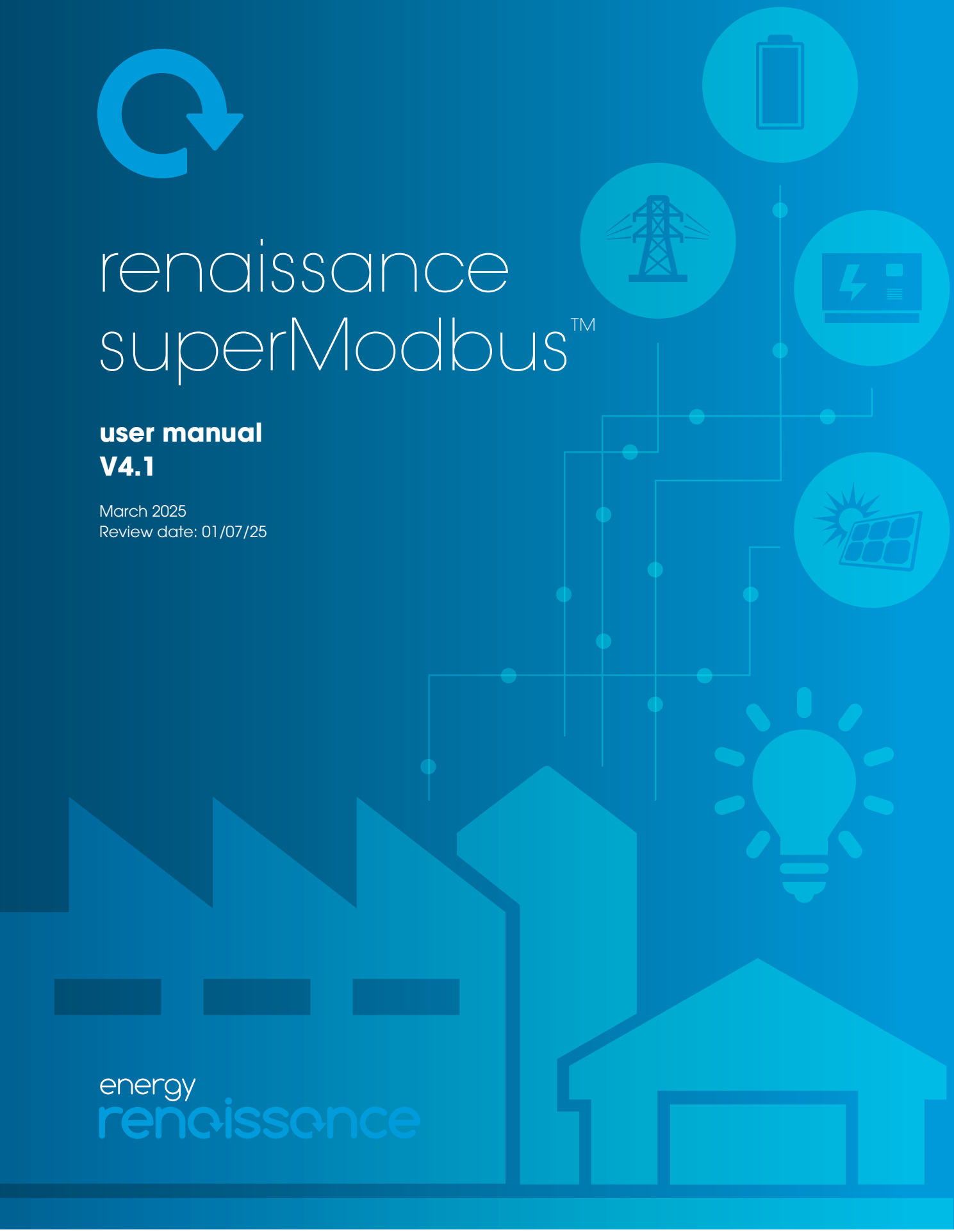
renaissance superModbus™

user manual
V4.1

March 2025
Review date: 01/07/25



energy renaissance

energyrenaissance.com

contents

Safety

	An extremely dangerous power hazard exists during battery energy system installation and connection. Take extreme caution during this process. Failure to do so may cause serious injury or death. Batteries are a constant power supply and should always be deemed to be a live source of energy.
	The battery pack should not be disposed of with household waste at the end of its working life.
	Read the manual before installing and operating the battery pack.
	Keep the battery module away from open flame or ignition sources.
	Wear appropriate personal protective equipment when dealing with the battery pack. Safety boots are required when lifting packs. Insulating gloves, insulating mat, safety goggles and long sleeved/legged non-flamable clothing for electrical connection.
	Keep the battery pack away from children.
	Under fault conditions, the battery pack may leak corrosive electrolyte.
	Under fault conditions, the battery pack may explode.
	The battery packs and superStorage™ products are heavy enough to cause severe injury. Safety boots are required for installation, connection and are required at all times in the work area.

	The battery pack should be disposed of at an environmentally safe recycling facility.
 **EXPLOSIONS**	Do not subject the battery pack to strong impacts. Do not crush or puncture the battery pack. Do not dispose of the battery pack in a fire. Only use insulated tools when dealing with batteries.
 **RISKS OF FIRE**	Do not expose the battery pack to temperatures in excess of 60°C. Do not place the battery pack near a heat source, such as heating systems. Do not expose the battery pack to direct sunlight. Do not allow the battery connectors to touch conductive objects such as wires or moisture or liquids. Do not short circuit battery packs. Ensure vermin, insects or other pests do not inhabit battery rooms or battery enclosures
 **RISKS OF ARCING**	Do not allow battery connectors (pack or rack) to touch conductive objects such as wires or moisture or liquids.
 **RISKS OF ELECTRIC SHOCK**	Do not disassemble the battery pack/rack. Do not touch the battery pack/rack with wet hands. Do not expose the battery pack/rack to moisture or liquids. Keep the battery pack/rack away from children and animals.

DANGER! Emergency situations

Risks of damage to the battery pack/rack

- X **Do not** tilt battery rack/battery enclosure
- X **Do not** allow the battery pack/rack to come into contact with liquids.
- X **Do not** subject the battery pack/rack to high pressures.
- X **Do not** place any objects on top of the battery pack/rack.
- X **Do not** expose battery pack/rack to high temperatures, high humidity or dust. (the product is warranted for use at 25 ± 5 °C)
- X **Do not** subject the battery pack/rack to short circuiting

