



FREQUENTLY ASKED QUESTIONS





Frequently Asked Questions

About the System and its Components

Which racks can be retrofitted with DVC™?

DVC is compatible with and retrofittable on digital GM racks (DGM racks) only. DVC is not compatible with AERO racks or 2GM racks.

Can the DVC rack be washed and autoclaved?

Yes. Exactly as a standard Individually Ventilated Cage (IVC) rack; however, you should avoid chlorine-based detergents and never exceed autoclave temperatures of 121°C/250°F. Please see DVC rack's SOP for more information.

Is it possible to upgrade just a few columns of a rack to DVC?

No. The minimum DVC unit comprises one complete side, which could be a single-sided rack or one side of a double-sided rack.

How do people interact with the DVC?

The facility manager will access the DVC application from the facility's computer, while operators may opt to use a tablet or smartphone. The DVC application received and displays the information from the cages, including alarms, tasks and cage conditions. Each module of the DVC has a dedicated interface with dedicated pages and features. DVC runs on a server and must be accessed through a device connected to the DVC network.

What is the lifespan of the boards?

The DVC boards have been tested and shown to last for up to fifteen cycles at 121°C/250°F while maintaining full functionality. Although aesthetics of the boards may change over time, they will work properly. A test report is available upon request; a burn-in[†] test result will be shared as soon as it becomes available.

^(†) A burn-in test is a widely accepted practice for detecting manufacturing failures/life span.

Does the DVC board produce a temperature increase around it?

No, the board uses very low electrical current. The heat loss coming from the boards is negligible.

Does the DVC board work in a dusty environment?

One of the Beta sites where the DVC was extensively tested had a particularly dusty environment. The function of the DVC boards was not affected. Tecniplast will have more data available in the future as more systems are installed.





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Is the DVC™ available for rat IVCs?

Due to the level of investment and resources required for product development, Tecniplast is primarily focusing on the GM500 product line for mice, which is the caging line most utilized by research institutions. We consider this to be our first step in the evolution of digital technology for the lab animal industry.

Should I change all my cage tops if I want to upgrade my DGM racks to DVC?

Even though the DVC utilizes the standard GM500 top, the strict requirement is that an RFID tag must be adhered to the microbiological filter. If a facility decides to upgrade their installed IVC racks, they will need to replace the microbiological filters with RFID tagged filters. We strongly recommend purchasing the orange filter retainer for easy identification, specially if the facility has both DVC and IVC cages. If a top without the RFID tag is placed into a DVC rack, a number of functions of the DVC will not be accessible.



How much power does each DVC rack use?

Each side uses approximately 60W of electricity.

Can a DVC Master manage all racks in a holding room?

A DVC Master can manage up to four sides, which can be either (4) single-sided racks or (2) double-sided racks.

Can the DVC Master be used if Air Handling Units (AHUs) are not present (e.g. Centralized air, HVAC, etc.)?

Yes. Currently, it is the DVC and not the AHU which manages the cages. If the AHU (e.g., Smart Flow, Easy Flow) is present, the DVC Master can be installed on top of it, and can manage up to four sides exactly as the AHU. If there are other types of AHUs or connections to an HVAC, the DVC Master can be placed on a shelf or a wall. The only requirement is to have the DVC Master properly connected to the racks and to a network.

About the Animal Activity Monitoring Module What is the activity measured by the DVC?

The board captures the presence of the animals by detecting their physiological composition (70% water). There are twelve (12) electrodes on the board; each of them collects several samples per second. A variance in the signal will indicate the presence or absence of the animal. The DVC uses an index of the variability of the signal over a period of time.





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Is the DVC™ able to track a single animal?

The DVC monitors the GLOBAL activity inside the cage which is seen by the system as global energy into the micro environment. We are not able to track animals individually even if they were to be implanted with a chip or RFID. It is possible to house a single animal in a DVC cage for a sample period of time (e.g., 24 hours) to capture data about the activity of that particular animal. DVC doesn't track animals the way other systems, such as the implantable animal telemetry systems (TSE) do.

