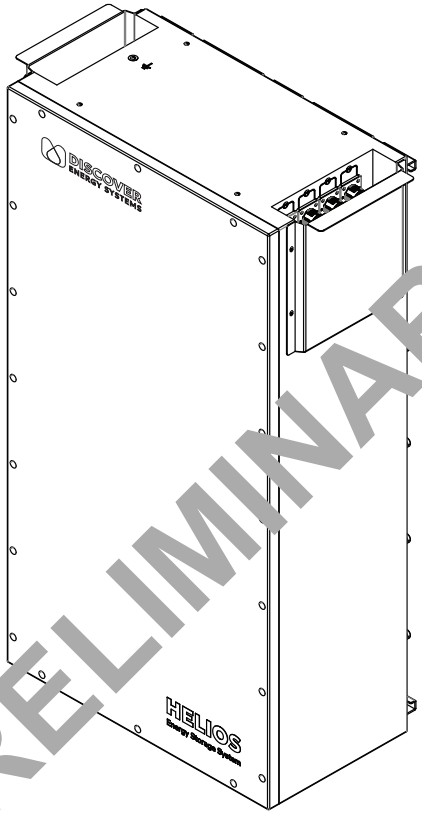
DISCOVER
ENERGY SYSTEMS



HELIOS ESS INSTALLATION AND OPERATION MANUAL

BATTERY MODEL

52-48-16000 | 900-0077

805-0090 REV A

Introduction

A battery from Discover Energy Systems (Discover), the HELIOS ESS is a high-capacity, low-voltage battery that can operate independently or in a battery bank configuration where multiple batteries are connected in parallel.

1. AUDIENCE, MESSAGES, WARNINGS, GENERAL SAFETY, PERSONAL PROTECTIVE EQUIPMENT

1.1 Audience

Configuration, installation, service, and operating tasks should only be performed by qualified personnel in consultation with local authorities having jurisdiction and authorized dealers. Qualified personnel should have training, knowledge, and experience in:

- Installing electrical equipment
- Applying applicable installation codes
- Analyzing and reducing hazards involved in performing electrical work
- Installing and configuring batteries
- Installing and configuring systems activated by relays

1.2 Warning, Caution, Notice, and Note Messages

Messages in this manual are formatted according to this structure.

Additional information concerning important procedures and features of the product. Read all the instructions before installation, operation, and maintenance.

Important information regarding hazardous conditions.

⚠ WARNING

Important information regarding hazardous conditions that may result in personal injury or death.

⚠ CAUTION

Important information regarding hazardous conditions that may result in personal injury.

NOTICE

Important information regarding conditions that may damage the equipment but not result in personal injury.

NOTE

Ad hoc information concerning important procedures and features unrelated to personal injury or equipment damage.

1.3 General Warnings

Do not crush, disassemble or dispose of the battery in fire or the garbage.

This product is made of recyclable materials and must be recycled.

⚠ WARNING

ELECTRIC SHOCK AND FIRE HAZARD

- This equipment must only be installed as specified.
- Connect the battery to isolated Power Conversion Systems (PCS) only.
- Do not install the battery in series.
- Do not disassemble or modify the battery.
- If there is damage to the battery case, do not touch exposed contents.
- There are no user-serviceable parts inside.

Failure to follow these instructions may result in death or serious injury.

⚠ WARNING

CHEMICAL HAZARD

Do not touch the exposed contents of a Lithium cell.

Failure to follow these instructions may result in death or serious injury.

⚠ WARNING

ELECTRIC SHOCK AND FIRE HAZARD

Do not lay tools or other metal parts across the terminals.

Failure to follow these instructions may result in death or serious injury.

⚠ CAUTION

HEAVY OBJECT

Two-person or three-person lift is recommended for the battery.

Failure to follow these instructions may result in injury.

⚠ CAUTION

ELECTRIC SHOCK HAZARD

- Do not touch the energized surfaces of any electrical component in the battery system.
- Before servicing the battery, follow all procedures to fully de-energize the battery system.
- Follow the Safe Handling Procedures below when working with the battery.

Failure to follow these instructions may result in injury.

1.4 Safe Handling Procedures

Before using the battery, read all instructions and cautionary markings on the unit and all appropriate sections of this manual.

- Use appropriate personal protective equipment when working with batteries.
- Do not dispose of the battery in a fire.
- Promptly dispose of or recycle used batteries following local regulations.
- Do not disassemble, open, crush, bend, deform, puncture or shred.
- Do not modify, re-manufacture, or attempt to insert foreign objects into the battery, immerse or expose the battery to water or other liquids, fire, explosion, or other hazards. If the user suspects damage to the battery due to water, heat, or other reason, take it to a service center for inspection.
- The battery should only be used for its intended purpose.
- Do not lift or carry the battery while in operation.
- The battery is heavy. When lifting the battery, follow appropriate standards.
- Only lift, move, or mount following local regulations.
- Take care when handling battery terminals and cabling.
- Do not expose the battery to high temperatures.
- Do not submerge the battery.
- Install the battery only in the orientation specified in this manual.
- Only use the battery with a charging system that meets specifications. Using a battery or charger that does not meet specifications may present a risk of fire, explosion, leakage, or other hazards.
- Do not short-circuit a battery or allow metallic conductive objects to contact battery terminals.
- Replace the battery with only another battery that meets the specifications of the system. Using a battery that does not meet specifications may present a risk of fire, explosion, leakage, or other hazards.
- Do not drop the device or battery. If the device or battery is dropped, especially on a hard surface, and the user suspects damage, take it to a service center for inspection.

1.5 Personal Protective Equipment

When handling or working near a battery:

- Use appropriate Personal Protective Equipment, including clothing, glasses, insulated gloves, and boots.
- Do not wear metal rings, watches, bracelets, or necklaces.

1.6 Emergency Procedure

Unusual Odor

- If there is a burning smell
  - Turn OFF the power conversion equipment.
  - Call the installer and schedule an immediate inspection.

Fire

- If there is smoke or other signs of fire:
  - Call 911 (or the emergency phone number in your area).
  - If there is an emergency STOP button, press it to shut down the system.
- Do not attempt to put out the fire.
- Do not spray water or other fire retardants.

2. ITEMS SHIPPED IN THE BOX

Confirm the contents of the box. Discover Power is its best to maintain quality and accuracy in the shipment of its products. If anything is damaged or missing, please contact customer support immediately.

Table 2-1, HELIOS ESS Box Contents

Items	Description
1	Battery
1	HELIOS ESS Installation and Operation Manual
2	CAT6 Cable (1.5 m, 59 inch)
1	Wall-mount bracket
2	Rope handle

3. SPECIFICATIONS

All specifications in this document are published @25°C / 77°F.

3.1 Electrical Specifications

Table 3-1, HELIOS ESS Electrical Specifications

Electrical Specifications	52-48-16000 | 900-0077
Nominal Voltage	51.2 V
Energy	16,080 Wh
Nominal Capacity	314 Ah
Charge Bulk Voltage - Bulk Vdc	55.2 – 56.8 V
Charge Absorption Voltage - U1 MAX	55.2 – 5[illegible] V
Charge Float Voltage - U2	[illegible] V
Charge Termination Current [a]	[illegible] A
Low Voltage Disconnect Recommended	48.0 V
Low Voltage Disconnect [b]	43.2 V
Max Continuous Charge Current [c]	200 A
Max Continuous Discharge Current [c]	200 A
Peak Discharge Current (15 seconds)	300 A RMS
Self Discharge Current (operation)	≤ 25 mA
Self Discharge Current (battery OFF)	≤ 4 mA
Breaker	Single-Pole (positive only) 200 A breaker (CVP-RH-P2BD5-D200-LT)
Maximum short circuit fault current (IBF / ½ IBF)	4.92 kA (500 ms) / 2.46 kA (500 ms)
Arc Flash Incident Energy IEm	1.064 Cal/cm^2
Arc Flash Incident Energy AFB	239 mm (9.41 in)

[a] Charge termination current is permitted to be less than specified.
[b] Low Voltage Disconnect is based on 2.7 VPC under load. In no load conditions, do not allow the battery to self-discharge below 3.0 VPC.
[c] The max continuous charge and discharge currents are the ratings for a full charge and discharge cycle with no rest and without tripping overtemperature protection at 25°C (77°F) ambient.

NOTE
Reduce the charge termination current to increase the time available for the internal balancing function.

