MARSHALL

2023

# ECO SYSTEM

ARCHITECTURE

# Document Version Management

| |
|---|
| **Version:** 2.0.1 |
| **Version Date:** 27 – 03 -2023 |
| **Original Release Date:** 17 – 10 - 2022 |
| **Document Prepared by:** ZECO Australian Energy Pty Ltd |

# Table of Contents



`

# 1.0 Marshall–Inverter Interface Architecture

Hybrid and solar inverters from a range of manufacturers can now be interfaced with Marshall Eco System. At this stage, inverter data is read via their Modbus RTU or TCP/IP interfaces. In some cases, inverter data is read via API. Data collected from inverters will be sent to the Marshall Cloud using REST API calls. Similarly, the inverter can be remotely configured and controlled using Marshall Cloud. In this scenario, the values for the configuration and control parameters are sent to the inverter by the cloud. Data connectivity to the Marshall Black Box can be provided via its own Telstra 4G dongle. It is also possible for Marshall Black Box to communicate with the Marshall Cloud using site WIFI or site routers.

## 1.1 Features

• Enables customers to monitor a range of essential parameters such as solar production and consumption, Energy Balance, Export and Import, Site Aggregates, Battery Performance, and Meter Parameters in Real-Time (Customers can also monitor these three parameters in cyclic patterns. E.g.: Yearly, Monthly, Weekly and Daily)

• Allows installers to remotely configure inverter basic controls

• Provides the ability to interface inverters with virtual power plants (VPPs), distributed energy manufacturing systems (DERMS), and other smart grid/ network features

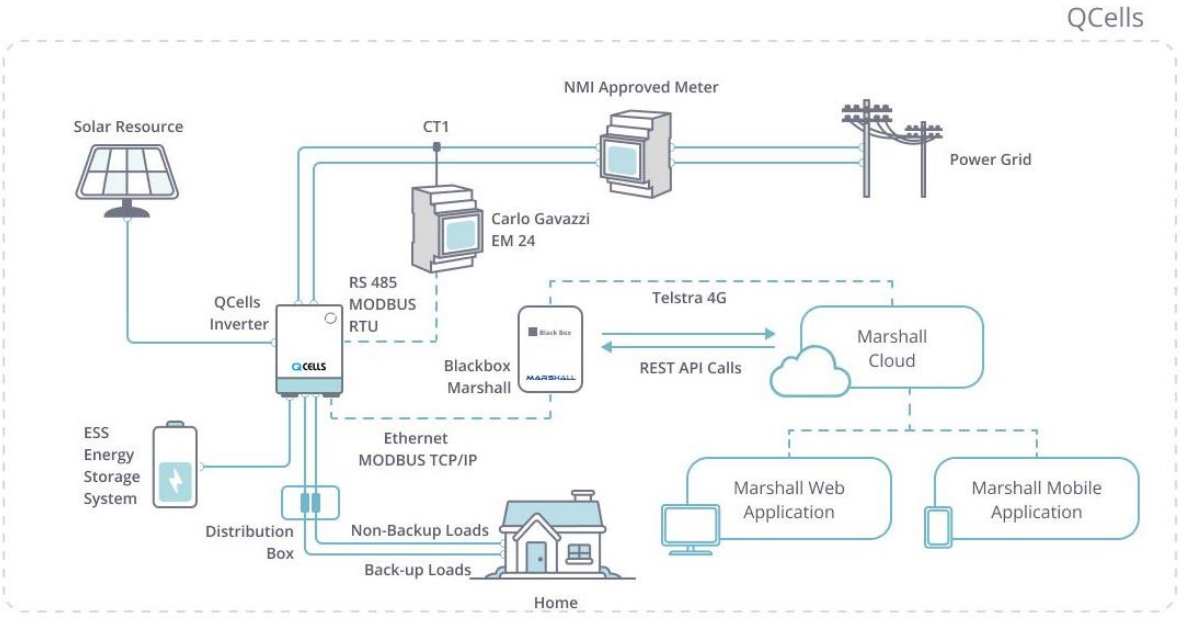


*Figure 1 - Marshall-Inverter interfacing Architecture – With QHCORE G3 Inverter*

