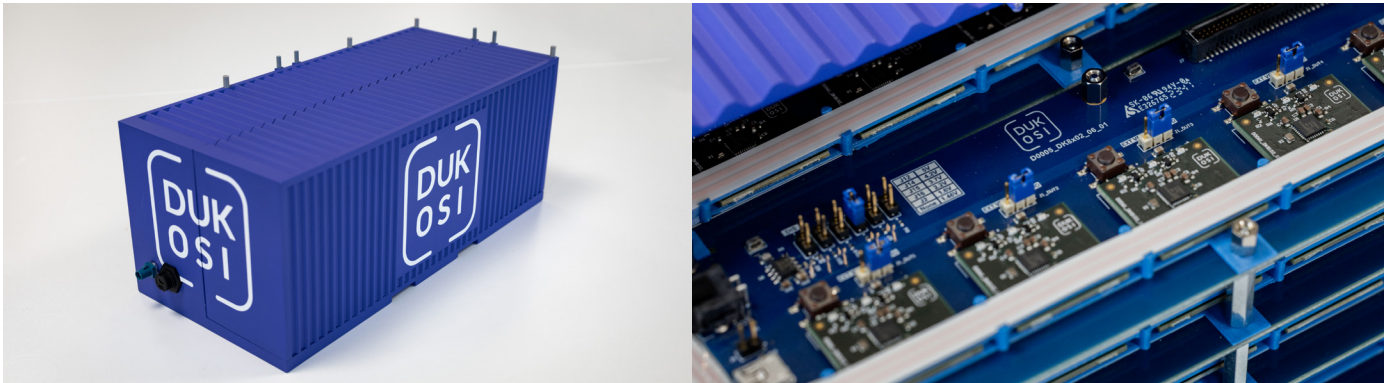


Design Brief

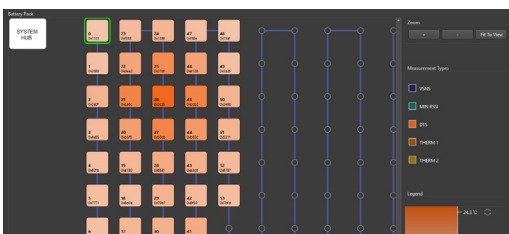
54 Channel Cell Monitor Demonstrator for Battery Energy Storage Systems (BESS)



Modeled after a Battery Energy Storage System (BESS) container, this live demonstration exhibits the Dukosi Cell Monitoring System (DKCMS) with 54 Cell Monitors (4 racks consisting of 8/8/8/6 CMs), 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)	Power (C)	DTS (C)	Min. Cell Voltage	Cell Address
1	200	00000	3.2100	1.0000	3.2100	0.0000	3.2100	00000
1	200	00001	3.2100	1.0000	3.2100	0.0000	3.2100	00001
1	200	00002	3.2100	1.0000	3.2100	0.0000	3.2100	00002
1	200	00003	3.2100	1.0000	3.2100	0.0000	3.2100	00003
1	200	00004	3.2100	1.0000	3.2100	0.0000	3.2100	00004
1	200	00005	3.2100	1.0000	3.2100	0.0000	3.2100	00005
1	200	00006	3.2100	1.0000	3.2100	0.0000	3.2100	00006
1	200	00007	3.2100	1.0000	3.2100	0.0000	3.2100	00007
1	200	00008	3.2100	1.0000	3.2100	0.0000	3.2100	00008
1	200	00009	3.2100	1.0000	3.2100	0.0000	3.2100	00009
1	200	00010	3.2100	1.0000	3.2100	0.0000	3.2100	00010
1	200	00011	3.2100	1.0000	3.2100	0.0000	3.2100	00011
1	200	00012	3.2100	1.0000	3.2100	0.0000	3.2100	00012
1	200	00013	3.2100	1.0000	3.2100	0.0000	3.2100	00013
1	200	00014	3.2100	1.0000	3.2100	0.0000	3.2100	00014
1	200	00015	3.2100	1.0000	3.2100	0.0000	3.2100	00015
1	200	00016	3.2100	1.0000	3.2100	0.0000	3.2100	00016
1	200	00017	3.2100	1.0000	3.2100	0.0000	3.2100	00017
1	200	00018	3.2100	1.0000	3.2100	0.0000	3.2100	00018
1	200	00019	3.2100	1.0000	3.2100	0.0000	3.2100	00019
1	200	00020	3.2100	1.0000	3.2100	0.0000	3.2100	00020
1	200	00021	3.2100	1.0000	3.2100	0.0000	3.2100	00021
1	200	00022	3.2100	1.0000	3.2100	0.0000	3.2100	00022
1	200	00023	3.2100	1.0000	3.2100	0.0000	3.2100	00023
1	200	00024	3.2100	1.0000	3.2100	0.0000	3.2100	00024
1	200	00025	3.2100	1.0000	3.2100	0.0000	3.2100	00025
1	200	00026	3.2100	1.0000	3.2100	0.0000	3.2100	00026
1	200	00027	3.2100	1.0000	3.2100	0.0000	3.2100	00027
1	200	00028	3.2100	1.0000	3.2100	0.0000	3.2100	00028
1	200	00029	3.2100	1.0000	3.2100	0.0000	3.2100	00029
1	200	00030	3.2100	1.0000	3.2100	0.0000	3.2100	00030
1	200	00031	3.2100	1.0000	3.2100	0.0000	3.2100	00031
1	200	00032	3.2100	1.0000	3.2100	0.0000	3.2100	00032
1	200	00033	3.2100	1.0000	3.2100	0.0000	3.2100	00033
1	200	00034	3.2100	1.0000	3.2100	0.0000	3.2100	00034
1	200	00035	3.2100	1.0000	3.2100	0.0000	3.2100	00035
1	200	00036	3.2100	1.0000	3.2100	0.0000	3.2100	00036
1	200	00037	3.2100	1.0000	3.2100	0.0000	3.2100	00037
1	200	00038	3.2100	1.0000	3.2100	0.0000	3.2100	00038
1	200	00039	3.2100	1.0000	3.2100	0.0000	3.2100	00039
1	200	00040	3.2100	1.0000	3.2100	0.0000	3.2100	00040
1	200	00041	3.2100	1.0000	3.2100	0.0000	3.2100	00041
1	200	00042	3.2100	1.0000	3.2100	0.0000	3.2100	00042
1	200	00043	3.2100	1.0000	3.2100	0.0000	3.2100	00043
1	200	00044	3.2100	1.0000	3.2100	0.0000	3.2100	00044
1	200	00045	3.2100	1.0000	3.2100	0.0000	3.2100	00045
1	200	00046	3.2100	1.0000	3.2100	0.0000	3.2100	00046
1	200	00047	3.2100	1.0000	3.2100	0.0000	3.2100	00047
1	200	00048	3.2100	1.0000	3.2100	0.0000	3.2100	00048
1	200	00049	3.2100	1.0000	3.2100	0.0000	3.2100	00049
1	200	00050	3.2100	1.0000	3.2100	0.0000	3.2100	00050
1	200	00051	3.2100	1.0000	3.2100	0.0000	3.2100	00051
1	200	00052	3.2100	1.0000	3.2100	0.0000	3.2100	00052
1	200	00053	3.2100	1.0000	3.2100	0.0000	3.2100	00053
1	200	00054	3.2100	1.0000	3.2100	0.0000	3.2100	00054

