

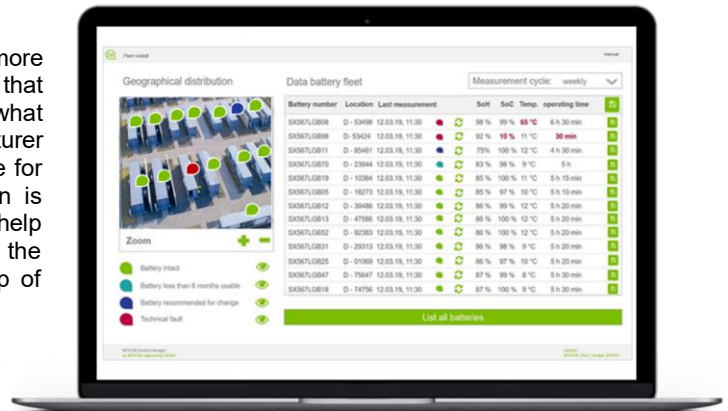
## NOVUM Battery Guard –

With artificial intelligence, we ensure the highest level of safety for your battery storage.

You choose the added values - we'll take care of the rest.

### General

Artificial intelligence can help make your batteries safer more sustainable and longer lasting. All we need for this is data that your batteries generate over the course of their lives. But what data? And how much? Since there are no cross-manufacturer standards for this yet, we have created the following guide for you. This will give you an overview of what information is required to be able to base storage monitoring on it with the help of artificial intelligence. Don't worry if you can't provide all the data on the list. We can also fill data gaps with the help of patented processes.



### Basic information

If you use batteries or battery modules, you will be provided with a data sheet by the manufacturer when you purchase these batteries. This data sheet contains the most important basic characteristic values of your batteries. The following information helps the artificial intelligence to build the basic framework for your battery monitoring.

#### Needed basic information

Characteristic	Level	Unit	Comments
Nominal capacity	Cell and module	Ah	
Cell chemistry	Cell	-	
Nominal C rate	Module		
Circuitry	Module	-	e. g. 16s4p
Voltage limits	Cell and module	V	
Internal resistance	Cell and module	mΩ	
OCV-curve	Cell and module	V (SOC <sup>1</sup> )	Table or plot
Temperature limits	Module		

<sup>1</sup>SOC: State of Charge

### Operational data

If a battery is used, its state variables such as current, voltage and temperature change permanently. These state variables are usually recorded by a battery management system that is located on the battery and sends the data to a central server. The data is then stored (usually online) by this server. In order to be able to use this data for safety monitoring or service life forecasts for your storage unit, we need the following operating data at regular intervals.

The following applies: the more data and the more detailed they are (sampling rate), the more meaningful the results of the artificial intelligence will be. In the following list, we have therefore marked for you which operating data are absolutely necessary and which have also proven to be helpful.

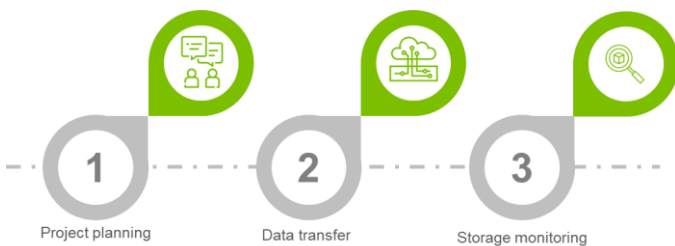
## Needed operational data

Category	Characteristic	Resolution	Sampling rate [s]	Comments	State
<b>Voltage</b>	Battery voltage	0,01V	1 - 60		necessary
	Module voltage	0,01V	1 - 60		necessary
	Min. cell voltage per module	1mV	1 - 60		useful
	Max. cell voltage per module	1mV	1 - 60		useful
	Single cell voltages	1mV	1 - 60		useful
<b>Current</b>	Rack current	0,01A	1 - 60		necessary
	Module current	0,01A	1 - 60	for parallel connection	necessary
<b>Temperature</b>	Module temperature	1°C	10 - 300		necessary
<b>DC internal resistance</b>					useful
<b>Battery condition</b>	State of charge (SoC) from BMS	1%	10 - 60		useful
	State of health (SoH) from BMS	1%	300+		useful

## No or too less data? -

### No problem with NOVUM!

If your data quality does not fulfil the requirements listed here or if there is no operating data from the BMS, we use a patented procedure and measure the condition of your batteries independently of the BMS. To do this, we equip your batteries with a small hardware add-on that is simply plugged into the contacts of your batteries or battery modules.



## The next steps

Your storage monitoring in three steps:

1. Use this guide and check what data is available in your systems
2. Contact NOVUM (Tel: +49 351 475 911 50, Mail: [info@novum-engineering.com](mailto:info@novum-engineering.com)) and establish a secure data connection between your storage and our cloud together with us.
3. Give artificial intelligence 2 months to learn and then trust in a reliable security monitoring, predictive maintenance and lifetime forecasts for your storage.