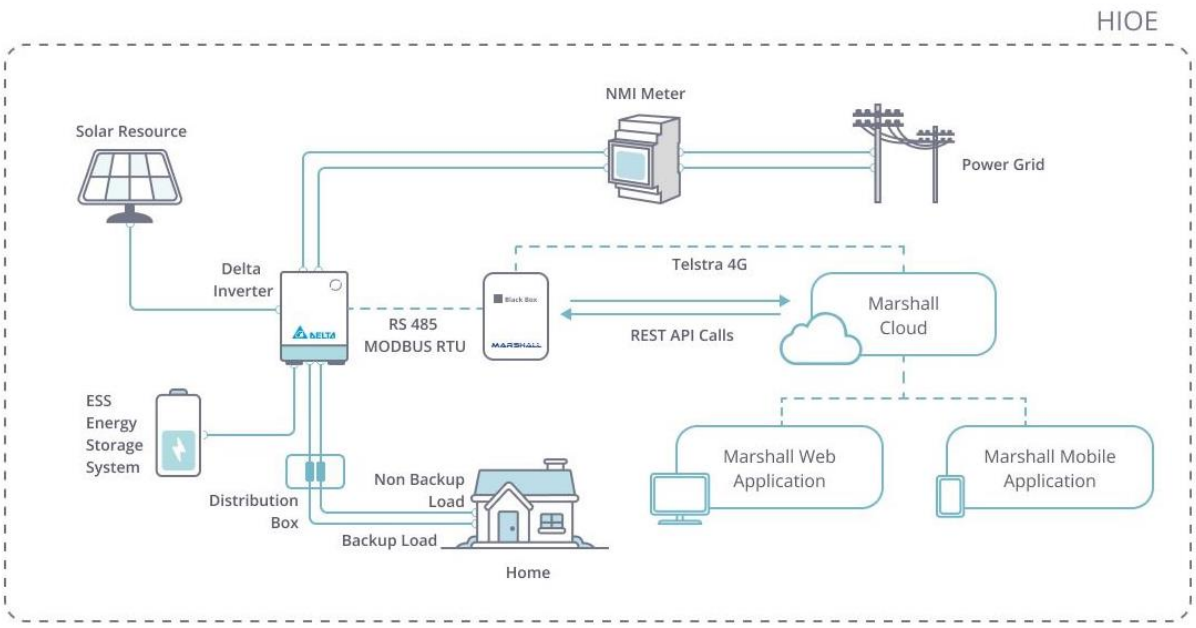


*Figure 2 - Marshall-Inverter interfacing Architecture – With Delta H10E Inverter*

# 2.0 Marshall–EV Interface Architecture

Marshall offers a range of charging solutions for both single-phase and three-phase EV chargers/EV charging stations. Now, Delta AC Max basic and AC Max Smart can couple with Marshall Black Box to provide four different types of charging modes: fast charge mode, eco charge mode, eco plus mode, and time of use mode.

## 2.1 Charge Modes

- Fast Charge Mode prompts a maximum charge rate from the customer and performs fast charging in a relatively short amount of time. Under single-phase conditions, the maximum allowable charge rate is 7 kW and under three-phase conditions, the maximum allowable charge rate is 22 kW.
- Eco Charge Mode also prompts a charge rate from the customer and performs EV charging minimizing the amount of energy required during the charging process. In Eco Charge Mode, Marshall Black Box diverts excess solar to the EV charger. However, in the absence of solar power, Marshall Black Box allows EV chargers to use grid power.
- Eco Plus Mode only allows EV chargers to use excess solar power. In absence of solar power. EV chargers automatically shut down.
- Time of Use Mode allows users to determine the charging time-period and the respective charge rate.

