# ThinkStation P-Series Memory Configurator

*ThinkStation P500, P700, P900, P510, P710, P910*

*Version 1.2*

# 1. Version History

| Version | Date Released | Comments |
|---|---|---|
| V1.0 | | Initial release |
| V1.1 | 5/20/2015 | Updated to add benchmark data |
| V1.2 | | Updated data for P910/P710/P510 |

# 2. Introduction

With the launch of the new P-Series line of ThinkStation systems, new memory technology is being introduced with the onset of DDR4. DDR4 memory design differs from its DDR3 predecessor in several ways.

Physical DIMM Differences

- DDR4 memory uses a 284-pin DIMM module as compared to a 240-pin DIMM module for DDR3.
- Physical DIMM size for DDR4 is very close to that of DDR3 due to the decreased pin pitch for the DDR4 modules (allows more pins over the same area).
- DDR4 sockets differ from DDR3 sockets and they are not interchangeable.

Operating Voltage

- DDR4 operates at a standard voltage of 1.2V compared to the standard voltage of 1.5V for DDR3. This lowered operating voltage results in lower power consumption.

Frequencies Supported

- DDR4 is capable of supporting frequencies ranging from 1600MHz to 3200MHz. Consequently, DDR3 frequencies ranged from 800MHz to 2133MHz.

## 3. DDR4 Memory Types

ThinkStation P500, P700, P900, P510, P710, and P910 support certain DIMM memory types across platforms, as shown in the chart below.

| Platform | UDIMM | RDIMM | LRDIMM |
|---|---|---|---|
| P500 | Not Supported | Supported | Supported |
| P700 | Not Supported | Supported | Supported |
| P900 | Not Supported | Supported | Supported |
| P510 | Not Supported | Supported | Not Supported |
| P710 | Not Supported | Supported | Not Supported |
| P910 | Not Supported | Supported | Supported |

The three DIMM types are UDIMM, RDIMM, and LRDIMM, and are described below:

UDIMM – Unregistered DIMM

- ➔ Individual DRAMs connect directly to the controller. Low latency, low density. Ideal for single DIMM per channel applications where low latency is required.

RDIMM – Registered DIMM

- ➔ Onboard register buffers the address and command signals (but not data). Lower loading allows for higher density DIMMs and higher overall memory capacity compared to UDIMM.

LRDIMM – Load Reduced DIMM

- ➔ Data, address, and command signals are all routed through an onboard memory buffer, which results in a greatly reduced electrical load and maximum memory capacities.

# 4. DDR4 Memory Configuration Guidelines

Supported DIMM types (subject to change):

**RDIMM SUPPORT**

P500 / P700 / P900:

- Capacities: 4GB, 8GB, 16GB, 32GB
- Frequency: 2133 MHz
- ECC Support: Yes

P510 / P710 / P910:

- Capacities: 4GB, 8GB, 16GB, 32GB
- Frequency: 2400 MHz
- ECC Support: Yes

**LRDIMM SUPPORT**

P500 / P700 / P900:

- Capacities: 32GB, 64GB
- Frequency: 2133 MHz
- ECC Support: Yes

P910:

- Capacities: 64GB
- Frequency: 2400 MHz
- ECC Support: Yes

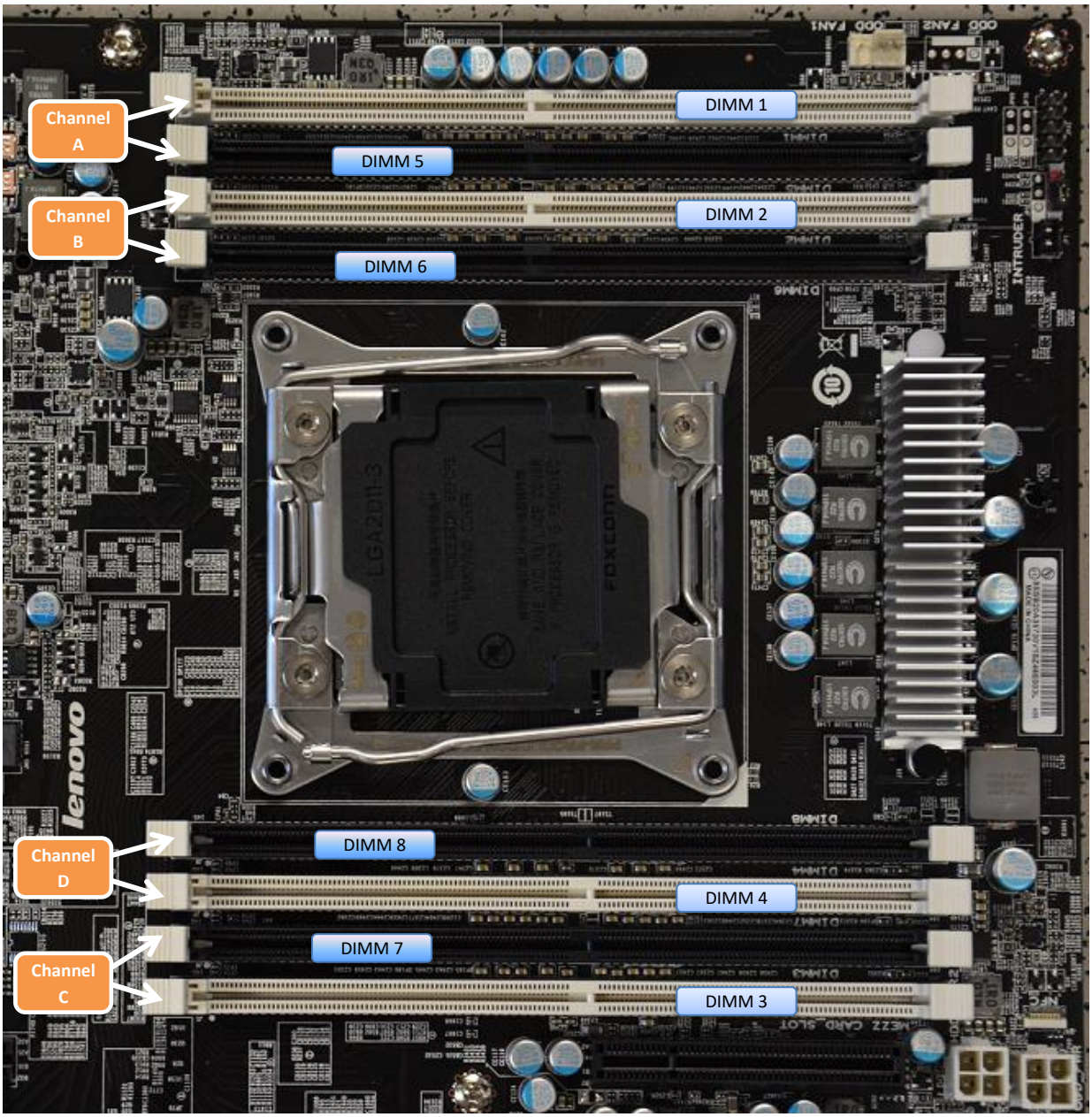
In previous ThinkStation platforms, there were limitations that existed on the number of DIMMs per channel that could be installed while still having the memory operate at what was considered “maximum” speed. For P500, P700, P900, P510, P710, and P910 platforms, all DIMMs will be able to run at full clock frequency in both single DIMM per channel (1DPC) and dual DIMM per channel (2DPC) configurations. The net result is being able to keep the memory running at maximum frequency while not adversely affecting the overall memory capacity of the platform.

It is important to note that final memory frequency is also dependent on the CPU installed. Since the memory controller is integrated into the CPU, the CPU memory frequency will also factor into the actual operating memory frequency. For example, if a user installs DIMMs capable of operating at 2400MHz, but the selected CPU is only capable of operating memory at 2133MHz, then the memory will only operate at 2133MHz.