3.2 Mechanical Specifications

Table 3-2, HELIOS ESS Mechanical Specifications

Mechanical Specifications	**52-48-16000 | 900-0077**
Chemistry	$LiFePO_4$
Height	900 mm (35.43 in)
Width	465 mm (18.31 in)
Depth (body only)	247 mm (9.72 in)
Depth (including Wall-Mount bracket)	271 mm (10.7 in)
Terminal	Quick Connect Plug and Pull Terminal
Weight	136 kg (299.83 lb)
Shipping Weight (includes Wall-Mount Bracket, cables, bolts, and rope handles)	150 kg (330.7 lb)
IP Rating	IP65
Case Material	Galvanized Steel Sheet
Color	Pantone Gray 3C

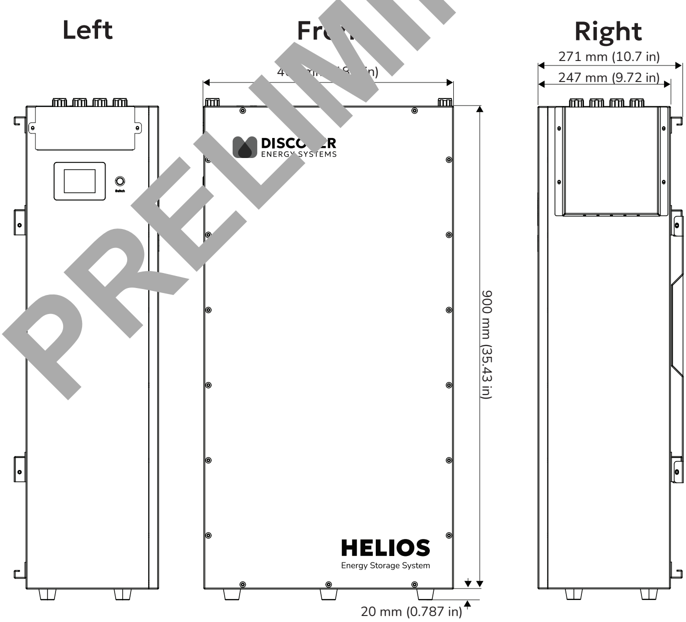


Figure 1. HELIOS ESS Battery Dimensions

Table 3-3, HELIOS ESS Wall-Mount Bracket Specifications

Specifications	Wall-Mount Bracket
Height	497 mm (19.57 in)
Width	363 mm (14.29 in)
Depth	22 mm (0.87 in)
Weight	3.8 kg (8.4 lb)
Material	Galvanized Steel Sheet

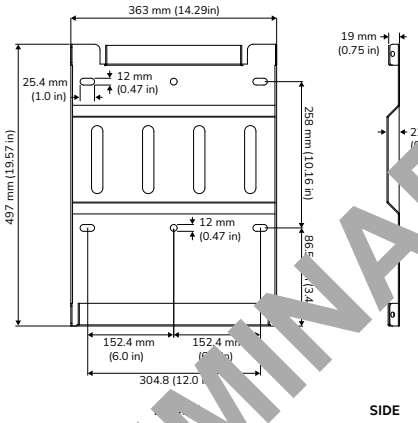


Figure 2. W[illegible]t Bracket Dimensions

3.3 Environmental Specifications

Table 3-4, HELIOS ESS Environmental Specifications

Environmental Specifications	52-48-16000 | 900-0077
Rated Altitude	Altitude of up to 2,000 m (6,561 ft) does not affect operating characteristics
Relative Humidity	5 to 95% (Non-condensing)
Charge Operating Temperature Range [b][c]	4°C to 55°C (39.2°F to 131°F)
Discharge Operating Temperature Range [b]	-25°C to 55°C (-13°F to 131°F)
Internal Heater Operating Temperature Range [d]	-25°C to 8°C (-13°F to 46.4°F)
Storage Temperature (1 month) [e]	-20°C to 55°C (-4°F to 131°F)
Storage Temperature (6 months) [e]	-10°C to 30°C (14°F to 86°F)

[a] Consider reducing charge parameters on power conversion equipment at higher altitudes.

[b] Specifies the temperature of the cells and not the ambient temperature. Ambient temperature and cell temperature may not be the same.

[c] Although the Battery Management System (BMS) does not allow charging when cells are below 4°C (39.2°F), the battery has a heater that warms the battery to a temperature that enables charging to resume at 4°C (39.2°F).

[d] When the HELIOS ESS battery cells are between -25°C (-13°F) and 5°C (41°F) and either connected to a charging source or the battery SOC is 50% or more, energy is diverted to the internal heater until the battery reaches 8°C (46.4°F).

[e] Storage outside of specified temperatures will result in permanent capacity loss and void the warranty.

3.4 Protection Specifications

Table 3-5, HELIOS ESS Protection Specifications

Protection Specifications	52-48-16000 | 900-0077
Overvoltage	
Protection [a]	Above 58.08 V for 3 seconds
Recovery [a]	Recovery after 120 seconds and less than 55.2 V
Undervoltage	
Protection [b]	Less than 43.2 V for 5 seconds
Recovery [b]	No automatic recovery. The battery shuts down after 120 seconds.
Over-Charge Current	
Protection	Greater than 200 A for 10 seconds
Recovery	Remove source. Recovery after 120 seconds
Over-Discharge Current	
Protection [c]	Greater than 200 A for 15 seconds
Recovery [c]	Remove load. Recovery after 120 seconds
Over-temperature in Charge	
Protection [d]	Cell temperature above 55°C (131°F) for 5 seconds
Recovery [d]	Cell temperature below 51°C (123.8°F)
Under-temperature in Charge	
Protection [d]	Cell temperature below 4°C (39.2°F) for 5 seconds and charge current detected.
Recovery [d]	Recovery after 120 seconds and cell temperature 4°C (39.2°F) or higher. Note: Discharge is available to -25°C (-13°F).
Over-temperature in Discharge	
Protection [d]	Cell temperature above 55°C (131°F) for 5 seconds
Recovery [d]	Cell temperature below 51°C (123.8°F)
Under-temperature in Discharge	
Protection [d]	Cell temperature below -25°C (-13°F) for 5 seconds
Recovery [d]	Cell temperature above -23°C (-9.4°F)
Load Qualification Protection	
Protection	Mixed System Voltage, Short Circuit, Reverse Polarity, Input Capacitance Overload
Recovery	Re-qualify after 120 seconds. After ten failed attempts to qualify, the battery switches OFF.

Protection Specifications	52-48-16000 | 900-0077

(a) Overvoltage protection monitors individual cell voltages. Protection is triggered when any cell is over 3.63 VPC and recovers when all cells are below 3.45 VPC for 120 seconds. Voltages are provided for guidance only.

(b) Undervoltage protection monitors the voltage of individual cells. Protection is triggered, and the battery is set to OFF when any cell is at or below 2.7 VPC. Manually set the battery ON to recover. Voltages are provided for guidance only.

(c) For time versus current interrupt details, refer to Figure 3. Over-Discharge Protection Time Curve.

(d) Specifies the temperature of the cells and not the ambient temperature. Ambient temperature and cell temperature may not be the same.

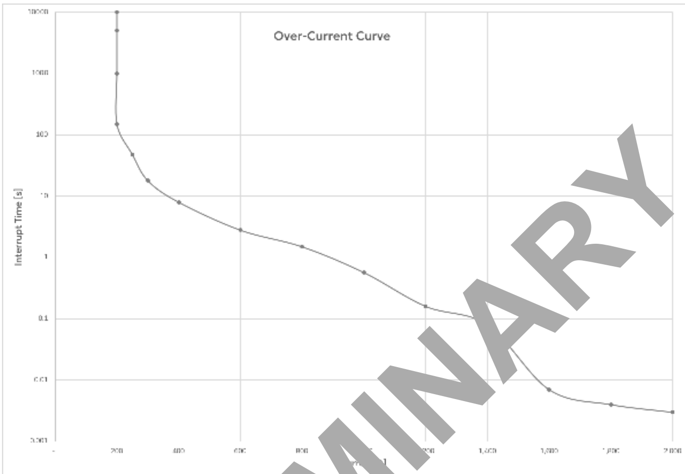


Figure 3. Breaker Protection Time Curve

3.4.1 Breaker Delay Specifications

Table 3-7, Breaker Delay

Rating [%]	Current	Delay Time (seconds) [1]
100	200 A	Breaker should not trip
100 - 125	200 - 250 A	Breaker may trip
150	300 A	18
200	400 A	8
300	600 A	2.8
500	1000 A	0.57
800	1600 A	0.007

(1) The delay time is approximate due to the breaker tolerance range.

3.5 Internal Heating Specifications

Internal heating is available on all HELIOS ESS (52-48-16000 | 900-0077) batteries.

Table 3-8, HELIOS ESS Internal Heating Specifications

Internal Heating Specifications	52-48-16000 | 900-0077
Heating Power	250 W
Heating On [a]	• Below 5°C (41°F), and • Either charge detected or SOC is 50% or more
Heating Off [a]	• Temperature above 8°C (46.4°F), or • No charge current detected and SOC is less than 50%

[a] Specifies the temperature of the cells, not the ambient temperature. Ambient temperature and cell temperature may not be the same.

3.6 Minimum Specifications for Battery System

Install HELIOS ESS batteries in parallel in a battery bank configuration to increase system capacity. Overall battery system capacity must be exactly sized to meet the requirements of the load and account for:

- Total Max Continuous Charge Current
- Total Peak Current
- Total Max Continuous Discharge Current

The total charging capacity of all charging sources in the system should not exceed the Max Continuous Charge Current operating limit of all the batteries in the system. The same is true for discharge. The total discharging capacity of all loads in the system should not exceed the Max Continuous Discharge Current operating limit of all the batteries in the system.

If the Max Continuous Charge Current or Max Continuous Discharge Current is exceeded for any battery in the system, the BMS in that battery will trigger the over-current protection and disconnect. The charging system's maximum charge current must be below the operating limit of installed batteries or be curtailed.

The sum of all the Peak Current values for the attached loads must be less than the Peak Current of the battery system, including inrush current values, for any motors and surge values for any inverters.

For HELIOS ESS batteries installed in parallel in a battery bank configuration, the sum of all battery capacities provides the overall capacity value for the battery system. Table 3-9, HELIOS ESS DC Capacity Values for Sample Battery Systems (@25°C, 77°F) (a) provides DC capacity values for sample Discover systems.

NOTICE

- Exceeding the Max Continuous Current of all the batteries in the system will lead to triggering the battery BMS over-temperature protection quicker, resulting in disconnection of all batteries in the system.
- Disconnection will result in a voltage spike (Load Dump), which may damage any component electrically attached to the battery system.

NOTE
The maximum number of batteries installed in a closed-loop configuration with a LYNK Gateway device is 36.

Table 3-9, HELIOS ESS DC Capacity Values for Sample Battery Systems (@25°C, 77°F) [a]

Parallel System	Peak Current	Max Continuous Discharge Current	Max Continuous Charge Current	Usable Capacity
1 battery	300 A	200 A	200 A	16 kWh
2 batteries	600 A	400 A	400 A	32 kWh
3 batteries	900 A	600 A	600 A	48 k Wh

[a] Table 3-9 specifies the upper performance values in a 1 battery, 2 battery, and 3 battery system. To achieve these performance numbers, all the components in your system, including cables and inverters, must be sized appropriately.