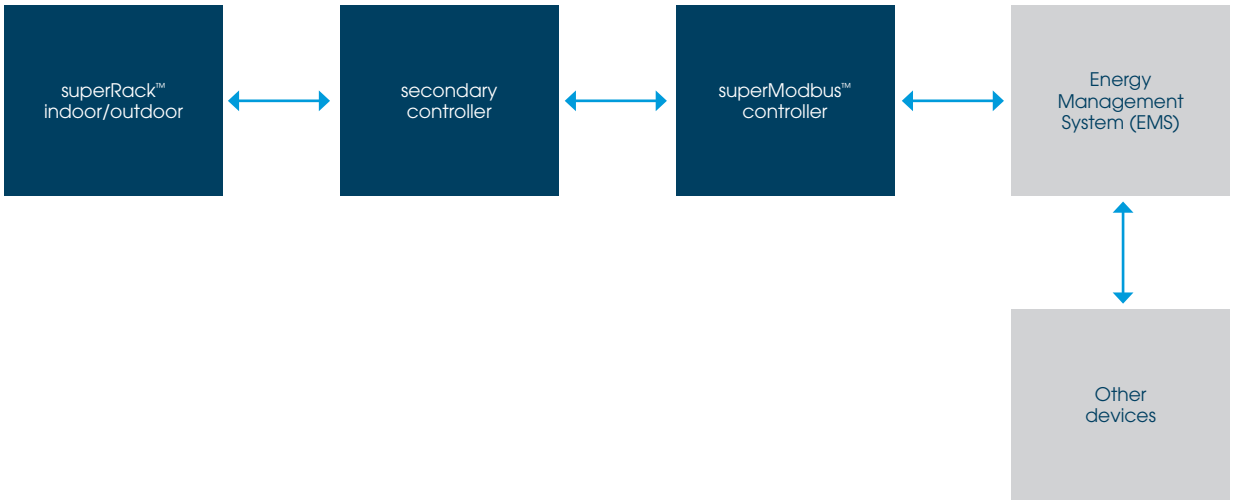
Leakages	**CAUTION!** Damaged batteries may leak electrolyte or produce flammable gas. **If you suspect a gas leak, take these actions:** • Immediately quarantine the location and do not allow any personnel near the potentially damaged battery. • Contact emergency services / call fire brigade and follow your site procedures. • Contact your provider for further advice and information. **In case of a fire, make sure that an appropriately rated fire extinguisher is nearby.** • The battery pack/rack may catch fire when heated above 150 °C. **If a fire breaks out near the battery pack/rack installation:** • Extinguish the fire potential before the battery pack/rack catches fire or if smoke is present. **If the battery pack/rack has caught fire:** • **Do not try to extinguish the fire**. • Evacuate people immediately and shut off any connected power systems. • Contact emergency services / call fire brigade and follow your site procedures. **If the battery pack/rack leaks electrolyte**, avoid contact with the leaking liquid or gas. Electrolyte is corrosive and contact may cause skin irritation and chemical burns. If anyone is exposed to the leaked substance, take these actions: **Inhalation:** Evacuate the contaminated area and seek medical attention immediately. **Eye contact:** Rinse eyes with flowing water for 15 minutes and seek medical attention immediately. **Skin contact:** Wash the affected area thoroughly with soap and water for 15 minutes and seek medical attention immediately. **Ingestion:** Induce vomiting and seek medical attention immediately.
Wet batteries	If the battery pack/rack is wet or submerged in water, do not try to access it. Contact your provider for technical assistance.
Damaged batteries	Damaged batteries are dangerous and must be handled with extreme caution. They are not fit for use and may pose a danger to people or property. If the battery pack seems to be damaged, contact your provider for advice. Do not handle.

Ensure you have read and installed your product as per the relevant installation manual which can be found on the Energy Renaissance resource centre before continuing.

Introduction

The superModbus™ is a superior solution to client energy management of battery racks and allows for 3rd party EMS integration via Modbus.

The architecture of Modbus revolves around a leader-follower communication model, where a central leader device such as an Energy Management System (EMS) initiates communication and coordinates data exchange with multiple follower devices (superModbus™ controller, inverters, power meters etc). This structured approach, coupled with a well-defined communication protocol and versatile data handling capabilities, makes Modbus a widely adopted and effective communication standard in industrial automation and control systems. The architecture is shown below.



superModbus™ controller vs secondary controller

The superModbus™ controller and secondary controller are similar but have hardware differences.

The **superModbus™ controller** is connected to the internet to provide monitoring via the client user interface (UI). It provides client Modbus communications via TCP or RTU.

The hardware components include:

- Power supply
- Ethernet router
- Processor

A single **secondary Controller** can communicate with up to 8 superRack™ systems. If your installation requires more than 8 superRack™ systems you will be provided additional secondary controllers.

The hardware components include:

- Power supply
- Ethernet switch
- Processor
- Relay module
- USB hub

superRack™ indoor vs superRack™ outdoor

The **superRack™ outdoor** comes pre-configured with a secondary controller and is partially pre-wired. The superModbus™ controller is supplied separately in its own IP66 rated enclosure and will require installation wiring.

The **superRack™ indoor**, has both the superModbus™ controller and the secondary controller supplied separately in their own IP66 rated outdoor enclosures and will require installation wiring.

For comprehensive wiring instructions, refer to the superRack™ indoor or superRack™ outdoor installation manuals.

superRack™ indoor and superRack™ outdoor DC output

Both the superRack™ indoor and superRack™ outdoor when combined with the superModbus™ will have a DC output.

With a superModbus™ controller, secondary controller and a 3rd party energy management system (EMS) controlling external devices, the Energy Renaissance UI has limited functionality. It can only display information relevant to the batteries. Features such as creating schedules, monitoring grid consumption or other generation are only possible through a 3rd party portal.

If using a superModbus™ it is important to ensure you have measures in place that are in line with the warranty documentation and operational compliance section mentioned in this manual to preserve the health of your batteries. Failure to do so will void your warranty.

Communication requirements

To facilitate the seamless transfer of data from the superModbus™ to our server and enable remote updates, you need to establish and always maintain both inbound and outbound network rules. If your network is externally managed, it is important you make your provider aware as blocking of any of the following ports may void your warranty.

These rules are as follows:

Inbound/outbound	Protocol	Port	Server
out	TCP	8883	a13d0jc5uidyq6-ats.iot.ap-southeast2.amazonaws.com
out	TCP	22	superapi.energyrenaissance.com
out	TCP	59841	superapi.energyrenaissance.com
out	UDP	123	debian.pool.ntp.org

Communication wiring

Secondary controller

Communication wiring for the superRack™ indoor

The superRack™ indoor requires Modbus RTU, USB, and a relay contact to the secondary controller. An Ethernet cable is required from the secondary controller to the superModbus™ controller.

Communication wiring for superRack™ outdoor

The superRack™ outdoor comes with the secondary controller and HVAC pre-wired. Only an ethernet cable from the network switch to the superModbus™ is required. If you wish, you can daisy chain multiple outdoor units from their network switch back to the router in the superModbus™ controller.

For comprehensive wiring instructions, refer to the superRack™ indoor or superRack™ outdoor installation manuals.

superModbus™ controller

Secondary controllers are connected to the superModbus™ controller via standard ethernet wiring. The internet modem (required – not supplied) is connected to the WAN port of the router in the superModbus™ also using standard Ethernet wiring.

The superModbus™ controller comes with two RS485 Modbus RTU ports labelled RS485-1 and RS485-2, RS485-1 of the processor is for EMS communication via RTU.