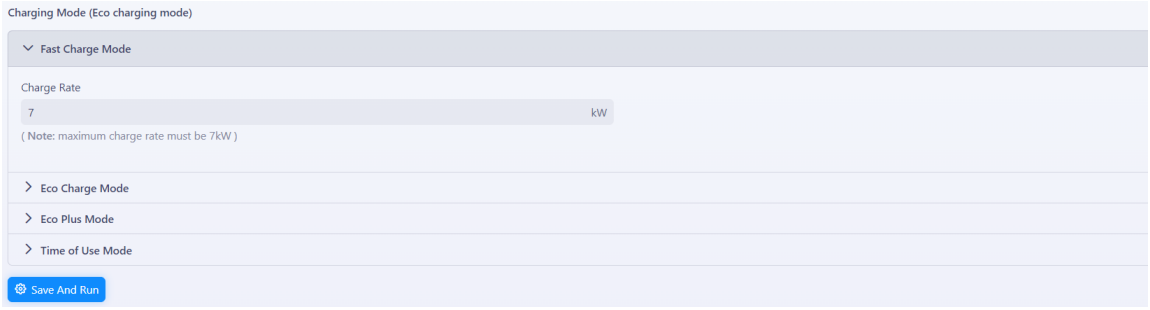


*Figure 3 - Marshall Cloud - Fast Charge Mode*

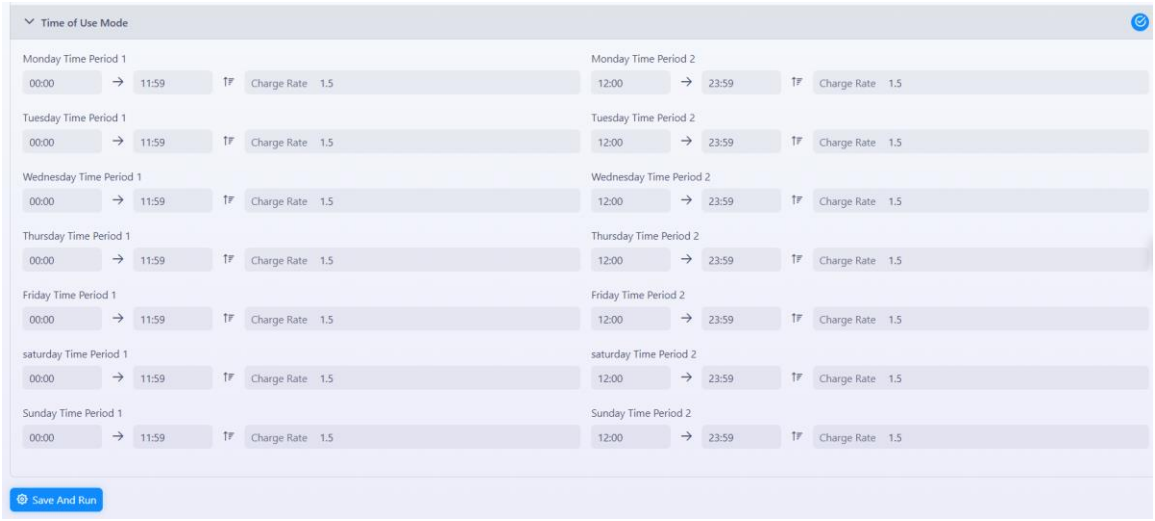


*Figure 4 - Marshall Cloud - Time of Use Mode*

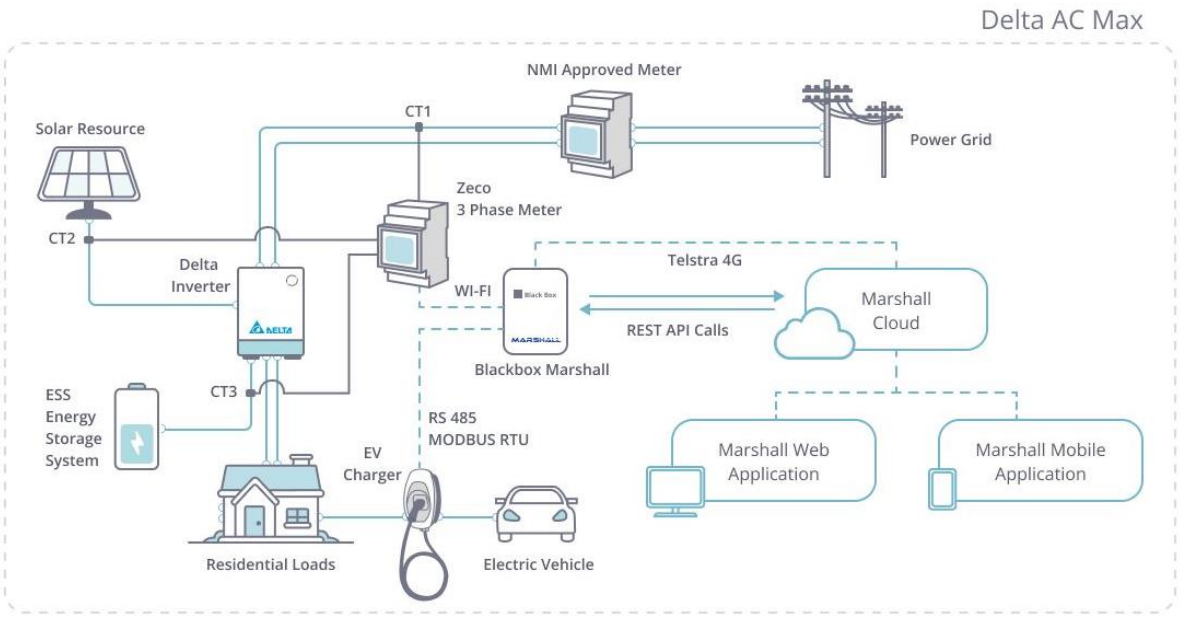


*Figure 5 - Marshall - EV Charger Architecture*

The data connectivity to the Marshall Black Box is provided via its own Telstra 4G dongle. the EV charge rate is determined based on the charging modes described above. Marshall Black Box is connected to the Marshall Cloud via Telstra 4G dongle and communication is done

through REST API calls. ZECO Meter and Marshall Black Box are connected to each other through Wi-Fi (LAN created by the Telstra 4G Dongle) while the EV charger is connected to Marshall Black Box via RS 485 Modbus RTU.

## 2.2 Plant Concept and Load Balancing

For a site where the connected EV Chargers must operate under a threshold of load value (kW) and imbalance of load (%), over the 3 phases, Marshall can be configured as Master and Slave.

Master Marshall connects to the ZECO Wi-Fi meter that monitors the Grid IMPORT/EXPORT power value through 3 x CTs, one on each phase. Each of the Slave Marshall is connected to an EV Charger and controls the charging power of this EV charger, based on allocation from Master Marshall.

Master Marshall allocates the charging power to each of the Slave Marshall, based on the difference of Allowed v/s Actual Load, per phase. It distributes the available power per phase, to each Slave Marshall. Slave Marshall controls the charging power of the connected EV charger, based on the lowest allocated power per phase.

Master Marshall will also re-allocate the charging power to each Slave Marshall, based on the slope of charging power over time. This is for non-OCPP-compliant EV chargers. For OCPP-compliant EV chargers, Master Marshall will use parameters like EV %SOC and Battery temperature, to allocate the charging power.

Master and Slave Marshalls, form a PLANT for the site and the dashboard for the PLANT shows dynamic Grid, Load, and PV power values. Also, each EV Charger's status and charging power value are visible on this PLANT.

