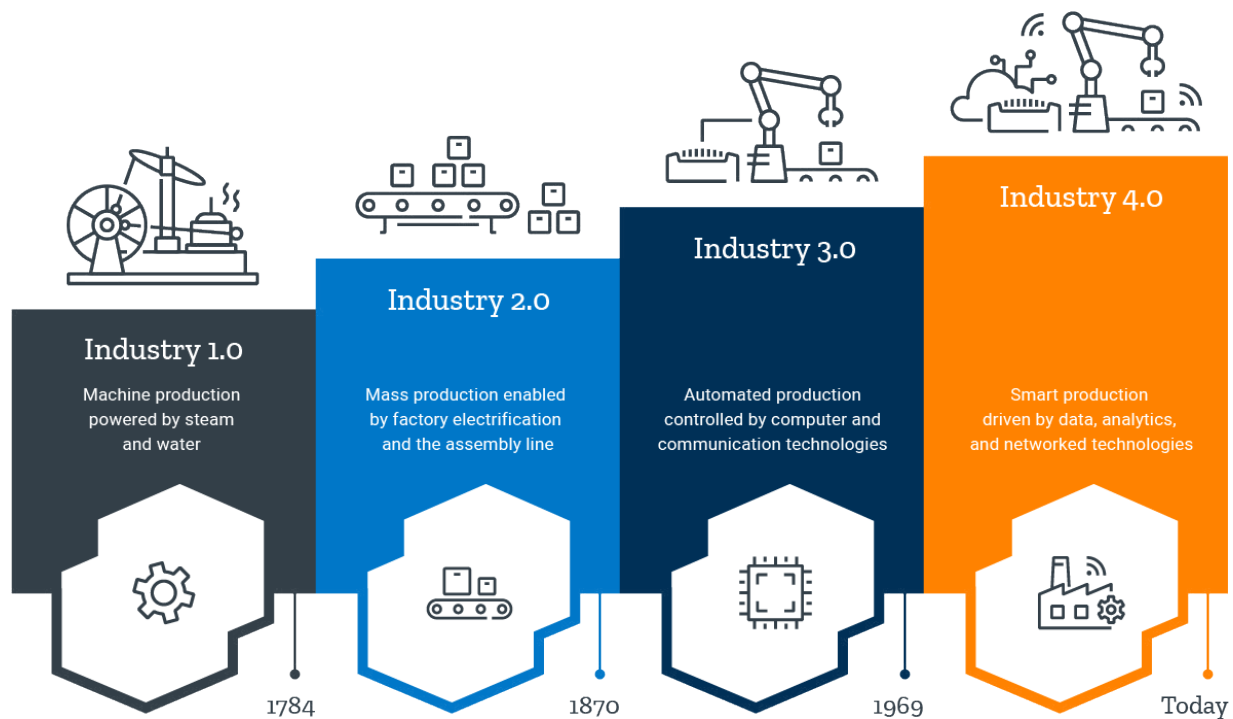


The Benefits of Fanless Computing

5 Ways Fanless Computers Can Help Your Business

Executive Summary

Digital technologies and the Internet of Things (IoT) have changed the face of business - from manufacturing to distribution. Factories are increasingly enabling communication between machines, sensors and other devices resulting in a more integrated, connected approach. This transformation is called Industry 4.0 and has resulted in a reduced need for manual labor and increased productivity. Industry 4.0 relies on computing power - from idea conception, to manufacturing, and distribution.



The key to success in Industry 4.0 is mitigating every risk for disruption. Using fanless industrial computers is one way businesses can mitigate risk. While the upfront cost for a fanless industrial computer can be more expensive than a commercial off-the-shelf system, fanless computers often provide a lower total cost of ownership, along with reduced downtime, increased meantime between failures, lower operating costs, smaller form factor, and quieter operation.

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Background - How Computers Stay Cool

Quite simply, computer CPUs generate heat and need to be kept cool or they will slow their performance or shut down. "Thermal Check" is a standard regulatory feature of all computers. This is a temperature threshold at which the computer will either throttle performance to reduce heat output or completely shut down to protect the components from melting. To keep a computer cool and prevent thermal check, a computer can be cooled by one of two means - active cooling (fanned) or passive cooling (fanless).

Active Cooling - Fanned

Active cooling of the CPU and other components is accomplished through the use of a fan inside a computer case along with vents to allow hot air to escape. Much like a fan inside your house, a computer fan draws cooler air through vents from the outside into the computer case and expels warm air through vents to the outside. Fans are also used to move air inside the computer. The air is often directed across a component called a heat sink designed to dissipate heat. A computer case has to be big enough to allow for circulation and the computer has to be placed in a location that allows for airflow through the vents.



