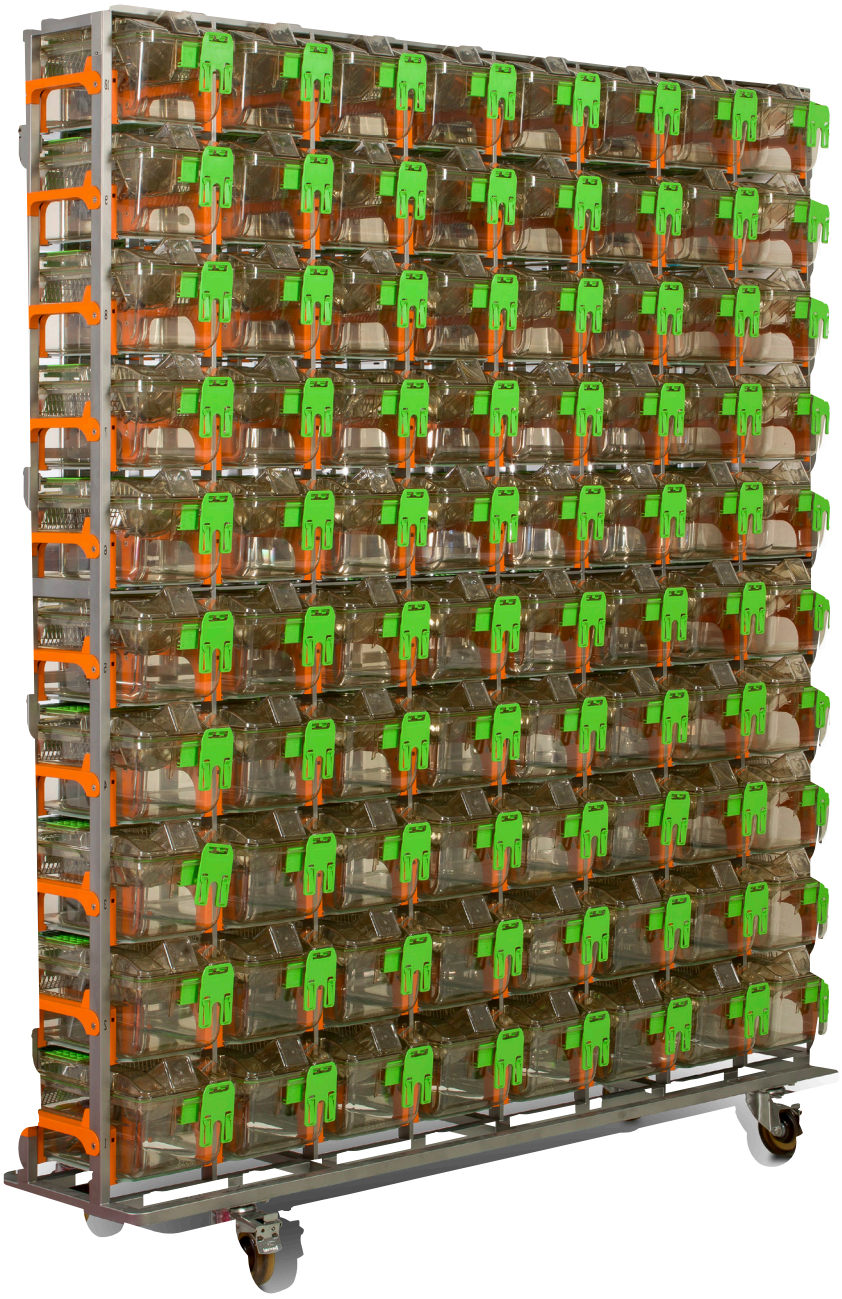
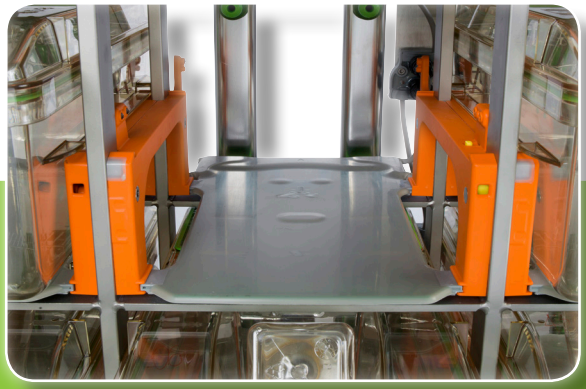
DVC™
DIGITAL VENTILATED CAGE

FAQ

Digital intelligence for the standardization and improvement to animal welfare, facility management and research





