MCR "DRIVE" series radiators (Rev. 3)

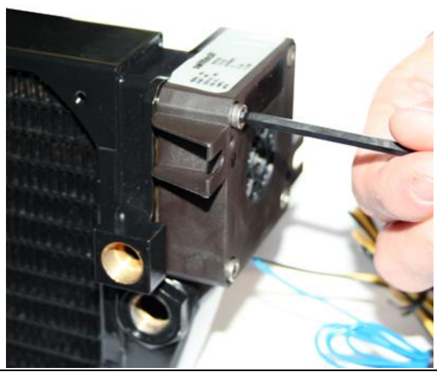
INSTALLATION GUIDE

MCR220-DRIVE-B
MCR220-DRIVE
MCR320-DRIVE-B
MCR320-DRIVE

One or more patents pending

MCR DRIVE-B versions (without pump) for existing MCP350 or 355 pump owners
MCP350 or MCP355 pump installation – skip this step if you have the MCR Drive with integrated pump version

Disassemble the MCP350 or MCP355 pump ports housing from the main motor housing by loosening and removing all 4 screws. Reassemble the pump body to the MCR drive radiator while making absolutely sure to keep the existing pump o-ring in place or the assembly will leak! To assemble, simply align the pump body with the MCR Drive pump housing, and fasten it with the supplied 8-32 x ¾" socket screws.



MCR220 and 320 Drive installation

1. Installation of the fittings :

The MCR Drive heat exchangers are shipped with G1/4 x ½" barb fittings (12mm) . Use a 5/8" (16mm) flat wrench or preferably a socket wrench to fasten the fittings very tight to the radiator body so as to prevent leaks.

The MCR Drive Rev3 series also feature two additional inlet ports that are available to parallelize various components in installations where multiple waterblocks are present. See paragraph 5 below for more explanations on the subject matter.

2. Installation orientation considerations and guidelines

The primary consideration in the notes below is safety. Because this type of pump is not self-priming, it is essential to configure the liquid cooling system so that it remains self-purging, in other words, that any air travelling through the lines could never accumulate in the pump, thus causing coolant circulation to stall.

In its default configurations, in other words vertical and right-side up, or horizontal with pump ports facing down, the MCR Drive pump can never lose its prime unless the coolant level was abnormally low. Therefore, as in any other “open-loop” liquid cooling system it is essential to monitor the coolant level every few months.

Alternate orientations to the factory default are discussed below, and may require an additional reservoir to safely operate the MCR Drive.

(*1): Vertical upside-down orientation, typical of an installation behind the front bezel, or at the back of the PC. This orientation would require an external reservoir; however, it is not recommended because depending on the reservoir location there is a risk for the pump of losing its prime if a sufficient amount of air was to travel through the lines: this could result in catastrophic failure of the cooling system. Additionally, it is not recommended to run the pump upside-down.

