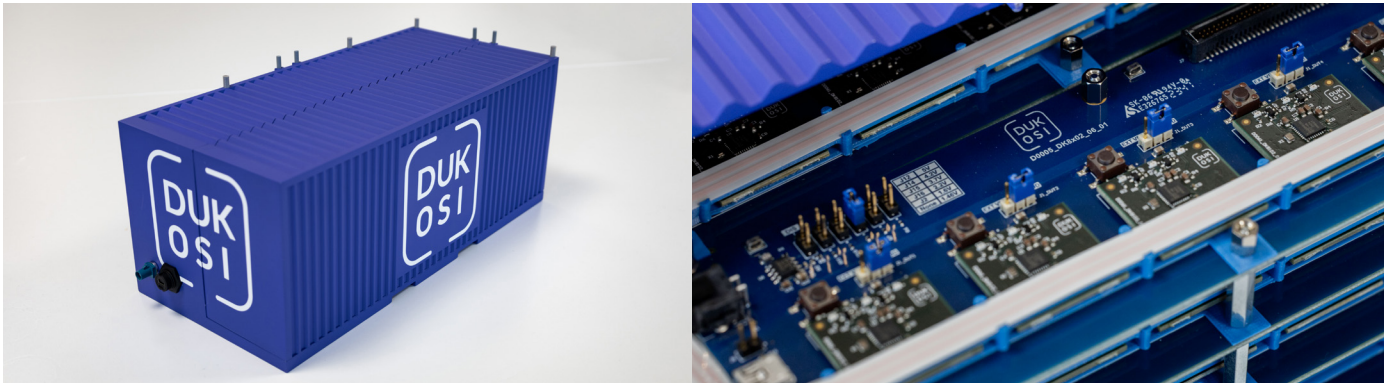


Design Brief

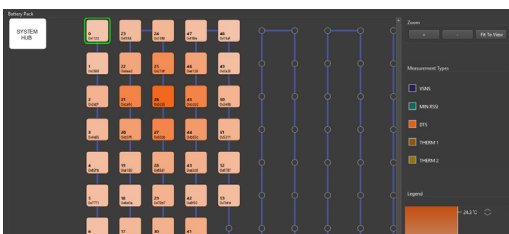
54 Channel Cell Monitor Demonstrator for Battery Energy Storage Systems (BESS)



Modeled after a Battery Energy Storage System (BESS) container, this live demonstration exhibits the Dukosi Cell Monitoring System (DKCMS) with 54 Cell Monitors in 4 layers, connected with a single bus antenna looped throughout. This represents a typical battery module configuration suitable for a 900-1500V rack. In this example, the Cell Monitors are not attached to live cells but still send data via near field contactless communications using Dukosi C-SynQ[®] proprietary protocol to the Dukosi System Hub connected via USB to a laptop. The laptop (not pictured) runs the Dukosi EVK GUI, which enables customers to easily evaluate our solution in their own proof of concept (PoC) designs. The simplicity of DKCMS is echoed in the fact that the Dukosi EVK can be set up, and the GUI running in under 5 minutes.

Dukosi Cell Monitoring System (DKCMS)

- Dukosi DK8102 Cell Monitor
- Dukosi DK8202 System Hub
- Dukosi C-SynQ[®] proprietary protocol
- Dukosi near field contactless communication