## P500 & P510

P500 and P510 offer a total of 8 DDR4 DIMM sockets, with a layout consisting of 4 channels and 2 DIMMs per channel. Following Intel guidance, the DIMM installation rules are to install DIMMs across memory channels first (in 1DPC configuration) and then install 2DPC as needed. This can easily be accomplished by simply installing DIMMs in order per the system service label found on the inside cover.

The below image shows the DIMM layout for the P500 & P510 system board and identifies the proper fill order for DIMM1 through DIMM 8. Note that white colored DIMM sockets always indicate the 1st DIMM of each channel, and black colored DIMM sockets always indicate the 2nd DIMM of each channel.



## P700 & P710

P700 and P710 use a dual socket motherboard that consists of 6 DIMM sockets for each CPU for a total of 12 DIMM sockets. Due to the nature of the dual CPU design and the specific motherboard layout, there are some considerations to be made when installing memory in the P700/P710 system:

- In single CPU configurations, only DIMM sockets associated with CPU1 can be used. For dual CPU configurations, all DIMM slots can be utilized.
- Each CPU has a total of 6 DIMM sockets. This means that all four channels have at least one DIMM socket per channel, with two channels having two DIMM sockets per channel.
- In dual CPU configurations, it is optimal to balance memory across the CPUs. This applies to both the quantity of DIMMs and DIMM capacity. The system will function with unbalance DIMMs, however overall memory performance could be affected.
- In dual CPU configurations, once DIMM quantity and DIMM capacity has been balanced across CPUs, users should follow the general installation order for each CPU (DIMM1 through DIMM 6). Largest capacity DIMMs should be installed first.

Example #1

Installing a total of 4 pieces of 4GB RDIMM in a dual CPU configuration

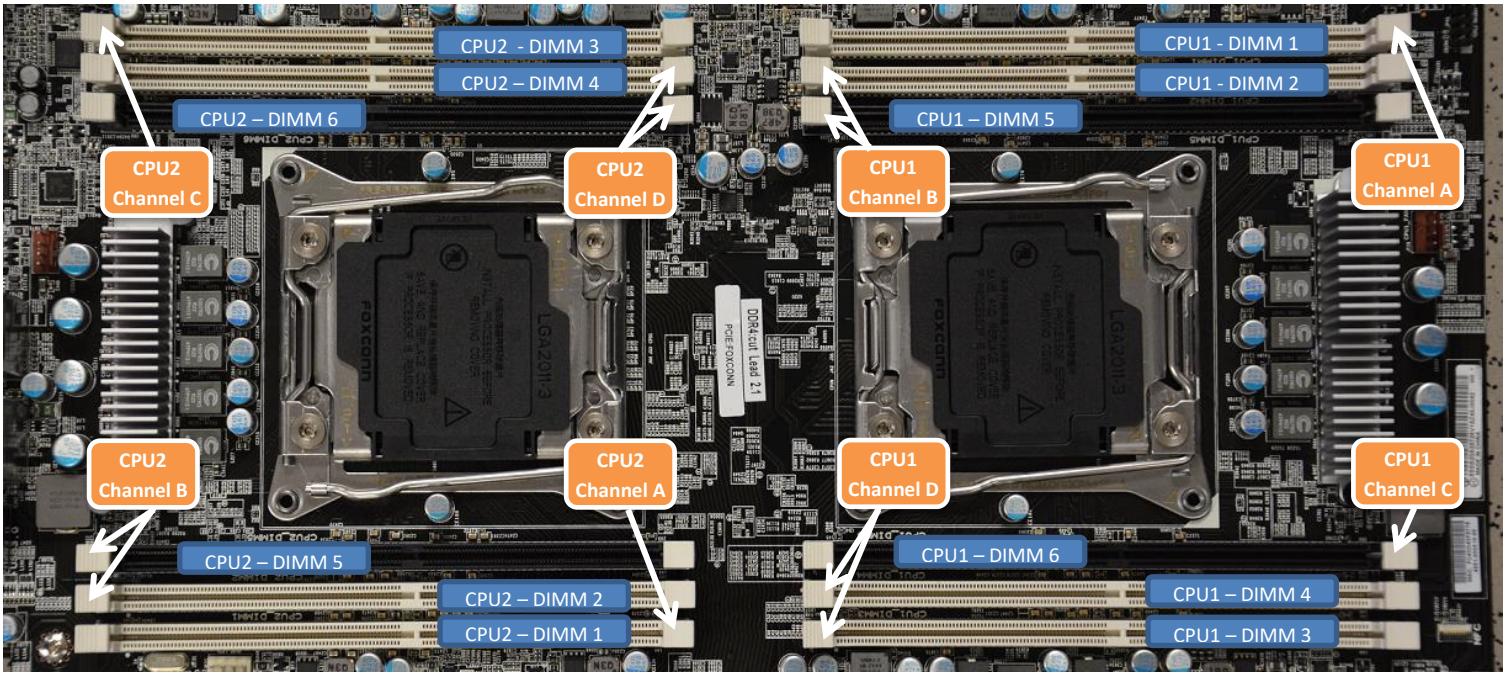
a. Install 1 piece 4GB RDIMM in CPU1-DIMM1
b. Install 1 piece 4GB RDIMM In CPU1-DIMM2
c. Install 1 piece 4GB RDIMM in CPU2-DIMM1
d. Install 1 piece 4GB RDIMM in CPU2-DIMM2