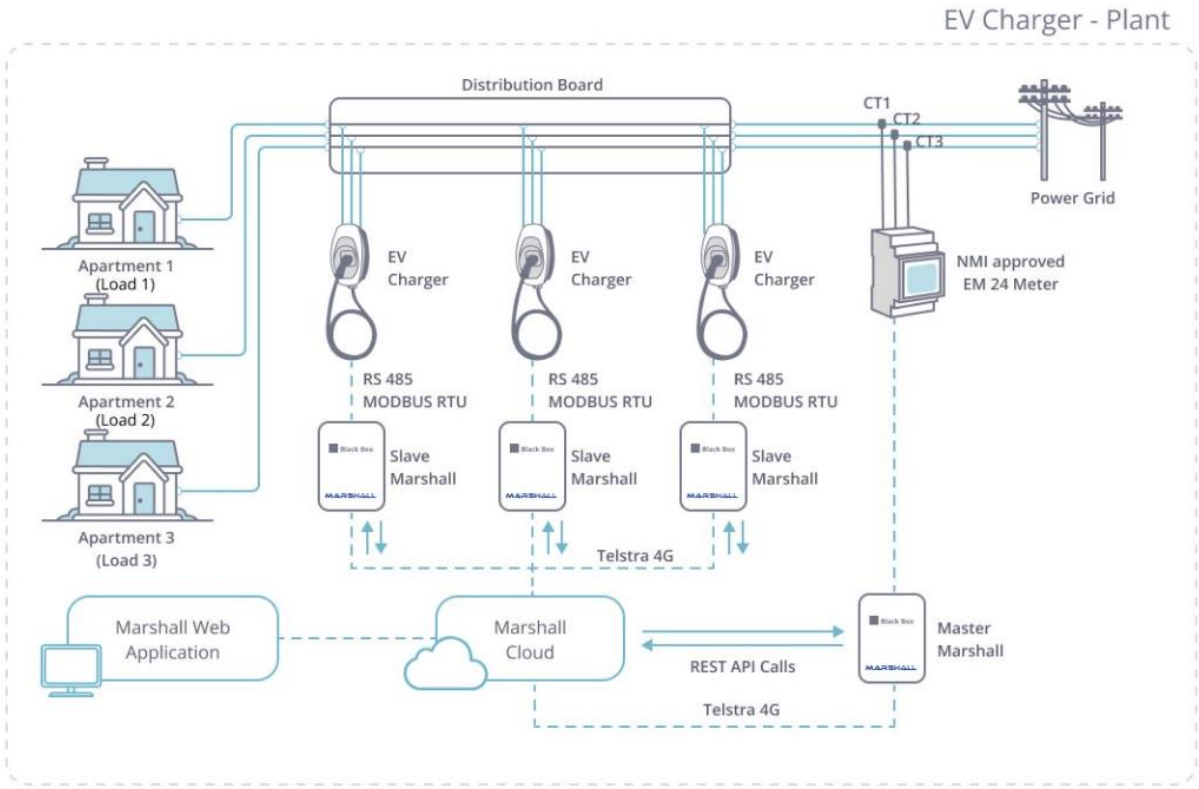


*Figure 6 - EV Chargers Plant Concept and Load Balancing*

# 3.0 Marshall–Ovida Interface Architecture

Marshall Eco-System enables OVIDA Energy Solutions to actively monitor the solar production, instantaneous power and power factor of its PPA sites. In this application, Marshall Black Box communicates with NMI-approved EM 24 Meter via its Modbus RTU interface through RS 485. Data collected from EM 24 is sent to the Marshall Cloud using REST API calls. Data connectivity to the Marshall Black Box is typically provided via its own Telstra 4G dongle. However, in certain scenarios, Marshall Black Box can communicate to the Marshall Cloud using site WIFI or site routers.

## 3.1 Features

• Enables customers to monitor, the solar production, instantaneous power and power factor in Real-Time (Customers can also monitor these three parameters in cyclic patterns. E.g.: Yearly, Monthly, Weekly and Daily)
• Provides billing options based on the energy generation
• Allows installers to remotely configure EM 24 basic controls

*The Marshall Black Box, NMI Approved Meter, and Telstra 4G dongle are provided by ZECO Energy.

