USER MANUAL

DMV CONTROL CENTER

Web application

Table of Contents

| Document history							
Version	Date	Details	Prepared by	Reviewed by	Approved by	Gen. Doc	Issued for
UP1184	**27-04-2023**	**First issue**	A. Nikolić, N. Tričković. M.S.Jovanović				Signal

1 INTRODUCTION

Control Center is a web-based application that allows users to remotely control and monitor devices from a remote location such as an office or control room. Operators can log in to the Control Center from any ordinary browser on www.dmv-control-center.com using their unique account credentials provided by DMV. There is no need to install any additional software on the user's computer. An internet connection is required to operate the Control Center. The application is supported on different operating systems such as Windows, Linux, iOS, and Android. It is also responsive and designed to be compatible with different screen resolutions.

2 MOBILE NETWORKS SETTINGS

Before making the first connection with a device over the Control Center app, the mobile network parameters need to be set. Follow the steps below to set the mobile network parameters::

1. Open the Signal Console app → Maintenance → Mobile Network → APN, User, Password (provided by the mobile network operator).
2. Turn off the device.
3. Unlock and open the device with the key
4. Insert a SIM card with mobile data. Any local mobile operator is allowed. Please note that a small metal part on the SIM card holder should be pushed downwards to unlock and upwards to lock the card in place.
5. Turn on the device.
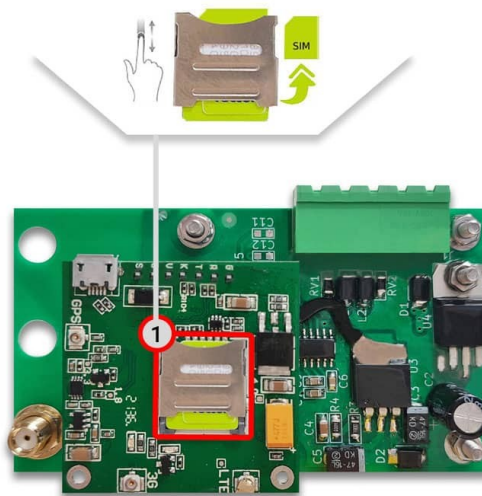
3 LOGGING INTO THE APPLICATION

To access the Control Center, log in with your unique account credentials on www.dmv-control-center.com. Once you have successfully logged in, you will be directed to the main page, which includes the following sections:

- Devices – a list of all devices assigned to your account.
- Interactive map – displays devices positioned on exact geographical locations.
- Tools menu – allows you to control and monitor devices (appears when a device is selected)

- Command Queue – a list of commands for the selected device waiting to be executed.
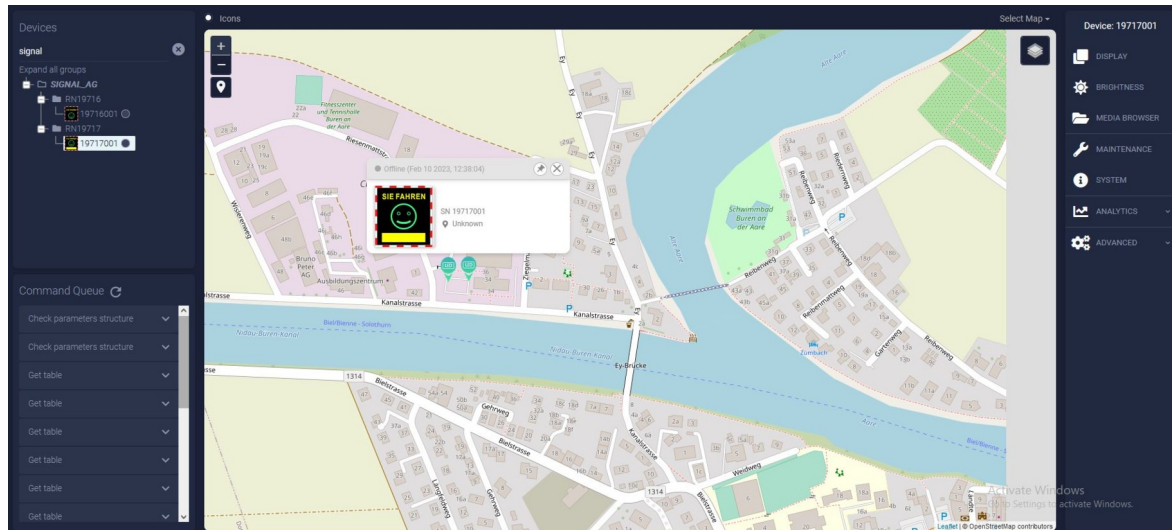
3.1 Devices

The Devices section contains a list of all devices assigned to your account, which are organized by device groups. Each device is assigned a name (usually the serial number, but it can be edited) and can be searched by its serial number, edited name, or device group name. Each device is represented by a green or transparent indicator that shows whether it is currently online or offline.