3.7 Regulatory

Table 3-10, HELIOS ESS Regulatory

Regulatory
UN38.3 Transportation
UL1973
UL9540A

4. TRANSPORTATION

Transport it in the original package or equivalent if the battery is not installed in equipment. Per the UN Handbook of Tests and Criteria, batteries are tested to part III, subsection 38.3 (ST/SG/AC.10/11/ Rev. 5). For transportation, the batteries belong to category UN3480, Class 9.

5. HANDLING

Before handling:

- Keep the battery away from sparks and flames
- Disconnect the cables from the battery
- Protect battery terminals from short-circuiting and touch
- Do not lift or carry the battery while it is in use or in operation
- Do not lift the battery by attached battery cables
- Set the battery breaker in the OFF (Open) position

6. FEATURES

6.1 Battery Features

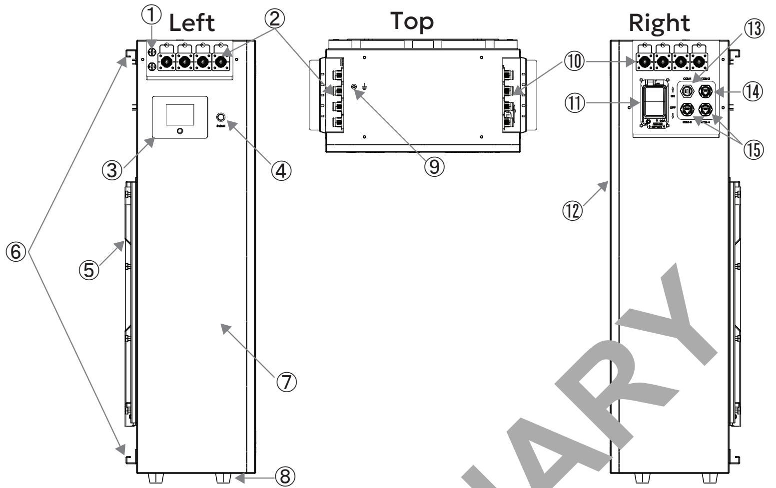


Figure 4. HELIOS ESS Battery Components

Item	Description
1	Breather valves
2	4 x Battery negative terminals (-) black (with quick connects)
3	LCD display (SOC, fault/warning, voltage level, amperes)
4	ON/OFF key
5	Wall-mount bracket
6	Brackets for lifting with rope handles
7	Rubber feet
8	Battery casing
9	Grounding screw
10	4 x Battery positive terminals (+) orange (with quick connects)
11	Single-Pole (positive only) 200 A breaker
12	Front casing cover
13	USB Type-C port for diagnostics and technical support
14	COM2: CAN port for closed-loop communication with supported inverters. For information about the COM2 port and which inverters support direct communication, see 6.6 COM 2 (CAN Port).
15	COM3, COM4: 2 x LYNK ports for connecting batteries in parallel

6.2 Conduit Box (Optional Accessory)

Available as an option, conduit boxes provide seamless connections between an inverter and the HELIOS ESS battery.

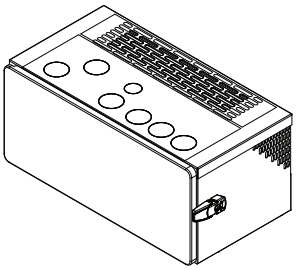


Figure 5. Conduit Box

Table 6-1, Conduit Boxes

Description	Part Number
HELIOS ESS Sol-Ark 15K 2P-N Conduit Box	95[illegible]

6.3 Battery Breaker

The battery breaker protects the electronic components of the battery's internal BMS from high, externally generated currents.

NOTICE
The breaker and the BMS are independent. Setting the breaker to the ON (Closed) position does not switch the BMS ON. Setting the breaker to the OFF (Open) position does not switch the BMS OFF. Independently set the BMS ON or OFF with the ON/OFF key.

NOTE
Additional external DC fusing may be required to protect the battery cables from DC overcurrent as to meet installation codes.

6.4 Battery ON/OFF Key

1. To turn ON the battery, first switch the breaker to the ON (closed) position.
2. Briefly press the battery's ON/OFF key to switch the battery ON. The LED lights up green.
3. To turn OFF the battery, briefly press the ON/OFF key. The LED turns OFF.
4. If desired, switch the breaker to the OFF (open) position.

NOTICE
The breaker and the BMS are independent. Setting the breaker to the ON (Closed) position does not switch the BMS ON. Setting the breaker to the OFF (Open) position does not switch the BMS OFF. Independently set the BMS ON or OFF with the ON/OFF key.

6.4.1 Battery ON/OFF Key LED States

LED	Description
Off	Battery is OFF.
On	Battery is ON.
Pulse	Battery breaker is either open or the battery is warning of an approaching protection limit.
Flash	Battery has faulted. Use LYNK Access software to identify and diagnose the issue.
Double-flash	Battery is identifying itself after the **Identify** command was issued from LYNK Access software.

6.5 LCD DISPLAY

WARNING

ELECTRIC SHOCK AND FIRE HAZARD

- Always assume the battery's main relay is ON (Closed), even if the BDI display shows that it may be off.
- Verify the terminal voltage with a voltmeter before removing and installing the battery.

Failure to follow these instructions may result in death or serious injury.

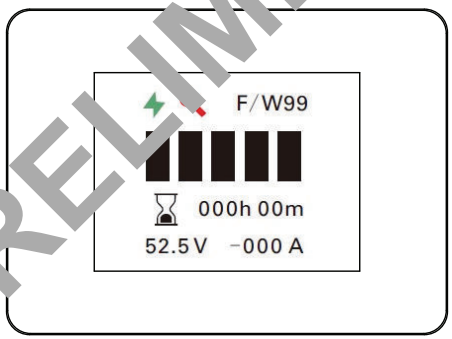


Figure 6. LCD Display

Table 6-2, LCD Display Icons and Values

Icon	State	Description
	Charging	This icon indicates the battery bank is charging and the Remaining Time is an estimate of how much time remains to fully charge all the batteries in the battery bank.
	Fault/ Warning	This icon indicates either a fault or a warning. The "F/W" number identifies the actual fault or warning. For descriptions about each fault or warning, refer to Table 6-3, Fault/Warning Table.

Icon	State	Description
	State of Charge	State of charge of all the batteries in the battery bank. A full charge is indicated when all the bars are displayed.
	Remaining Time	The remaining time is an estimate of how much time remains until: • (Charge) All the batteries in the battery bank are fully charged. • (Discharge) All the batteries in the battery bank are fully discharged based on the current load.
52.5 V	Volts	This value identifies the voltage level of all the batteries in the battery bank.
000 A	Amps	This value identifies the total charge or discharge current, in amps, of all the batteries in the battery bank.

NOTE

The LCD Display shows the state of all the batteries in the battery bank. To isolate the values on the LCD Display for a specific battery, disconnect the cables from COM3 and COM4. After confirming the state of the single battery, reconnect the cables to the COM ports to restore closed-loop communication for the entire battery bank.

Table 6-3, Fault/Warning Table

Number	Fault/Warning	Recovery
1	Under voltage	The battery is shut down. Connect the charger and turn ON the battery for it to charge.
2	Over voltage	Decrease charge voltage and automatically recovers after 120 seconds.
3	Under temperature	Connect a charger to turn ON the internal heater.
4	Over temperature	Automatic recovery after the battery cell temperature drops to an acceptable level.
5	Over-discharge current	Disconnect the load. Try again in 120 seconds.
6	Over-charge current	Disconnect the charger. Try again in 120 seconds.
7	Load qualification	The battery failed load qualification at startup. The load qualification could indicate reverse polarity, short circuit, mixed voltage system, or a large capacitive load
8	Breaker	Breaker is open. Turn off the battery and use a DMM to confirm the battery is OFF. Follow all safety precautions as defined in 1.4 Safe Handling Procedures. Confirm why the breaker was switched OFF (open) and resolve the issue. Close the breaker and turn ON the battery.
9	BMS over-temperature	Pause charging for 5 minutes to allow the BMS to cool down. Consider derating the charge current before continuing.

Number	Fault/Warning	Recovery
10	Under-temperature in charge	Leave the charger connected to engage the internal heater. Charging will continue after the battery cell temperature reaches 4°C (39.2°F) or higher.
13	Over-temperature in charge	The battery stops charging and will continue charging only after the battery temperature is below the recovery threshold.

For information on protections, refer to 3.4 Protection Specifications.

NOTICE
Damage to the LCD display due to sunlight exposure is not covered by the warranty.

6.6 COM 2 (CAN Port)

The COM2 port on the HELIOS ESS enables closed-loop communication without using the LYNK II Communication with some brands of inverters (see Table 6-4). Using the LYNK II Communication Gateway enables communication with all supported inverter brands. The LYNK II Gateway also enables using LYNK ACCESS software for battery diagnostics and connects to LYNK CLOUD for remote battery monitoring.