- Food & Water Levels
- Bedding Conditions
- Animal Activity
- Leak Detection
- Facility Planner
- Cage Identification
- Cage Census & Location

TECNIPLAST
innovation through passion℠

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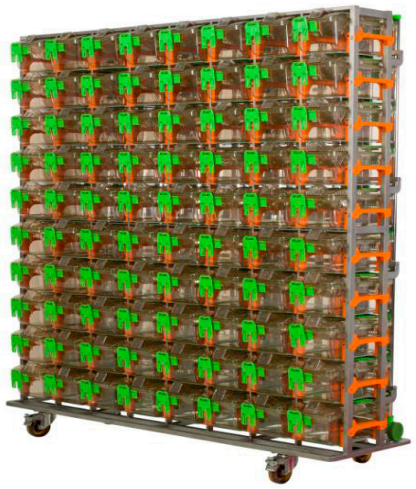
Frequently Asked Questions

GENERAL QUESTIONS



- ### Which racks can be retrofitted with DVC?
  DVC is compatible and retrofittable on DGM racks only. DVC is not compatible with other Green Line or Blue Line racks.

- ### Can the DVC rack be washed and autoclaved?
  Yes. The DVC rack can be treated the same way as a standard IVC rack. You must avoid chlorine-based detergents and never autoclave at a temperature higher than 121°C/250°F. Please refer to the DVC SOP for details.

- ### Is it possible to make a partial DVC upgrade on a rack?
  No. The minimum DVC system comprises a full rack, which could be either a single-sided rack or one side of a double-sided rack.

- ### How do people interact with the DVC?
  The DVC software and application run on the facility's server and can be accessed through a computer or a mobile device when connected to the DVC dedicated network. Each module in the DVC has a dedicated interface with dedicated pages and features to allow functionalities such as receiving or showing information about the cages, issuing alarms, assigning tasks, informing about cage conditions, etc. The facility manager is expected to access the data from his desktop or laptop computer. The operators will access the system in the animal room by means of a tablet or smartphone.

- ### What is the lifespan of the DVC board?
  The DVC boards have been tested through multiple autoclave cycles at 121° C, simulating a lifespan of more than eight years. Even though some boards' appearance has changed over time, washing and autoclaving hasn't affected their functionality. These reports are available upon request. We are currently running some heat testing to determine the lifespan and durability of the electronic components inside the board. We'll share the results as they become available.

- ### Does the DVC board cause temperature increase around it?
  No. The voltage used by the board is very low and doesn't increase the temperature around it.

- ### Can the DVC board work in a dusty environment?
  Yes. The DVC has been tested in dusty environments, showing no effects in the system's functionality. We keep monitoring this aspect as our installed base continues to increase. We will share the information as it becomes available.

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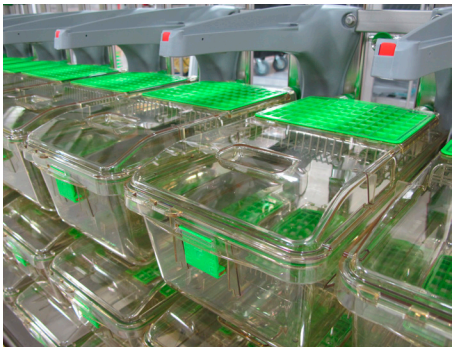
- ## Is the DVC available for rat IVCs?

  No. The DVC is Tecniplast's first step in digital technology applied to the vivarium. Since DGM500 racks are used broadly, we chose it to be the system for this new technology. As DVC continues to grow, we expect to expand our offering to other Tecniplast IVC systems.

- ## If I upgrade from DGM to DVC, do I need to change all my cage tops?

  No. To track the cages and generate other related data, the DVC uses RFID technology. In this case, an RFID tag is adhered to the cage's microbiological filter, which is located on the top of the cage inside a plastic retainer, so you **only need to replace the standard microbiological filters with the RFID tagged filters** and the retainer (in orange for the DVC). The color allows to distinguishing between cage tops with and without RFID tags in a facility that has both. As a proactive step, you may want to start purchasing the **RFID tagged filters and orange retainers** now in case you decide to upgrade your system in the future.



- ## How much power does the DVC rack use?

  The power consumption of a DVC rack is approximately 60W or approximately around 150/200W when having four one-sided racks (320 cages).

- ## Can a DVC Master manage all racks in one room?

  A DVC Master can manage up to four (4) single-sided or two (2) double-sided racks.

- ## Can the DVC Master be used even if no AHUs are present (centralization/HVAC connect)?