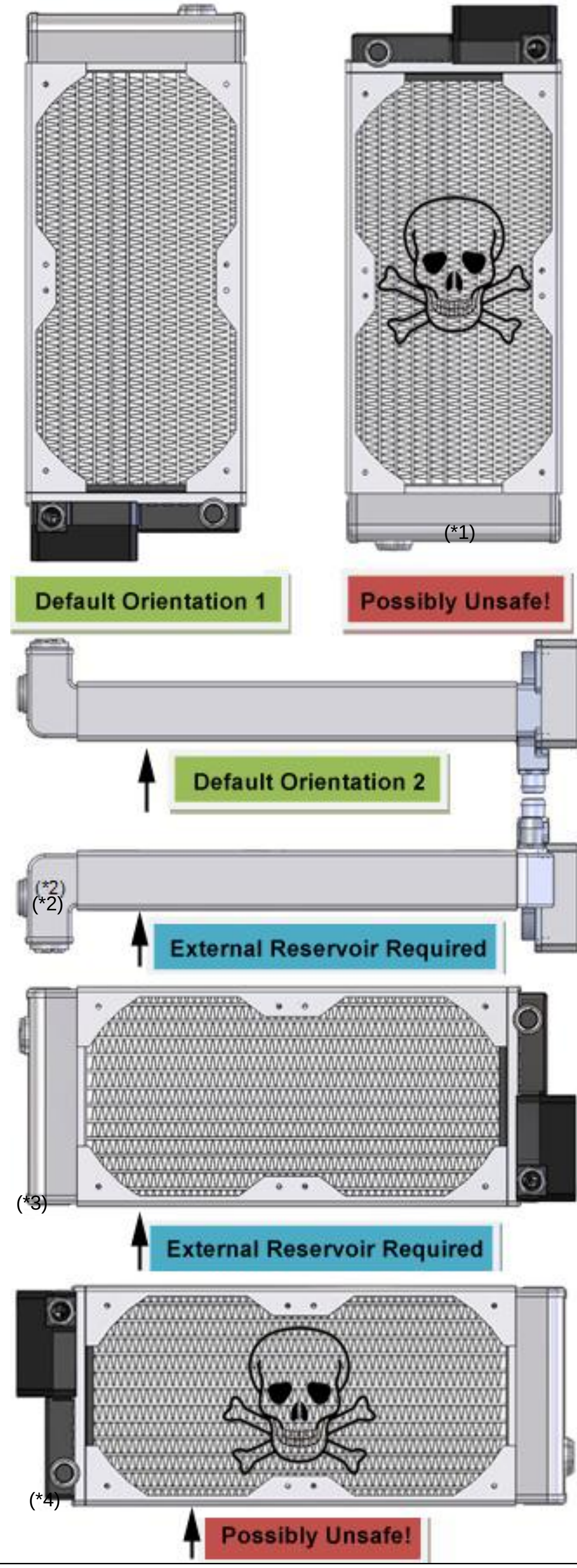
(*2): Horizontal & inlet/outlet ports facing up, typical of an installation at the bottom the PC. This configuration necessitates the use of an external reservoir but is fully acceptable as long as that such reservoir will always be located higher than the radiator.

(*3): On-the-edge orientation with pump at the bottom, typical of an installation in a lower compartment of the PC. When used in this orientation the radiator integrated reservoir will only be fully functional if completely filled-up. Furthermore as the coolant level drops over time, the uppermost radiator channel(s) may not circulate fluid, resulting in cooling performance degradation. Use of an external reservoir located above the radiator is required to avoid this risk.

(*4): On-the-edge orientation with pump at the top, typical of an installation in a lower compartment of the PC. This orientation would require an external reservoir; however, it is not recommended because depending on the reservoir location there is a risk for the pump of losing its prime if a sufficient amount of air was to travel through the lines: this could result in catastrophic failure of the cooling system. Such orientation is ONLY acceptable if an external reservoir was located completely above the radiator.

Advanced/Extreme applications:

It is also possible to install two MCR Drive in series. In such case it is recommended to install one of the units in the factory recommended default orientation; this will allow installation of the second unit in ANY orientation, including the orientations listed above as not recommended. The reason is that the primary unit in default orientation will naturally and safely purge any air going thru the lines, thus eliminating any risk that the second pump might stall.



3. Installation of the fans and to a panel:

See schematic to the right.

The 2 conventional methods to attach the fans and the assembly to a panel are:

Standard:
Using the provided four long screws (2) per fan thru the fan guard (3), the computer panel (1), and thru the fans (6) to fasten the entire assembly to the panel.

Acceptable thread types:
The original thread size is M3,5; standard US 6-32 thread can easily be used. Once 6-32 type screws have been used, going back to metric is not recommended.

Long screw length tolerance specifications are:
- Min/Max inch size: 1 1/4"
-Metric: 30mm

The above are the only adequate sizes available in this length range for 120x25mm fans.

Use 6-32x1 5/8” or M3,5 x 40mm for 120x38mm fans.

Alternate:
Using the provided four 6-32 x 3/8” short screws (1) per fan to fasten the lower lip of the fans to the radiator body first, and then another fastener of your choice (not provided) to secure the radiator/fan assembly to the computer panel (1). Standard fan screws (4) often provided with the fans work well to attach the radiator/fan assembly to the panel. Other acceptable choices are 8-32 x ½” screws with nut (or M4 x 12mm + nut), or Snap-rivets