Table 6-4, Closed-Loop Communication with Inverters

Inverter	Closed Loop without LYNK II		Closed Loop with LYNK II	LYNK ACCESS with LYNK II	LYNK CLOUD with LYNK II
	Straight cable	Create your own cable			
Deye SUN 3-16K single-phase Hybrid Inverters SUN 5-12K three-phase Hybrid Inverters	Yes	No	Yes	Yes	Yes
Luxpower LXP-LB-US 8K/12K Hybrid Inverter SNA-US 6000 ECO Hybrid Inverter	Yes	No	Yes	Yes	Yes
NOARK 3K - 8K single-phase and 5K - 12K three-phase low-voltage Hybrid Inverter	Yes	No	Yes	Yes	Yes
Schneider Electric XW Pro 6848 NA 120/240 XW Pro 6848 NA 120 XW Pro 8548 IEC 230 MPPT 60-150 MPPT 80-600 MPPT 100-600	No		Yes	Yes	Yes

Inverter	Closed Loop without LYNK II		Closed Loop with LYNK II	LYNK ACCESS with LYNK II	LYNK CLOUD with LYNK II
	Straight cable	Create your own cable			
Schneider Electric (Legacy) Conext XW+ 5.5/6.8 Conext XW+ 7.0/8.5 Conext MPPT 60-150 Conext MPPT 80-600 Conext MPPT 100-600	No		Yes	Yes	Yes
Sol-Ark 5K to 15K-P (Outdoor) and 12K to 15K-2P (Outdoor)	Yes	No	Yes	Yes	Yes
Sol-Ark (Legacy) 8K - 12K Hybrid Indoor inverters	No	Yes	Yes	Yes	Yes
SUNSYNK 3K - 16K single-phase and 8K - 12K three-phase low-voltage Hybrid Inverters	Yes	No	Yes	Yes	Yes
Victron Energy Color Control GX Venus GX VE.CAN Devices	No	Yes	Yes	Yes	Yes

6.6.1 COM2 Port RJ45 Pin Assignment

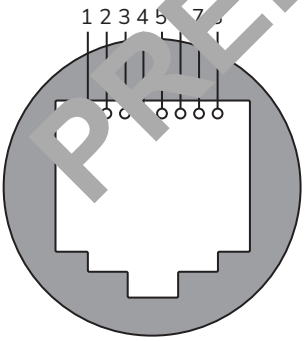


Figure 7. HELIOS ESS COM2 Pins

Pin Number	Function
1	(Do not use)
2	(Do not use)
3	(Do not use)
4	CAN High
5	CAN Low
6	CAN Ground
7	(Do not use)
8	(Do not use)

6.6.2 Closed-Loop Communication Without LYNK II (Straight Cable)

The HELIOS ESS supports closed-loop communication with the following inverters through a CAT6 or higher cable. Refer to Table 6-4, Closed-Loop Communication with Inverters.

- Sol-Ark 5K to 15K-P (Outdoor) and 12K to 15K-2P (Outdoor)
- Deye SUN 3-16K single-phase, 5-12K three-phase Hybrid Inverters
- Luxpower LXP-LB-US 8/10/12K Hybrid, SNA-US 6000 ECO Hybrid Inverters
- NOARK 3K - 8K single-phase and 5K - 12K three-phase low-voltage Hybrid Inverters
- SUNSYNK 3K - 16K single-phase and 8K - 12K three-phase low-voltage Hybrid Inverters

Connect the CAT6 or higher cable from the battery's COM2 port directly to the battery port on the inverter.

NOTICE

- Use a straight-through cable. Do not use a cross-over cable.
- Isolate unused pins. Crossing pin functions may cause sys[illegible]damag[illegible].
- Do not terminate unused wires to ground, power, or [illegible]ther f[illegible]ions.
- Mixing this communication line with the LYNK Network [illegible]ay [illegible]sult in equipment malfunction and damage.

6.6.3 Closed-Loop Communicatio[illegible]ithout LYNK II (Create Your Own Cable)

The HELIOS ESS supports closed-[illegible]op c[illegible]mm[illegible]nication with the following inverters through a modified CAT6 or higher ca[illegible]e. Refer to Table 6-4, Closed-Loop Communication with Inverters.

Legacy Sol-Ark

- (Legacy) Sol-Ark [illegible]- 1[illegible]K H[illegible]ybrid Indoor inverters

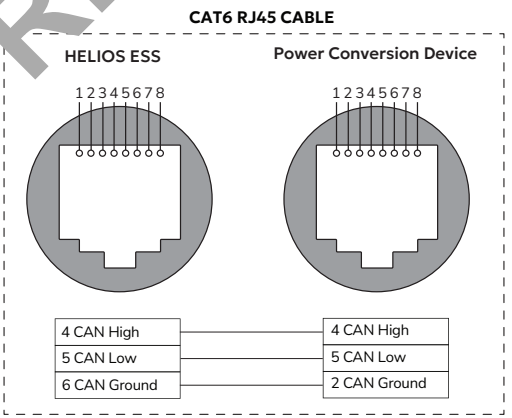


Figure 8. Create Your Own Cable (Legacy Sol-Ark)

Victron Energy

- Victron Energy Color Control GX, Venus GX, VE.CAN Devices

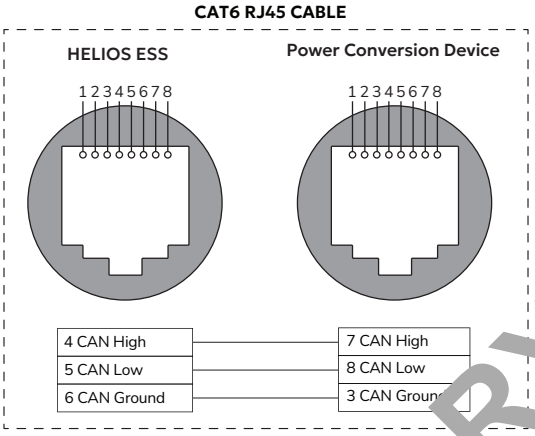


Figure 9. Create Your Own Cable (Victron Energy)

6.7 COM3/COM4 (LYNK Port)

The COM3 and COM4 ports enable multiple Lithium batteries to communicate and interact in a closed-loop network. The COM3/COM4 ports enable multiple HELIOS ESS batteries to work together in a closed-loop communication system with other networked devices, such as inverter-chargers. A closed-loop system enables safety and optimizes system performance.

6.7.1 LYNK Port Communication RJ45 Pin Assignment

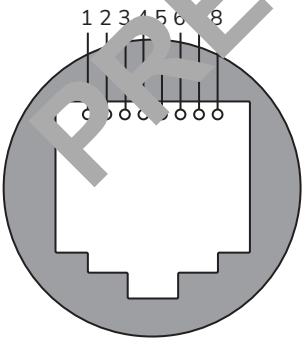


Figure 10. LYNK Port Communication RJ45 pin assignment

Pin Number	Function
1 (1)	Reserved. Do not use.
2 (1)	Reserved. Do not use.
3 (1)	Reserved. Do not use.
4	CAN Low
5	CAN High
6 (1)	Reserved. Do not use.
7	CAN Ground
8	CAN Ground

(1) Do not populate. Do not terminate to power. Do not terminate to ground. Do not terminate to CAN_L or CAN_H.

NOTICE
• Use a straight-through cable. Do not use a cross-over cable. • Isolate unused pins. Crossing pin functions may cause system damage. • Do not terminate unused wires to ground, power, or other functions. • Mixing the LYNK Network with other networks may result in equipment malfunction and damage.

7. THEORY OF OPERATION

7.1 Ingress Protection IP65

Ingress protection rates the degree of protection provided by mechanical casings and electrical enclosures against intrusion, dust, accidental contact, and water under specified conditions.

The IP65 rating indicates that the product is protected against:

- Dust
- Accidental contact, such as from fingers or tools
- Water, such as low pressure water jets, condensation, and water spray.

NOTE
The battery is not protected against high pressure water jets or submersion in water.

IP codes guide suitability for use under different environmental conditions. IP ratings do not indicate fitness for purpose or confer a performance guarantee.

7.2 Internal Heating (HELIOS ESS)

The HELIOS ESS battery is equipped with internal heating. When the battery's internal temperature is below 5°C (41°F) and the battery is either connected to a charging source or SOC is 50% or more energy is diverted to the internal heater to avoid the under-temperature fault.

The heating stops when:

1. The battery's internal temperature reaches 8°C (46.4°F).
   - Once the cell temperature reaches this threshold, all the energy is directed to charging the cells.
2. No charge current is detected and SOC is less than 50%.
   - After the heating stops, if the battery's internal temperature drops below 5°C (41°F) and the battery is connected to a charging source, the heater turns ON again.

For information about internal heating, refer to Sections 3.4 Protection Specifications and 3.5 Internal Heating Specifications.

NOTE
Charging and heating can occur simultaneously. However, the BMS will not allow charging to continue when cell temperature drops below 4°C (39.2°F) for 5 seconds.

7.3 Battery Management System

7.3.1 Battery Management System Protections

The Battery Management System's (BMS) primary function is to monitor cell module voltage, temperature, and battery current. The BMS uses this information to maintain cell operation within operating specifications. If a parameter falls outside of operating specifications, the BMS will disconnect and protect the battery from:

1. **Overvoltage:** Charge voltages that are too high.
2. **Undervoltage:** Discharged voltage that is too low.
3. **Overcurrent:** Current is too high when powering up a load (high inrush current) or from a sustained charging or discharging current above the specified limit.
4. **Over-temperature:** Cell temperature that is too high during charge and discharge.
5. **Under-temperature:** Cell temperature that is too low during charge and discharge.
6. **Load Qualification:** Protection may occur when switching the battery ON. The protection qualifies the load attached to it to prevent switching on into a reverse polarity, short circuit, mixed voltage system, or large capacitive load.

For trigger and recovery values, refer to Table 3-5, HELIOS ESS Protection Specifications.

The BMS reconnects when it hits recovery threshold. Manually switch the battery ON if the BMS disconnects due to low voltage protection. If low voltage fault is constantly affecting the system, there may be a constant parasitic draw. To prevent the low-voltage fault when the battery is not in use, a physical disconnect switch is recommended.

After a load qualification fault, there is a 120 second delay until you can switch ON the battery again.

