



Australian Energy Storage Knowledge Bank (AESKB)

MOBILE AND FLEXIBLE MICROGRID TEST PLATFORM

TECHNICAL SPECIFICATIONS

Power networks are transforming at an immense scale involving various distributed generation sources (including PV, wind and battery) and embedded and off-grid microgrid structures.

A more than \$3 million test platform has been built by investments from the University of Adelaide, ARENA and industrial partners. It comprises two key components, the mobile microgrid test platform and the University's microgrid test centre at its Thebarton campus. The grid battery platform offers Australia's most flexible and innovative testing, training and demonstration of battery energy storage system.

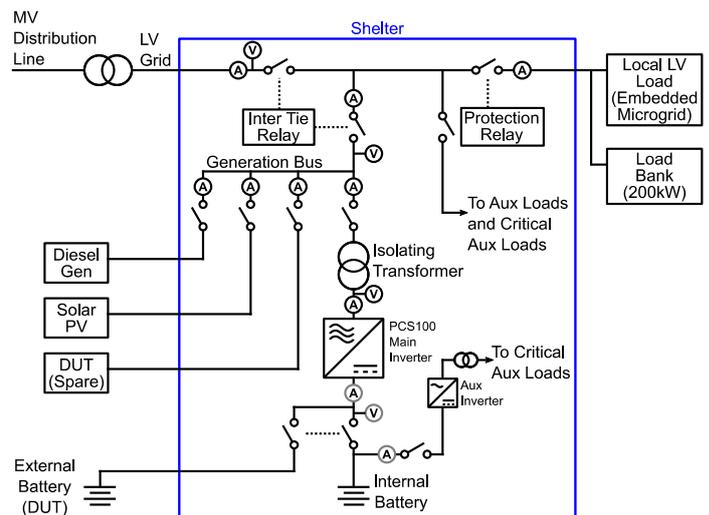
New inverter/converter applications, interactions between complex technologies, and supplying old loads in new ways, can all raise questions that need highly accurate, high bandwidth, high sampling rate data acquisition capabilities to help us understand and interpret issues arising on networks, microgrids and energy storage applications.

The Australian Energy Storage Knowledge Bank (AESKB) grid battery is equipped with a state-of-the-art LabVIEW/NIDAQ system, high capacity, redundant data storage and remote 3G and 4G capabilities to allow close inspection of any network parameter of interest.

Detailed knowledge of a wide range of battery storage applications is needed to better understand and optimise the operation, performance and impact of a given system. Therefore, the technical specifications of the microgrid test platform are designed to address technical issues, respond to industry needs and provide training and research platforms.

Electrical features

- Capable of connecting to a three phase, 400V, 50Hz, including unbalanced 230V single-phase networks.
- Currently fitted with three bi-directional ABB PCS100 modules (upgradable to four) providing 270kVA (expandable to 350kVA), 4-Quadrant operation (in voltage or current source mode) with a wide range of battery storage applications.
- The 270kW/270kWh battery storage system (BSS) (expandable to 350kW/350kWh) comprises of three LG Chem R800 91kWh Racks using JH3 cell modules (space for a fourth rack).



- AC auxiliaries supply is guaranteed by a static transfer switch (STS) monitoring the critical loads switchboard (controllers/relays/communications/loggers/active sensors etc) via an on board 5kVA Schäfer inverter (from 588V-823V DC battery voltage to single phase AC).
- Two potential AC input sources for auxiliaries, (line side/load side) controlled by a manually transfer switch (MTS) provides further flexibility for independent operation of the auxiliary inverter when the system is running in island mode.