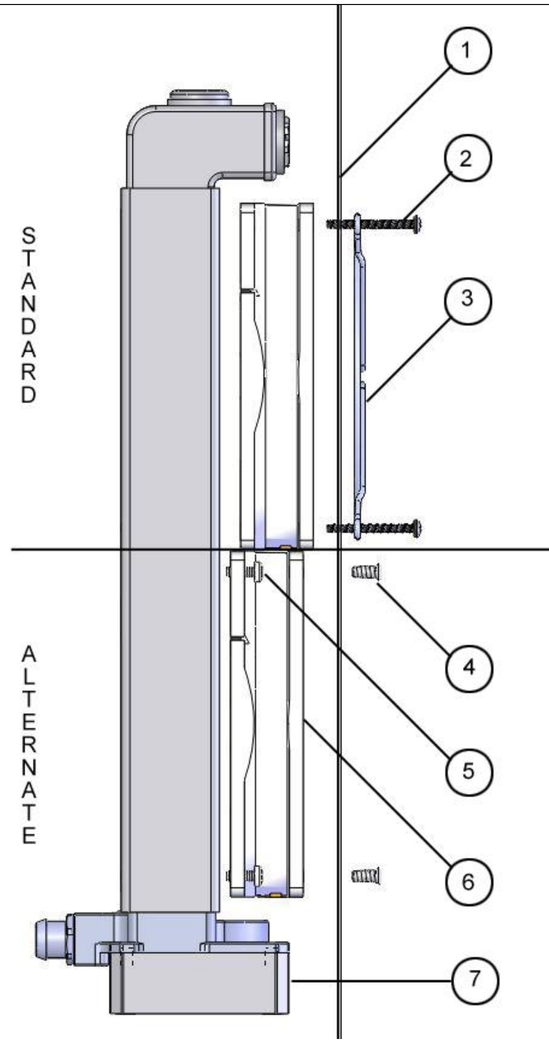
Short screw length tolerance specifications are:
Min/Max inch size: 3/8”
Min/Max Metric size: (8mm~10mm)

WARNING: do not exceed the maximum recommended screw length or irreversible damage to the radiator will occur, and will not be covered under your warranty.

You are now ready to connect tubing to the MCR Drive inlet and outlet fittings, using the provided hose clamps, and to complete the loop by a waterblock of your choice.

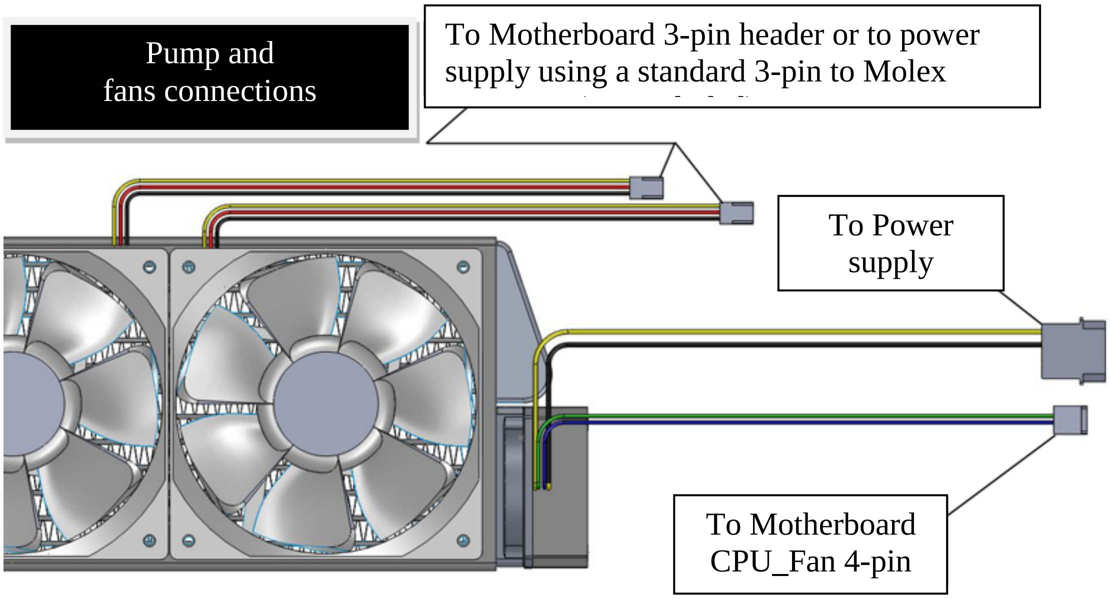
Legend

1 : Computer panel
2 : Long screw M3,5 x 30mm or 6-32 x 1 ¼” (4 per fan)
3: Fan guard (not supplied)
4: Fan screw (not supplied)
5: Short screw (4 per fan)
6: Fan (not supplied)
7: MCR Drive