NOTE
• Charge and discharge have different operating temperature limits. • If the BMS disconnects in response to temperature or current limits, the battery automatically restarts only after 120 seconds elapse and the temperature or current reaches normal operating limits.

7.3.2 BMS Pre-Charge System

Turn on all the batteries in the battery bank before energizing any inverter-chargers to prevent tripping a breaker in the battery bank while trying to pre-charge the system.

The battery has a Pre-Charge System to energize external capacitive loads before switching the main relay ON. The maximum input capacitance for a single battery should not exceed the values in Table 3-1, HELIOS ESS Electrical Specifications.

NOTICE
When switching ON batteries, the inrush current may cause the batteries to fault as they energize external capacitive loads. If the battery fails to turn ON, it retries up to 10 times. Verify the cables and connections, then switch ON the batteries again.

7.3.3 Battery Management System Load Qualification

When the battery switches from the OFF state to the ON state, the battery BMS will qualify the external load before switching ON the main relay. Load qualification will reject switching ON into short circuit, reverse polarity, mixed voltage systems, or capacitive loads that exceed the batteries limits.

The battery will attempt Load Qualification a maximum of ten times. After ten failed attempts at Load Qualification, the battery switches OFF.

During Load Qualification, or when a load is disqualified, the ON/OFF key flashes and displays fault code 7 on the LCD display (see Table 6-3, Fault/Warning Table).

7.3.4 Battery Management System Cell Balancing

The cell balancing circuits in the battery compare all cells in a battery and balance the cell voltage at the end of the charge. When there is a network of batteries over the LYNK port, all battery cells are balanced as an entire system, not as individual batteries.

7.3.5 Battery Charge and Discharge Settings

The HELIOS ESS supports direct closed-loop communication with some brands of power conversion devices. Other types of inverters, such as Schneider XW+ and XW Pro with Xanbus, require a LYNK Communication Gateway. In addition to communication, the LYNK II provides other benefits such as monitoring, diagnostics, programmable relays, and LYNK CLOUD. For further information, please refer to the LYNK II Gateway Communication User Manual available from the discoverenergysys.com website, or contact your Discover provider for assistance.

Refer to the appropriate LYNK II Communication Gateway Application Note available from discoverenergysys.com for the setup of closed-loop parameters and integration with specific brands of solar inverter-chargers and solar charger controllers.

7.4 LYNK Network Communication

Discover batteries use CAN communication over the LYNK Network to coordinate performance with other batteries and communicate with accessories such as the LYNK II Communication Gateway.

NOTICE
The battery has intelligent CAN termination. Terminating resistors are not required when deploying the battery in a LYNK Network.

7.4.1 LYNK Network Power

A Discover battery provides the LYNK network power through the LYNK port (COM3/COM4). Discover documentation specifies how many batteries are required to provide sufficient power for the LYNK network and compatible accessories. Some accessories may require more than one battery to provide sufficient power.

NOTICE
Do not use an external power source to power devices over the LYNK Network.

NOTE
The LYNK II Communication Gateway is required for diagnosis of the batteries and to use the LYNK Cloud web service.

7.4.2 LYNK Network Size

One LYNK Network can support up to 36 HELIOS ESS Batteries. The total length of the LYNK network cables must not exceed 36 m (118 ft).

7.4.3 LYNK Network Cables

CAT6 or higher cables (included with HELIOS ESS batteries) network HELIOS ESS batteries.

8. OPTIONAL ACCESSORIES

The following optional accessories are available for the HELIOS ESS battery.

Table 8-1, HELIOS ESS Accessories

Accessory	Part Number
LYNK II Communication Gateway	950-0025
HELIOS ESS Sol-Ark 15K Conduit Box	950-0067
HELIOS ESS Battery to Inverter Power Cables	

• 2 pairs of 200 A cables with lug and quick connect:
  • **2/0 AWG** Positive Power Cable (1.0 m, 39.37 inch)
  • **2/0 AWG** Negative Power Cable (1.0 m, 39.37 inch)
	950-0070

• 2 pairs of 150 A cables with lug and quick connect:
  • **1/0 AWG** Positive Power Cable (1.0 m, 39.37 inch)
  • **1/0 AWG** Negative Power Cable (1.0 m, 39.37 inch)
	950-0071

HELIOS ESS Parallel Wire Kit (battery to battery)
• 1 pair of 200 A cables with quick connects:
  • 2/0 AWG Positive Battery Cable (1.35 m, 53 in)
  • 2/0 AWG Negative Battery Cable (1.35 m, 53 inch)
• CAT6 Cable (1.35 m, 53 inch) (COM3/COM4)
	950-0068

HELIOS ESS Terminal Connector Set	950-0072
HELIOS ESS Battery Lifting Handles	950-0069

9. INSTALLATION

The following instructions describe how to connect single or multiple batteries in parallel to an inverter.

⚠ WARNING

ELECTRIC SHOCK AND FIRE HAZARD

- This equipment must only be installed as specified.
- Do not disassemble or modify the battery.
- Do not touch exposed contents if the battery case has been damaged.
- There are no user-serviceable parts inside.

Failure to follow these instructions may result in death or serious injury.

NOTICE

- Some chargers and inverters support temperature-compensated charging. Disable temperature-compensated charging on the charger or inverter.
- Do not use or install a battery temperature sensor.

NOTE

It is the responsibility of the installer to ensure that all applicable installation requirements and standards are met.

9.1 Tools

- Insulated tools sized to match nuts, bolts, and cables
- True RMS Voltmeter
- Wall stud finder
- Appropriate personal protective equipment

9.2 Location

The HELIOS ESS battery can be installed indoors or outdoors.

Install the battery in locations that meet the following requirements:

1. **Wall mount.** The battery is designed to be wall mounted. Secure the batteries so that at least 4 bolts of the Wall-Mount Bracket are supported by wall studs.
2. **Spacing.** If installing one battery only, allow spacing of at least 300 mm (11.8 in) to each side to access the various ports and terminals and view the battery information.

   When installing batteries in parallel, space the batteries at least 305 mm (12 in) between each other. If your installation requires the batteries to be spaced farther apart, you may need to create your own cables with the HELIOS ESS Connector Kit (950-0072).

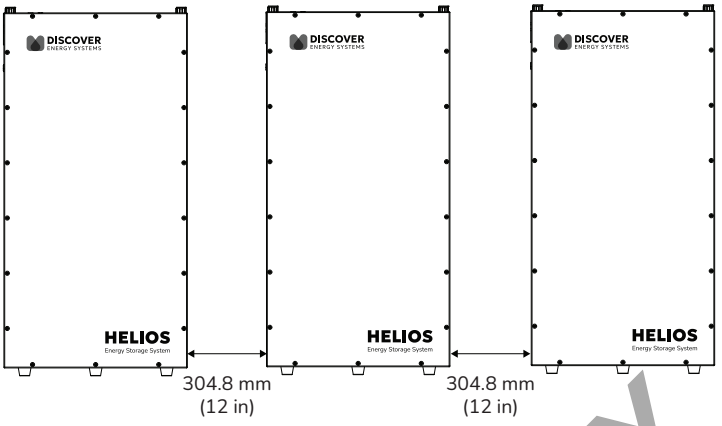


Figure 11. Battery spacing

3. **Do not install in direct sunlight.** Avoid installing the battery in an area with high ambient temperature.

NOTICE
Damage to the LCD display due to sunlight exposure is not covered by the warranty.

4. **Moderate temperature.** The ambient temperature should be between 4°C and 40°C (39.2°F and 104°F). Ambient temperature of 15°C to 20°C (59°F to 68°F) are ideal for extending battery life.
5. **Ventilation.** If housing the batteries in a room, add vents to allow airflow to the outdoors.
6. **Away from water.** Do not install in locations that are susceptible to flood or water leakage. If flooding is a danger, install above the ground.
   The rubber feet provide the battery with 20 mm (0.787 in) of clearance above the ground. Check with local requirements on whether the installation requires extra space below the battery.
7. **Orientation.** Installing the battery with its feet pointed towards the ground is the recommended orientation. **Never install the battery upside down (feet pointing up).** If you install the battery using any other orientation, ensure the battery is securely mounted and supported to prevent movement and stress on the connections.

NOTE
• Do not use the battery in a location with excessive vibrations. • The battery has not been evaluated for seismic environments. • Using this product in a location that does not meet requirements will void the warranty. • Using this product in any orientation except the recommended orientation may affect performance and the warranty. If you use an alternative orientation, regularly monitor the battery to check for abnormalities.

9.3 Attaching the Battery onto a Wall

⚠ CAUTION

HEAVY OBJECT

Two-person or three-person lift is recommended for the battery.

Failure to follow these instructions may result in injury.

The following instructions are based on installing the battery onto a wall. Instructions on installing the inverter itself are provided in the inverter manufacturer's documentation.

1. Use a stud finder to locate the wall studs.
   Identify a location that optimizes usability and support for the inverter and battery. The battery's Wall-Mount Bracket requires at least 4 bolts supported by wall studs.
2. Attach the rope handles to the battery and using a two/three-person lift, move the battery to the installation location.

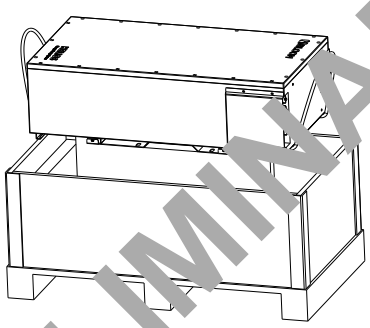


Figure 12 Use rope handles to lift battery

   The Wall-Mount Bracket is attached to the back of the battery.
3. Remove the screws affixing the Wall-Mount Bracket to the battery. Put the screws aside in a safe location.
4. If installing the battery off the ground and if the wall studs are not in ideal locations, consider adding appropriate structural supports to spread the weight of the 136 kg (299.83 lb) battery.
5. Use the dimensions in the following diagram to mark the location of holes for the HELIOS ESS battery Wall-Mount Bracket. Verify the holes are level and at the right height.