By selecting a device from the device list, it will be highlighted on the map, and the "Tools" menu will appear, allowing you to operate the device.

3.1.1 Edit location

To change the location of a device, right-click on the device from the device list and select "Edit location". Then, enter the new coordinates and click "Confirm". By default, the device is set to the customer's company headquarters unless specified otherwise by the customer.

3.1.2 Rename location

To rename a device, right-click on the device from the device list and select "Rename Device". Fill in the new name, which should be a closer determination of the device, then click "Confirm". If no specific name is requested by the customer, the default name for the device is its unique serial number.

3.2 Command Queue

The Command Queue is a list of pending commands for a selected device that have not been executed yet. A command refers to any action of providing or receiving information from the device, such as changing the display's symbols and text, adjusting the brightness control method, or setting speed limits. When the device establishes communication with the DMV cloud server, the pending commands will be executed first. The connection interval is defined in the Advanced → Cloud → Connection Interval technique, with the

default connection interval set to 240 minutes. The recommended connection interval for this device is 2 minutes. Commands can be cancelled by clicking on the trash icon.
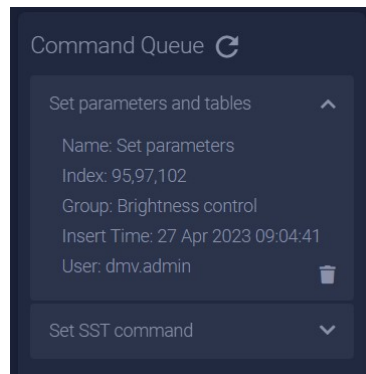
3.3 Interactive map

The Interactive Map displays all the devices that are linked to your account and their respective locations on the map. You have the option to choose between the World map, with StreetMap or Satellite view, or a dedicated map based on customer demand. When zooming in on the map, clusters of devices in close proximity to each other will appear.

You can select a device from the device list or click directly on its location on the map to open the device window, which provides information on the device's online/offline status, health information, and location. Additionally, you have the ability to pin multiple device windows simultaneously.
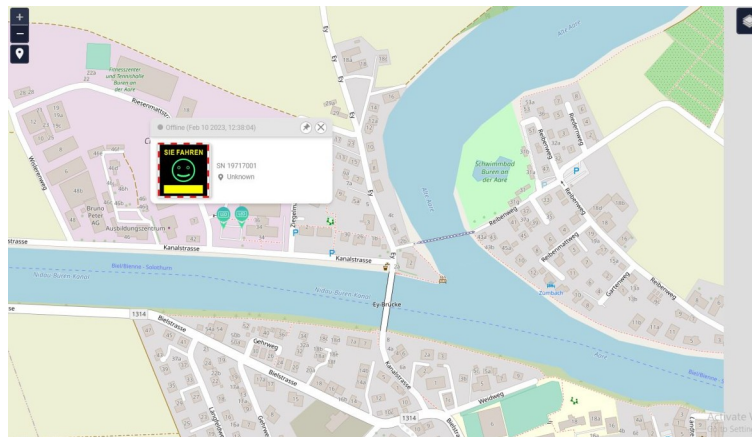
3.4 Techniques

DMV devices can be controlled and monitored using a variety of tools known as Techniques. Techniques consist of a collection of functionalities, parameters, and tables that are grouped together in order to facilitate easier device control. Upon selecting a device, the available Techniques will be displayed, which may vary depending on the type of device. Some standard Techniques that are available across all device types include System, Brightness, Maintenance, and Parameters.

4 WORKING WITH DEVICE

4.1 Scenarios and panels

A scenario is a visual display of information that corresponds to the real situation on the road or street. Scenarios can include information such as vehicle speed, warning or informative messages, and more. A

device can have one or more scenarios defined, and each scenario can have one or more panels. A panel is a momentary display on the device screen. Panels can be activated and deactivated from the scenario, and only activated panels will be displayed in the activated scenario.

The panels in the selected scenario are displayed cyclically, one after the other. The number of panels and scenarios is initially set by DMV, but can be adjusted later by the user. The content of the panel depends on the device type and can include images, animations, traffic symbols, text, date and/or time, and more.For every panel, its duration can be adjusted.

