YOUR GUIDE TO IMPLEMENTING AN EV TEST SYSTEM DESIGNED TO MEET CHANGING REQUIREMENTS

INTRODUCTION

According to a Reuters report, global automakers are planning to spend at least $300 billion to develop and procure batteries and electric vehicles (EV) over the next five to ten years. But as the industry accelerates at full speed, at the heart of this significant gear change lies a key challenge. The ability to accurately, efficiently and effectively test EV powertrain technology in what is an increasingly complex and rapidly changing environment.

Unprecedented technological advances in battery technology, teamed with the race to bring increasingly innovative power electronics technologies to market, is calling for more technically demanding test environments than ever before. With already high and increasing power demands, and the need to acquire and process bigger data sets, test facilities are being faced with a plethora of new test cases and often little or no historical data to help with characterising the latest configurations. Not to mention the challenge of managing conflicting targets, such as performance VS. efficiency, and the added unknown of subsystem interaction when it comes to incorporating new technologies into the EV architecture. Think 5G for autonomous driving which is anticipated to be increasingly built around and controlled via the battery management system[1].

And with more innovation comes more demanding performance requirements which result in heavier time and cost investment. But as manufacturers look to be first out of the blocks, the need for speed, alongside the desire to cut costs to increase profitability, have hit new heights. The pressure is on to drive efficient test configuration and deployment systems that can meet both current and future demands.

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FINDING THE RIGHT SOLUTION TO MEET YOUR ORGANISATION’S NEEDS

The long and ever-changing list of requirements for an optimised test system is making it increasingly challenging for organisations to identify the right solution to suit their needs. And there isn’t a lot of time. Quick deployment demands are requiring organisations to make a key technology decision that will ultimately define their time-to-first-test and thus their competitive status in the market.

The difficult decision lies between building the test system in-house, or buying an off-the-shelf system. Within this decision lies four key challenges that all businesses must carefully consider before investing in the right solution.

1. National Instruments spokesperson, EE Times 2019

FOUR STEPS TO FINDING THE BEST EV TEST SYSTEM SOLUTION TO FIT YOUR REQUIREMENTS

1. How quickly can you build a suitable solution in-house?

When analysing this option, it's important to take stock of how much resource you have in-house and the range of platform specific skill sets that exist within the team. Application bundle solutions on the market allow you to build your own system using platform components. These comprise of a software stack with a native development environment, a hardware platform, and then a connecting layer for integration with other systems. For those on a tight budget, and with comprehensive and plentiful in-house skills, this can seem like a very compelling option. A more bespoke approach to tackling the test challenges at play. It's crucial, however, to not underestimate how much precious in-house resource would be diverted away from actual product development in order to develop a test system in this way.

And while integration with existing devices, instrumentation and systems would be easier with a more flexible platform, it would still require time-consuming overheads to configure to purpose. This would include the challenge of integrating custom devices and sensors without a standard application-specific framework. This is a vital element to take into consideration when investigating your in-house capabilities to develop a test system for quick time-to-first-test results. As well as recognising the resource required to continually develop and build on the system as test conditions quickly change.

2. How complex are your test system integration requirements?

Integrating legacy systems into a new configuration is not only an incredibly time-intensive task with big financial implications for the business, but can also be a very frustrating process for engineers. This is an important factor to recognise when exploring external, off-the-shelf solutions to help to develop your test system. Their complex architectures mean that there are so many integration areas to take into account such as new hardware devices, models, applications, protocols, drivers, cell services...the list goes on. And with the rapidly changing environment, this list will only grow longer and more robust.

As such, it's important to not only analyse your integration requirements in detail, but also your test approach now and into the future. An off-the-shelf vendor solution is great for a known situation with pre-defined and unchanging test requirements. Once you've invested initial time into the integration process, not much more work on that front should be required. But ensuring that you're calculating your lifetime return on investment here is crucial. Time investment into integration with legacy systems can be a long and frustrating process, and the limited flexibility offered by an off-the-shelf solution can fall short on its ability to cater to changing requirements into the future.

3. What support does your team need in order to work at optimum level?

Ascertaining how efficiently your team is working is another important element when looking at your solution options. Wasted or duplicated efforts are often the costly result of siloed working, something often found in (but not limited to) large in-house settings where multiple engineers are tackling different test focus areas.