A fan can introduce dust and dirt into a computer.

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5 Problems with Fans



1 - They Introduce Dust Inside the Computer

When the fan is running, it not only carries in cool air through the vents, but also any airborne particulate including dust, pollen, dirt, grease, and insects. Over time, this particulate builds up and it's only a matter of time before it begins to cause problems.



2 - They Can Break

As with any moving part, fans are prone to breakage. They are even more prone to breakage after they become weighed down with dust and have to work even harder than normal.



3 - They Are Not Vibration Resistant

Vibrations can wreak havoc on any moving part. Most industrial machines introduce vibrations into the environment which can loosen connections and cause fan interference. As computers are pushed even further to the edge including inside vehicles or in a mine shaft, the need for vibration resistance is paramount.



4 - Fans Need Room to Circulate Air

To ensure airflow in and out of the computer case, a fanned computer has to be placed in a location that has adequate airflow without blocking the vents. Also to ensure airflow, most computer cases are full of empty space, making them bigger and bulkier than their fanless counterparts. For these reasons, computers with fans lack placement versatility.



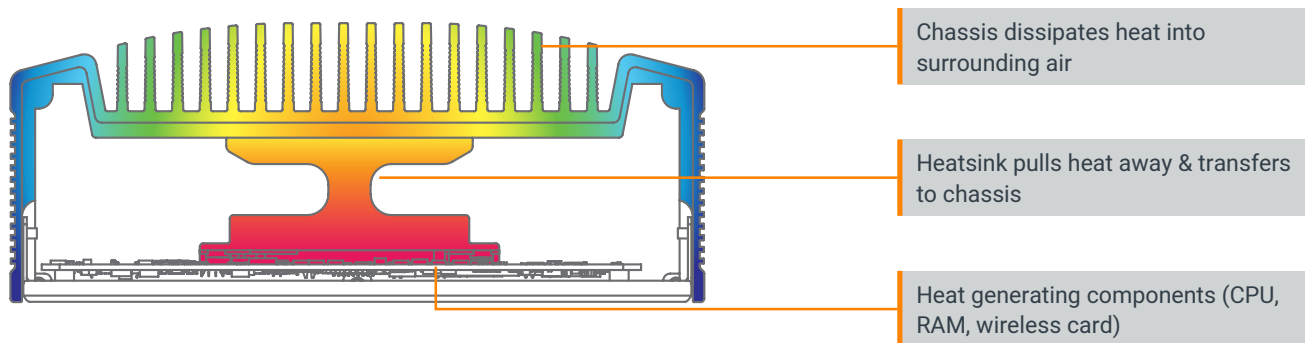
5 - They Are Noisy

Fans generate a constant hum which can be problematic in many working environments. And, the noise can get louder if the fan has to work harder after being covered in dust or if they get vibrated a little out of place.

Passive Cooling - Fanless

Passive cooling keeps the computer cool and running efficiently through clever design and engineering without a troublesome fan. Using thoughtful thermal design, heat can be directed from sensitive components, such as CPUs and internal power supplies, to the external body panels of the computer chassis, which serve as a giant heatsink, with a broad surface area and heat dissipation fins. This design allows for heat to convect and radiate into the surrounding environment, cooling the system. A good passive cooling design minimizes thermal junctions and dissipates heat over a broad surface area without a moving fan. Advancements in passive cooling technology have opened the door for not only fanless cooling, but ventless chassis designs that allow a system to be efficiently cooled without any openings in the computer enclosure.

Fanless PC Heat Transfer Process



Top 5 Benefits of Fanless Computing

Understanding the benefits gained when moving to fanless will help you and your team better weigh the value of investing in fanless computers.

- Reduced downtime
- Increased mean time between failures
- Lower operating costs
- Smaller form factor
- Quieter operation

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Reduced Downtime

Most computer downtime is caused by overheating. Eliminate dust and a faulty fan and you've eliminated the most common reasons for overheating.

What is the Cost of Downtime?

In a survey conducted by ITIC a few years ago, 95% of respondents indicated that a single hour of downtime could cost their business upwards of \$100,000.

Increased Mean Time Between Failures

The meantime between failures (MTBF) is defined as the length of time a computer will last before it can't be used anymore. Removing any moving parts in a computer, like a fan and a rotating hard drive, eliminates the biggest reason computers fail. Another feature that ensures a long life is a well designed chassis to protect the sensitive electronics. Your industrial computer chassis should not only be strong, but also ventless to prevent dust ingress and build up. Read more about mean time between failure in our [Understanding MTBF white paper](#).