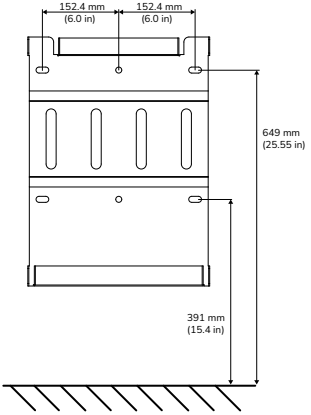


Figure 13. Wall-Mount Bracket Drill Holes

6. Drill the holes for the Wall-Mount Bracket.
7. Secure the Wall-Mount Bracket to the wall using appropriate fasteners that can support the battery's weight and are compatible with the material of the wall or studs.
8. Attach the HELIOS ESS battery to the Wall-Mount Bracket.
   a. Using a two/three person lift, lift the battery at the battery lifting handles (950-0069), hydraulic lift, or other industrial equipment and hook it onto the Wall-Mount Bracket.

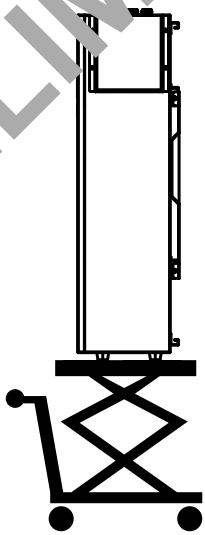


Figure 14. Hydraulic Lift to Mount Battery onto Wall-Mount Bracket

   b. From the right and left sides, secure the battery to the Wall-Mount Bracket with the screws that you put aside in step 3.

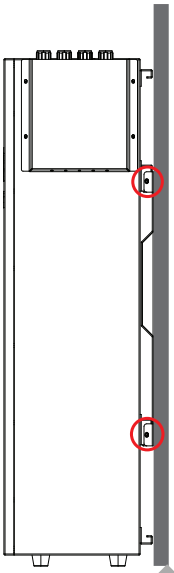


Figure 15. Secure Battery to Wall-Mount Adapter

9. Install the inverter near the battery. Refer to the inverter manual for instructions.
10. Next, wire the batteries and the inverter.

NOTE

The cover plate protecting the battery terminals and COM ports is installed inside out for shipping purposes. Please keep this in mind when re-attaching the cover plate after wiring the battery and communication cables.

9.4 Wiring

9.4.1 DC Cables

⚠ CAUTION

FIRE HAZARD

Undersized cables can become hot and may potentially catch fire.

Failure to follow these instructions may result in injury.

Use the Battery to Inverter Power Cables 2/0 AWG (950-0070) or 1/0 AWG (950-0071) to wire the batteries to the inverter. Select the cables compatible with your inverter and inverter settings. You can also use your own DC cables by using the HELIOS ESS Connector Set (950-0072) if the cables are rated for the maximum voltage of any circuits sharing the same wiring space, sized according to local codes, and meet the following requirements.

1. **Copper-stranded cable.** DC cables must be stranded, copper, and rated 90 °C minimum. Terminate the cables on one side with lugs that fit the DC terminals on the

inverter, and use the quick connect on the other side of the cable for the positive or negative battery terminal.

2. **Minimum and equal cable lengths.** Select a location that minimizes the length of battery cables to reduce voltage drop from the impedance leading to reduced performance. If installing multiple batteries in parallel, the length of all the battery cables should be the same.
3. **Appropriate cable gauge.** The cables should be capable of carrying the normally expected current, plus a margin of safety.
4. **Proper polarity.** Positive (+) is connected to positive (+), and negative (-) is connected to negative (-). Verify the polarity of all connections before energizing batteries.

9.4.2 DC Protection

⚠ CAUTION

FIRE HAZARD

- Undersized fuses and disconnects may become overloaded and potentially cause a fire.
- Fuses and disconnects are required to open before the cable reaches its maximum current carrying capability.

Failure to follow these instructions may result in injury.

Each battery comes equipped with an integrated breaker that opens the positive pole. When multiple batteries are installed in parallel, additional DC overcurrent protection is recommended between the battery bank and the inverter-charger.

1. **Appropriate size.** Size the fuses and disconnects following local codes to protect the wiring in the system. The fuses and disconnects are required to open before the cable reaches its maximum current carrying capability.
2. **Install protection in the positive cable.** The fuse and disconnect should be located close to the battery and installed in the positive cable. Local codes may limit how far the protection can be from the battery.

NOTE

- AC circuit breakers and DC circuit breakers are not interchangeable. Check the label on the circuit breaker to ensure it is the correct type and rating. Use only DC circuit breakers.
- The local electrical code in your area may require both positive and negative DC disconnect switches. Refer to your applicable code and check with the authority having jurisdiction to confirm local requirements.

9.4.3 Terminal Connections and Hardware

Plug and pull quick connects are used to mate with the plug and pull terminals on the HELIOS ESS battery.

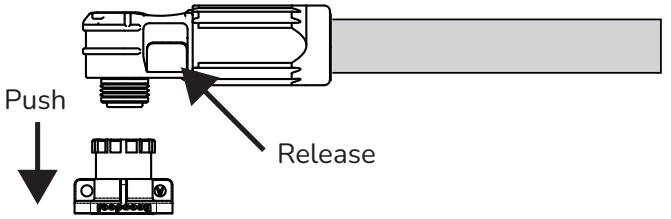


Figure 16. Plug and Pull Quick Connect

1. Plug the connector into the plug and pull terminal.
2. Gently pull the connector to confirm it is snapped in place.
3. To disconnect, press the release button on the side of the conne

9.5 Single Battery Installation

Install equipment following the standards set by the local au having jurisdiction.

⚠ CAUTI

FIRE HAZARD

Use cables that meet specifications. Undersiz cables can become hot and potentially catch fire.

Failure to follow these instructions ay result in injury.

To optimize performance, batte cables (battery to load and battery to charger) must meet the following requ ements.

1. **Minimum cable leng .** Se ect a location that minimizes the length of battery cables to reduce the olta e dr .
2. **Equal cable g ge.** The battery cables should be the same gauge.
3. **Equal cable eng .** The battery cables should be of equal length.

9.5.1 Sing Battery Installation Procedure

⚠ CAUTION

ELECTRIC SHOCK AND FIRE HAZARD

- Take precautions to avoid bridging the terminals.
- Do not contact the terminals with metal mountings, fixtures, or body parts.

Failure to follow these instructions may result in injury.

Install equipment following the standards set by the local authority having jurisdiction. The following instructions assume the battery and inverter have been attached to the wall.

1. Prepare the inverter and battery for wiring.
   a. If the inverter is wired to a power source, open the disconnect and set the inverter OFF.
   b. Use a DMM or other voltage measuring device to confirm the circuit is de-energized.
   c. If the circuit in which the battery is installed has a disconnect, open the disconnect to isolate the battery.
   d. Set both the battery BMS and the breaker to the OFF position.
   e. Use a DMM or other voltage measuring device to confirm the circuit is de-energized.
2. Wire the inverter.

   The Battery to Inverter Power Cables 2/0 AWG (950-0070) or 1/0 AWG (950-0071) are available to wire the batteries to the inverter. Select the cable compatible with your inverter and inverter settings.

   a. Ensure the cable connections are clean and in working order.
   b. Connect the positive battery cable to a positive battery terminal on the inverter.
   c. Connect the negative battery cable to a negative terminal on the inverter.

NOTE
The following example uses two pairs of cables between the battery and the inverter.

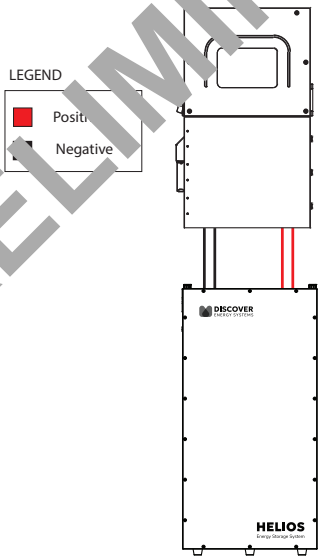


Figure 17. Wiring for One Battery

3. Connect the positive battery cables to the receiving pins of the positive battery terminals and push down to enable the connection. Refer to 9.4.3 Terminal Connections and Hardware.

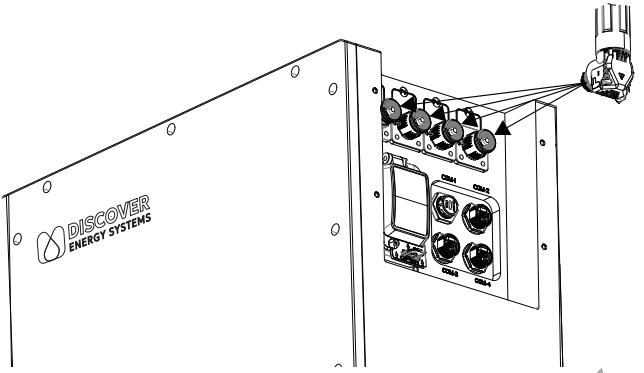


Figure 18. Connect Cables to Battery Terminals

4. Connect the negative battery cables to the receiving pins of the n[illegible]e battery terminals and push down to enable the connection.
5. Connect the CAN communication cable.

Closed-Loop Communication with the LYNK II Co[illegible]n Gateway

If you are using the LYNK II Communication Gate[illegible]ay, c[illegible]ect the CAT6 communication cable from the inverter to the LYNK [illegible]evic[illegible] and then to the battery.

a. Attach the CAT6 or higher cable from th[illegible]nve[illegible]er to the LYNK II Communication Gateway's CAN port.