Another area to assess is your current process frameworks and best practice sharing - an often neglected part of testing. Do you, for example, have a robust version control management system in place? Can engineers seamlessly modify parts of the system without fear of the wrong version being shared with colleagues? Or being unable to go back to the original configuration? Ensuring teams have the right technical frameworks and communication channels in place in order to work flexibly at an optimum level is extremely valuable and an added bonus feature to any solution you're looking at as it could save you a lot of money.

4. How do you buy something when you don't yet know what you need?

At a time of unprecedented change in the EV industry, we're experiencing moving goal posts with regards to deliverables and new legal and safety requirements due to a shifting fundamental understanding of its potential. In the current market, there's no doubt that future-proofing your technology purchase is the ultimate goal when it comes to measuring your return on investment.

Taking the time now to make your test cells flexible and adaptable into the future is critical and will provide you with a significant competitive advantage moving forward.

Having recognised this integral piece of the puzzle, we at Austin Consultants have designed a test system solution designed specifically to cater to this changing environment.

INTRODUCING EVOLUTION - BUILT TO MEET CURRENT AND FUTURE TEST DEMANDS

EVolution is our off-the-shelf, ready to deploy software that offers an open and real-time platform for test cell control and data acquisition. It has been purposely built to tackle the time and complexity challenges presented by 'build it yourself' and external off-the-shelf solutions in order to form a best of both worlds approach. With top speed deployment and adaptability into the future in mind, its modular design offers maximum flexibility and extensibility to integrate across any test cell configuration. Created for an optimised test process, outlined below are the key benefits of the EVolution solution.

Accelerated Test Development

- EVolution is unique in that it is quick and easy to deploy, configure and replicate.
- The open services orientated architecture provides a framework to allow users to quickly and easily write low-cost plug-ins to add new sensors or bespoke protocols.
- Advanced workflows and processes guide users through the required steps for loading models, channel assignments with scaling and calibration data, sensor databases, and test profile creation.
- A simple import function supports multiple high-speed deterministic model formats including MATLAB/ Simulink, AVL Boost and Cruise, Technalia, DynaCar, IPG CarMaker and LabVIEW.
- A profile builder for generating new profiles means that the system can be configured for new tests without any programming.

Expanded Test Coverage

- The flexible nature of the platform, teamed with its high speed data acquisition capabilities, allows for maximum scalability in order to facilitate multiple test applications and expand coverage.
- Harmonious tech integration and efficient collaboration tools mean less errors and in turn more accurate and innovative testing.
- Application specific generic test scripts that are a great starting point for automated testing and can be used as provided, or as a solid foundation for further customisation to create bespoke tests.
- Defined device categories for standard equipment remove the requirement to characterise individual devices providing rapid creation of generic tests so little time investment is required before you're up and running. This is essential in today's competitive market.

Improved Reproducibility and Team Efficiency

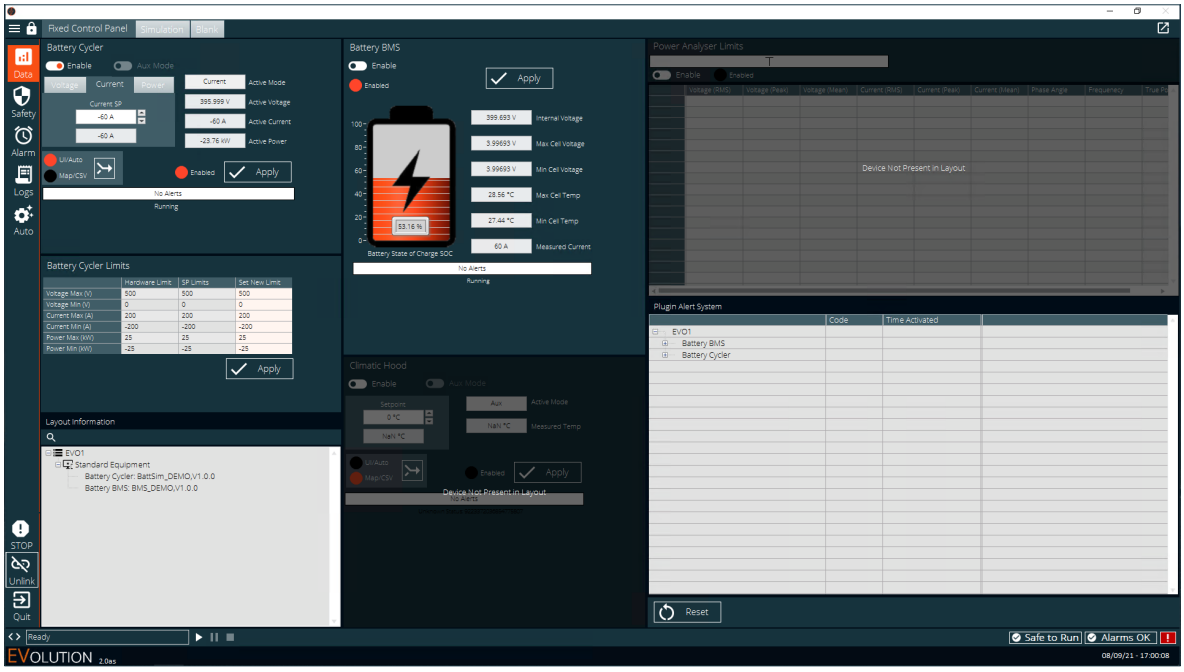
- EVolution standardises the test platform across your organisation with its pre-architected framework.
- This ensures engineers are working from the same base which cuts down duplicated efforts, makes it easier to transfer and trace information and knowledge, and makes replication a quick and pain-free process.
- Its user-friendly interface encourages best practices, enables automation of tasks like data management, and increases the efficiency of the team.
- Multiplying this impact by multiple areas and teams generates a significant financial saving for the business and encourages best practices at all levels of testing.