Visual representation of real-time cell temperatures

Network Address	SuperFrame	CellID	Voltage (V)	Current (C)	Temp (C)	DTI (C)	Max. Cell Voltage	Cell Address
1	200	00000	3.2000	0.0000	25.00	0.00	3.2000	00000
1	200	00001	3.2000	0.0000	25.00	0.00	3.2000	00001
1	200	00002	3.2000	0.0000	25.00	0.00	3.2000	00002
1	200	00003	3.2000	0.0000	25.00	0.00	3.2000	00003
1	200	00004	3.2000	0.0000	25.00	0.00	3.2000	00004
1	200	00005	3.2000	0.0000	25.00	0.00	3.2000	00005
1	200	00006	3.2000	0.0000	25.00	0.00	3.2000	00006
1	200	00007	3.2000	0.0000	25.00	0.00	3.2000	00007
1	200	00008	3.2000	0.0000	25.00	0.00	3.2000	00008
1	200	00009	3.2000	0.0000	25.00	0.00	3.2000	00009
1	200	00010	3.2000	0.0000	25.00	0.00	3.2000	00010
1	200	00011	3.2000	0.0000	25.00	0.00	3.2000	00011
1	200	00012	3.2000	0.0000	25.00	0.00	3.2000	00012
1	200	00013	3.2000	0.0000	25.00	0.00	3.2000	00013
1	200	00014	3.2000	0.0000	25.00	0.00	3.2000	00014
1	200	00015	3.2000	0.0000	25.00	0.00	3.2000	00015
1	200	00016	3.2000	0.0000	25.00	0.00	3.2000	00016
1	200	00017	3.2000	0.0000	25.00	0.00	3.2000	00017
1	200	00018	3.2000	0.0000	25.00	0.00	3.2000	00018
1	200	00019	3.2000	0.0000	25.00	0.00	3.2000	00019
1	200	00020	3.2000	0.0000	25.00	0.00	3.2000	00020
1	200	00021	3.2000	0.0000	25.00	0.00	3.2000	00021
1	200	00022	3.2000	0.0000	25.00	0.00	3.2000	00022
1	200	00023	3.2000	0.0000	25.00	0.00	3.2000	00023
1	200	00024	3.2000	0.0000	25.00	0.00	3.2000	00024
1	200	00025	3.2000	0.0000	25.00	0.00	3.2000	00025
1	200	00026	3.2000	0.0000	25.00	0.00	3.2000	00026
1	200	00027	3.2000	0.0000	25.00	0.00	3.2000	00027
1	200	00028	3.2000	0.0000	25.00	0.00	3.2000	00028
1	200	00029	3.2000	0.0000	25.00	0.00	3.2000	00029
1	200	00030	3.2000	0.0000	25.00	0.00	3.2000	00030
1	200	00031	3.2000	0.0000	25.00	0.00	3.2000	00031
1	200	00032	3.2000	0.0000	25.00	0.00	3.2000	00032
1	200	00033	3.2000	0.0000	25.00	0.00	3.2000	00033
1	200	00034	3.2000	0.0000	25.00	0.00	3.2000	00034
1	200	00035	3.2000	0.0000	25.00	0.00	3.2000	00035
1	200	00036	3.2000	0.0000	25.00	0.00	3.2000	00036
1	200	00037	3.2000	0.0000	25.00	0.00	3.2000	00037
1	200	00038	3.2000	0.0000	25.00	0.00	3.2000	00038
1	200	00039	3.2000	0.0000	25.00	0.00	3.2000	00039
1	200	00040	3.2000	0.0000	25.00	0.00	3.2000	00040
1	200	00041	3.2000	0.0000	25.00	0.00	3.2000	00041
1	200	00042	3.2000	0.0000	25.00	0.00	3.2000	00042
1	200	00043	3.2000	0.0000	25.00	0.00	3.2000	00043
1	200	00044	3.2000	0.0000	25.00	0.00	3.2000	00044
1	200	00045	3.2000	0.0000	25.00	0.00	3.2000	00045
1	200	00046	3.2000	0.0000	25.00	0.00	3.2000	00046
1	200	00047	3.2000	0.0000	25.00	0.00	3.2000	00047
1	200	00048	3.2000	0.0000	25.00	0.00	3.2000	00048
1	200	00049	3.2000	0.0000	25.00	0.00	3.2000	00049
1	200	00050	3.2000	0.0000	25.00	0.00	3.2000	00050
1	200	00051	3.2000	0.0000	25.00	0.00	3.2000	00051
1	200	00052	3.2000	0.0000	25.00	0.00	3.2000	00052
1	200	00053	3.2000	0.0000	25.00	0.00	3.2000	00053
1	200	00054	3.2000	0.0000	25.00	0.00	3.2000	00054