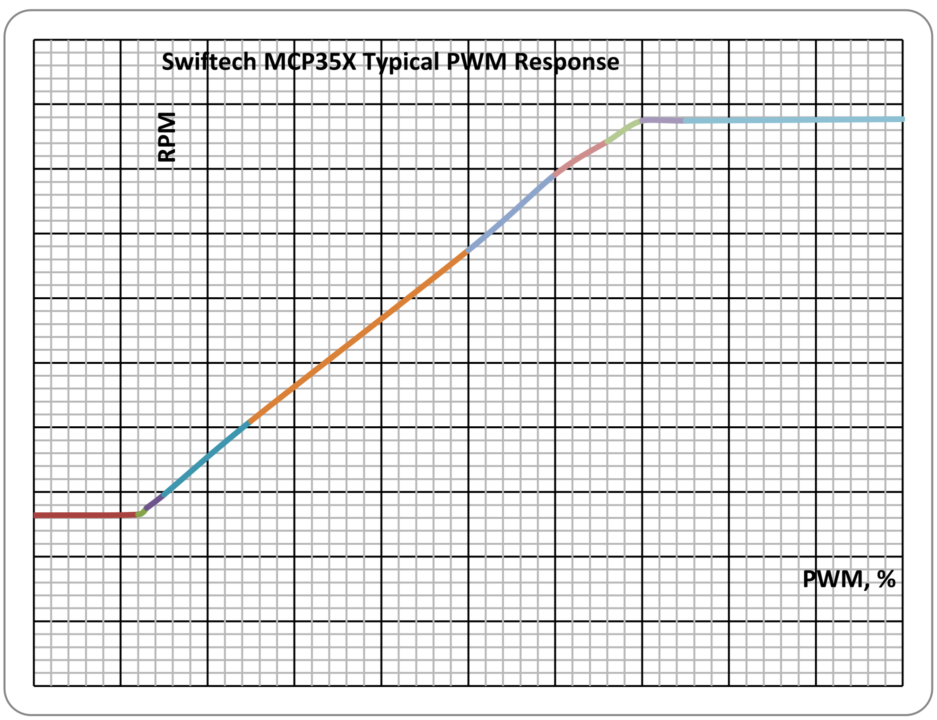


4. Electrical connections, pump general operations, specifications, warranty

a/ **Electrical installation:**
The pump uses two connectors: a standard Molex 4-pin (2 wires are used only) which connects to the PSU power connectors, and a standard 4-pin (2 wires) which typically connects to the motherboard CPU_Fan 4 pin header.



The 4-pin connector allows the motherboard to fully control the pump speed from 1300 rpm up to 4500 rpm. If not connected, the pump will run at full 4500 rpm speed by default. The following graph reports the pump speed response to % adjustments in the BIOS:



b/ **Operating precautions:**

The MCP35X pump should never be run dry, even for a quick test. You should always prime the pump by filling-up the MCR Drive radiator with fluid before you start operating it (see warranty note *).

Use of coloring die or fluorescent additives containing particulate fillers will cause excessive wear to the pump's impeller bearing (see warranty note **).

c/ **Specifications:**

Motor type	Electronically commutated, brushless DC, spherical motor
Nominal voltage	12 V DC
Operating voltage range	9 to 13.4 VDC
Max. nominal power (@12 V)	18 W
Max. nominal current (@12 V)	1.5 A
Max. nominal head (@12 V)	14.7 ft (4.4m)
Max nominal discharge (@12 V)	Max nominal discharge (@12 V)
Maximum pressure	22 PSI (1.5 BAR)
Temperature range	Up to 140°F (60°C)
Electrical power connector	Molex 4 pin
PWM + RPM signals	4-pin connector
ROHS	Compliant
Port thread standard	G1/4"
MTBF (Mean Time Between Failures)	50,000 Hours

WARRANTY: This product is guaranteed for a period of **24 months** from date of purchase for defects in material, and workmanship. Guarantee consists of replacing defective parts with new or reconditioned parts. Guarantee is considered void in case of **improper use (*)(**)**, handling or negligence on the part of user. Original invoice showing date and place of purchase is required for exercise of the warranty. ***(*) WARNING: DO NOT ATTEMPT TO RUN THIS PUMP DRY. THIS WILL CAUSE IMMEDIATE AND PERMANENT DAMAGE TO THE PUMP. (**) EXCESSIVE WEAR DUE TO INNAPROPRIATE FLUIDS.***

DISCLAIMER: Swiftech assumes no liability whatsoever, expressed or implied, for the use of this product, and more specifically for any, and all damages caused by the use of this product to any other devices in a personal computer, whether due to product failure, leak, electrical shorts, and or electro-magnetic emissions.