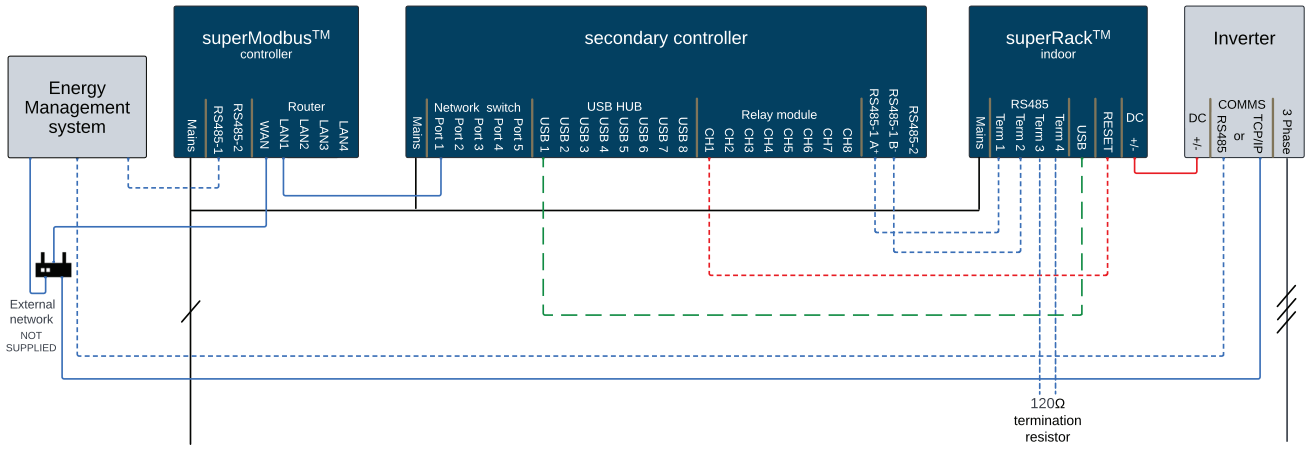
Port forwarding is set up in the case you wish to connect via TCPIP and requires no further ethernet connections as communications are established via the WAN port of the incoming network connection.

IP address, rack serial numbers and MAC addresses will be provided to you at the time of commissioning for you to configure your router and set static addresses. It is important that the IP addresses are static and not DHCP. A change in IP address could result in the loss of communications to your installation or instructions from your EMS being sent to the wrong superRack™/s and cause damage to your installation.

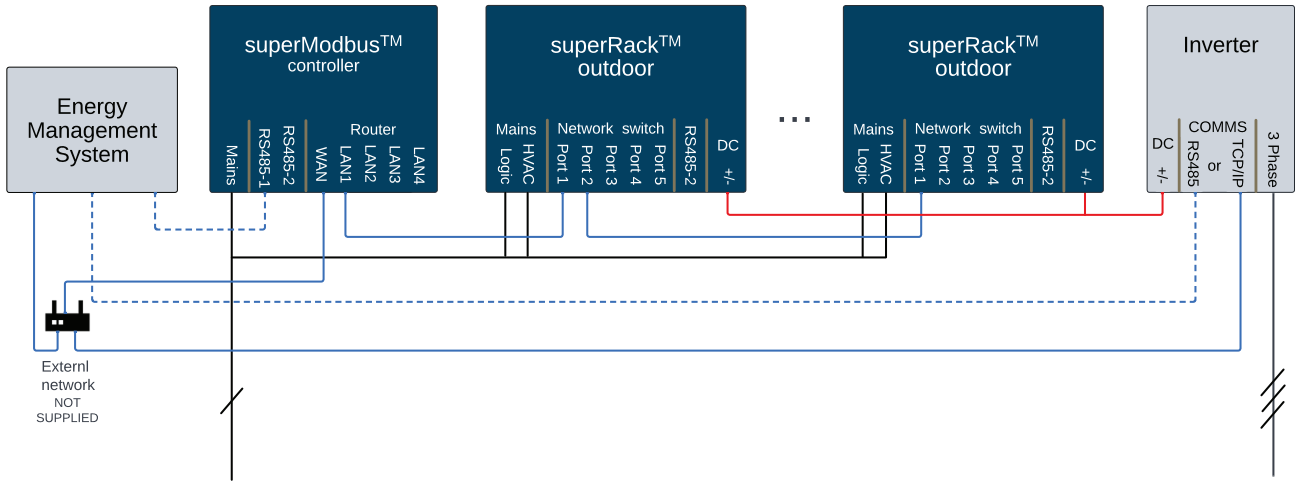
For more information on the communications requirements for superModbus please see 'Appendix D – Modbus protocol'.

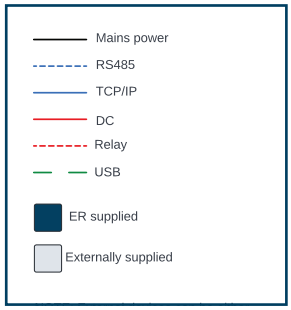
For comprehensive wiring instructions, refer to the superRack™ indoor or superRack™ outdoor installation manuals.

Example wiring superRack™ indoor with superModbus™



Example wiring superRack™ outdoor with superModbus™

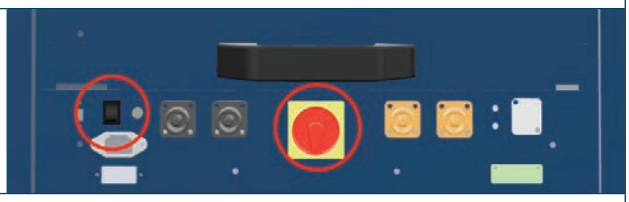




superRack™ indoor on/off procedures

If you are attempting an initial start of your system, you MUST book in a time for commissioning with Energy Renaissance. You MUST NOT leave the system on without having it commissioned by Energy Renaissance as this risks damaging your batteries and voiding your warranty.

On

1	Remove the switchgear cover.	
2	Turn on the rack isolating switch, and logic supply switches above the IEC cable on the rack. This should cause the rack LED to illuminate.	
3	Lastly turn on the circuit breaker for the secondary controller and superModbus™ controller.	
4	To confirm power to the superModbus™ and secondary controller there will be LEDs lit on the processor inside each enclosure.	

Note: If no LEDs are flashing, de-energise and check your installation manual to ensure all cabling connections are correct.

After powering up and initial site commissioning with Energy Renaissance is completed, the superModbus™ controller and secondary controller will be ready for integration and awaiting instruction from your energy management system (EMS).

For more information on EMS integration see 'Appendix D: Modbus protocol'.

On rack power up

1	System check: Rack LED is amber for about 1 s.
2	System waiting for rack-on command from the 3rd party EMS: Rack LED flashes red.

On rack-on command

1	Rack LED solid red (for about 10 s, whilst the below contactor sequence completes).
2	Negative contactor closes and check is made that current is zero (earth fault detection).
3	Pre-charge contactor closes for approximately 1 s: a. if PCS voltage equals battery voltage close positive contactor and open pre-charge contactor. b. else open precharge contactor, wait 60 s and try closing precharge contactor again (repeat step 3).
4	Rack LED solid green to indicate normal operation.
5	Refit the switchgear cover.