Scenario 1

Panel 1 – 2.5s   Panel 2 – 2.8s

Scenario 2

........   Panel 1 – 2.5s   Panel 2 – 2.8s
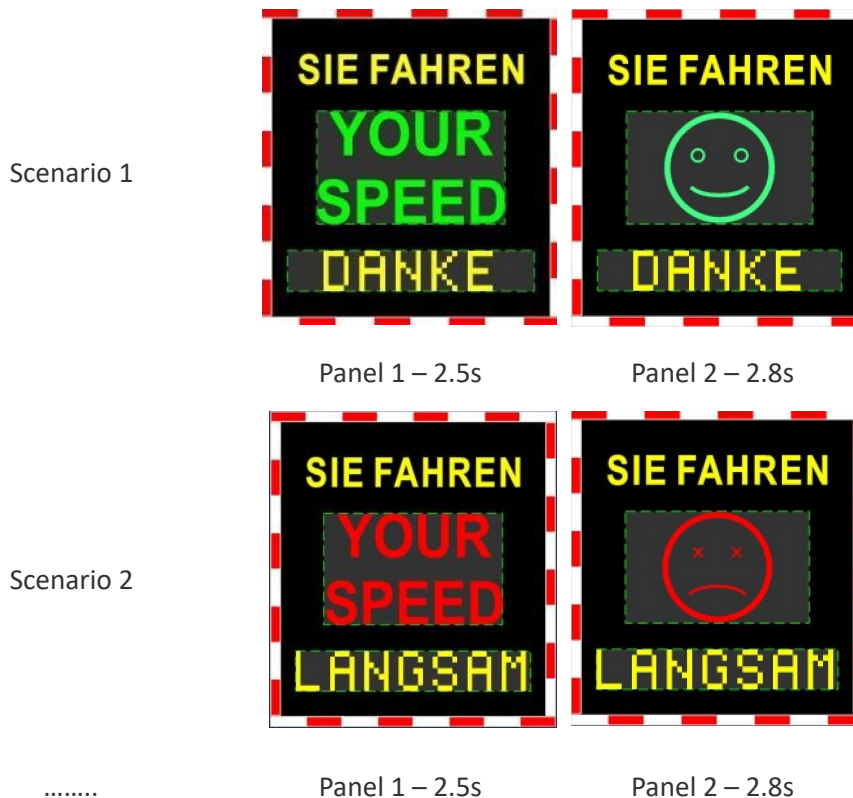
4.2 Modes of operations

Vehicle activated signs (VASL) equipped with a built-in Doppler radar are capable of measuring the speed of an approaching vehicle. If the speed exceeds a certain pre-defined "triggering" speed, the sign will be put into a specific working mode and display various combinations of pictograms, speed limits, and text messages.

Normally, two or three triggering speeds (TS) are set in the sign. Vehicles that travel below the first triggering speed (TS1), such as slow-moving vehicles or bicycles, are ignored, and the sign will remain black. Vehicles that drive faster than the first triggering speed but slower than the second triggering speed (TS2), which is usually the speed limit, are within the allowed speed range, and the sign will usually display the measured speed and a greeting message such as a smiley face. Vehicles that drive faster than the second triggering speed are considered to be speeding, and the sign will typically show the measured vehicle speed and a sad face.

In addition, the sign may have a third triggering speed (TS3) to identify reckless drivers. If a vehicle passes with a speed higher than the third triggering speed, the sign will usually display the measured vehicle speed and a stricter warning message, such as an angry face.

The number of working modes (Default, Threshold 1, Threshold 2, Threshold 3, etc.), triggering speeds, triggering speed values, and sign behaviour for each triggering speed are all adjustable in the **Display technique**.
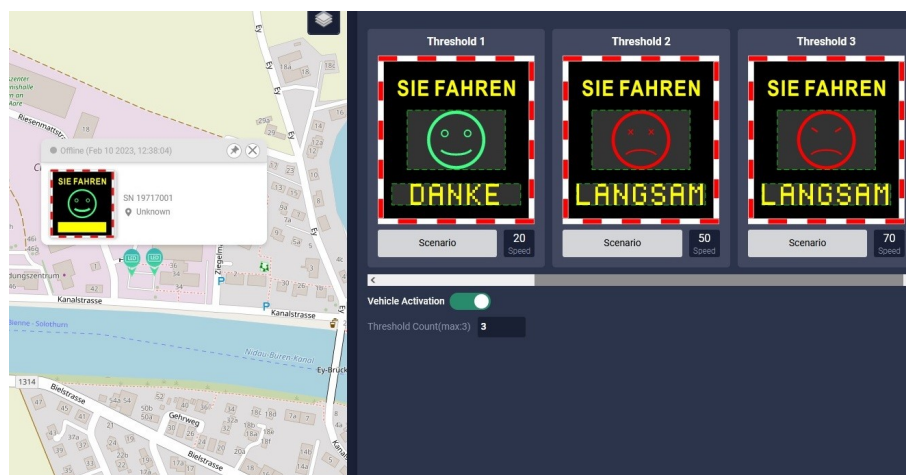
Example 1:
A sign with two triggering speeds can have three modes of operation:

- Slow drive – vehicle speed lower than TS1 – sign remains black
- Normal drive – vehicle speed between TS1 and TS2 – sign alternately shows measured speed and smiley face
- Over speeding – vehicle speed higher than TS2 – sign alternately shows measured speed and angry face

Default	Threshold 1	Threshold 2
Slow drive	Normal drive	Over Speeding

Example 2:
A sign with three triggering speeds can have four modes of operation:

- Slow drive – vehicle speed lower than TS1 – sign remains blank
- Normal drive – vehicle speed between TS1 and TS2 – sign alternately shows measured speed and smiley face
- Over speeding – vehicle speed between TS2 and TS3 – sign alternately shows measured speed and sad face
- Violent driving – vehicle speed higher than TS3 – sign alternately shows measured speed and angry face

| Default	Threshold 1	Threshold 2	Threshold 3
Slow drive	Normal drive	Over Speeding	Violent driving

4.3 Changing display in Display technique

The Display technique allows for various adjustments such as configuring threshold speeds and their corresponding values. Users can also activate or edit scenarios and panels within each scenario. Additionally, panel duration can be set and users can choose whether panels should blink or not, along with the duration of the blinking. It is also possible to pre-save scenarios that can be activated at a later time.
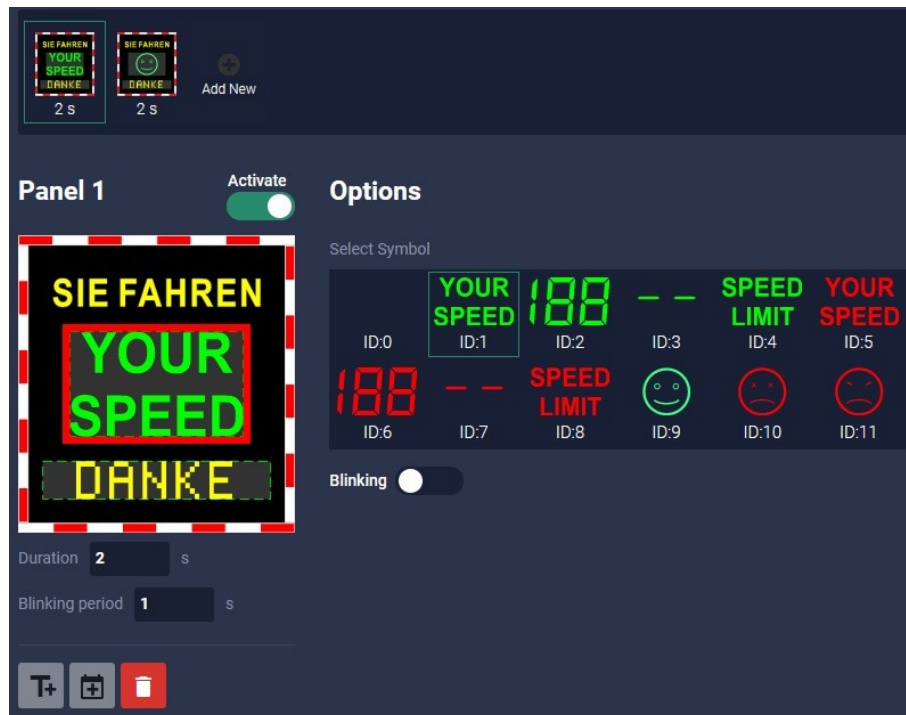
4.3.1 Editing scenario

To edit a scenario in the Display technique, follow these steps:

1. Open the Display technique menu.
2. Choose the working mode you want to edit (Default, Threshold 1, Threshold 2, etc.).
3. Select the "Scenario" button for that working mode. Choose the specific scenario you want to edit (Scenario 1, Scenario 2, Scenario 3, etc.).
4. In this window, you can see which scenario is currently active in the chosen working mode (with a green check mark). You can activate other scenarios, delete existing scenarios, or add new ones.
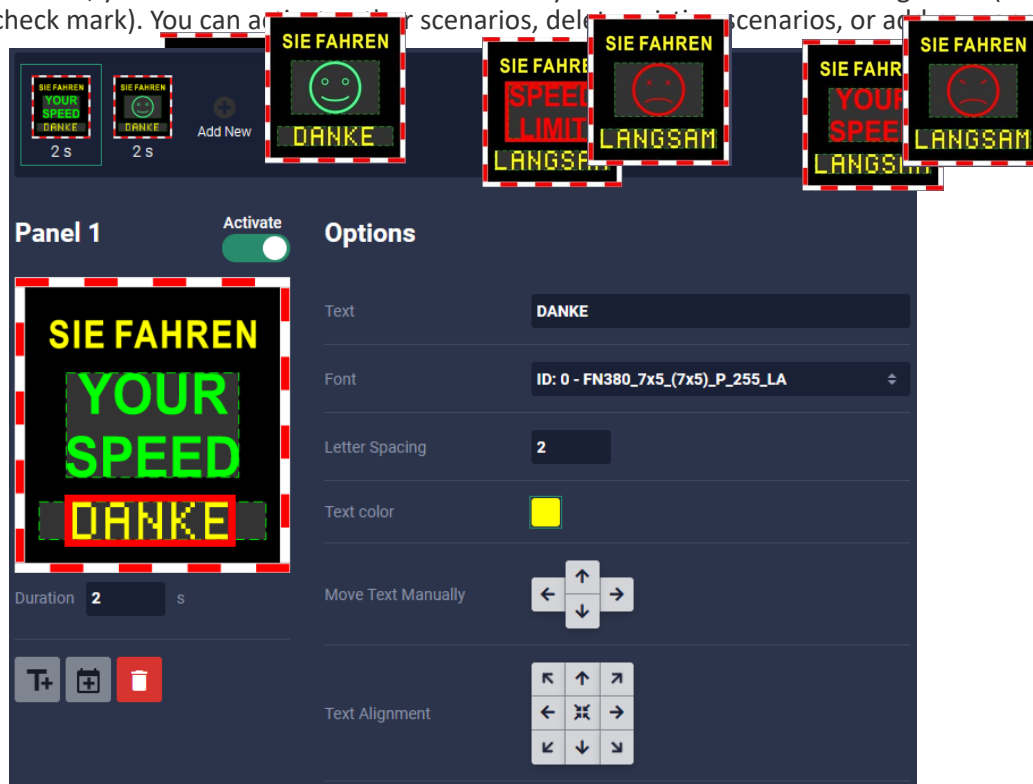
5. To edit the content, select the symbol that will be displayed on the sign, such as the detected vehicle speed (YOUR SPEED), speed limit, happy/sad/angry face, etc. Define which text will be displayed on the sign, including its content, font, letter spacing, colour, and text positioning. You can

6. Also activate/deactivate blinking and set its duration.
7. After defining content and settings go to **Save**.

4.3.2 Activating scenario

To activate a scenario in the DMV device, you can follow these steps:

1. Go to the Display technique menu on the device.
2. Choose the working mode in which you want to activate the scenario (Default, Threshold 1, Threshold 2, etc.).
3. Select the Scenario button for the chosen working mode.
4. Choose the scenario you want to activate by selecting the green check mark in the upper left corner of the scenario area.
5. Click the Confirm button to activate the selected scenario.

It is important to note that you can define and save content for different scenarios and panels, but in order to display the scenario on the sign, it must be activated.

4.4 Brightness technique

The DMV devices come with a built-in precise brightness control that can be adjusted in increments of 1%. There are four different methods for controlling the brightness:

- Automatic, which is based on information from a light sensor that measures the external illuminance
- Automatic, which depends on the time of day and geo-location algorithm
- Fixed, which is manually set to a certain brightness level

- External brightness control, which is only available when the device is controlled by an external system.

It is important to select the desired brightness control method to ensure optimal performance of the device.

4.4.1 Automatic regulation methods

To activate light sensor regulation, press the Auto brightness button. The display's brightness will automatically adjust based on the readings from the light sensor, allowing it to adapt to the surrounding environment. If the sensor fails or becomes dirty, the device will switch to the Daylight control method by default. This method regulates brightness based on the time and date of the device's internal clock and its defined geographical location, taking into account monthly changes in sunlight throughout the year. The regulation method is precise enough for all locations within a 500 km diameter circle in relation to the defined location. Brightness is regulated based on a table of defined dawn and dusk moments.