Low Cost Investment with Great Return

- The EVolution system offers an entry-level price point which provides a fast return on investment. This is thanks to its quick and easy integration and deployment capabilities which minimise the crucial time-to-first-test.
- The standard framework and easy collaboration features achieve significant cost savings by minimising duplicated efforts and creating better resource sharing.
- In addition, by facilitating seamless technology integration throughout the system with plug-ins and the right frameworks, the generation of valid data is both quicker and more efficient.

BRINGING EVOLUTION TECHNOLOGY TO LIFE

Our EVolution system has already been implemented and proven demonstrable results with some key players in the industry who were seeking accessible and cost-effective technology to help them to tackle a demanding test environment with a number of different variables. Please find below some examples.



Example Battery System User Interface

CASE STUDY - PROVENTIA

Hybrid Electric Vehicle Battery Pack Test Laboratory Control and Data Acquisition System.

The Challenge

As a free system integrator and turnkey supplier, Proventia provides modular test laboratories and centres for electric vehicles, engines, powertrains, hybrid systems and battery packs.

Proventia wished to build a commercial test facility for climatic EV battery testing designed for both module and complete battery pack requirements.

With the need to meet not only their own testing and demonstration purposes but also the test requirements of third party customers, adaptability to accommodate changing test configurations was paramount.

The Solution

The EVolution off-the-shelf solution is designed for both module and complete battery pack testing. Based on the NI HIL test engine to ensure that the system can run high speed models, it has been designed with maximum flexibility and extensibility in mind.

The modular system comprises:

- Test Cell Control and Data Acquisition System
- Test Cell Management Unit
- Remote Patch Panel

The test cell and infrastructure were developed by the Proventia team and the test cell control and data acquisition system, and integration was provided by Austin Consultants.

Results

- Cost-effective, rapid deployment.
- Driving savings through innovation and utilisation of an extensible platform.
- Accelerating ROI on transformation initiatives.
- Improved data management – access and use.
- Adaptable to accommodate new/changing technologies and test requirements.
- Enabling advances in engineering through design and build of innovative systems.
- Driving measurable productivity gains.

View the full case study here.

CASE STUDY - WMG

Electric Vehicle Test Cell Control and Data Acquisition System

The Challenge

As WMG already has an existing test cell infrastructure, the solution had to address a number of key issues:

- Meet the demanding technical requirements of the system for multiple e-machine axis control and data acquisition.
- Provide cost-effective reuse of the existing test equipment and cell infrastructure by integrating directly with it.
- Integrate with a wide range of equipment, sensors and protocols.
- Provide flexibility to easily add new equipment in the future.
- Make the platform accessible and easy to use for as many operators as possible with varying levels of expertise.
- Ensure the safety of all operators and equipment is paramount at all times.
- Provide management and integrity of data acquired from multiple axis.

The Solution

The Test Cell Control and Data Acquisition System offers a cost-effective solution to accommodate the current test and integration requirements, combined with the extensibility to adapt to future hardware and test requirements by offering an extendable chassis for increased demands. New sensors or bespoke protocols can be added via a simple low-cost, plug-in (or custom device) upgrade.