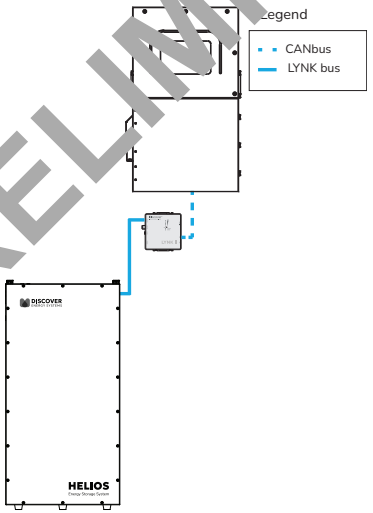


Figure 19. Closed-Loop Communication with LYNK II

b. Attach another CAT6 or higher cable to the LYNK port on the LYNK II, then attach the other end of the CAT6 or higher cable to COM3 or COM4 (LYNK port) on the battery. For more information about LYNK network connections, refer to 9.8 LYNK Network.

Closed-Loop Communication Without the LYNK II Communication Gateway

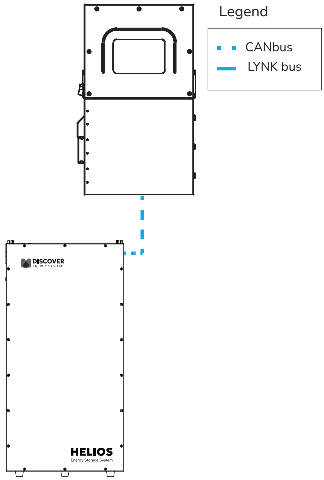


Figure 20. Closed-Loop Communication Without LYNK II

Closed-loop communication **without** the LYNK II Communication Gateway is available with select inverters. Refer to 6.6 COM 2 (CAN Port) for the list of supported inverters and the specifications on the cable required to communicate with the inverter.

a. After confirming the HELIOS ESS supports CAN communication with your inverter without the LYNK II, and after setting up the appropriate CAT6 or higher cable, attach it from the inverter's CANbus port to the battery's COM2 port (CAN port).

6. Set the battery breaker ON (close).
7. Set the battery BMS ON (ON/OFF key).
8. Close the disconnect if it is open.

NOTICE
• Avoid short circuits. Short circuits will damage the battery and void the warranty. • Failure to securely lock the ends of battery cables to the receiving pins on the battery will increase resistance and lower voltage, leading to burnout of the terminals and voiding of the warranty. • Some inverter-chargers support temperature-compensated charging. Disable temperature compensated charging on the charger or inverter. • Do not use or install a battery temperature sensor.

9.6 Parallel Battery Installation

⚠ CAUTION

FIRE HAZARD

Use cables that meet specifications. Undersized cables can become hot and may potentially catch fire.

Failure to follow these instructions may result in injury.

Batteries used in a parallel system must meet the following requirements:

a. **Same model.** Batteries must be the same model.

b. **Equal voltage.** The battery has a Pre-Charge System that allows you to connect batteries at different SOC. The best practice is to confirm batteries are within 50 mV (0.05 V) of each other before installing them in parallel.

Cables interconnecting the batteries must meet the following requirements to optimize performance:

1. **Minimum cable length.** Select a location that minimizes the length of battery cables to reduce voltage drop from the impedance.
2. **Equal cable gauge.** The interconnection cables should be the same gauge.
3. **Equal cable length.** The interconnection cables should be of equal length.
4. **Connectors.** Battery terminal connections require specific connectors. Refer to 8. OPTIONAL ACCESSORIES.

NOTE

To connect HELIOS ESS batteries in parallel, use either the HELIOS ESS Parallel Wire Kit (950-0068) or busbars.

9.6.1 Parallel Battery Installation Procedure (Parallel Wiring Kit)

The following instructions identify how to connect batteries and inverters in parallel using the HELIOS ESS Parallel Wire Kit (950-0068). One kit is required to parallel two batteries. Two kits are required to parallel three batteries.

⚠ CAUTION

ELECTRIC SHOCK AND FIRE HAZARD

- Take precautions to avoid bridging the terminals.
- Do not contact the terminals with metal mountings, fixtures, or body parts.

Failure to follow these instructions may result in injury.

NOTICE

UNBALANCED BATTERY CELLS

Paralleling more than three batteries using the Parallel Wiring Kit may lead to unbalanced battery cells.

Failure to follow these instructions may result in equipment damage.

Install equipment following the standards set by the local authority having jurisdiction.

1. Prepare the inverter and battery for wiring.
   a. If the inverter is wired to a power source, open the disconnect and set the inverter OFF.
   b. Use a DMM or other voltage measuring device to confirm the circuit is de-energized.
   c. If the circuit in which the battery is installed has a disconnect, open the disconnect to isolate the battery.
   d. Set both the battery BMS and the breaker to the OFF position.
   e. Use a DMM or other voltage measuring device to confirm the circuit is de-energized.
2. Wire the inverter.

   The Battery to Inverter Power Cables 2/0 AWG (950-0070) or 1/0 AWG (950-0071) are available to wire the batteries to the inverter. Select the cable compatible with your inverter and inverter settings.

   a. Ensure the cable connections are clean and in working order.
   b. Connect the positive battery cable to a positive battery terminal on the inverter.
   c. Connect the negative battery cable to a negative terminal on the inverter.

When using ONE Set of Battery to Inverter cables

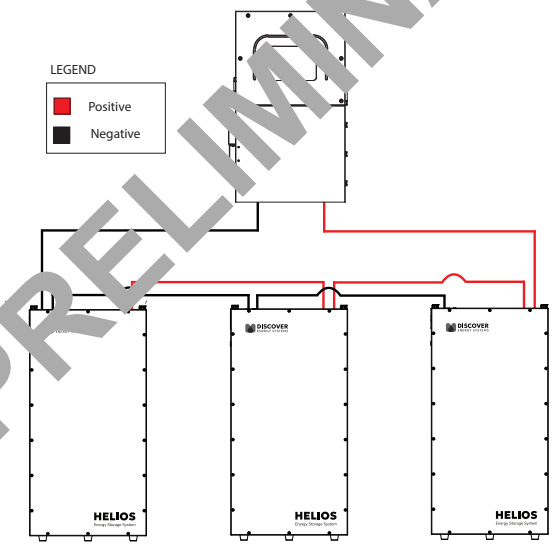


Figure 21. Three Batteries in Parallel (Two Parallel Wire Kits 950-0068)

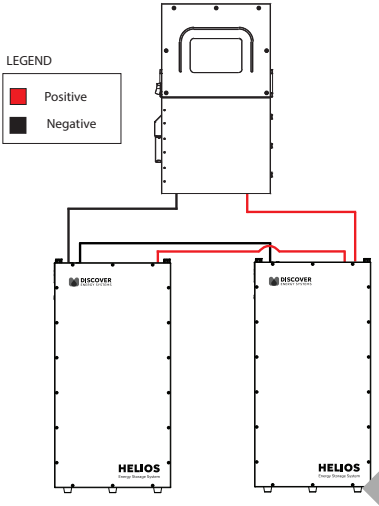


Figure 22. Two Batteries in Parallel (One Parallel Wire Kit 950-0068)

3. Connect the positive (+) battery cable in the HELIOS ESS Parallel Wire Kit (950-0068) to a receiving pin of the positive battery terminals on a battery at one end of the battery bank. Push the ends of cables against the receiving pins to secure the connection.

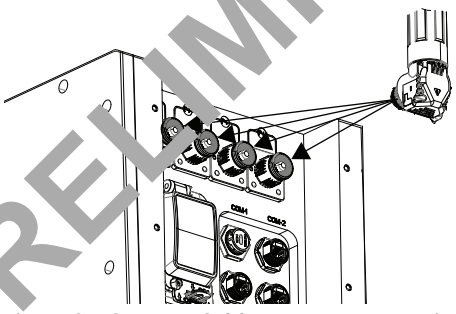


Figure 23. Connect Cables to Battery Terminals

4. Connect the negative (-) battery cable to a receiving pin of the negative battery terminals on the battery at the other end of the battery bank. Push the ends of cables against the receiving pins to secure the connection.
5. Connect the positive (+) and negative (-) battery cables in the HELIOS ESS Parallel Wire Kit (950-0068) to the receiving pins of the positive and negative battery terminals on batteries as shown in the diagrams below. Push the ends of cables against the receiving pins to secure the connection.

When using TWO Sets of Battery to Inverter cables

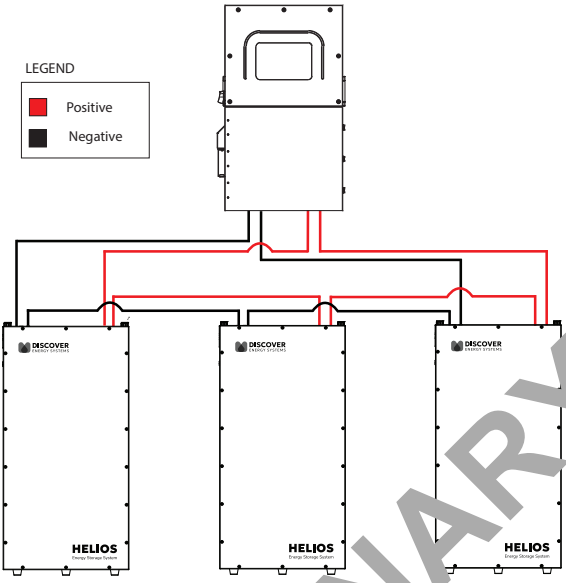


Figure 24. Three Batteries in Parallel (Tw[illegible]Wire Kits 950-0068)

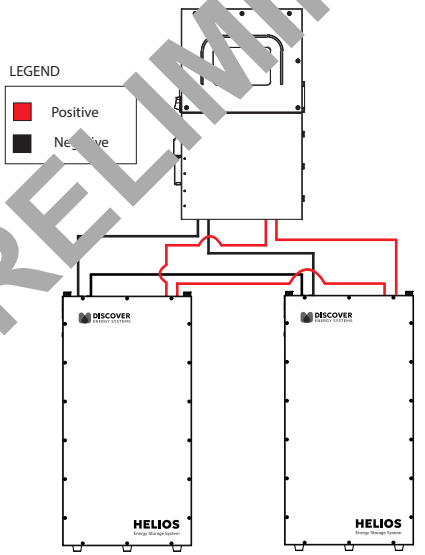


Figure 25. Two Batteries in Parallel (One Parallel Wire Kit 950-0068)

3. Connect one of the positive battery cables from the inverter to a battery on one end of the battery bank, and connect the other cable to the battery on the other end of the battery bank. Push the ends of cables against the receiving pins to secure the connection. Refer to Section 9.4.3 Terminal Connections and Hardware.

