

**Aqua Computer introduces LEAKSHIELD, an great innovation in the field of water cooling. It eliminates the only real danger in using water cooling systems: Leaks.**

**It also offers other cutting-edge features that should not be missing from any water cooling system from now. Read the FAQ to understand how LEAKSHIELD works and to answer many of your questions about this new technology.**

### How does LEAKSHIELD work?

The ingenious principle of LEAKSHIELD is based on the fact that the cooling system is provided with a precisely controlled negative pressure by a vacuum pump.

The negative pressure established by LEAKSHIELD as a protective shield is calculated in such a way that, in the event of a leak, no coolant escapes but only air enters the water cooling system. The entry of air is detected by LEAKSHIELD and subsequently further steps are triggered to maintain a safe condition of the system.

### What are the benefits of LEAKSHIELD?

LEAKSHIELD brings a number of advantages over existing water cooling systems. The biggest advantage is that it actively prevents leaks. It can also detect leaks and warn you in time.

Before commissioning a system, you can test it for leaks with LEAKSHIELD. This is done fully automatically by pressing a button.

When bleeding the system, LEAKSHIELD is a great help. By pumping out air and releasing it again, the system is actively vented.

The system can be filled with the help of LEAKSHIELD. Coolant is easily sucked into the reservoir.

In addition, LEAKSHIELD is a fully functional info display and can visualize almost all data about your hardware.

### Which variants of LEAKSHIELD are offered?

LEAKSHIELD was developed for Aqua Computer's ULTITUBE expansion tanks and is offered in a version specially adapted to these expansion tanks.

For older types of expansion tanks and tanks from other manufacturers, a special version, LEAKSHIELD UNIVERSAL, is offered. The two variants do not differ in terms of functionality and operation.

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**Does LEAKSHIELD affect pump performance or flow?**

No! The negative pressure generated by LEAKSHIELD in the cooling loop has no impact on the performance of the pump or the flow rate. Nor does it affect the cooling capacity.

**How does LEAKSHIELD calculate the necessary negative pressure?**

LEAKSHIELD requires additional data from the system: LEAKSHIELD determines the maximum possible water pressure in the system from the pump type and pump speed used and the flow rate. It adjusts the negative pressure accordingly. If Aqua Computer pumps with connection to the aquasuite software are used, the data will be assigned automatically. If you do not own any sensors, an assistant will help you with the manual adjustment.

**Which pumps can I use?**

All pumps with a pressure of up to 470 mbar (4.7 m head) can be used. This includes nearly all pumps offered by Aqua Computer.

**Does LEAKSHIELD work if I connect two pumps in series?**

This depends on the set speed and the generated pressure of the pumps. Again, 470 mbar is the maximum total pressure. If the pumps in total exceed the pressure at the set speed, LEAKSHIELD can only be used as a leakage monitor. Protection against leakage of the coolant is no longer provided in this case.

**Why does LEAKSHIELD not allow a higher negative pressure than 450 mbar?**

The maximum negative pressure is limited to 450 mbar in the firmware of LEAKSHIELD. Higher negative pressures could damage water cooling components and would only be compatible with very stable tubing. In addition, at higher vacuums, water begins to boil at low temperatures and cavitation effects can occur at very high negative pressures. This condition should certainly be avoided and therefore we limit LEAKSHIELD to a vacuum of 450 mbar.

**At which temperature does water boil under 450 mbar negative pressure?**

Water boils at 88°C / 190° F at the maximum negative pressure of LEAKSHIELD. This point is therefore not within the normal operating range of a water cooling system.

## Which coolants can I use?

Approved for use with LEAKSHIELD is water and all DP ULTRA series products. Many other coolants on water/glycols mixture should usually be compatible. However, we cannot guarantee this.

Under no circumstances should coolants with flammable ingredients be used. The use of additives is also not permitted.

Pigments can clog the membrane of LEAKSHIELD and restrict the function or make it impossible! If coolants with nanoparticles or pigments are used, these must not come into direct contact with the membrane. This also applies to transport.

## Do I need special components for the use of LEAKSHIELD?

No. You need suitable components and tubing or hardtubes for LEAKSHIELD. Almost all Aqua Computer components are suitable for LEAKSHIELD. The hoses or hardtubes must be sufficiently stable to withstand the negative pressure.