The modular system comprises:

- Test Cell Control and Data Acquisition System
- Test Cell Management Unit
- Power Analyser Rack and Remote Patch Panel

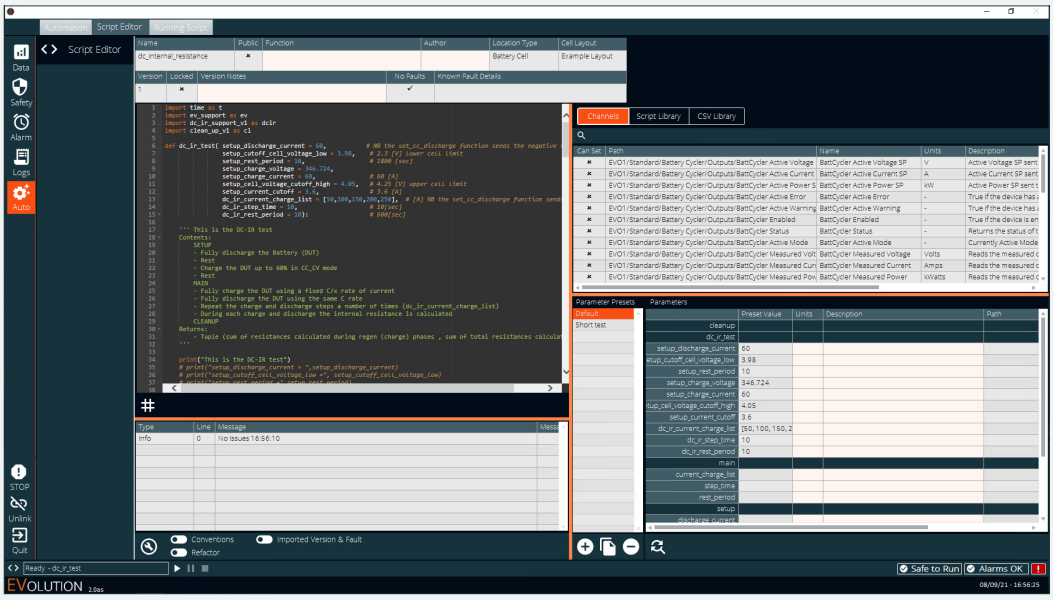
Results

"The EVolution Test Cell Control and Data Acquisition System was integrated with the existing test cell infrastructure and equipment to maximise existing resource utilisation and return on investment whilst at the same time incorporating the latest test cell features and requirements. The Austin Consultants team have been invaluable in integrating the new high-speed deterministic system into our test cell, efficiently and effectively managing all the complex integration issues and our specific needs.
The state-of-art multi-axis e-machine test capability is a unique asset for our research activities and industrial collaborators."

Dr Juliette Soulard, Associate Professor Electric Machines, WMG, University of Warwick

View full case study here.

EVolution Electric Vehicle Test Cell Control and Data Acquisition System and Power Analyser Rack Developed by Austin Consultants



Python Scripting Engine

CONCLUSION

With the UK government having recently moved forward the ban on fossil fuel vehicles to 2030, the expectation to deploy test systems quickly is only going to accelerate. In parallel, the heightened pressure for automakers to deliver more competitive innovation more quickly will rapidly complexify the already demanding test environments. As such, it is a pivotal time to ensure that you are investing in technology that is flexible, interoperable with a wide ecosystem, and able to deliver maximum returns for your organisation.

The right solution should ensure that your resource is fully focused on the test system requirements and not distracted by integration issues or architecting bespoke configurations. Standard frameworks should be put in place so application specific workflows are taken care of and best practice is encouraged from the get-go for more efficient test processes. Information and data sharing, version control management and the ability to quickly and easily reproduce test environments should be seamless.

Most importantly of all, the solution must be built to withstand the rapidly changing demands of the EV test industry. In fact, the EVolution software has been built for just that. An open platform, it boasts greater modularity which means it can respond and adapt quickly to the need for different model integration, custom sensors, applications and more.

Get in touch to arrange a demonstration or find out how Austin Consultants' EVolution platform can adapt to your test needs and ensure the most competitive deployment times and accurate and efficient testing processes.

Get in touch to arrange a demonstration or to discuss your requirements.
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