
# Molex BittWare XUP-VV8

## Introduction

The *FLEX 3134-SX+* is a server designed to house up to four double-width FPGAs. Whilst developing the product, we wanted to ensure we could meet the thermal and power requirements for such a configuration. The BittWare XUP-VV8 is a common FPGA card used by electronic trading clients, and an ideal target use case for the FLEX server.

We set out to validate the integration of the BittWare XUP-VV8 into the server, ensuring full performance of the cards could be utilized with adequate power delivery and thermal management, without impacting the server's performance. This meant ensuring that the CPU and RAM overclocking remained stable and within normal operating parameters.

## FLEX Overview



The FLEX chassis has certain modifications to facilitate the increased design and hardware requirements of installing multiple FPGA cards.

## **Cooling & Airflow**

The FLEX chassis design has an additional row of fans just in front of where the PCIe devices (NIC / FPGA Cards) will be installed. These 4x fans are rated up to 10K RPM, outputting ~100CFM (cubic feet per minute) and 480pa of static pressure; we measured 2300LFM (linear feet per min) max when measuring the fans directly. This provides additional airflow versus our traditional chassis and was added in direct response to the increased airflow requirements of high-powered FPGA cards.

## **Dual Redundant PSUs**

The server can hold up to 2 x 2000W fully redundant power supplies (four modules in total). One of the power supplies is designated to power the CPU, motherboard, custom water-cooling loop, and drives. The other PSU is dedicated to powering the FPGAs and their additional cooling.

## **Cable Management Arm**

High-power NICs/FPGAs require additional power cables to be plugged into the cards. If cables are not organised in the server in a certain way, it can obstruct airflow and cause the cool air to not get to the cards effectively and therefore cause the devices to overheat and lose performance. This could cause the added cards to downclock due to thermal limitations. The FLEX product has an efficient solution to this problem: the cables are neatly attached to a cable management arm that means the cables are positioned in a way that does not obstruct airflow, keeping them away from the airflow path for the cards and positioning the ends of the cables in an appropriate position to plug these cables into the NICs/FPGAs. This also helps make it easier to perform maintenance on the cards.

## Ducting

The fans are fitted with custom 3D-printed parts that help redirect the airflow from the fan array to focus directly onto the heatsink of the NICs/FPGAs – this increases the static pressure to penetrate the heatsinks on the cards and also results in a higher airflow to assist in evacuating the hot air picked up from the heatsinks as quickly as possible, resulting in a more efficient cooling solution. These were developed alongside the testing and integration of the BittWare cards.

## PCIe Slots & Installation of BittWare Cards

Due to the space constraints of the server using 2 redundant power supplies to adequately power the components inside the server, one of the slots (Slot 1) is designed to take a dual-slot full-height card mounted horizontally and connected to the motherboard via a riser cable. We have used tool-less mounting points to be able to remove the entire horizontal assembly, making it convenient and simple to add or remove the card.

The remaining slots are mounted traditionally and installed by directly plugging the device into the PCIe slot on the motherboard and fixing it in place with a screw.

## Testing the Cards



## Preparing the Software Environment

Software required:

- Linux OS
- BittWare Toolkit [*bw2tk-2024.1.el8.x86\_64.rpm*]
  - BWConfig
  - BMC BWMonitor
  - BWShell
- Vivado Labs  
[*FPGAs\_AdaptiveSoCs\_Unified\_2023.2\_1013\_2256\_Lin64.bin*]

Initially, we attempted to use Rocky Linux 9.5, and whilst this version does support loading the BittWare Toolkit, it did not support Vivado 2023, which was required for the test files we had been provided.

Additionally, we found it necessary to have a GUI running to interact with the Vivado 2023 software for our purposes.

Instead, we used Rocky Linux 8.10. You must install various development packages, which can be easily installed with the “Development Tools” group package.

```
yum groupinstall "Development Tools" -y
```

We then installed the BittWare drivers for the cards via the “BittWare Toolkit.” Lastly, we installed Vivado Labs 2023.2 as per the [documentation](#).

One of the issues that we came across was that the BittWare ‘BMC BWMonitor’, which adds GUI features such as the sensor monitoring and programming software, was not natively compatible without adding certain dependencies. You must install *libqt5widgets*, and *qt5-base* for full functionality.