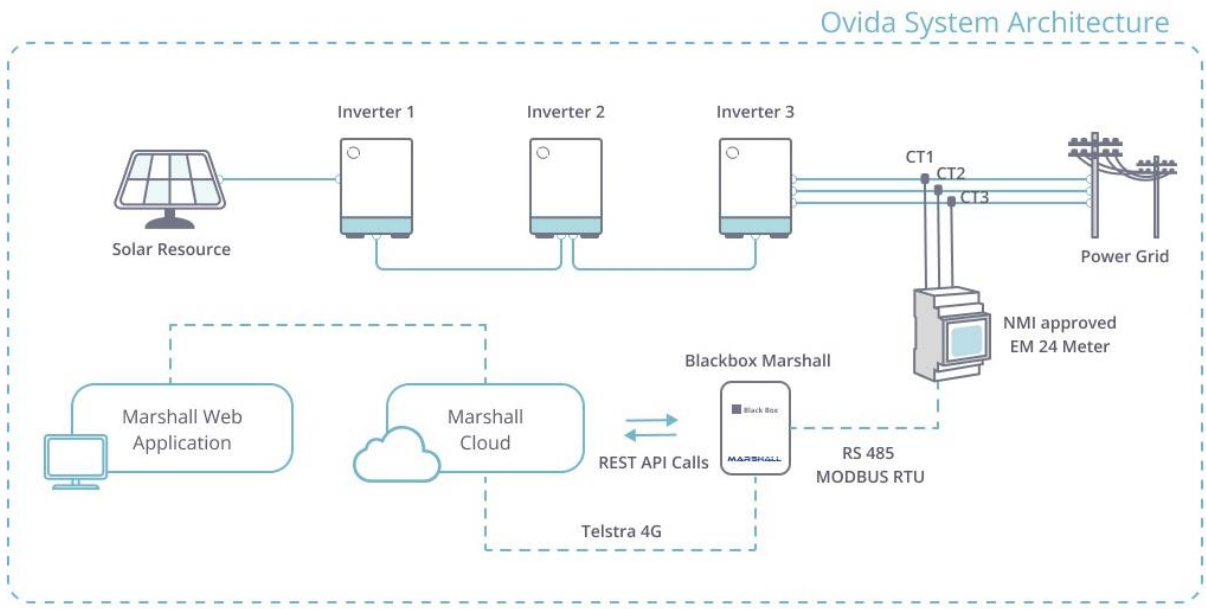


*Figure 7 - Marshall - Ovida Interfacing Architecture*

# 4.0 Marshall–BX 6.3 Interface Architecture

Marshall eco-system now offers single-phase and three-phase monitoring solutions to Delta BX 6.3 AC coupled battery system. In both single-phase and three-phase scenarios, the data from BX 6.3 battery is read via Modbus RTU through RS 485. Even though BX 6.3 could read

grid power in a single-phase scenario, it is not capable of reading solar power values in either single-phase or three-phase. Therefore, the Marshall Black box reads solar power values using the ZECO 3-Phase Wi-Fi Meter.

Additionally, in a three-phase scenario, Marshall reads grid power values via the Delta P3 Meter and Delta Data Collector 1 (DC1) combination. Marshall hardware is fully capable of communicating with the DC1 Modbus TCP/IP interface through Wi-Fi (Typically generated by the Telstra 4G dongle).

## 4.1 Features

- Customers who are part of VPP managed by Nectr can monitor the critical parameters such as load, grid and solar power values of their Delta BX 6.3 Battery assets.