Note: The rack contactors will not close if there is a fault. If this happens the rack LED will go solid red.

Faults and warnings are reported in the user interface (UI) at superems.energyrenaissance.com and are described in 'Appendix A: Faults' and 'Appendix B: Warnings'.

See section 'Commissioning' to commission your system after every other start up.

Off

After receiving an off command the switchgear will open the contactors. Care needs to be taken that an off command isn't sent while there is current flow as this will damage the internals of the switchgear and can void your warranty.

Note:

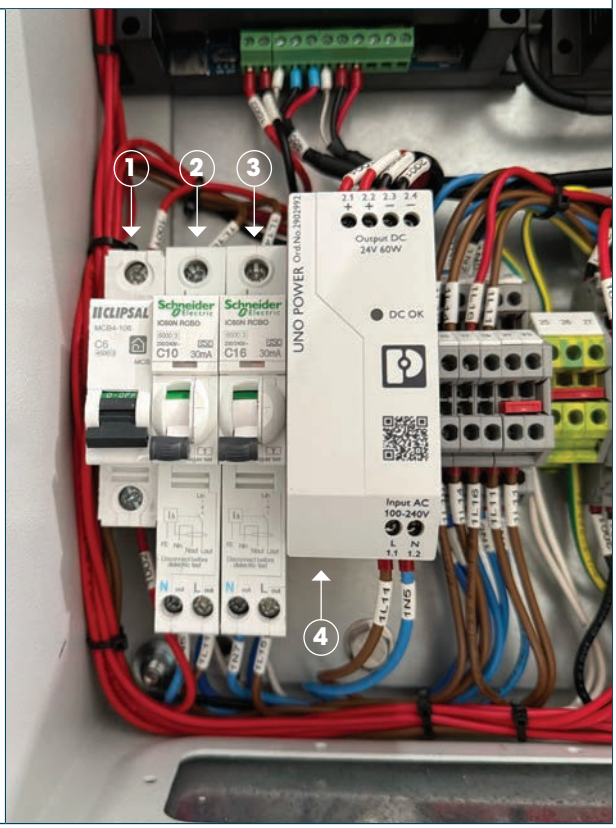
- Ensure before turning your system off that all superRack™'s are at a safe SoC level (above 30%)
- Removing power from the superModbus™ controller and/or secondary controller for extended periods can void warranty.
- DC voltage will remain at the battery terminals of the rack.

superRack™ outdoor on/off procedures

If you are attempting an initial start of your system, you MUST book in a time for commissioning with Energy Renaissance. You MUST NOT leave the system on without having it commissioned by Energy Renaissance as this risks damaging your batteries and voiding your warranty.

On

1	Turn on each secondary controller in each superRack™ outdoor.
2	Turn on the superModbus™ controller.
3	To confirm power, there will be LEDs lit on the controller's processor found within the superModbus™ controller and secondary controller enclosures. If no LEDs are flashing, check your installation manual to ensure all cabling connections are correct.
4	Turn on the logic and HVAC circuit breakers on your units top control enclosure. (1) secondary controller (2) logic (3) HVAC (4) PSU



After powering up and initial site commissioning with Energy Renaissance is completed, the superModbus™ and secondary controller will be ready for integration and awaiting instruction from your energy management system (EMS).

For more information on EMS integration see 'Appendix D: Modbus protocol'.

See section 'Commissioning' to commission your system after every other start up.

Off

After receiving an off command the switchgear will open the contactors. Care needs to be taken that an off command isn't sent while there is current flow as this will damage the internals of the switchgear and can void your warranty.

Note:

- Ensure before turning your system off that all superRack™'s within your outdoor unit are at a safe SoC level (above 30%)
- Removing power from the superModbus™ controller and/or secondary controller for extended periods can void warranty.
- DC voltage will remain at the battery terminals of the rack and your PV installation if fitted.

Operational compliance

As part of maintaining the health of your batteries and remaining compliant with the terms of your warranty the following conditions must be met:

- Contactors are only to be instructed to open when there is nil current flow
- Logic power only to be removed when there is nil current flow
- Isolator on switchgear to be turned off when there is nil current flow
- The max charge and discharge currents to be within limits stipulated by the Modbus registers in the protocol (see appendix E)
- A cell in any of your batteries are not to be left at or below 3V for longer then 6hrs
- A cell in any of your batteries are not to go below 2.5V or above 3.65V
- Monitoring of standby cell voltage when less then 10% SoC be maintained to ensure cells do not bleed to critical fault levels (2.5V as stated above) when stressed. Recommended top up of at least 30% SoC to be maintained for any standby periods.
- Do not over charge or discharge to critical fault levels causing the superRack™/s to open their contactors – this happens when the max charge and discharge currents are ignored.
- The difference between the minimum and maximum cell voltages in any superRack™ are less than 600mV to maintain operation and never go beyond 1000mV. This information can be found in your "log" section of the Energy Renaissance user interface (explained below). If your battery is reporting "Cell mV span – reduce current" the cell voltage differential is between 500 – 600mV and you will be required to charge the battery to reduce the cell voltage differential. If the user interface is reporting "Cell mV span – zero current" the cell voltage differential is between 600 – 1000mV and the max charge and discharge currents will report 0 but contactors will remain closed. If the user interface is reporting "Cell mV span fault" the cell voltage differential is above 1000mV.

Commissioning

For full explanations of your user interface please see section 'User Interface (UI) explanation' below.

1	Ensure all your electrical connections are correct, if not please review your installation manual for correct installation.
2	On your web browser go to: https://superems.energyrenaissance.com
3	Enter your email and password that was assigned to you as part of your installation documentation to log into the superModbus™ user interface. If you need a login or need to update your password contact Energy Renaissance on 1300 472 020, email service@energyrenaissance.com, or visit energyrenaissance.com/service to fill in a service and support form.
4	**My profile**: Contains your personal details including name, email, and mobile number.
5	**Sites**: Your site will automatically appear in a list once you are logged in. Your battery system will already be set up as a site. Click on your site to see your installation dashboard. You can return to your sites selection at any time by pressing the "sites" tab on the side menu.
6	On your **dashboard** under **"last seen"** you will see if you have a current network connection at your site. If there is a green tick your system is communicating with the server. If there is a red cross this indicates you have lost your network connection at the site and will need to be investigated. The "last seen" does not indicate if there is any other fault on your system, for information, warnings and faults click on your "log" tab. Please refer to 'Appendix A: Faults', 'Appendix B: Warnings' and 'Appendix C: Information' for explanations and possible rectifications.
7	On your **dashboard** under **"logs"** you will see any outstanding faults. There will be one entry for every initiated fault and another for every fault cleared.
8	**Settings:** Your battery system settings will be pre-populated. If any of these details are incorrect, including your time zone please contact Energy Renaissance on 1300 472 020, email service@energyrenaissance.com, or visit energyrenaissance.com/service to fill in a service and support form.

After completing the above steps if your system is still not operational, please contact Energy Renaissance on 1300 472 020, email service@energyrenaissance.com, or visit energyrenaissance.com/service to fill in a service and support form.