Busbars and Switchgears

- All generator bus circuit breakers are moulded case breakers fitted with a standard thermal magnetic trip unit.
- The AC generation bus (800A) allows the connection of multiple AC generation sources including an internal inverter battery connection (with a 630A nominal rating), an AC coupled solar PV system (200A), a diesel generator (400A) and one spare AC connection (200A) for other potential sources (such as fuel cell or flywheel).
- A separate "load" bus/switchgear (800A) accommodates embedded local grids or external load for dynamic testing

- Switchgear is motorised for AC grid connection and 800A/1000V, 24kA DC battery busbar (for internal and external links)
- The DC switchboard comprises three DC 4-pole circuit breakers. Interlocked two 800A circuit battery breakers for internal/external battery configurations with a key trapped in "ON" breaker.
- Isolation transformer: 370kVA, star/delta; 415V (with taps at 400V/440V); secondary current of 577A; efficiency: 98.8%.

Protection/Safety/Alarms

- With indication lamps on the switchboard and around the shelter to help local operation and minimise any associated operational risks.
- One generator and intertie protection relay (SEL-700GT), and one feeder protection relay (SEL-751) on 'load' breaker.
- The voltage, frequency, current and active/reactive power for protection, control and alarms are measured by the protection relays, the PaDECS® control system, and a power meter.
- A surge protection device (TDX100M – 277/480, rated to 40kA 8/20 µs) is installed at the network interface and monitored by the PLC and with alarm.
- A Safety PLC (located in the inverter room) manages all critical safety functions, including monitoring of conditions in the separate battery compartment.
- With an APAC fire panel (linked to the Safety PLC) connected to one smoke detector in the inverter room and two smoke detectors in the battery room. PLC activates an active alarm in the alarm log.
- When the sensors are simultaneously activated, the IG55 inert gas suppression system is activated after a countdown sequence that is controlled by the fire panel.
- Partitioned room structure with separate air conditioning (A/C) units (and redundant units in battery room) for effective, reliable cooling and safety measures for fire extinguishing.
- Precision air conditioning units for inverter room (Uniflair) and battery room air conditioner (Mitsubishi).
- The Uniflair A/C in the inverter room with an operating set point of 30°C and two 3.5kW DX A/C units in the battery room that operate independently from each other to maintain the room temperature between 20-25°C. Extra cooling capacity is available in the battery room for fourth battery rack.

Sensors and Transducers

- 36 LEM voltage and current transducers distributed throughout the entire power network, including DC side and three phase system.
- 10 RTD temperature probes embedded throughout the shelter: six wall-mounted, two ceiling-mounted, two floor-mounted, and two ambient/air temperature sensors for the inverter and battery rooms.
- External weather station (Vaisala) with pyranometer, wind speed and direction, pressure, temperature, humidity, solar radiation and rain level.

- Custom developed LabVIEW based data acquisition software and hardware with GPS locked frequency source: 100kHz to 500kHz sample rate high speed waveform recorder, IEC 61000-4-30 power quality recording, and IEEE C37.118.1 phasor measurements.

Other features of the mobile unit

- Footprint: 6.95m x 2.85m
- Dimensions with the air conditioning units and the door openings: 7.85m x 4.85m
- Height: 3.0m
- Total weight: 7800kg (without battery modules fitted), approximately 10 tonnes (with modules fitted)
- An extra space is provided in the battery room to house a future fourth battery rack (with an extra weight of 850 kg)
- Remote and onsite control options
- 4G and GPS antennas, lightning surge protection
- Lightning protection system with two air terminals
- Deployable to any Class C (Cyclonic) region wind zone
- A low centre of gravity shelter with most of the weight fixed directly to base frame
- With suitable support points for lifting by a crane for loading/unloading to a truck

Thebarton Campus Facility

- 500kVA diesel generator set
- A changeover switch board for grid, diesel generator and local load connections
- Large AC loads: six variable speed motor drive each with 130kW induction motor

Acknowledgements

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To discuss your potential projects or for training or for site visits, contact us via the following details

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For further information refer to Summary of Applications leaflet.

For detailed information and self-reading about battery storage systems and to access real test data, visit the Australian Energy Storage Knowledge Bank (AESKB) website at www.aeskb.com.au or www.energystorageknowledge.com.au