4.4.2 Manual regulation methods

To activate the fixed (manual) brightness method, you need to deactivate the Auto brightness button. Then, you can adjust the brightness level using the slider or the text input field, with values ranging from 1 to 100. Once a brightness level is set, it remains constant until a new value is set.

After selecting a certain brightness method, make sure to click on the Save button to confirm your selection.

4.5 Media browser technique

The Media Browser technique is used to manage media files such as fonts, images, and animations. Media files that are already stored in the device's memory are displayed in groups (fonts, images, animations). The supported types of media files depend on the sign type (for example, signs with predefined symbols and one-row text matrix fields support only fonts, while images and animations are not supported).

Users can add new media files or delete existing ones from the device. After performing any of these actions, users need to save the changes.

4.6 Maintenance technique

The maintenance technique section of the Control Center allows for a quick check of the status of the device's installed hardware and software components, including battery state, temperature alarm, light sensor, internal memory, reset and watchdog, radar, and LED boards.

The **Battery State** feature monitors and displays the battery voltage and indicates whether it is in a low, normal, or high state. There are four possible states: over-voltage, normal, low, and display off. The battery condition can affect the device's display, with the brightness automatically decreasing by 50% in low battery state and the display turning off completely in display off state to conserve power.

The **Temperature Alarm** feature monitors and displays the internal temperature of the device, indicating whether it is in a low, normal, or high state. If the temperature exceeds the warning threshold, a warning will be activated, and if the current temperature exceeds the alarm threshold, the temperature alarm will appear. The temperature is checked every minute, with its values logged every 10 minutes.

The **Light Sensor** feature shows the measured outside light in lux and whether the sensor is functioning properly or not (due to being dirty or malfunctioning). The light sensor is checked for accuracy every second.

The **Internal Memory** feature checks for errors in the device's memory, with its correctness checked every minute.

The **Reset and Watchdog** feature monitors and displays the total number of hardware and software resets of the device and the number of allowed resets (set by the manufacturer and cannot be changed).

The **Radar** feature shows the date and time of the last detected vehicle and whether the radar is functioning or not. If no vehicle has been detected in the last 24 hours, an error status will appear.

The **LED Boards** feature monitors and displays whether the LED boards are functioning properly, with any malfunction or disconnection shown as an error status and a graphical overview of all display boards with marked LED board chains where the malfunction occurred. The correctness of the LED boards is checked every 8 minutes (this interval can be changed in the Advanced Parameters section).

Maintenance technique recognizes installed hardware (battery, light sensor, clock, etc.) and software components (reset and watchdog) and enables a quick check of their current status (such as normal, warning, error).

4.6.1 Events logs

The Events Logs section describes the various events that can occur during device operation, such as temperature alarms, low battery events, and more. These events are categorized as alarms, warnings, regular events, and deactivation events, and can be recorded in the device memory along with their time and date of occurrence and description. The **Actions on events** column determines which types of events will be saved in the device memory. The event logs can also be exported as a CSV file.

4.6.2 Actions on events

When certain situations occur during device operation, such as the internal temperature exceeding predefined thresholds, the battery voltage dropping below a minimum threshold, or an error occurring on an LED board, the device will detect an event. The Actions on Events section allows users to customize the device's response to different types of events, such as logging events in the device's memory, sending event information to the cloud, or sending SMS notifications to the user. Events are grouped into categories, such as temperature, battery, hardware, and timer, and specific actions can be set for each event type.

These actions can be configured in the Control Center under Actions on events. There are several types of actions that the device can take:

- Log Enable: The device will memorize the event in its memory, along with the time and date it occurred and a description of the event.
- Send2Cloud Enable: If the device has cloud connectivity, it can send the event information to the cloud.
- SMS Enable: The device can send event information via SMS to the user. User phone numbers are set in Control Center → Advanced → Mobile Networks → Phone numbers and privileges table.