5. **Flow Parallelization:** *"How to create a mixed serial+parallel configuration in complex loops for dramatically improved flow performance" using the MCR Drive Rev3 series radiators and the Apogee HD.*

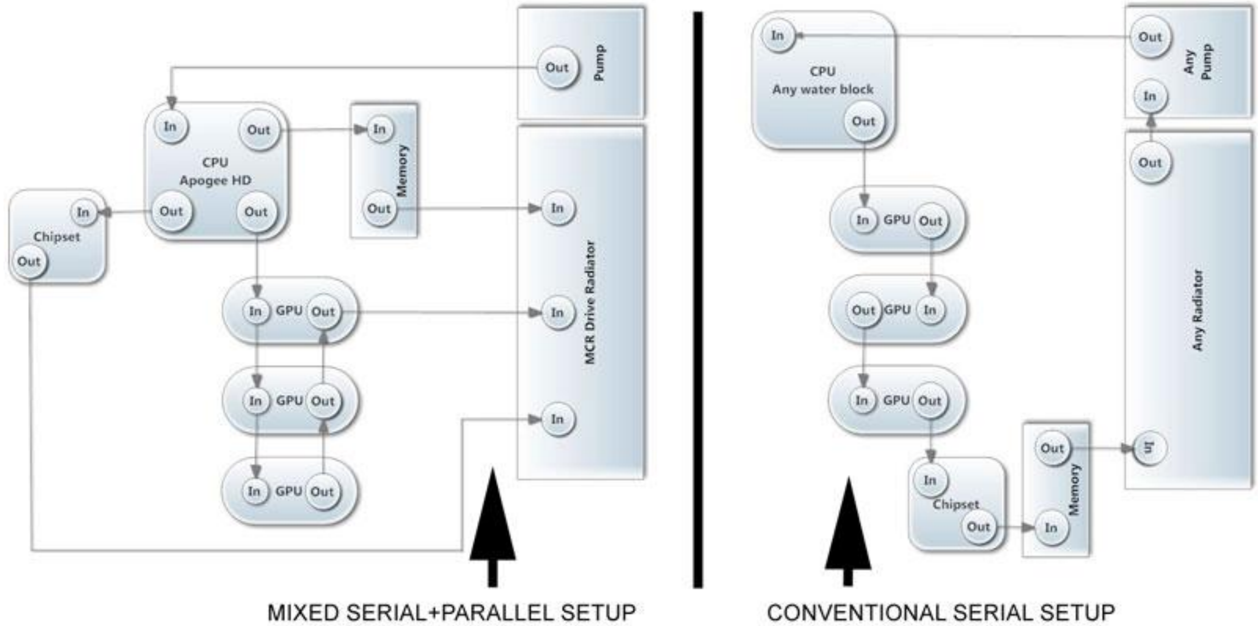
Among the most obvious benefits of harnessing the power of water-cooling is the ability to daisy-chain multiple devices for the CPU, Graphics, Chipset, and even memory.

Up until now, the most common way to do this has been to connect the waterblocks in series. In this type of configuration however, the pressure drop generated by each one of the devices cumulates, which substantially reduces the overall flow rate in the loop; and as the flow rate diminishes, so does the thermal performance of the system. Many extreme users have been resorting to adding a second pump to their system to mitigate this effect.

There is another strategy to connect multiple water blocks: the parallel configuration. It is very advantageous because in this type of setup, when two devices are parallelized, the flow is divided in half, but the pressure drop is divided by a factor of four, thus alleviating the need for a second pump. However, it necessitates splitting the main line using Y connectors, and it is seldom used because connectivity is awkward and cumbersome.

Enter the Multi-port Apogee™ HD waterblock, and MCR Drive *Rev3* Radiators. With two additional outlet ports for the Apogee™ HD and two additional inlet ports for the MCR Drive *Rev3* radiator, it is now possible to conveniently setup a high flow multi-block loop without using splitters. We will show below that while it always remains preferable to keep the CPU waterblock in series with the main line whenever possible, all other electronic devices in the loop are perfect candidates for parallelization. The resulting configuration is a **mixed serial + parallel setup, i.e. the best of both worlds!**

The following flow-charts illustrate two extreme setups (CPU + tripe SLI + chipset + memory) and quantify an order of magnitude in flow performance that can be gained from using a mixed serial + parallel configuration:



- The Pressure Drop in the mixed serial + parallel setup is approximately 1/4th that of the conventional serial setup.
- With an MCP35X pump, the flow rate in the serial setup would be in the range of .7GPM, whereas it would be in the range of 2GPM in the mixed serial+parallel setup.