Can the DVC detect the animals' access to food and water?

This feature is currently unavailable, however, Tecniplast is investigating the potential for offering this function. The existing sensors could potentially detect an animal while drinking by correlating the presence of the animal below the bottle (activity noted by the board) with the signal detected by the Water IR LED.



Which research field can take advantage of the animal activity data?

The answer is ALL. As we've presented the DVC to researchers, each of them has envisioned an application and evolution in his own research field, whether it is neurosciences, behavioral, post-surgery, pain therapy, recovery, tumor studies, locomotor-issues, cancer research, phenotyping, etc.

Are EMF dangerous for the animals?

We have measured the value of the EMF generated by the DVC. The results showed an effect of approximately 1V/m in the cage. As a comparison, the effect of the EMF generated by the light in the holding room is approximately 8V/m, while the effect of other measuring points in the room (e.g., closer to the electrical system) can rise up to 30 V/m. The EMF coming from the digital caging system is minimal. As a reference, maximum exposure values are around 2500V/m. Tecniplast had commissioned studies by independent parties to conduct histopathological tests, breeding test and behavioral test (comparing cages with and without DVC). The results obtained showed no signs of clinical or pathological effects in the mice. For more details see the EMF brochure.



About Food & Water Detection Module

Is it possible to install just the Food & Water Module (without the DVC board)?

No. The electronics driving the infra-red LEDs to detect food and water levels, are embedded into the DVC board; therefore, a stand-alone configuration is not possible.

If I am using auto-watering system (AWS) only, will I get the bottle-missing alarms?

We can disable the bottle and water alarms if we know that AWS or water pouches are used. In the future, since DVC™ is capable of identifying and tracking every cage, we could enable or disable the sensors if we know the protocols for each. For instance, some studies require the use of a bottle and some require AWS.

Is the light stream of the IR LED dangerous for the mice (especially the eyes)?

The IR LEDs are located in two places:

- Food: this light stream passes through the food hopper which is not a position accessible to mice
- Bottle and Water: the LED is activated for a few milliseconds every 30 minutes, so the probability of the light streams hitting the mouse's eyes is extremely low, in addition to it being in an unusual position to connect with the animals



Is the DVC able to detect bottle leaking?

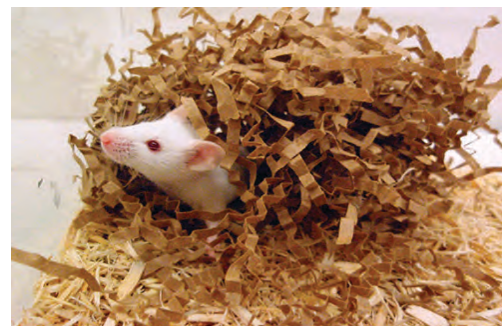
Right now this feature is not available. The system design* has the potential for this to be implemented with time and validation. It is under consideration as a future development.

(*) Right below the bottle there is an electrode that can be used to detect quick changes in bedding humidity. The principle is similar to the Leak Detection System (LDS) but related to a bottle leaking or flooding.

Bedding Condition Module

Does the type of bedding affect the cage change planning suggested by the DVC?

Absolutely NOT. The DVC runs the Bedding Condition algorithm based on parameters established during the initial "learning phase". Normally, the bedding used during the learning phase is the same as the facility will use during the running phase, so the criterion defining a "dirty cage" in the system are tuned and tailored to the facility parameters. In the event that the choice of bedding changes, and the operator's feedback about the cage condition ("too dirty" or "too clean") is not enough to tune-up the algorithm to match the new parameters, then a new learning phase would be necessary.



How long is the learning phase?

The duration will depend on the criteria defining a dirty cage. The learning phase consists of a single side with cages prepared to have maximum variability of cage population: ideally, cages with 2, 3, 4, and 5 males, and 2, 3, 4, and 5 females randomly distributed across the rack. During the learning phase, every cage has to be changed when declared "dirty" by the person in charge of changing the cages. The learning phase concludes when all cages have been changed once.