User Interface (UI) explanation

login screen

Open your web browser and enter superems.energyrenaissance.com

Here is where you enter your login details or access the demo site (top right button).

The 'energy renaissance' title or logo will take you to the main Energy Renaissance website where you can view company and product information.

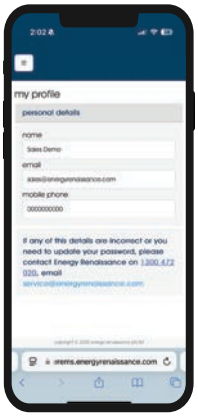
After entering your login information, please click the login button.

sites

After logging in you will automatically be directed to the 'sites' page.

Your sites will be listed, and their locations pinned on the map.

To view your specific site information, click on the site you wish to view, and you will be taken to that site's dashboard (see section dashboard below).

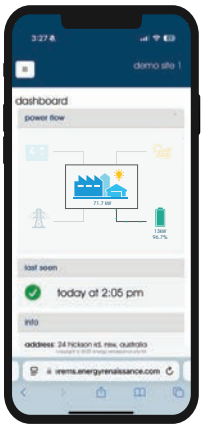


my profile

Clicking the 'my profile' in the menu will take you to user specific information.

Ensure these details are correct as your email address and mobile number are where alerts that are time sensitive will be sent you.

If you need to change your password or any other information, please contact Energy Renaissance on 1300 472 020, email service@energyrenaissance.com, or visit energyrenaissance.com/service to fill in a service and support form.



dashboard

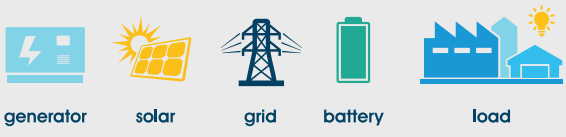
Once you have clicked on your site that you wish to view you will be directed to that site's dashboard.

This dashboard will only provide you with data relevant to the battery.

dashboard: power flow

In the 'power flow' section it gives you real time information about your battery.

See below for icon explanations.



Only the battery data will be shown, all other icons should be ignored

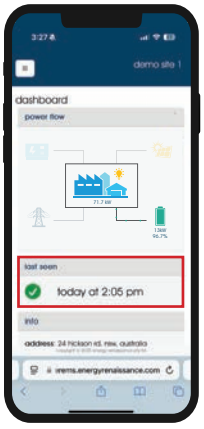
The value in kW below each icon indicates the real time power transfer.

Note:

Negative values for the battery indicate the battery is charging.

Positive values for the battery indicate the battery is discharging.

The % value below the battery gives the sites State of Charge (SoC) of the lowest battery in that installation.



dashboard: last seen

In the 'last seen' section you will be able to see if your system is currently online. If there is a green tick your system is communicating with the server. If there is a red cross, this indicates you have lost your network connection to the site and this will need to be investigated.

Note, this section does not show if there are any current other warnings or faults.

To view all information, warnings and faults, click on the 'log' tab on your menu.

Indications are as follows:

System Online

System Offline

dashboard: info

The 'info' section gives you the address, local time, and weather forecast information.

If any of these details are incorrect, including your local time, please contact Energy Renaissance on 1300 472 020, email service@energyrenaissance.com, or visit energyrenaissance.com/service to fill in a service and support form.

dashboard: pie charts

Scrolling down in your dashboard will bring you to your pie charts.

These can be filtered by day, week, month, year, or all time (from installation).

The 'battery' pie chart reflects the information provided by your in-rack battery management system (BMS - superBMS™).

Within the selected period it will display the energy that has been used to either charge or discharge your battery over a time scale.

Clicking/hovering over the segment or key will indicate the category and display the kWh usage.

dashboard: energy and SoC graph

The energy graph provides comparative information scaled by the same day, week, month etc information as above in the pie charts.

Your x-axis is your time scale, the LHS y-axis indicates your kWh and the RHS y-axis indicates your battery system's lowest State of Charge (SoC).

The legend at the top of the graph allows you to deselect or select based on what information you wish to view. When deselecting the y-axis will automatically scale to make the best use of the space.

The download icon will allow you to download a csv file showing the data record history for the selected time period.

Example 1:

Deselecting all in the legend to show only the battery discharged values.

Example 2:

Hovering over/ clicking the bars of the graph will give you more information relating to that time.

info

The info tab brings you to your site's information.

This information will come pre-populated.

If any of the information in this tab is incorrect, please contact Energy Renaissance on 1300 472 020, email service@energyrenaissance.com, or visit energyrenaissance.com/service to fill in a service and support form.

log

The log tab will give you details on past and present warnings, faults, and information.

You will see a type, code, date, date-time, and who the event was initiated by, this will be a system generated event which will alert you of which device within your system has initiated a notification.

Except for time, all the other criteria including date can be filtered by the drop-down menus at the top. The arrow beside each heading will arrange the history into either ascending or descending order.

The types of events are:

System Information is informative only and will not inhibit system operation. For more information on system information, see 'Appendix C: Information'.

System Warnings are noting that a condition is getting close to a fault but will not inhibit system operation themselves. For more information on system warnings, see 'Appendix B: Warnings'.

System Faults are to notify the user that the system is no longer in operation due to a fault. If your system is still in fault after you have completed the steps suggested to rectify the fault in 'Appendix A: Faults' please contact your installer.

The download icon will allow you to download a csv file showing the log of notifications for the selected time period.

Appendix A: Faults

Faults will inhibit operation. Contact a licenced electrician to investigate and rectify all faults before attempting operation.

Code	Fault	Description	How to rectify
superBMS™			
1000	Network connection	Your system has lost its connection to the internet.	Ensure your network is connected to your superModbus™.
1001	Cell mV high fault	One of the cells in your installation faulted on high cell voltage and opened the battery contactors - you will not be able to operate this superRack™/s until this fault is rectified.	If using a superModbus™ ensure you have protocols in place to stop charging before it reaches this fault level.
1002	Cell mV low fault	One of the cells in your installation faulted on low cell voltage and opened the battery contactors - you will not be able to operate this superRack™/s until this fault is rectified.	If using a superModbus™ ensure you have protocols in place to stop discharging before it reaches this fault level.
1003	Rack vol high fault	The total rack voltage of one of the racks in your installation faulted on high voltage and opened the battery contactors - you will not be able to operate this superRack™/s until this fault is rectified.	If using a superModbus™ ensure you have protocols in place to stop charging before it reaches this fault level.
1004	Rack vol low fault	The total rack voltage of one of the racks in your installation faulted on low voltage and opened the battery contactors - you will not be able to operate this superRack™/s until this fault is rectified.	If using a superModbus™ ensure you have protocols in place to stop discharging before it reaches this fault level.
1005	Charge over current high fault	You have charged the superRack™/s in your installation at a dangerously high current and the battery contactors have opened.	If using superModbus™ ensure you are following the max charge current recommendation.
1006	Discharge over current fault	You have discharged the superRack™/s in your installation at a dangerously high current and the battery contactors have opened.	If using superModbus™ ensure you are following the max discharge current recommendation.

