

# Dispatch of electric vehicles

## LIO-Volta

Electric vehicles have an important role to play on the way to climate-neutral public transport, avoiding local emissions and clearly reducing noise pollution. There are new challenges involved in operating electric vehicles, but the control system can provide valuable support in this respect.



The greatest operational challenge consists in the reduced range of electric vehicles compared to a diesel bus, particularly in view of the daily fluctuations that are involved. What is the best way to integrate electric vehicles in a control system?

### Different charging concepts

Different charging concepts are used to ensure the vehicle batteries always have sufficient energy:

- Charging in the depot (depot charging)
- Charging at the wayside (opportunity charging)
- Charging during the trip (trolley buses)

The requirements for monitoring the vehicles thus differ greatly. In any case, it is crucial to avoid total discharge of the batteries as this puts vehicles out of operation for several weeks and causes high repair costs.

Dispatchers in the control centre should concentrate as ever on their core tasks, such as timetable adherence,

headway and transfer protection, as well as working and resting times for the drivers.

They therefore need support from the control system with regard to the charging concepts. In this respect, the dispatchers can rely totally on LIO-Volta.

### System architecture

LIO-Volta is based on a high-performance, scalable, multi-client capable cloud system hosted in Germany or Switzerland.

In the basic system, LIO-Volta facilitates the data flow for real-time data from the vehicles to the control system, and provides the basic monitoring functions.

Furthermore, numerous additional function packages and interface packages are available. A list with brief explanations can be found on the back of this product information.

### Seamless monitoring

LIO-Volta constantly monitors the critical signals of the vehicles. Most important of all is to monitor the state of charge (SoC) of all vehicles. Furthermore, LIO-Volta monitors the residual range and residual runtime of the individual vehicles and displays these details together with the SoC in the vehicle table of the control system. Individual threshold values can be defined, with LIO-Volta triggering an alarm in the event console if the values fall below these levels.

### Data from the CAN bus

The required real-time data are obtained from the vehicle CAN bus and transferred to LIO-Volta, preferably using the ebblo on-board computer linked by cable to the vehicle's CAN gateway. The signals needed for this transfer are described in the ebblo whitepaper "Works with

Volta™. These are a subset of the signals defined in the VDV recommendation 238.

The on-board computer processes the signals received from the CAN bus and transfers them with bandwidth optimisation to LIO-Volta. The most important of these signals is the battery state of charge. LIO-Volta creates a history from these data for constant prediction of the residual range and residual runtime.

As well as the ebblo on-board computer, the data can also be collected using a fleet monitoring box from the vehicle manufacturer or a third-party vendor and then transferred to LIO-Volta via a corresponding backend system.

## Why is LIO-Volta important for your operations?

Thanks to LIO-Volta

- vehicles no longer get stranded with a flat battery. You can thus avoid dissatisfaction among your passengers with possibly negative reporting.
- totally discharged batteries are a thing of the past. This saves you from having vehicles out of operation for several weeks with high repair costs.
- control centre staff can take measures in good time if there are signs of an energy shortage. In this way, you can safeguard your operations in the accustomed good quality.

## Technical data

### Software and hardware prerequisites

- Control system LIO
- IDR or ITT on-board computer with equipped CAN interface
- IP-based communication from vehicle to backend system

### Available licence packages

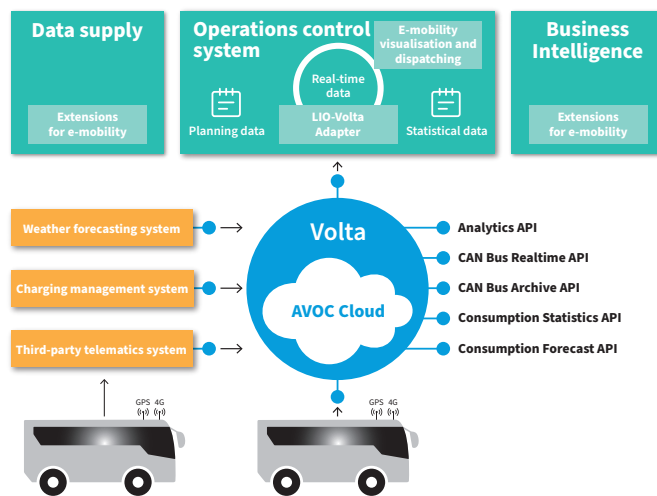
The basic LIO-Volta system consists of the AVOC platform and the two licence packages Volta-Feed and Volta-Monitor. It can be expanded with the following function packages:

- Volta-Data – visualising and processing electromobility master data
- Volta-Predict – considering dispatch measures in range prediction
- Volta-Charge – monitoring the charging infrastructure and charge processes
- Volta-Temp – monitoring the battery temperature
- Volta-Telltale – processing, monitoring and forwarding telltales
- Volta-Fallback – upholding basic functionality if LIO-Volta is no longer available

### Available interfaces

The system can be expanded with the following interfaces:

- Volta-RealtimeAPI – data flow from vehicle CAN bus to third-party systems
- Volta-ArchiveAPI – access to recorded data from vehicle CAN bus
- Volta-AnalyticsAPI – data flow (raw and prediction data) to third-party systems
- Volta-StatisticsAPI – energy consumption levels, charge processes and telltales
- Volta-ForecastAPI – energy consumption forecasts for vehicle dispatching



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