Events are classified into groups:

RST – moment of device reset

Chg Scenario – moment when display on the sign changes for some reason eg. due to a time-dependent operation, a command received through a communication channel, due to some other event

Temp – moment when device temperature exceeds certain threshold values eg. it gets too hot, too cold, the moment the fan turns on, the moment the heater turns off, etc

LED – moment when an error is detected on LED boards or the number of LED errors exceeds the critical values

Batt – moment when battery voltage exceeds certain threshold values or returns within thresholds. It alerts user to replace the battery or power supply system

Hardware – moment when something happened to one of the components. There are constant checks of some hardware components inside the device such as light sensors, temperature sensors, real time clock, flash drive, etc. In case of failure, the event will be triggered

Timer – moment when set time has expired, eg. time the device connects to the cloud

GPRS Call – moment when happened call or SMS

Radar – moment when passed violent driver on the street or radar is neactive for a longer time, etc

Once the desired actions have been set for each event type, click "Save" to apply the changes. The device will then take the specified action when an event occurs. Additionally, all events, including their type and description, can be viewed in the Events logs, which are stored in the device's memory and can be exported in a CSV file.

4.7 System technique

System technique provides a range of device parameters information such as the software version number, device serial number, device working hours, time of the last reset, device time, etc. It also allows for synchronization of device time with the current time zone and manual resetting of the device.

4.8 Analytics technique

The Analytics technique provides data collected from various sources such as radar, internal temperature sensor, light sensor, battery voltage, and more.

4.8.1 Radar stats

DMV devices are equipped with built-in radar that measures vehicle speed and collects various traffic data. This data is processed into different traffic statistics and displayed and archived in the Radar stats technique. The traffic data is stored in the device memory and can be exported as a CSV file for traffic analysis. This data can be used to detect the periods with the highest number of traffic violations, identify aggressive drivers, and other important traffic information.

4.8.1.1 Hour by hour statistics

The Hourly Stats feature of DMV devices provides a comprehensive overview of traffic data collected by the built-in radar. Every hour, the system records data for the entire hour and saves it in the device's memory. Hourly data includes:

- the number of vehicles detected,
- the number of overspeed vehicles,
- the time when the highest speed was detected,
- the distribution of vehicle numbers by speed range (e.g. 0-24 km/h, 25-35 km/h, >125 km/h),
- average vehicle speed,
- maximum vehicle speed,
- street occupancy percentage, and
- sign activity percentage.

These data are presented in a table format and can be used for traffic analysis, such as identifying peak periods for traffic violations, detecting aggressive drivers, and more. The speed ranges can be customized based on the installation location.

4.8.1.2 Vehicle by vehicle statistics (VBV)

The VBV statistics provides traffic data for each individual detected vehicle, including the exact time and speed at the moment of detection. The device collects and sends new data to the VBV log every ten minutes or after a certain number of detected vehicles (by default, 100 vehicles).

The VBV statistics are available upon request and can be viewed in the **VBV log table**.

4.8.1.3 Number of vehicles per hour – graphical overview

The Vehicle per Hour histogram provides a graphical overview of the number of vehicles and the number of vehicles that exceeded the speed limit for each hour.
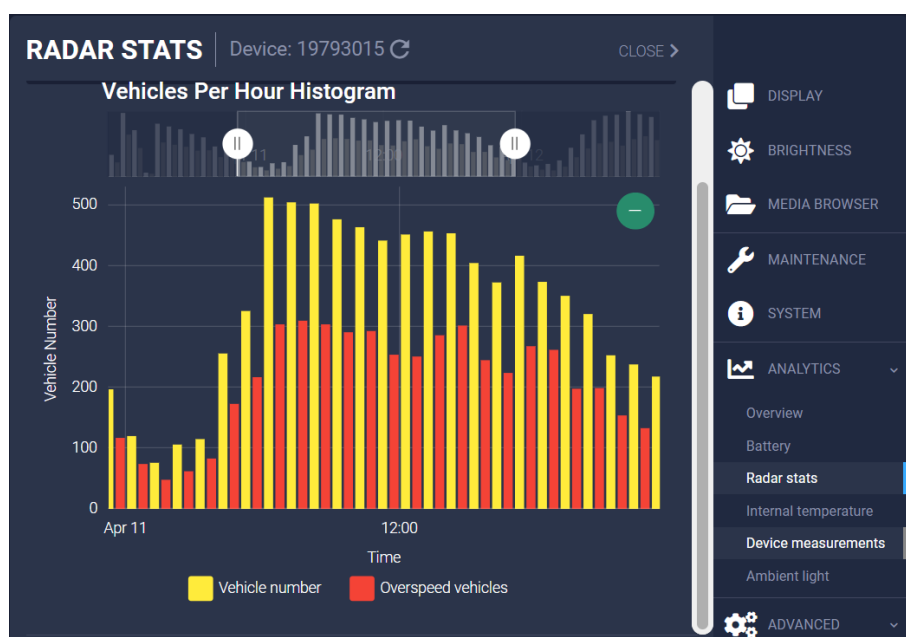
4.8.1.4 Vehicle distribution per speed ranges – graphical overview

In Speed histogram are shown number of vehicles per 12 speed ranges (0-25km/h, 25-35km/h...125+km/h).