Embedded Applications Require Especially Reliable Hardware

Hardware replacement is a fact of life in the IT industry, but for embedded engineers, the prospect of having to remove and replace a vital component of a much larger project is a daunting proposition. The importance of a reliable hardware infrastructure is magnified when a PC is stashed within the inner workings of a robot, tucked into a machine vision system, or buried deep in a mine shaft. Replacing one of these systems isn't as simple as unplugging the dead computer and plugging in a new one. If a breakdown necessitates a hardware change, it might necessitate additional testing, recertification or even product redesign.

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Lower Operating Costs

By using a fanless computer you can reduce your operating costs by reducing maintenance costs and reducing power consumption.

Reduced Maintenance Time

- Cleaning dust from PCs is time consuming and can be costly if you have to take the computer offline. Cleaning dust may also be potentially harmful to your computer components. Whether you clean with canned air or a vacuum cleaner, the risk factor of damage is great. And, blowing the dust off of PC vents might make your system look better on the outside, but it's doing nothing to solve the problem. The reality is that you're only relocating the dust from the outside to the inside of your computers.

Reduced Power Consumption

- Fanned desktop computers generally have power supplies in the range of 240 to 650 Watts. These are integrated in the chassis of the system and due to their power, often need additional cooling from a fan to get rid of heat generated by the power converted itself. Fanless computers on the other end, can work with (external) power supplies and adapters in the range of 35 to 80 Watts.
- Power usage is often referred to as kWh, which corresponds with the amount of kiloWatts used when the device is turned on for 1 hour. Let's estimate what the power usage for both devices would look like over the course of a year, assuming they will both be used for 8 hours a day, 5 days a week. Also, let's take the low end of the desktop spectrum and the high end of the power adapter spectrum to get the most realistic comparison:

Fanned	Fanless
$0.24\text{kW} * (8 \text{ hours} * 5 \text{ days} * 52 \text{ weeks})$ = 499.2 kWh	$0.08\text{kW} * (8 \text{ hours} * 5 \text{ days} * 52 \text{ weeks})$ = 166.4 kWh

Bottom line: fanless computers use up to 66% less power

In this scenario, a fanless system with a powerful adapter, uses 66% less power than its fanned counterpart with an "economical" power supply. So we can run 3 fanless systems on the same power usage as we do for just 1 desktop PC.

To put a dollar figure to it, in 2020 the average cost per KWh was \$0.13 making the average cost to run a fanned computer per year about \$66. The same cost for a fanless computer would be \$22. Multiply that by the number of computers needed, and that cost per year can quickly add up. Ultimately, the goal for more and more companies is to become energy-neutral. Going fanless is one impactful step in reducing power consumption.

Smaller Form Factor

Fanless computers are significantly smaller than their commercial counterparts. This small footprint allows for easy installation including wall mounting or tucking into small spaces. If you have a pre-established small space, you can most likely find the fanless computer to fit. If you wanted to put a fanned computer in a pre-existing tight location, you may need to spend time and money reconfiguring a space for adequate ventilation.



Quiet Operation

By their very nature, fans are noisy and become even noisier when they have to work harder when caked in dust or if the moving components become loose and vibrate against the frame of the computer. This may not be an issue in a noisy warehouse, but it can certainly become an issue in certain environments like healthcare or entertainment where a quiet environment is a must.

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Compare Specifications of a Fanless PC to a Typical Commercial PC

Feature	Commercial PC	Fanless PC	Advantage
Power Input	110~230V	9~48V	Less dependency of AC power/wall socket
Power Consumption	240~650W	35~80W	More Power Efficient
Chassis	Open	Closed	Far better ingress protection
Footprint Size	Medium to large	(Ultra) small	Easy Integration
Volume/dimensions	Average SFF around 338 x 379 x 100 mm ¹	As little as 83 x 116 x 34 mm ²	Little real estate required to implement
Expansion	PCIe/SATA	mPCIe/mSATA	Small sized, solid state expansion for storage and connectivity
Storage	HDD / SSD	M.2/mSATA SSD	Solid state system, no moving parts resulting in higher reliability
Mounting	None	VESA, DIN	Installation Flexibility

¹ Size of HP Elitedesk 800 SFF Fanned desktop computer

² Size of Logic Supply CL200 USSF Fanless PC

Making the Case for Fanless

In summary, making the business case for fanless hardware is relatively simple. A fanless computer can have a significant, long term positive impact on your business. By removing the fan, the most common failure point in computers, you are creating a solution with optimal reliability. While the initial cost for a fanless computer can be higher than an off-the-shelf computer, the long term benefits far outweigh the initial upfront cost and in the end, result in a lower total cost of ownership.

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Contact

Have more questions about fanless computing? [Contact our team to learn more!](#)

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