Example #2

Installing 4 pieces of 8GB RDIMM and 4 pieces of 4GB RDIMM in a dual CPU configuration (48GB total)

a. Install 8GB RDIMMs in CPU1–DIMM 1 and CPU1–DIMM 2
b. Install 8GB RDIMMs in CPU2–DIMM 1 and CPU2–DIMM 2
c. Install 4GB RDIMMs in CPU1–DIMM 3 and CPU1–DIMM 4
d. Install 4GB RDIMMs in CPU2–DIMM 3 and CPU2–DIMM 4

The image below shows the DIMM sockets for the P700 & P710 motherboard and identifies the proper fill order for each CPU.  Note that while colored DIMM sockets represent the first DIMM in each channel, and black colored DIMM sockets represent the second DIMM for each channel (if applicable).



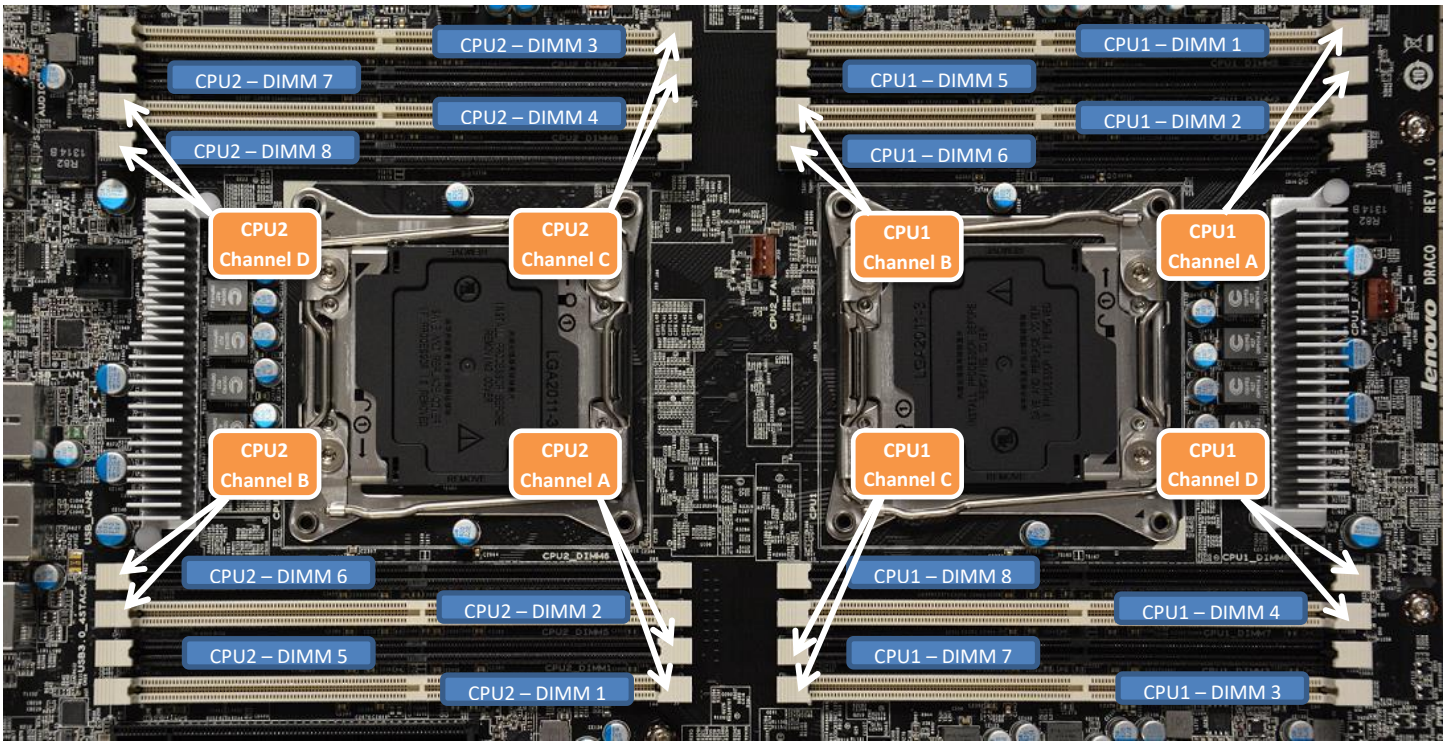
## P900 & P910

P900 and P910 use a dual socket motherboard (like the P700/P710). However due to the larger size of the board, there is room for expanded DIMM sockets. The P900/P910 motherboard can support a total of 16 DIMM sockets (8 per CPU) which includes support for 4 channels with two DIMMs per channel (2DPC) for each CPU.

Similar to the P700 and P710, some considerations should be made when installing memory in the P900 system:

- In single CPU configurations, only DIMM sockets associated with CPU1 can be used. For dual CPU configurations, all DIMM slots can be utilized.
- Each CPU has a total of 8 DIMM sockets. This means that all four channels have support for two DIMMs per channel (2DPC).
- In dual CPU configurations, it is optimal to balance memory across the CPUs. This applies to both the quantity of DIMMs and DIMM capacity. The system will function with unbalance DIMMs, however overall memory performance could be affected.
- In dual CPU configurations, once DIMM quantity and DIMM capacity has been balanced across CPUs, users should follow the general installation order for each CPU (DIMM1 through DIMM 8). Largest capacity DIMMs should be installed first.