Code	Fault	Description	How to rectify
superBMS™			
1007	Cell temp high fault	One of the cells in your superRack/s has reached a high temp fault.	If using superModbus™ ensure you follow the max charge and discharge recommendations as these will be reduced when cells get too hot to avoid overheating. Ensure you have adequate cooling in your installation.
1008	Cell temp low fault	One of the cells in your superRack™/s has reached a low temp fault.	Ensure you have adequate heating in your installation.
1013	Cell mV span fault	The cell voltage difference between any 2 cells in your superRack™/s is too large and caused a fault.	Contact your installer or Energy Renaissance.
1014	Cell temp span fault	The cell temperature difference between any 2 cells in your superRack™/s is too large and caused a fault.	If using superModbus™ ensure you are following the max charge and discharge current recommendation as this can regulate temperature. Ensure you have adaquate ventillation and cooling in your installation.
1020	Pack fault	There is a fault in one of your packs in your installation.	Contact your installer or Energy Renaissance.
1021	Isolating switch open	Your isolating switch and/or e-stop is open.	Close your isolation switch and/or e-stop.
1022	Contactor error	There is a fault with one or more contactors in your superRack™/s. Expanded in fault codes 1026, 1027 and 1028.	Contact your installer or Energy Renaissance.
1023	Communication error with pack	There is a communication error with one or more of the packs in your superRack™/s.	Contact your installer or Energy Renaissance.
1024	Battery mismatch	The sum of the cell voltages has a difference greater then 20V to the battery voltage or, the amount of counted packs is different to the allocated packs.	Contact your installer or Energy Renaissance.
1025	Permanent lockout	One or more of your superRack™s have gotten to dangerous fault levels and you are now permanently locked out of operating your rack/s.	Contact your installer or Energy Renaissance.

Code	Fault	Description	How to rectify
superBMS™			
1026	Voltage drop across contactors incorrect	The voltage drop across one or more of the contactors for your superRack™ is not correct for the driven state.	Contact your installer or Energy Renaissance.
1027	Current through contactor is not correct	The current through one or more of the contactors for your superRack™ is not correct for the driven state.	Contact your installer or Energy Renaissance.
1028	Feedback from contactor is not correct	The feedback from one or more of the contactors for your superRack™ is not correct for the driven state.	Contact your installer or Energy Renaissance.
1029	Permanent lockout current	One or more of your superRack™s are reading a reporting an earth leakage fault.	Contact your installer or Energy Renaissance.
superModbus™			
1090	No EMS data for 24 h	External EMS has not communicated to the superModbus™ for 24 h.	Check your internet connection.
1091	No EMS data timeout	External EMS has not communicated to the superModbus™ for 3 seconds and system shutdown.	Check your communication connections.
1092	No data between ER devices	A secondary controller has not communicated with the superModbus™ and has shut down.	Check the communication connections between your ER devices

Appendix B: Warnings

Warnings will not inhibit operation but will likely derate your unit while in operation until warnings have been cleared. Some warnings are part of standard operation i.e., cell voltage warnings and require no action, other warnings if frequent could be cause for investigation i.e., operating temperatures.

Code	Warning	Description	How to rectify
superBMS™			
1101	Cell mV high - Reduce current	One of the cells in your installation has reached a threshold to start reducing the charging current. This is a warning only and wont inhibit operation of the battery system.	Follow the max charge/discharge rates.
1102	Cell mV low - Reduce current	One of the cells in your installation has reached a threshold to start reducing the discharging current. This is a warning only and wont inhibit operation of the battery system.	Follow the max charge/discharge rates.
1103	Rack vol high - Reduce current	The total voltage of your installation has reached a threshold to start reducing the charging current. This is a warning only and wont inhibit operation of the battery system.	Follow the max charge/discharge rates.
1104	Rack vol low - Reduce current	The total voltage of your installation has reached a threshold to start reducing the discharging current. This is a warning only and wont inhibit operation of the battery system.	Follow the max charge/discharge rates.
1105	Charge over current high - Reduce current	The charging current is above the recommended charging current.	Follow the max charge/discharge rates.
1106	Discharge over current - Reduce current	The discharging current is above the recommended charging current.	Follow the max charge/discharge rates.
1107	Cell temp high - Reduce current	One of the cells in your installation has reached a temperature threshold and you are required to reduce the charging/ discharging current.	Follow the max charge/discharge rates.

Code	Warning	Description	How to rectify
superBMS™			
1108	Cell temp low - Reduce current	One of the cells in your installation has reached a temperature threshold and you are required to reduce the charging/ discharging current.	Follow the max charge/discharge rates.
1111	SOC low	The SoC of one of your batteries in the installation is below 10%.	Follow the max charge/discharge rates.
1112	SOC high	The SoC of one of your batteries in the installation is above 90%.	Follow the max charge/discharge rates.
1113	Cell mV span - Reduce current	There is a voltage difference between 2 cells in your superRack™ have reached a threshold that requires you to reduce the charging/ discharging current.	If using superModbus™ ensure you are following the max charge and discharge current recommendation and frequently charge your superRack™/s to ensure balancing.
1114	Cell temp span - Reduce current	There is a temperature difference between 2 cells in your superRack™ that have reached a threshold that requires you to reduce the charging/discharging current.	Follow the max charge/discharge rates.
1121	Cell mV high - Zero current	One of the cells in your installation has reached a threshold that requires you to stop charging.	Stop charging.
1122	Cell mV low - Zero current	One of the cells in your installation has reached a threshold that requires you to stop discharging.	Stop discharging.
1123	Rack vol high - Zero current	The total superRack voltage in your installation has reached a threshold that requires you to stop charging.	Stop charging.
1124	Rack vol low - Zero current	The total superRack™ voltage in your installation has reached a threshold that requires you to stop discharging.	Stop discharging.
1125	charge over current high - Zero current	The charging current is above the recommended charging current.	Follow the max charge/discharge rates.
1126	Discharge over current - Zero current	The discharging current is above the recommended charging current.	Follow the max charge/discharge rates.

Code	Warning	Description	How to rectify
superBMS™			
1127	Cell temp high - Zero current	One of the cells in your installation has reached a temperature threshold and you are required to stop charging/ discharging current.	Follow the max charge/discharge rates.
1128	Cell temp low - Zero current	One of the cells in your installation has reached a temperature threshold and you are required to stop charging/ discharging current.	Follow the max charge/discharge rates.
1133	Cell mV span - Zero current	There is a voltage difference between 2 cells in your superRack™ have reached a threshold that requires you to stop charging/ discharging.	If using superModbus™ you can open the battery contactors for 24hrs to see if the lowest cell recovers, if this fails contact your installer or Energy Renaissance.
1134	Cell temp span - Zero current	There is a temperature difference between 2 cells in your superRack™ have reached a threshold that requires you to stop charging/ discharging.	Follow the max charge/discharge rates.
1140	Temp lockout	Your superRack™ is in a temporary lockout due to soft start failure.	You are not required to do anything, your superRack™ will re-attempt to close every minute.
1141	Maintenance	Your rack is in maintenance mode.	Contact Energy Renaissance.
superModbus™			
1190	No EMS data for 1 h	EMS has not written data for 1 h.	Check your internet connection.