  Yes. The DVC is designed to manage the cages, not the AHUs. The DVC Master can be placed on top of the AHU (e.g. SmarFlow, Easy Flow, WiFlow) to manage up to four (4) single-sided or two (2) double sided racks exactly as the AHU does. If there are other types of AHUs or the racks are connected to an HVAC system, the DVC Master can be placed on a shelf or on the wall, as long as the location allows for the master to be properly connected to the racks.

ACTIVITY

- ## How does DVC measure animal activity?

  The board is suited with twelve (12) electrodes, which captures several measures per second. Due to the body's physiological composition (70% water) the sensors detect the animal's presence or absence based upon an index of the variability in the signal over time, which is a quantitative measure of the global activity captured by each sensor.

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- ## Can DVC track a single animal?

It is possible to house a single rodent for a short period of time (24 hours) and track it with the DVC; however, the DVC cannot track individual activity in a cage with multiple animals, even if the animals were implanted with a chip or RFID. The DVC is designed to primarily monitoring global activity into the cage. DVC is different from a TSE system.

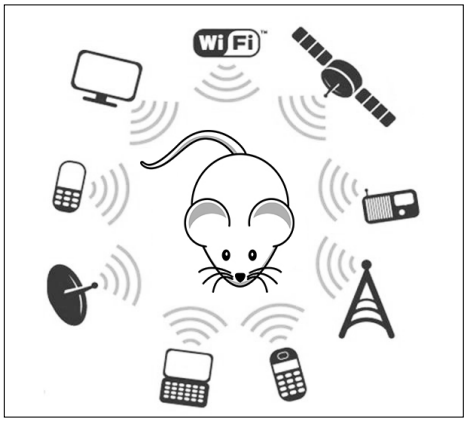
- ## Can the DVC detect the animal's access to food and water?

At the moment, this is not part of our offering. However, the probability to implement this feature has not been discarded, as it might be possible to correlate the presence of the animal under the bottle (the activity noted by the board) with the signal detected by the infrared LED. Tecniplast will investigate more and conduct some tests to establish the feasibility of adding it into the system.

- ## Which research field(s) can benefit from the DVC Animal Activity Module?

ALL of them. Many prestigious research facilities around the world are using DVC to conduct different studies in mice, including strain comparisons, SOD testing, diet effects, behavior, and breeding. These studies are available upon request.

Tecniplast has introduced the DVC to Principal Investigators in a variety of research fields: neuroscience, behavior, post-surgery, nociceptive behavior and therapy, recovery, tumor studies, locomotor-issues, cancer research, phenotyping, etc. All of them have noted the benefits and potential for application in their fields of expertise.



- ## Are EMFs dangerous for the animals?

Studies conducted by independent sources show the levels of EMFs generated by the DVC to be negligible having no breeding or behavioral effect on the mice. These studies are available upon request.

When we measured the EMF at a Facility, the values of the Electrical Field in the cage generated by the DVC were approximately (at lower frequencies) of around 1V/m (lights can generate even 8V/m).

Since October of 2015, Tecniplast has commissioned additional studies where the observations are conducted in cages with and without DVC to determine if there is any effect on the mice with regard to histopathology, breeding and behavior. No signs of clinical or pathological effects have been detected. We will share these reports when they become available.

For addtional information and studies about this topic, please refer to our EMF brochure.

FOOD AND WATER

- **Is it possible to acquire the Food & Water module separately and without the DVC board?**
  No. The infra-red LEDs detecting food & water levels are embedded in the runners and connected to the board; therefore, they are part of the entire system.

- **If I am using AWS, will I get "bottle missing" or "bottle misplaced" alarms?**
  We can disable the alarms when AWS or water pouches are being used. Potentially, since DVC tracks and recognizes every cage and the protocols can be identified, we could enable/disable these sensors based on the cage protocol (AWS, bottles or pouches).

- **Is the infrared LED light stream dangerous for the mice, especially their eyes?**
  No. Because of the LED's location and frequency of its activation, the chances for the light stream to get in contact with a mouse's eyes is implausible. When reading the food levels, the light stream passes through the food hopper at a height and location unlikely for the mice to reach. Likewise, when detecting the bottle's presence or reading water levels, the LED is at a position that is unusual to the mice. Furthermore, in either case, the LED gets activated only for few **milliseconds every 30 minutes**, so the probability for the light streams to hit the mice's eyes is slim to none.

