

# NovaCarts CMC Simulator

Simulation of battery monitors (Cell Module Controllers) to validate battery management systems

- » Real-time capability thanks to FPGA
- » Early availability of virtual CMCs
- » User-friendly tracing
- » High security of investment
- » Adjustments hand-in-hand with development

**NOVACARTS**

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## The purpose of a battery monitor

Safe operation of lithium-ion batteries requires continuous monitoring of the cell voltage and temperature of the individual battery cells. This task is performed by cell module controllers (CMC), also known as cell sensor circuits (CSC) or cell supervision electronics (CSE).

Each battery cell is connected to such a battery monitor (CMC). These CMCs constantly measure the voltage and temperature of the cells and pass this information on to the battery management system (BMS). Multiple CMCs are connected to each other in a daisy chain configuration and coupled to a CMC base device.

In order to receive product approval, a BMS must undergo and pass a number of tests together with the CMCs. However, it often happens that not all components are available when these tests commence. What's more, a real setup on the HiL system is extremely complex. In these cases, simulation allows for much earlier testing and optimizes the HiL design.

**1** The NovaCarts CMC Simulator can be used as a stand-alone application or as part of a battery HiL simulator. A rackmount kit is used for installation in 19" racks.

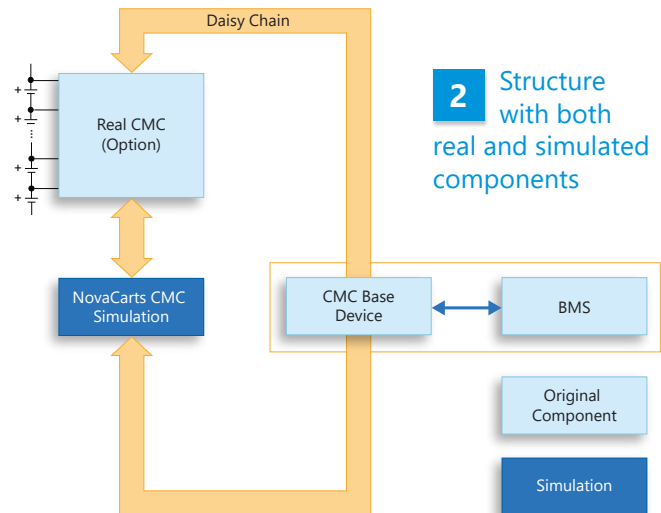


## NovaCarts CMC Simulator – a comprehensive development tool

NovaCarts CMC Simulator, based on the NovaCarts prototype solution NC-UFD3800, features Dual Core ARM® and a FPGA (Field Programmable Gate Array). Depending on the model, the simulation board replicates up to 63 CMC chips in real time. Plug-on modules are used to adapt the signal to the respective daisy chain.

## Simulation scope

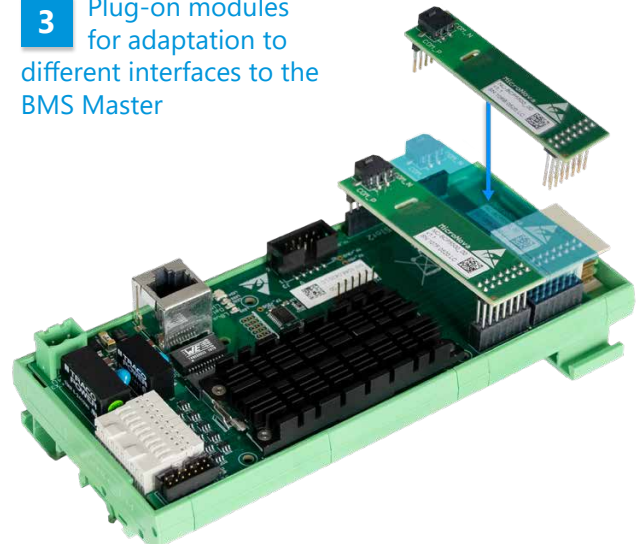
- » Emulation of the respective communication interface (TI Daisy Chain, UART, SPI, ISO-SPI) with the associated protocol
- » Various READ and WRITE commands for reading and writing simulated chip registers
- » Preset cell voltages and GPIOs (equivalent of temperature)
- » Fault simulation such as undervoltage/over-voltage, incorrect checksums, wire breakage in the daisy chain