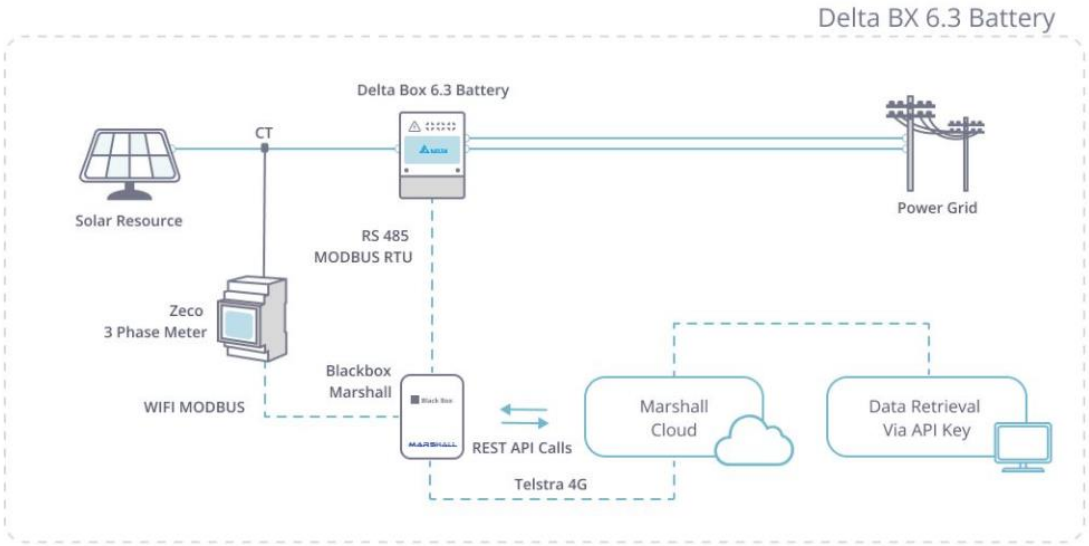


*Figure 8 - Single-Phase BX 6.3 Battery Architecture*

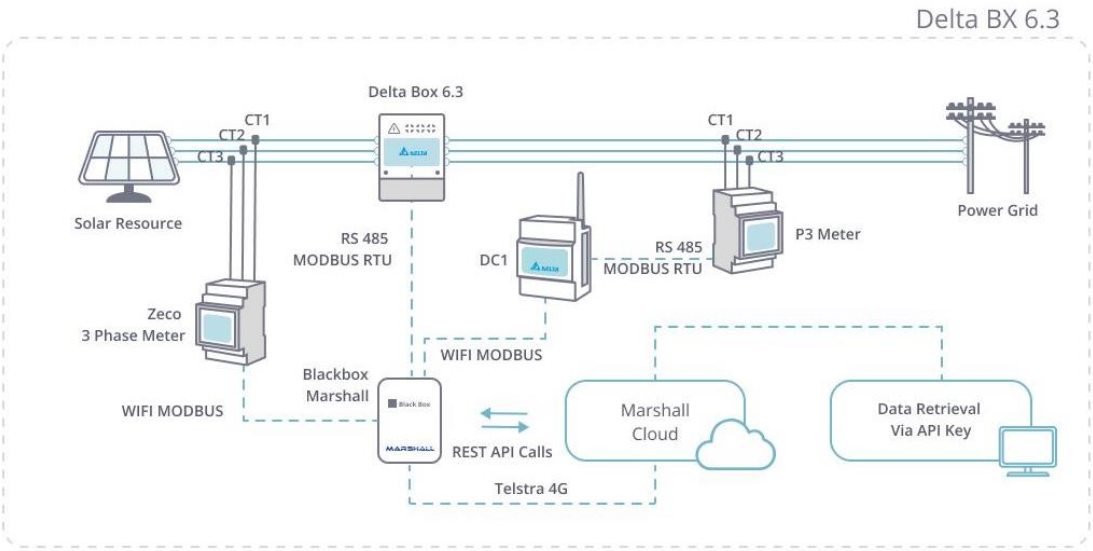


*Figure 9 - Three-Phase B.X 6.3 Battery Architecture*

# 5.0 Marshall Cloud Architecture

Marshall Cloud Architecture has 4 basic components.