Appendix C: Information

Code	Information	Description
superModbus™		
1201	On instruction	The superModbus has received an "on" instruction
1202	Contactors closed	The contactors closed on 1 or more of your superRack™s
1203	Off instruction	The superModbus has received an "off" instruction
1204	Contactors open	The contactors opened on 1 or more of your superRack™s
1205	Info	Info

Appendix D: Modbus protocol

The following Modbus mapping is to be used for real time data accessibility for operational monitoring and diagnostics.

All faults and warnings reported by the superModbus™ can be found in the Energy Renaissance UI as described in "log" under the user interface (UI) explanation section with further descriptions in Appendix A, B and C.

Notes	
1	The protocol described is for one or more superRacks™ that are DC connected only and does not support control or reporting of anything else at all, e.g. no inverter control nor reporting.
2	The purpose of the protocol is for when clients want a DC coupled bank of superRack™s and want to use their own EMS to control all other site devices.
3	The data provided by this interface is a summary across all the superRacks™ that make up the bank.
4	Each rack in the bank has the same number of packs.
5	The Energy Renaissance UI functions as normal, however you can't schedule events and you can't obtain history records about anything other than the racks (i.e. no inverter data etc.).
6	Both superModbus™s and secondary(s) controllers are present, but only used for reporting. The superModbus™ does not provide any control functions other than turning the racks on or off.
7	The superModbus™ acts as a Modbus Server (a.k.a. secondary, a.k.a. follower), i.e. another device polls the superModbus™ for the information.
8	The Modbus ID is 145. When used over ethernet the IP address is set static via your router.
9	The hardware protocol is either: A. RTU (RS485), in particular port RS485-1 on superModbus™, baud = 9600, one start bit, one stop bit, 8 data bits, and no parity. Or B. TCP. Both are simultaneously active.
10	The common hexadecimal notations 0xXX (8 bit unsigned integer) and 0xXXXX (16 bit unsigned integer) are used.
11	Addressing is fraught in Modbus because many standards exist; the addresses written below are in hex and dec and are zero biased, i.e. what is sent down the wire.
12	A further address complication, in addition to 0 or 1 offset discussed above, is that in some documents a Holding Register is prefixed with 4 (Input 3, etc.), e.g. address 0x0000 below is written as 400001.
13	Another area of difficulty with Modbus addressing is that there are 4 separate address spaces, e.g. Input is space 3 and Holding 4, to prevent confusion unique addresses are used (even if this is not necessary because of different address spaces).
14	Finally the naming of addresses as Input and Holding isn't informative, think of them as read-only and read-write respectively.
15	For reading input registers, 0x0010 onward, only function code, FC, 0x04 Read Multiple Input Registers is supported.
16	For reading holding registers, 0x000 to 0x000F, only function code, FC, 0x03 Read Multiple Holding Registers is supported.
17	For writing holding registers, 0x000 to 0x000F, only function code, FC, 0x10 Write Multiple Holding Registers is supported.
18	All registers are 16 bit unsigned integers (except `current` and `temp`, which are signed integers, two-complement), in usual Modbus Big-Endian format.
19	The bits of the registers, n, are numbered 0 to 15 and have the integer value 2^n (except `current` & `temp` which is a signed, twos-complement integer).
20	If incorrect values are written, or if CRC errors occur; standard Modbus errors are used.

Notes	
21	If incorrect addresses are used, see comments in table below for behaviour.
22	If a command completes successfully the standard Modbus response or acknowledgement is generated.
23	A useful Modbus reference, including flowcharts documenting responses and errors, is: https://ozeki.hu/p_5873-modbus-function-codes.html
24	An easy introduction to Modbus is: https://www.automation.com/en-us/articles/2012-1/introduction-to-modbus
25	Code that implements this interface uses variable names as specified in Name column and for class names the headings control, information, and status (this simplifies documentation).
26	In the document when it says a notification is sent these are available on the Energy Renaissance UI via the Log.

Address (hex)	Address (dec)	Name	Description
Read or write Holding registers (FC = 0x10 - write & FC = 0x03 - read) control (checked once per second)			
0x0000	0	on_off	Write 0x0000 to turn off bank (start up state).
			Write 0x0001 to turn on bank.
			Before turning off the bank the current should be reduced to zero to prevent excessive ware on DC contactors.
			If there are no Modbus communication (any valid register) for 10 seconds then 0x0000 is automatically written to this register, thus turning the bank off.
			See read register 0x0030 (`n_c`) for current number of connected racks (`n_c` accounts for faults and time delays whereas `on_off` doesn't).
			Reading this register just gives the last value written to it; as noted above, 0x0030 (`n_c`) gives the number of racks actually connected.
			Every time a new value is written to `on_off` a notification is sent (this includes if a 0 is written because of a comms timeout).
			If the value does not change with a write no notification is issued, e.g. if already 0 and 0 written then no notification (this includes if a 0 is written because of a comms timeout).
			The notification for a comms timeout is distinct from a normal write.

Address (hex)	Address (dec)	Name	Description
Read only Input registers (FC = 0x04) information (does not change with time)			
0x0010	16	v_16_31	Bits 8-15 = X3 and bits 0 to 7 = X2 of software version number vX3.X2.X1.X0. Increment in X3 = incompatible change, X2 = new feature, X1 = bug fix, and X0 = dev release.
0x0011	17	v_0_15	Bits 8-15 = X1 and bits 0 to 7 = X0 of software version number vX3.X2.X1.X0. Increment in X3 = incompatible change, X2 = new feature, X1 = bug fix, and X0 = dev release.
0x0012	18	id_high	Unique site ID - High ID bits 16 to 31.
0x0013	19	id_low	Unique site ID - Low ID bits 0 to 15.
0x0014	20	n_r	Number of racks in bank.
0x0015	21	nom_trip_ current	Current amplitude (either positive or negative and with all racks connected) above which the bank will trip in amps (typically 80 A per rack).
0x0016	22	nom_ capacity	As new bank capacity when all racks are connected in amp hours (typically 100 Ah per rack).
0x0017	23	min_volts	Lowest operating bank voltage in volts (will be operating at zero discharge current at this voltage).
			Typically 64.8 V per pack (all racks in a bank have the same number of packs).
			Zero discharge current may occur before this voltage is reached, for example if an individual cell is low on voltage or an individual cell is hot.
0x0018	24	nom_volts	Nominal bank voltage in volts.
			Typically 76.8 V per pack (all racks in a bank have the same number of packs).
0x0019	25	max_volts	Highest operating bank voltage in volts (will be operating at zero charge current at this voltage).
			Typically 87.6 V per pack (all racks in a bank have the same number of packs).
0x001A	26	nom_current	The rated bank current in amps when all racks are connected (typically 50 A per rack).
			Bank C-rate in per hour can be calculated as `nom_current / nom_capacity` (typically 0.5 / h).
status (changes in realtime - updated once per second)			