As mentioned earlier however, the consequence of parallelizing cooling devices is that the flow rate inside of said devices is also divided, therefore slower. So we now need to introduce another concept to further qualify the rationale behind parallelization: the heat flux generated by the different electronic devices, i.e. the rate of heat energy that they transfer through a given surface.

CPU's

• Modern CPUs generate a lot of heat (up to and sometimes higher than 200 W), which is transferred through a very small die surface (the die is the actual silicon, and it is usually protected by a metallic plate called a heat spreader or IHS). Among other things, what it means in practical terms is that higher flow rates will have relatively more impact on the CPU operating temperature than on any other devices. For this reason, and in most configurations, the Apogee™ HD CPU waterblock will preferably always be connected in series with the main line, so it can benefit from the highest possible flow rate.

ALL other devices except radiators

• GPUs, whether they have an IHS or not, also generate a lot of heat (sometimes even more than CPU's). However the physical size of the dies is substantially larger than that of any desktop CPUs. The resulting lower heat flux makes GPUs much less sensitive to flow rate. In fact, when both are liquid cooled, we can readily observe that the GPU operating temperature is always much lower than that of the CPU. For this reason, it is 1/ always preferable to parallelize multiple graphics cards with each-other, and 2/ when one or more GPU blocks are used in conjunction with one or more other devices like chipset and/or memory, it is always beneficial to parallelize the GPU(s) with said devices using the Apogee™ HD multi-port option.

• Chipsets, Memory, Hard Drives and pretty much everything else one would want to liquid cool in a PC can also be placed in the same use-category as GPUs, either because they have a low or moderate heat flux, or because the total amount of heat emitted by the devices can be handled without sophisticated cooling techniques. What it boils down to, is that they are even less flow-sensitive, and we submit that parallelization of these blocks should in fact become a standard.

Radiators

The higher the flow rate inside of a radiator, the quicker it will dissipate heat. For this reason, radiators will always remain on the primary line, just like the CPU block, in order to benefit from the highest possible flow rate.

In conclusion, we can see that the multi-port Apogee™ HD when coupled with the MCR Drive *Rev3* radiators makes a compelling case for optimizing complex loops: it maximizes the flow rate where it matters most (on the CPU, and radiator) while offering a splitter-free parallelization of up to three other components (GPUs, chipset, etc.).

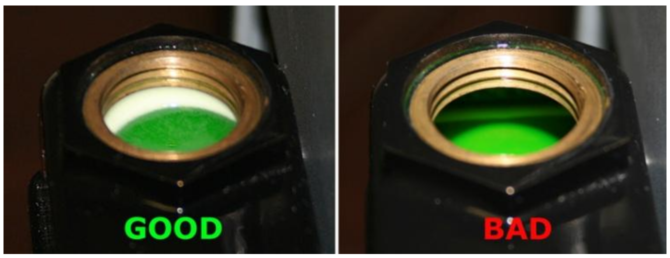
Alternate configuration:

The Apogee™ HD allows an alternate configuration: by using the main outlet as an entry port instead of the inlet, you can then parallelize the CPU with up to two more components: a second CPU, a GPU, a Chipset, etc. While it remains true as explained earlier that CPUs benefit from higher flow rate than other components, the few degrees in performance gains might not be consequential to some users. In these situations then, using

the “alternate” configuration could for example be beneficial as follows:
• When cooling two CPUs, it might be desirable to parallelize them in order to maintain the exact same temperature for each CPU.
• For one of the quickest upgrades ever: one could get started with a CPU-only loop, and use the alternate configuration initially. Then when installing additional water-blocks (graphics for example), all would be needed is to drain the liquid out, replace the plug(s) by fitting(s), and connect the tubes to the new device(s). There is no need to remove the Apogee HD, no need to remove and recut tubes to length: the existing loop doesn’t need to be modified.

5. Filling up the radiator:

Simply remove the reservoir fill-cap, and fill-up the radiator with a funnel. Adequate level is shown below:



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