- Database/s
- Backend services
- Web UI
- Mobile application

The web UI and mobile UI are both served with the same backend service. The backend service performs authentication, access control, and data manipulation as a RESTful API. The backend service is compatible with any relational DBMS like MySQL or PostgreSQL. Additionally, it also uses a Mongo database and an Apache Hadoop instance depending on the configuration.

## 5.1 Databases

The relational database is hosted at AWS RDS service. The configuration is set to a MySQL 8.0 database cluster instance with a load balancer. The database servers can be scaled up both horizontally and vertically as required at any point with minimum downtime.

## 5.2 Backend Services

The backend service is written with Java Spring boot. It compiles into a jar file that has an embedded tomcat instance. With the AWS Elastic beanstalk, the backend service has been deployed on a server cluster which also has a load balancer. Both the backend and the database are open to each other's security groups exclusively.

## 5.3 Web UI

The web UI is hosted at an AWS S3 storage bucket with static web hosting enabled. Since it is written with Angular 14, it can be built into a static single-page web application. The S3 bucket web content is served with the help of AWS CloudFront through the domain which is https://www.datamarshall.au/.

## 5.4 Mobile application

Mobile application is developed with the Ionic framework. Android and IOS builds are planned to be deployed on the Google play store and Apple app store (By 5th April 2023).

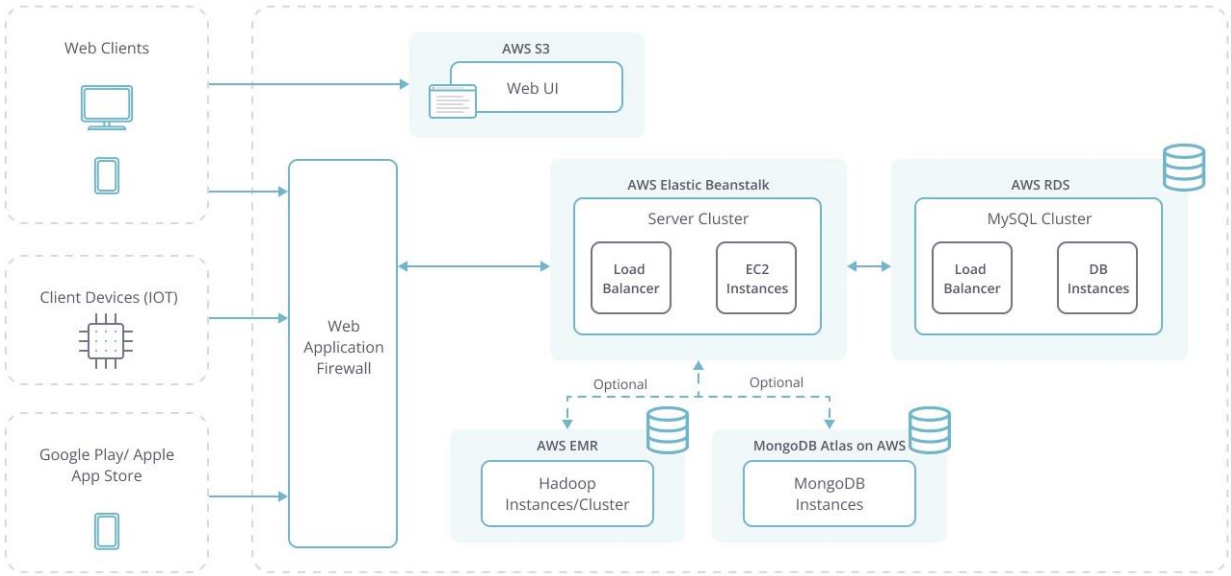


*Figure 10 - Marshall Cloud Architecture*

datamarshall.au

03 4422 4455

support@datamarshall.au

**ZECO Energy**

6C/148 Chesterville Road,
Moorabbin
VIC Australia 3189

A.B.N 16 111 222 456