Address (hex)	Address (dec)	Name	Description
0x0030	48	n_c	Number of racks connected.
			There is typically a 60 s delay from asking the racks to turn on (0x0000 - `on_off`) to the 1st rack turning on.
			All racks may take as long as 10 minutes to connect.
			Turning racks off is much quicker (no soft start procedure) than turning on, but still typically a few seconds.
			When a rack's contactor closes or opens a notification is sent.
			Racks with faults will not close their contactor, racks with warnings will.
0x0031	49	n_w	Total number of warnings across all racks.
			Racks can have a warning when not connected.
			When a rack issues or clears a warning a notification is sent.
			Warnings clear when the cause of the warning, e.g. close to too hot, ceases and they do not cause rack contactors to open.
			`n_w` is always available, whether racks are connected or not.
			To stay within Warranty a bank's worst case cell needs to be above 2.5 V at all times, it is therefore recommended that every 6 h notifications for low-cell voltages are checked.
0x0032	50	n_f	Total number of faults across all racks.
			Racks can have a fault when not connected.
			When a rack issues a fault or a fault is cleared after a restart a notification is sent.
			A fault causes contactors to open, so a contactor open notification is also sent.
			Faults clear when the cause of the fault, e.g. too hot, ceases, but they do not auto close the rack contactors and these will require closing again by instructing all racks to turn on (`on_off`).
			The bank will continue to operate in reduced capacity if there are some but not all racks in fault.
0x0033	51	max_charge	Max recommended current to charge at in amps (typically 50 A per rack connected).
			Transiently this value may be exceeded, however doing so will eventually trigger a warning and then a fault caused by overheating/ overcharging/over-discharging/etc.

Address (hex)	Address (dec)	Name	Description
0x0033	51	max_charge	See `nom_trip_current` above, which absolutely limits this current.
			if connected rack have max charge currents `i_cs(x)`, then `max_charge = n_c * min(i_cs(0), …, i_cs(n_c-1))` A.
			If no racks are connected the maximum charge current is 0 A.
			The state of charge power, SoCP, is `max_charge * volts / 1_000` kW.
			If `max_charge < nom_current * n_c / n_r` then other generating sources, e.g. a PV, should be turned off because the bank is close to full. A warning notification is logged.
0x0034	52	max_ discharge	Max recommended current to discharge at in amps (typically 50 A per rack connected).
			Transiently this value may be exceeded, however doing so will eventually trigger a warning and then a fault caused by overheating/ overcharging/over-discharging/etc.
			See `nom_trip_current` above, which absolutely limits this current.
			If connected racks have max discharge currents `i_ds(x)`, then `max_discharge = n_c * min(i_ds(0), …, i_ds(n_c-1))` A.
			If no racks are connected the maximum discharge current is 0 A.
			The state of discharge power, SoDP, is `max_ discharge * volts / 1_000` kW.
			If `max_discharge < nom_current * n_c / n_r` then other generating sources, e.g. a generator, should be turned on because the bank is close to empty. A warning notification is logged.
0x0035	53	current	The bank current in amps.
			16 bit, two's compliment, signed integer.
			If connected racks have currents `i_s(x)` then `current = sum(i_s(0), …, i_s(n_c-1))` A.
			If no racks are connected the current is 0A.
			A negative number indicates that the bank is charging.
			A positive number indicates that the bank is discharching.
0x0036	54	volts	The connected racks' voltage in volts (typically 76.8 V per pack) as measured on the output/ PCS/load terminals (not input/battery terminal voltage).
			All the racks are connected in parallel, so the voltage of all the racks is the same.

Address (hex)	Address (dec)	Name	Description
0x0036	54	volts	In practice there will be some measurement error; for each connected rack the voltage is `v_s(x)`, `voltage = mean(v_s(0), …, v_s(n_c-1))`.
			If no racks are connected, then the voltage is zero.
0x0037	55	soc	State of charge (SoC), as a %.
			If connected racks have SoCs `soc_s(x)`, then `soc = min(soc_s(0), …, soc_s(n_c-1))` %.
			If no racks are connected, then `soc = 0` %.
			SoC is provided for information only, use `max_charge` and `max_discharge` for control (they embody much more information like temperature, well beyond SoC alone).
0x0038	56	soh	The state of health (SoH), expressed as a %, is `soh = capacity / nom_capacity * 100` %.
			If connected racks have individual SoHs `soh_s(x)`, then `soh = min(soh_s(0), …, soh_s(n_c-1))` %.
			If no racks are connected, then `soh = 0` %.
			The capacity of the bank is `nom_capacity * soh / 100` Ah.
			State of Energy (SoE) for when at least one rack is connected is `soe = n_c * soc / 100 * nom_capacity * soh / 100 * volts / 1_000` kWh.
0x0039	57	min_cell_voltage	Minimum bank cell voltage in mV.
			If connected racks have min cell voltages `mincv_s(x)`, then `min_cell_voltage = min(mincv_s(0), ..., mincv_s(n_c-1))` mV.
			If no racks are connected, then `min_cell_voltage = 0` mV.
			Notifications for low cell voltage are still sent, it is recommended that these are checked at least once every 6 h to stay within Warranty.
0x003A	58	max_cell_voltage	Maximum bank cell voltage in mV.
			If connected racks have max cell voltages `maxcv_s(x)`, then `max_cell_voltage = max(maxcv_s(0), ..., maxcv_s(n_c-1))` mV.
			If no racks are connected, then `max_cell_voltage = 0` mV.
0x003B	59	temp	Average bank cell temperature in °C.
			16 bit, two's compliment, signed integer.
			If connected racks have average temps `avgtemp_s(x)`, then `temp = mean(avgtemp_s(0), ..., avgtemp_s(n_c-1))`°C.
			If no racks are connected, then `temp = 0` °C.

Address (hex)	Address (dec)	Name	Description
0x003C	60	min_cell_ temp	Minimum bank cell temperature in °C.
			16 bit, two's compliment, signed integer.
			If connected racks have min cell temps `minct_s(x)`, then `min_cell_temp = min(minct_s(0), ..., minct_s(n_c-1))`°C.
			If no racks are connected, then `min_cell_temp = 0` °C.
0x003D	61	max_cell_ temp	Maximum bank cell temperature in °C.
			16 bit, two's compliment, signed integer.
			If connected racks have max cell temps `maxct_s(x)`, then `max_cell_temp = max(maxct_s(0), ..., maxct_s(n_c-1))`°C.
			If no racks are connected, then `max_cell_temp = 0` °C.
0x003E	62	heartbeat	A counter that increments every second.
			Counter is an unsigned 16 bit integer and overflows back to 0.
			The purpose of the counter is to indicate the superModbus™ code is still operating correctly (system might have faults etc. but code is still operating as expected).
			The initial value, at start-up, can be any value, therefore test that value read is different to previous value read to check that superModbus™ is 'still-alive'.

contact

Renaissance One
7 Epsom Drive
Tomago, NSW 2322, AU

Contact HELP Number (Australia)
1300 472 020

energyrenaissance.com/service

energy renaissance