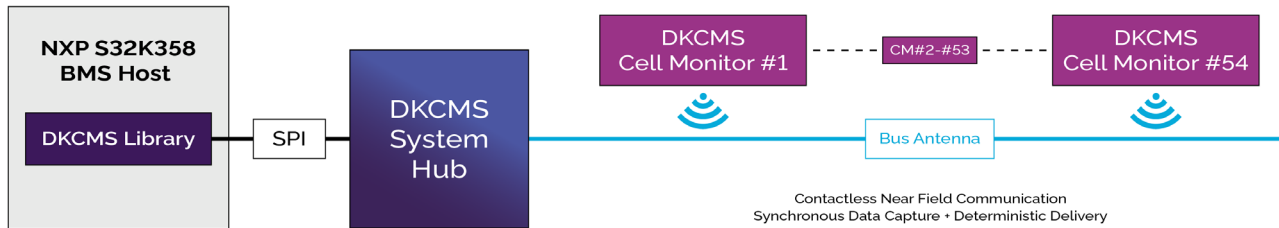
Real-time data stream from every Cell Monitor

Dukosi EVK & GUI

The DK8102 GUI is an intuitive software environment that enables system designers to functionally evaluate the DKCMS. Typically used in conjunction with a DK8x02 Evaluation Kit (EVK) to gain an understanding of the data and options being presented, it can later be used to take the first steps in developing an in-house application using Dukosi technology. It visualizes the battery with real-time data streamed from connected Cell Monitors, which helps to diagnose and optimize settings quickly and easily during early development stages.

Design Brief

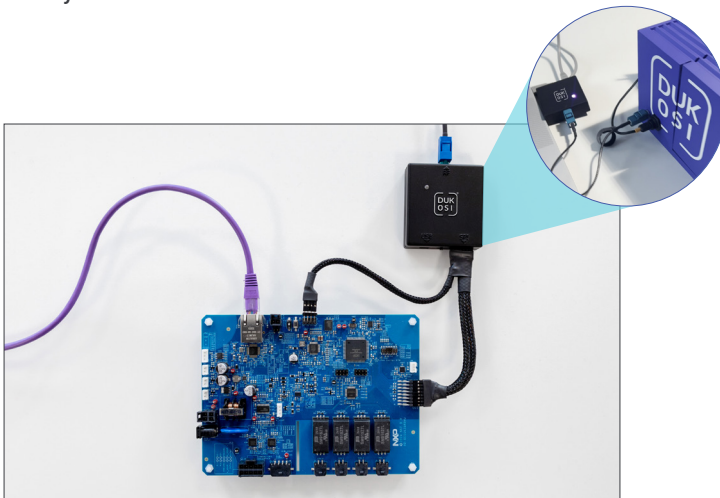
End-to-End BESS Proof of Concept using DKCMS



This PoC, developed in partnership with eInfochips, represents an end-to-end BMS design using DKCMS, ready for full-size BESS applications. While the DK8102 Cell Monitors (CM) are not attached to live cells in this model, it still sends data via near field contactless communications using Dukosi C-SynQ® proprietary protocol to the Dukosi System Hub, which is connected to a NXP S32K358 uProcessor BESS Host board via SPI.

The model contains 54 x Cell Monitors in 4 layers networked with a single bus antenna looped throughout. This number was chosen based on an existing NXP system that uses 3 x 18 channel AFE's (MC33774), and represents a typical battery module configuration suitable for a 900-1500V BESS rack.

DKCMS is adaptable to various BMS host processors, while also exceeding the capabilities of other battery architectures as its Cell Monitors provide best-in class voltage accuracy and temperature datapoints from every cell.



NXP Board with Dukosi System Hub unit

Name	Value	Unit
CellVoltage[13]	3.702	V
CellVoltage[14]	3.703	V
CellVoltage[15]	3.697	V
CellVoltage[16]	3.7	V
CellVoltage[17]	3.728	V
TemperatureSensor[0]	24.1	°C
TemperatureSensor[1]	23.0	°C
TemperatureSensor[2]	23.6	°C
TemperatureSensor[3]	23.6	°C
TemperatureSensor[4]	23.6	°C
TemperatureSensor[5]	23.3	°C
TemperatureSensor[6]	24.3	°C

Modified NXP GUI with Dukosi CM data displayed

About Dukosi

Dukosi develops revolutionary technologies that dramatically improve the performance, safety and efficiency of high-power battery systems, and enable a more sustainable value chain.

About Arrow Electronics

Arrow Electronics (NYSE:ARW) sources and engineers technology solutions for thousands of leading manufacturers and service providers.

About eInfochips

eInfochips, an Arrow Electronics company, is a leading provider of digital transformation and product engineering services.



Dukosi

For more information email info@dukosi.com or visit www.dukosi.com