4.8.2 Battery voltage

Battery-powered devices continuously monitor the current battery voltage and indicate whether it is within or exceeds the allowed thresholds. Additionally, the device provides the voltage history for different time intervals, such as one day, seven days, or 30 days. To ensure stable device operation, the battery voltage needs to remain within the allowed thresholds, which include:

- the over-voltage threshold,
- low voltage threshold, and
- display off threshold. The voltage status can be normal (between the overvoltage and low voltage thresholds), over-voltage (above the over-voltage threshold), low voltage (between the low voltage and display off thresholds), or display is off (below the display off threshold).

Whenever the voltage exceeds one of the thresholds, the device detects it as an event, which is treated as an alarm, warning, or deactivation event. Based on the event detected, the device may perform different actions, such as activating energy-saving mode when the battery is in a low voltage state. The energy-saving mode reduces display brightness by 50% and turns off all peripheral components that affect energy consumption, such as the Wi-Fi module, GPRS module, Bluetooth module, fan, and heaters, etc.

4.8.3 Internal temperature

The DMV devices are capable of monitoring the current temperature inside the device and indicating whether it is within or has exceeded the allowed temperature thresholds. Additionally, temperature history for different time intervals such as 1 day, 7 days, 30 days, etc., can be accessed. There are three temperature thresholds that are set as follows: alarm threshold, warning threshold, and fan threshold (in case vents are installed, above which fans will be automatically turned on).
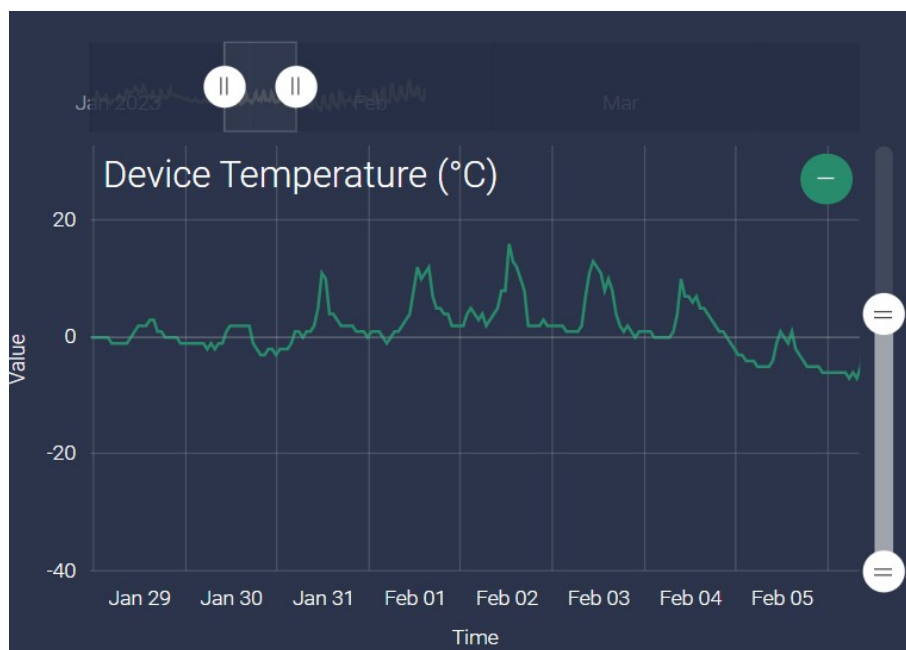
Temperature statuses are categorized as normal, alarm, and warning. The normal status indicates that the temperature is below the warning and alarm thresholds. The alarm status indicates that the temperature has exceeded the alarm threshold, and the warning status indicates that the temperature is between the warning and alarm thresholds.

4.9 Connection interval

One of the event types is the periodic timer event. If this event is set to trigger device reporting to the server (this is configured in the "Actions on events" section within the Maintenance technique), the device will establish a connection with the server every time the periodic timer expires. The interval between two consecutive connections can be configured and defines the time period between two events. It should be noted that device connection to the cloud server can also be initiated by other events such as LED or

hardware errors, radar events, etc., according to the settings in the "Actions on events" section within the Maintenance technique.

The recommended reporting interval for this device is 5 minutes.