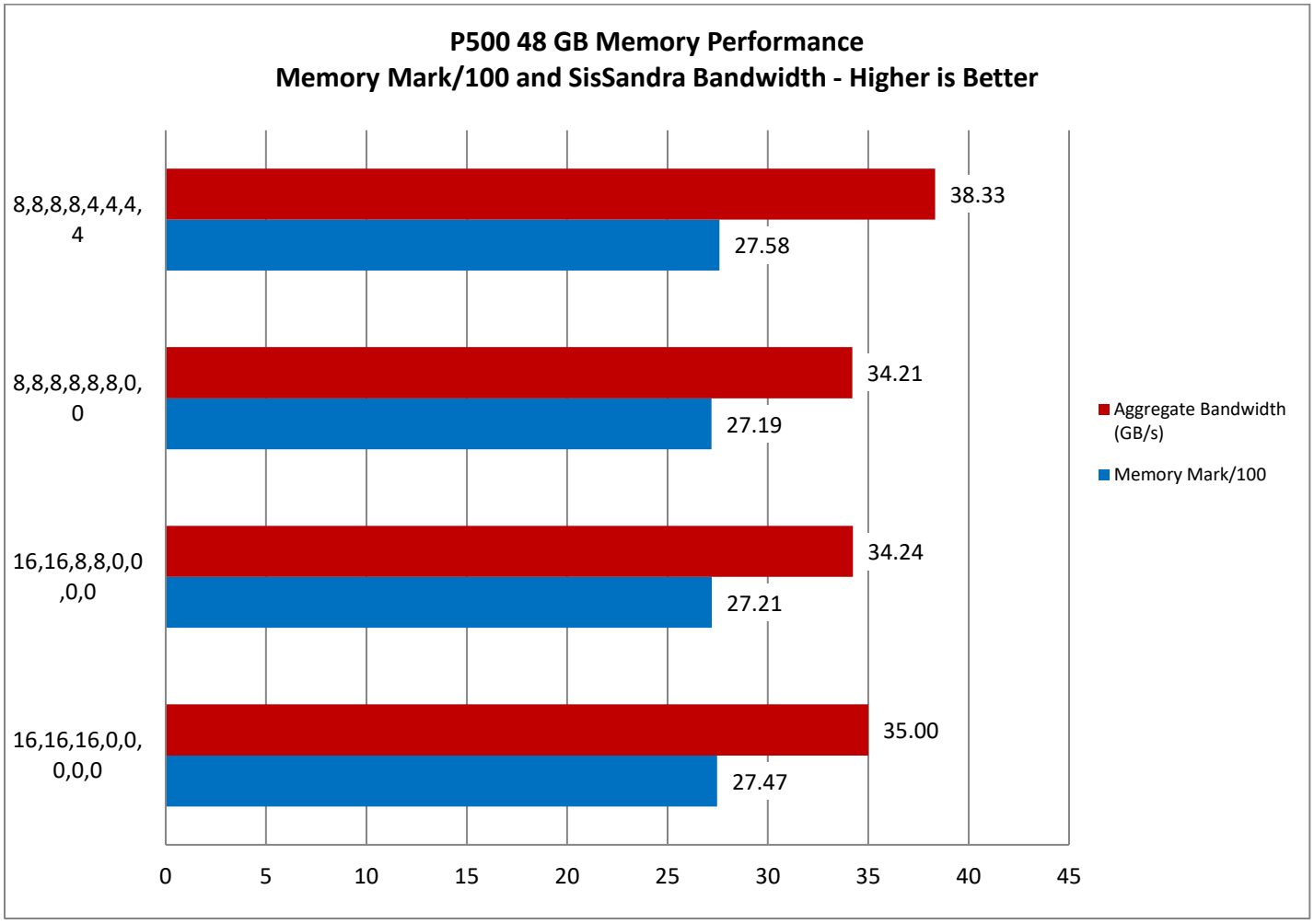
The image below details the DIMM socket layout for the P900/P910 motherboard and identifies the proper fill order for each CPU. Note that while colored DIMM sockets represent the first DIMM in each channel, and black colored DIMM sockets represent the second DIMM for each channel.