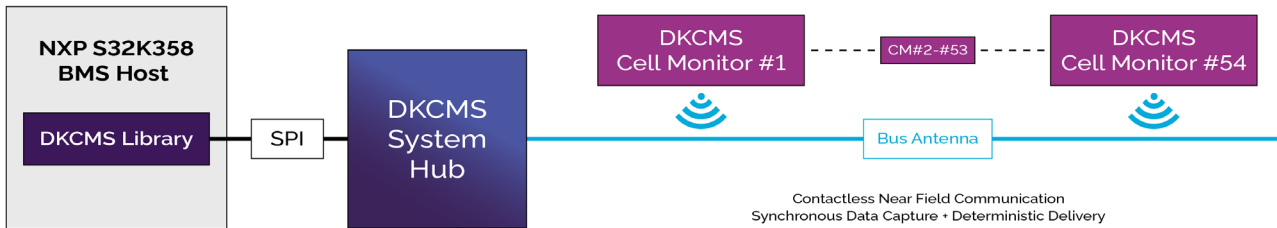
Real-time data stream from every Cell Monitor

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

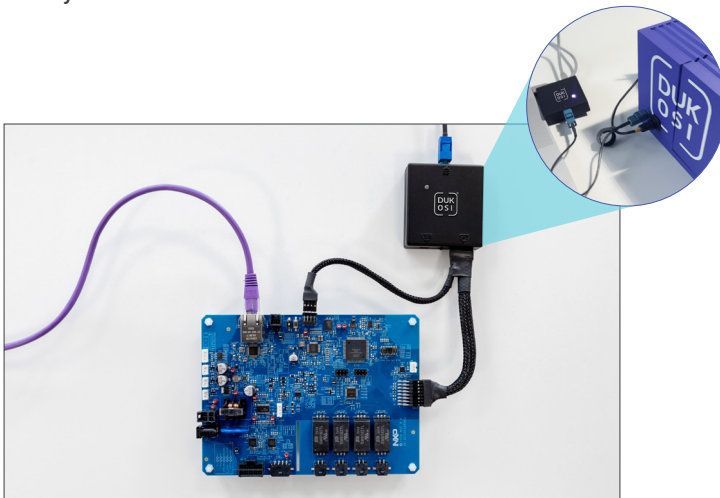
End-to-End BESS Proof of Concept using DKCMS



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 (4 racks consisting of 8/8/8/6 CMs) 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

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