If a PI prefers to keep changing cages on a fixed schedule, can the DVC™ be setup for that?

Yes, the cage changing can be programmed based on the cage(s) protocol.

Why don't we rely on ammonia concentration?

Ammonia (NH₃) concentration is not a reliable index for multiple reasons:

- a. Cage ventilation affects the readings making the detected values extremely variable.
- b. Measured values could be extremely different depending on when the probe is inserted and where the urine is concentrated.
- c. Male urine generates a very high concentration of ammonia, female urine ammonia concentrations are lower. This is a key factor in the choice of moisture as the parameter defining a dirty cage.
- d. The concentration of NH₃ in the urine could vary significantly among strains of mice, as well as age and gender.

Inventory Module

Is the inventory module available as a stand-alone module?

A lighter version of the DVC, called DVC Lite™, is available for those interested in the inventory module. DVC Lite™ utilizes a smaller plate, has less modules, and can help manage less complex operations within the facility, such as cage changing and washing planning, scheduling personnel, detection of cage flooding, etc. The components and installation requirements of DVC Lite™ are the same as the DVC, but the operating software is less complex, which makes it convenient from an operational and budgetary stand point. For more information contact your sales representative.

Does the RFID antenna or tag interfere with RFID tags implanted in animals?

No. By law, the RFID tags used in animals are required to be of Low Frequency (LF). The DVC uses High Frequency (HF) tags. Since they operate at different ranges, interference does not occur.

Installation Requirements

Is it possible to use the DVC without Wi-Fi networks?

A Wi-Fi network is needed if an operator wants to access the DVC software interface from a portable device such as a smartphone or a tablet. If the operator or manager wants to use only a laptop instead of a mobile device to access the application, the connection to the network can be wired (Ethernet) in which case Wi-Fi connectivity is not needed. From a functionality standpoint, there is no difference between using a laptop or a portable device. The preference will depend on the operator's choice for convenience, portability, and ergonomics.

Does the DVC need a dedicated server and network?

Yes. The DVC does need a dedicated server from which the software and application are installed and run. The DVC network* can rely on the existing Ethernet or Wi-Fi infrastructure where we build a VPN to encrypt the DVC so it is password-protected and the access to the data is protected from unauthorized users. To function properly, the operators' tablet or computer has to be connected to the same network (server) where the DVC is running.

(*) The DVC "network" comprises one or more of the following: A server to host and run the DVC software/application, a DVC Master, and a laptop/tablet to access the application.



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Is the DVC™ network protected or encrypted?

The DVC Network is a VPN (Virtual Private Network), which is an encrypted network created onto the existing network infrastructure, so only the users who have installed the certificate enabling them to access the DVC Network can decrypt and access the data exchanged on the DVC Network itself. All other users, even though they are linked to the same network infrastructure, cannot see or have access to the DVC Network and its data.



Does Tecniplast provide the Server?

The server where the DVC will be installed and run from, can be either provided by Tecniplast or by the facility. In the first case, Tecniplast product specialists will discuss with the client the specifications of the server. If the facility provides its own server, this should meet the minimum requirements for network and product installation. For details, please refer to the DVC Server & Network Requirements section in the product brochure.

Power or Network Failure

What happens if there is a power failure? And if there is a DVC network failure?

If there is a **power failure** and no UPS are installed, the DVC Master, as well as the server, will shut down. Data will not be collected during this period and the DVC won't be accessible. The data collected until the time the power went off, was kept in memory either on the Server or in the cloud. When the power comes back, the DVC will re-start working in all its functions; and the data kept in memory will be restored. Only the data that wasn't collected or recorded during the power failure will be missing.

In case of a DVC **Network failure** (the DVC Master is unable to connect to the server and DVC interfaces are not accessible), the problem is occurring at Server or Network level. In this case, data collection and recording is limited by time and the number of connectec boards. As soon as the connection is restored all data will be sent to the Server.