# 5. Performance Data

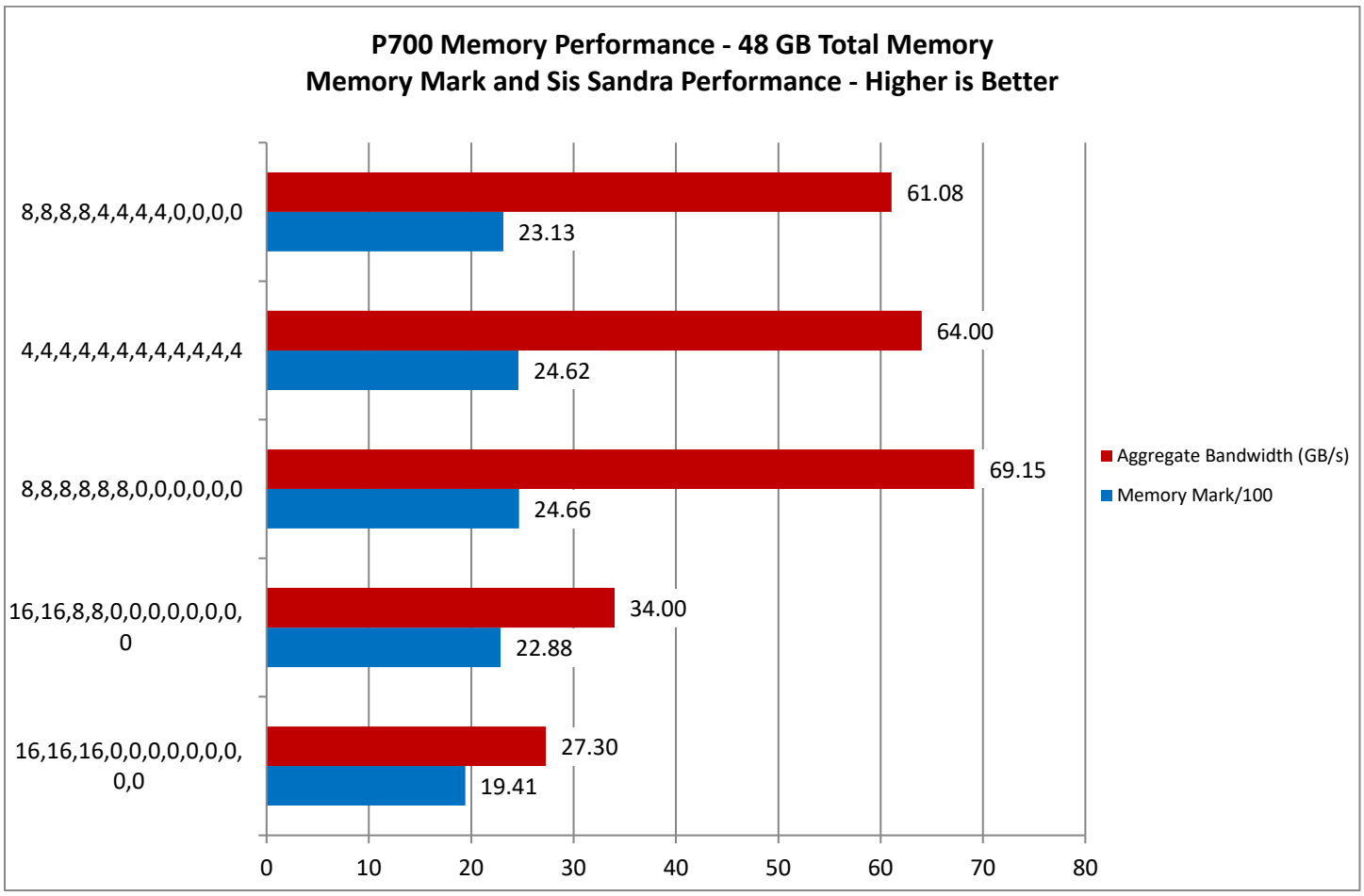
## P500

The following chart shows benchmark data for the P500 using both Memory Mark and SisSandra benchmarks. For this example, several DIMM configuration options are listed for a specific total capacity (48GB) to show how channel loading will affect memory performance.



## P700

The following chart shows benchmark data for the P700 using both Memory Mark and SisSandra benchmarks. For this example, several DIMM configuration options are listed for a specific total capacity (48GB) to show how channel loading will affect memory performance. Note that DIMMs are balanced across CPUs (as allowed by DIMM count).



## P900

The following chart shows benchmark data for the P900 using both Memory Mark and SisSandra benchmarks. For this example, several DIMM configuration options are listed for a specific total capacity (48GB) to show how channel loading will affect memory performance. Note that DIMMs are balanced across CPUs (as allowed by DIMM count).