As a rule of thumb, the outer diameter of PVC hoses should be at least 1.5 times the inner diameter. For PUR hoses, a factor of 1.2 is usually sufficient. Hardtubes are generally suitable. Without information on compatibility, we recommend testing at slightly increased negative pressure and maximum water temperature before use.

## Can I retrofit LEAKSHIELD?

Yes, the easiest way is to use systems with ULTITUBE reservoirs. Here, only the lid needs to be replaced. The installation takes only seconds.

With other reservoirs you need a connection on the lid of the reservoir so that there is always air in this area. The container should be large enough to provide at least 100ml of air volume. Smaller tanks are also suitable in principle, but will require frequent re-pumping of the negative pressure.

In combination with a LEAKSHIELD UNIVERSAL you can then also use such a reservoir.

The tubing from the reservoir to the LEAKSHIELD UNIVERSAL should be routed so that water can freely drain back into the reservoir. The LEAKSHIELD UNIVERSAL also has an integrated membrane and is protected against the ingress of water. However, this remains impermeable if water remains in the line.

## How do I test a system with LEAKSHIELD for leaks before using it?

Even when using LEAKSHIELD, we recommend a leak test before putting the system into operation. To do this, you can enter the leak test mode by pressing the button on the right side of the device. LEAKSHIELD then creates a vacuum in the system and indicates leaks on the display.

Important: To ensure a stable measurement, the temperature in the system should not change during the measurement. Even strong sunlight can affect the measurement result.

Even partially filled systems can be tested. It does not make sense to test running systems. The reason for this is that the operation of a pump in the circuit can cause pressure fluctuations in the system. The measurement becomes inaccurate.

LEAKSHIELD will indicate small leaks in many systems due to the highly accurate measurement and the non-constant temperature of the air volume. In addition, due to their design, solenoid valves will always have a minimal leak. However, this is not significant in practice and the values obtained are well below the threshold for a real leak.

#### **The test showed that my system is not properly sealed. How do I proceed?**

Almost every cooling system is not 100% tight. Micro leaks and porosity in plastic, but also e.g. on the valves of LEAKSHIELD cannot be avoided. Nevertheless, the highly accurate measurement of LEAKSHIELD shows these. In operation with the LEAKSHIELD system these are insignificant, because LEAKSHIELD protects you from leakages. Larger leakages should of course be repaired in any case. Here you can narrow down and approach the leak by testing parts of the circuit.

#### **How must LEAKSHIELD be supplied with power?**

LEAKSHIELD only needs a USB connection. This must be configured to provide power even in standby. Since LEAKSHIELD should react to a leak at any time, the electronics need constant power. LEAKSHIELD detects when the computer is in standby and deactivates display and LEDs on demand.

#### **What happens in case of a leak?**

If a leak occurs, LEAKSHIELD detects it in a few seconds.

LEAKSHIELD can immediately determine the size of the leak and, depending on this, either simply issue a warning or initiate alarms in two stages.

LEAKSHIELD can shut down the computer via the background service of the aquasuite or via the connection for the power button of the mainboard if desired. LEAKSHIELD also registers itself as a USB keyboard and can alternatively shut down the computer via corresponding key commands. This shuts down the pump of the system in consequence and creates safety by the then no longer existing pump pressure.

LEAKSHIELD draws attention to itself via acoustic and optical alarms. In parallel, LEAKSHIELD can suck the coolant back into the reservoir in an emergency. For this purpose, it can drastically increase the power of the vacuum pump compared to the normal function. Larger leaks can also be prevented without fluid escaping in this state.

#### **How does the negative pressure affect my system?**

The negative pressure in the system has an extremely positive influence on the stability of the components. As an example, consider a CPU waterblock with a plexiglass cover. At normal pressure, the screws have to apply the force to compress the O-ring. This often leads to stress cracks. In a system with LEAKSHIELD, the air pressure pushes the lid onto the copper base and relieves the stress on the screw connections. This goes so far that in a system protected with LEAKSHIELD you can theoretically remove the screws during operation - the system will remain tight. This applies to all components! In addition, e.g. with GPU coolers, the Plexiglas covers will better seal the water channels against the copper plate.

#### **How can LEAKSHIELD help me to deaerate the system?**

LEAKSHIELD has a special deaeration mode. When activated, LEAKSHIELD cyclically builds up and releases negative pressure. This works out air bubbles in the system. Cooling circuits can be deaerated much easier and faster with LEAKSHIELD!