- **Can the DVC detect water bottle leakage?**
  No. For the moment this is not possible; however, the current layout of the electrodes in the sensor plate might allow us to add this feature later on. Right below the bottle there is an electrode that can be used to detect quick changes in bedding humidity related to a bottle leakage or flooding. This feature requires some R&D and due diligence before it gets implemented.

BEDDING CONDITION MONITORING

- **Does the type of bedding affect the cage change plan suggested by the DVC?**
  No. It doesn't if you continue to use the same type of bedding used during the learning phase. The algorithm in the Bedding Condition module is determined based on the parameters defined during the "learning phase." If you continue to use the same type of bedding during your running phase, nothing should change. If you decide to change the type of bedding, a new learning phase might be necessary for the algorithms to be adjusted and fine-tuned to the new parameters defining "dirty."

- **What do you mean by "learning phase" and how long does it take?**

  The learning phase is the first step right after the installation that will allow the DVC to provide you with accurate information and alert you when one or more cages need to be changed. For this to happen, the system has to "learn" about what you consider a "dirty" or a "clean" cage.

  To implement this phase you need a single sided rack with cages housing a great array of population. We recommend including cages with 2, 3, and 4 males and 2, 3, and 4 females, randomly distributed across the rack. The person in charge of the learning phase in your facility will change each cage **ONCE** when he/she declares it "dirty." The phase will conclude when all cages have been changed.

- **If a PI wants to change cages under a fixed schedule, can the DVC be setup accordingly?**

  Yes. This would be a setting related to the protocol of those cages.

- **Why don't you rely on ammonia (NH3) concentration to determine cage changing?**

  Because the concentration of ammonia is not a reliable index due to multiple factors:

  1. The cage ventilation affects ammonia readings
  2. The ammonia values may vary greatly depending on when and where the probe is inserted
  3. The concentration of NH3 in the urine could vary depending on the strain, the animals' age, the type of study, the protocol where water intake is part is one of the variables, etc.
  4. More importantly, males' urine has a very high concentration of ammonia when compared to females'

     This is a key reason why we chose *moisture* as the parameter when defining a dirty cage.

INVENTORY MODULE

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

  Yes. It is also compatible with DGM and 2GM racks.

- **Does the RFID antenna/tag interfere with RFID tags implanted in animals?**

  No. The tags in animals and the DVC tags operate in different frequency ranges (LF vs. HF), so no interference occurs between the two.

INSTALLATION REQUIREMENTS

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

  It depends. A Wi-Fi network is mandatory IF the operators are to use portable devices such as smart phones or tablets to connect to the server and access DVC application. When using a PC, the connection to the server can be done via Ethernet cable and Wi-Fi would not be necessary. In both cases, the system's functionality will be the same. The only difference is about convenience, personal preference, and ergonomics.

- ### Does the DVC need a dedicated server and network?

  Yes. The DVC needs to be installed and run on a dedicated server. To properly function, the DVC network relies on an existing Ethernet/Wi-Fi infrastructure hosting a Virtual Private Network (VPN), which allows the communication between the DVC Server, the DVC Master and the devices accessing the DVC interface.

- ### Is the DVC network protected or encrypted?

  The DVC network is an encrypted network (VPN) built onto an existing Ethernet/Wi-Fi infrastructure. This guarantees that the access is RESTRICTED to authorized users only. Even if other users are connected to the same network, they cannot access the DVC network or application and they can't see its content either.

- ### Does Tecniplast provide the DVC server?

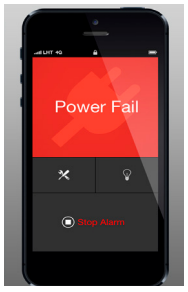
  Yes. The DVC server can be provided by either Tecniplast or by the facility. **Before you acquire your own server, please contact us to find out about the DVC's server and network requirements.**

DISASTER PLANNING

- ### What happens if the power goes off or if there is a DVC network failure?

  POWER OUTAGE:

  If the power goes off and no uninterrupted power sources (UPS) are in place, the DVC Master, as well as the DVC's server, will shut down. The system will not be accessible. The data collected by the DVC until the power outage occurred, will be stored in the server's memory or in the cloud. The system will not capture and store new data while shutting down. When the power comes back, the DVC should re-boot and re-start all its functions normally.



  NETWORK FAILURE:

  During a network failure, the DVC Master wouldn't connect to the server and the DVC interface couldn't be accessed. In such a case, this issue is located at the server or network level. If a network failure happens, the DVC Master collects and stores data for a certain amount of time, which will vary based upon the number of boards connected to the Master. As soon as the connection is restored, all data will be sent to the Server.