## Loading the test files

Now that the software environment is configured, we must load the power glob files - these are FPGA designs created to put the cards under a simulated load - onto the cards using the programming tool [BWConfig] as well as using the programming tool in Vivado we were able to run the cards and desired power targets and we were able to monitor performance through the GUI BWMonitor software. For documentation regarding the procedure for flashing the cards,

you must access the developer portal via a registered account at [developer.bittware.com](https://developer.bittware.com)

Whilst bringing up the software environment and getting the cards correctly loaded with the test files, we utilised Molex support, who were extensively knowledgeable and helpful in this process.

## Testing

### SUT

| Component        | Specification                            |
|------------------|------------------------------------------|
| SERVER           | <a href="#">Blackcore 3134-SX+</a>       |
| CPU              | Intel Xeon 3595X - 60 Cores @ 4.2GHz     |
| RAM              | 384GB (8x48GB) 5200MHz Overclocked DIMMs |
| BIOS             | Version 9901                             |
| FPGA Cards       | 4 x BittWare XUPVV8                      |
| FPGA Design/Glob | intload_dds4_16_pwrglob2                 |

### Test Setup

The server was put under a stress load using prime95, configured in “Blend” mode and with AVX and HT disabled. This fully loads all CPU cores and utilizes 95% of the server RAM.

The XUP\_VV8 cards were loaded with the example stress design *intload\_dds4\_16\_pwrglob2* and can be configured to run at various power loads up to 100%, or 250W.

Both stress tests would be run in parallel, which meant the downstream air being used to cool the BittWare cards was being heated up by the heat dissipated through the radiator from the CPU located at the intake of the server.

### Stress Test Results

The server was running these stress tests for a minimum of 16 hours per run to simulate the working conditions of the servers being used by our customers.

See below the results of temperature readings, airflow, and PSU load distribution observed across the server with BittWare cards:

## Thermal and Power Performance:

| Device      | Power Draw [W] | Temperature [° C] | Airflow in front of AIC [LFM] |
|-------------|----------------|-------------------|-------------------------------|
| FPGA1       | 231W           | 81 °C             | 4400                          |
| FPGA2       | 235W           | 87 °C             | 4000                          |
| FPGA3       | 235W           | 83 °C             | 4000                          |
| FPGA4       | 239W           | 90 °C             | 3500                          |
| CPU_Package | -              | 73 °C             | -                             |
| VRM         | -              | 85 °C             | -                             |
| DIMMs       | -              | 63 °C             | -                             |

## PSU Load distribution:

| Power Domain                                               | PSI Module                         | Power Draw [W] | Domain Total |
|------------------------------------------------------------|------------------------------------|----------------|--------------|
| Domain 1: Server Power (CPU, Motherboard, RAM, Drives)     | PSU 1, Module 1<br>PSU 1, Module 2 | 720W 770W      | 1490W        |
| Domain 2: FPGA Power (4x BittWare XUP-VV8 Cards & Cooling) | PSU 2, Module 1<br>PSU 2, Module 2 | 520W 490W      | 1010W        |

## Observations:

**True Redundancy:** The FPGA domain drew a combined 1,010W [520W and 490W across modules]. Since the FLEX server utilizes 2000W PSU modules, a single module can handle the entire load of four peak-capacity FPGAs in a failover scenario.

**Balanced Load Distribution:** The near-equal draw across PSU 2 modules [520W vs. 490W] demonstrates highly efficient active power-balancing. This minimizes component wear and thermal stress, maximizing server reliability for demanding trading environments.

## Conclusion

The Blackcore FLEX server can deliver above the recommended requirements to keep the cards under the thermal throttle limit [95c] whilst maintaining the recommended peak power draw limit of the cards [230W]

Integrating the BittWare products into the FLEX server is straightforward and intuitive for users who wish to include these into their products.

Molex (manufacturer of the BittWare cards) has a very knowledgeable support team to get the technical issues resolved. They were very reassuring when we ran into technical issues and software compatibilities and helped us solve them promptly and quickly.

**Further information:**

***FLEX 3134-SX+***

<https://www.blackcoretech.com/product/flex-3100-sx-plus-fpga-servers>

**BittWare XUP-VV8**

<https://www.bittware-molex.com/products/xup-vv8/>

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