#### **LEAKSHIELD can measure the level in the system. How does it work?**

To determine the level in the system, LEAKSHIELD has two highly accurate sensors: a high-precision 24-bit pressure sensor with a resolution of a fraction of a millibar and a sensor for the pumped volume.

These two values are used to determine the pumped volume, the pressure and the necessary time when the vacuum is built up. Since water is not compressible, LEAKSHIELD can determine the volume of air in the system very precisely from these values. This is then used to determine the fill level.

#### **When is the level measured?**

LEAKSHIELD is always active in the background and measures the level when parameters or operating modes in the system have changed that indicate a change in the fill level. This is the situation, for example, when the reservoir is opened or there are significant pressure fluctuations.

Since the system is hermetically sealed and continuously monitored by LEAKSHIELD, this is not very often the case. Nevertheless, the reading is always up to date and reliable.

## How often does LEAKSHIELD have to build up negative pressure?

In practice, depending on the size of the system, it takes LEAKSHIELD between hours to days to readjust the negative pressure. This depends on the volume of air available to LEAKSHIELD, the temperature fluctuations and the tightness of the system.

## How much noise does LEAKSHIELD produce during operation?

In normal operation, LEAKSHIELD does not generate any noise. When the vacuum is built up, a low operating noise of approx. 50 dB is perceptible for a few seconds. The pumping time is usually much less than 10 seconds.

A great amount of effort was invested in the reduction of the operating noise during the product development and therefore LEAKSHIELD is hardly noticeable in many situations.

It is also possible to specify that this operation occurs at specified times. LEAKSHIELD schedules these times and tries to adjust the negative pressure only during these periods.

## What can be displayed on the screen?

In short, almost everything. We have given LEAKSHIELD the capabilities of our VISION technology in addition to the basic functionality. This allows almost all hardware monitoring data of the aquasuite to be visualized on the display.

From CPU utilization to flow rate - there are an incredible number of possibilities.

## What influence do I have on the installed LEDs?

We have also provided the possibilities known through our RGBpx technology for the installed LEDs. The LEDs can be freely assigned with effects via RGBpx as long as they do not currently represent a function for LEAKSHIELD itself. Of course, they can also be deactivated.

## How can I transport a system with LEAKSHIELD?

Systems with LEAKSHIELD can be transported normally. In this case, the negative pressure is initially maintained even without power supply. If LEAKSHIELD should remain active during transport, e.g. a USB power bank can be used and continue to supply LEAKSHIELD with energy. LEAKSHIELD is protected against liquid ingress by a special membrane. Systems can therefore also be transported upside down. However, it is not possible to build up negative pressure in this position.

### What connectors does LEAKSHIELD have?

In addition to a USB port, LEAKSHIELD has the option to be connected to the power button port of the mainboard.

With LEAKSHIELD UNIVERSAL you will of course also find a G1/4" connection to connect the vacuum to the reservoir.

### Can I convert the LEAKSHIELD variants?

Yes - In the LEAKSHIELD UNIVERSAL variant, additional housing components are included. These can be unscrewed without tools and LEAKSHIELD can then be connected to an ULTITUBE reservoir.

Likewise, a conversion to UNIVERAL is possible.

### What can I choose with the button at LEAKSHIELD?

A short press changes the information shown on the display. If the key is pressed for longer than 1 second, the operating mode can be selected via the button. The following modes can be chosen here:

- SHIELD (Complete protection with configured vacuum and leak detection).
- MONITOR (LEAKAGE SENSOR)((Low vacuum, leak detection only)
- TESTER (LEAKAGE TESTER)(Test the cooling system for leakage)
- DEAERATION (VENTILATION)(Supports deaeration of the system during filling.)
- LEVEL SENSOR(Measure the fill level in the reservoir)
- RELEASE (System is switched off, pressure is automatically released, pressure compensation takes place automatically if necessary)

### In which mode does LEAKSHIELD start after a power failure?

If LEAKSHIELD is supplied with power, either SHIELD or MONITOR mode is launched, depending on the last selected operating mode. If the device was switched off manually before, it will not start automatically even after a power failure.

The other modes are ignored as they would not provide leakage protection for the system.

## **Can I turn the display in the direction I want?**

Yes. The upper part of LEAKSHIELD with display, LEDs and connectors is rotatable against the lower part. It can be aligned and rotated against the lower part as desired. Even multiple rotations are no problem.