## Supported chips

Manufacturer	Chip
Texas Instruments	BQ79606A-Q1
Texas Instruments	BQ79616-Q1, BQ79614-Q1, BQ79612-Q1
Texas Instruments	BQ79718-Q1, BQ79716-Q1, BQ79714-Q1
ADI / MAXIM	MAX17853, MAX17854, MAX17859, MAX17860
ADI / LTC	LTC 6804, LTC6812, LTC 6813
Analog Devices	ADBMS6815

- 3 Plug-on modules for adaptation to different interfaces to the BMS Master



## Operating modes

### In conjunction with a NovaCarts HiL simulator

The CMC simulation is fully integrated into the NovaCarts environment. NovaCarts supports applications from stand-alone testing of a BMS to complex HiL simulators.

### Stand-alone mode (without HiL simulator)

The CMC simulation is started via a pre-configured setup, with a defined number of chips of the specified type to be simulated and cell and GPIO voltages (each of which can be individually adjusted).

### Control via API

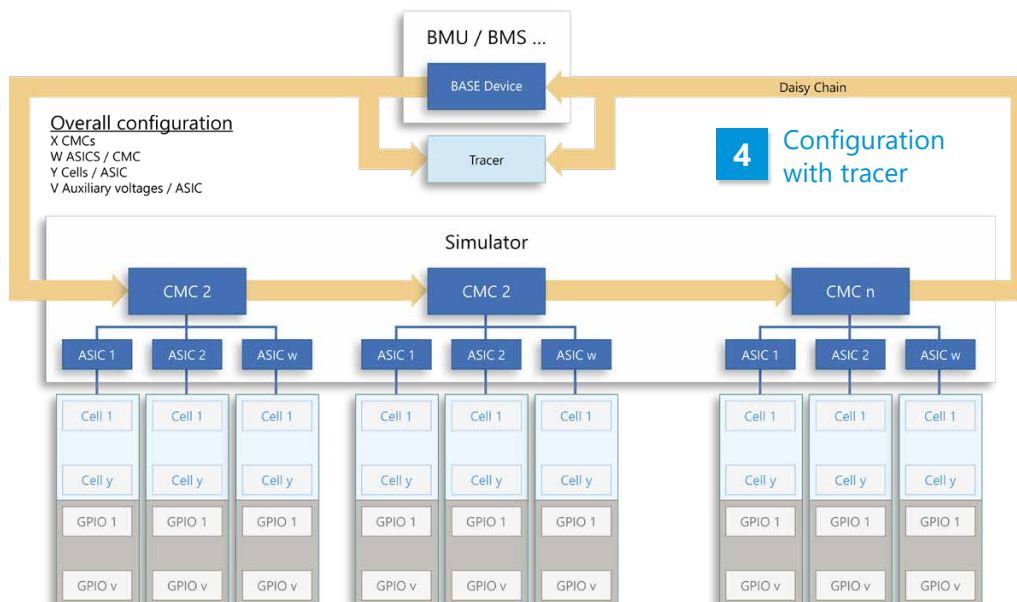
A Windows API allows the CMC simulation to be controlled by third-party software.

### Control via UDP

A master HiL system communicates with the CMC simulator via the UDP network protocol. This feature allows for simple integration into third-party HiL systems.

### Special mode: Tracer

Tracer mode records all daisy chain traffic with a time resolution of 1  $\mu$ s. Data is saved locally on the board and can then very easily be exported for analysis



## Benefits of NovaCarts CMC Simulator

- » Simpler setup compared to testing with real CMC chips, with clear cost benefits.
- » No measurement errors due to external influences such as can occur when using real CMC chips.
- » Calculated measurement errors can be simulated as desired and reproducibly.
- » It is possible to simulate faults that are difficult to replicate in a real-world setup.
- » User-friendly tracing with the same board.
- » High level of availability in the development process: Virtual CMCs are available even before the real ones are fully developed. Adjustments can be made hand-in-hand with development.
- » High security of investment: The firmware can be adapted in almost any fashion. The interface to the daisy chain can easily be adapted to other chips via inexpensive adapter boards.
- » Highly flexible: Besides its use with NovaCarts HiL systems, NovaCarts CMC Simulator is also suitable for third-party HiL simulators or for use as a stand-alone system.

**NovaCarts CMC Simulator reduces the development risk for BMS, shortens development times and improves validation during development.**

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