## **Can coolant leak through LEAKSHIELD?**

No. LEAKSHIELD is protected against coolant by an innovative membrane. It is not possible for coolant to leak out.

## **Does LEAKSHIELD require maintenance?**

LEAKSHIELD is designed to operate for many years.

The vacuum pump and valves are mechanically stressed components and are also subject to a certain amount of wear in LEAKSHIELD. Aqua Computer therefore offers a replacement service for all components that are subject to wear. This includes the pump, valves, seals and internally installed molded hoses. LEAKSHIELD monitors the running times and switching cycles of the components.

## **How much air should I keep in my reservoir?**

We recommend keeping at least 100ml of air in the reservoir. The more air there is in the system, the less often the vacuum needs to be rebuilt. In addition, if there is a large leak, more capacity in the reservoir will allow some of the coolant in the system to be sucked back in. In short, the larger the air cushion, the better for the LEAKSHIELD system.

## **How can I remove the pressure to open the system?**

For this purpose LEAKSHIELD has a mode to release the negative pressure. Integrated valves open and ventilate the system selectively. Afterwards, the system is pressure-free and can be easily opened. This process takes about 2-10 seconds.

## **What influence does the lower pressure have on my coolant?**

The negative pressure reduces the amount of gas in the coolant and slightly improves the cooling performance. In addition, the reduced air pressure reduces the available oxygen in the cooling system. This improves the durability of the coolant.



## **My hoses are only suitable up to a low vacuum. I don't want to replace them - what can I do to use LEAKSHIELD?**

To use LEAKSHIELD in such a system there are several options. First, you should set the pump power as low as possible. This will reduce the vacuum required by LEAKSHIELD accordingly.

If this is not possible, LEAKSHIELD can be operated in a second mode exclusively as a leakage sensor. This mode works with a minimum negative pressure and is compatible with all components.

## **Do I need software for the operation?**

With LEAKSHIELD you get our aquasuite software. With this powerful piece of software you can perfectly adjust LEAKSHIELD to your system. In addition, you can view and visualize all current measurement data. The aquasuite also offers you a wide range of options for further data processing.

For the operation itself, LEAKSHIELD does not require any running software on your system. The system works completely autonomously. However, if parameters change on your system (e.g. pump performance) LEAKSHIELD needs an update of the parameters. This can be done automatically via the background service of the aquasuite.

## **Which materials get in contact with my coolant?**

Only the -plastic membrane of LEAKSHIELD will get in contact with your coolant.

## **How do I connect LEAKSHIELD to my mainboard?**

To shut down the system and the pump in case of a leak, LEAKSHIELD comes with a connection cable for the mainboard's power button. The existing push button is connected in parallel to another outlet of this cable.

## **Can I use a reservoir with pressure compensation together with LEAKSHIELD?**

No.

## **Can I test a system with LEAKSHIELD for leakage with Dr. Drop?**

No. LEAKSHIELD is designed in a way that overpressure always discharges. This happens even when the system is switched off. The leakage test should be performed accordingly using LEAKSHIELD itself.

### Can I supply LEAKSHIELD via a USB power supply?

Yes. The power supply should provide a proper supply voltage of 5V and should be able to supply at least 1A of current. Only use power supplies from brand manufacturers!

### After establishing negative pressure, the pressure always decreases first, then stabilizes. What is the reason?

When LEAKSHIELD builds up negative pressure in the system, the air in the reservoir gets colder at the same time. Then it warms up again on the water and the walls of the tank. As a result of this warming, the pressure rises again.

In addition, the vacuum pump is heated and the LEAKSHIELD housing then transfers the heat to the air in the tank. This also leads to an increase in pressure.

After approx. 30 minutes, a stable pressure can be expected in the system again.

### What are the technical specifications of LEAKSHIELD?

- Dimensions:	Diameter 72 mm, height 29 mm
- Supply voltage:	DC 5V
- Current consumption:	Max. 500 mA
- Negative pressure:	Max. 450 mbar
- Valve air leakage rate:	typ. < 2 ml/min at 300 mbar vacuum
- Material:	Acetal (POM)
- Noise:	Max. 60dB, typ. 50dB in pump mode
- Acoustic alarm:	Buzzer, approx. 85 dB
- Illumination:	6 digitally controlled RGB LEDs
- Display:	OLED, 128x64px, dimmable and can be switched off
- Interfaces:	USB 2.0, power button