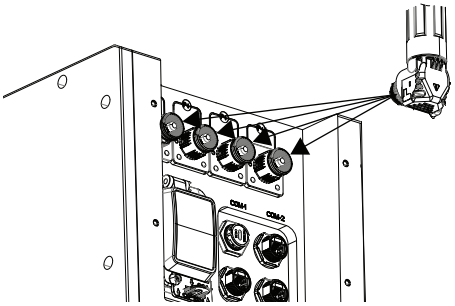


Figure 26. Connect Cables to Battery Terminals

4. Connect one of the negative battery cables from the inverter to a battery on one end of the battery bank, and connect the other cable to the battery on the other end of the battery bank. Push the ends of cables against the receiving pins to secure the connection.
5. Connect the positive (+) and negative (-) battery cables in the HRMOS ESS Parallel Wire Kit (950-0068) to the receiving pins of the positive and negative battery terminals on batteries as shown in the diagrams that follow. Push the ends of cables against the receiving pins to secure the connection.
7. Connect the CAN communication cables.

Closed-Loop Communication with the LYNK II Communication Gateway

If you are using the LYNK II Communication Gateway, connect the CAT6 communication cable from the inverter to the LYNK device and then to the battery bank.

a. Attach the CAT6 or higher cable from the inverter to the LYNK II Communication Gateway's CAN port.

b. Attach another CAT6 or higher cable to the LYNK II Communication Gateway's LYNK port, then attach the other end of the CAT6 or higher cable to COM3 or COM4 (LYNK port) on the battery. For more information about LYNK network connections, refer to 9.8 LYNK Network.

c. Attach CAT6 or higher cables between all the batteries. Attach a CAT6 or higher cable to COM3 or COM4 (LYNK port) on the first battery and to COM3/COM4 on the next battery, and so on, until all the batteries are connected.

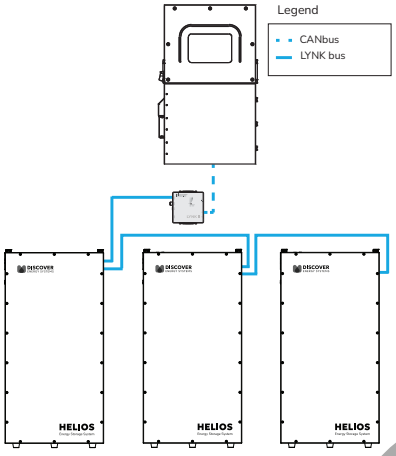


Figure 27. Closed-Loop Communication wit[illegible] LY[illegible]

Closed-Loop Communication without the LYNK II [illegible]mun[illegible]ation Gateway

Closed-loop communication **without** the LYNK II [illegible]mmu[illegible]ication Gateway is available with select inverters. Refer to 6.6 C[illegible]2 ([illegible]N Port) for the list of supported inverters and the specifications on the com[illegible]uni[illegible]tion cable required to communicate with the inverter.

a. After confirming the HELIOS ESS [illegible]pports [illegible]AN communication with your inverter without the LYNK II, and after [illegible]ttin[illegible] up[illegible]e appropriate CAT6 or higher cable, attach it from the inverter's CAN[illegible]s po[illegible]t to the battery's COM2 (CAN port).
b. Interconnect all the batte[illegible]s by attaching CAT6 or higher communication cables (straight cable) to th[illegible] batter[illegible] COM3 or COM4 ports (LYNK port).

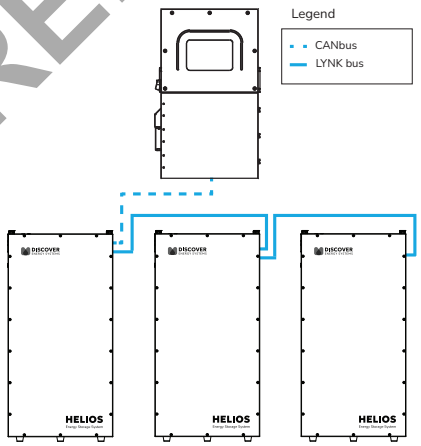


Figure 28. Closed-Loop Communication Without LYNK II

8. Set all battery BMS to ON (ON/OFF key).
9. Energize the system by setting all battery breakers to ON (close).
10. Close the circuit disconnect if it is open.

NOTICE

Failure to securely lock the ends of battery cables to the receiving pins on the battery will increase resistance and lower voltage, leading to burnout of the terminals and voiding of the warranty.

NOTE

- Whenever replacing an old battery in a parallel string, use a battery of the same age, model, capacity, and voltage.
- Before installing the battery in parallel, charge each module to 100% SOC. Open battery breakers may result if the batteries are not at the same SOC.

9.6.2 Parallel Battery Installation Procedure (Busbar)

This parallel installation method (busbar) is required when paralleling four or more HELIOS ESS batteries. The following instructions describe how to connect batteries in parallel through busbars. Size the busbars so that they are capable of handling the maximum total charge and discharge current capacity of the loads and batteries.

The inverter connection is not identified as this can vary depending on the inverter type, number of inverters, and distance from the busbar.

⚠ CAUTION

ELECTRIC SHOCK AND FIRE HAZARD

- Take precautions to avoid bridging the terminals.
- Do not contact the terminals with metal mountings, fixtures, or body parts.

Failure to follow these instructions may result in injury.

NOTICE

All DC positive and DC negative cables from the busbar to each battery should be the same gauge and same length.

Install equipment following the standards set by the local authority having jurisdiction.

1. Prepare the battery for wiring.
   a. If the circuit in which the battery is installed has a disconnect, open the disconnect to isolate the battery.
   b. Set both the battery BMS and the breaker to the OFF position.
   c. Use a DMM or other voltage measuring device to confirm the circuit is de-energized.

2. Wire the batteries.

   You can use the Battery to Inverter Power Cables 2/0 AWG (950-0070) or 1/0 AWG (950-0071) to wire the batteries to the busbar.

   a. Ensure the cable connections are clean and in working order.

   b. Confirm the power cables are capable of carrying the normally expected current in the system, plus a margin of safety.

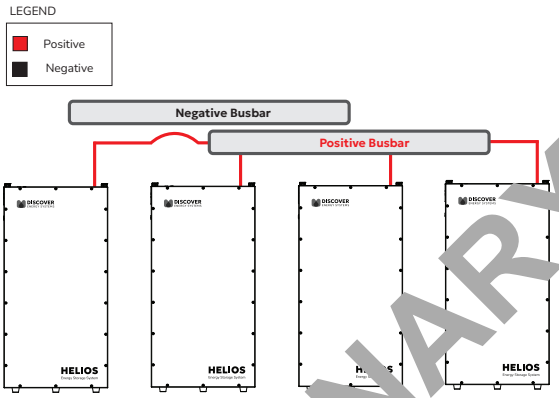


Figure 29. Wiring Battery Positive Terminals to Positive Busbar

   c. Push the ends of the positive (red +) power cables to the receiving pins on each battery's positive terminals to secure the connection. Refer to Section 9.4.3 Terminal Connections and Hardware.

   d. Connect the other end (lugs) of the positive battery cables to the positive busbar.

   e. Push the ends of the negative (black –) power cables to the receiving pins on each battery's negative battery terminals to secure the connection. Refer to Section 9.4.3 Terminal Connections and Hardware.

   f. Connect the other end (lugs) of the negative battery cables to the negative busbar.

   g. Repeat until all the batteries are connected to the busbars.

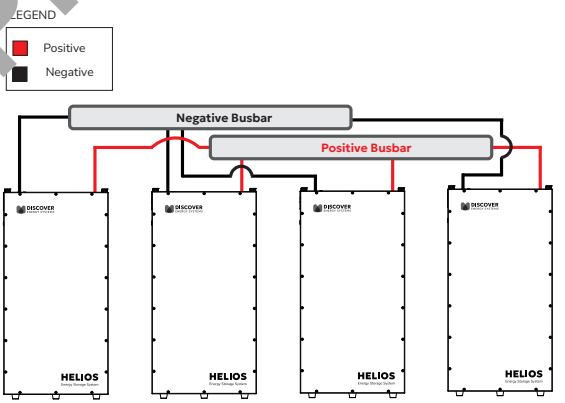


Figure 30. Wiring Battery Negative Terminals to Negative Busbar

9.7 Grounding

At the top of the HELIOS ESS battery is a grounding screw.

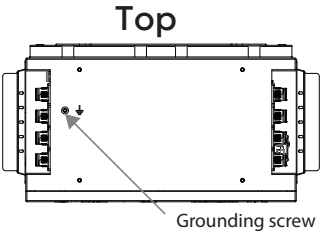


Figure 31. Grounding Screw at Top of HELIOS ESS Battery

9.7.1 Grounding a Single Battery

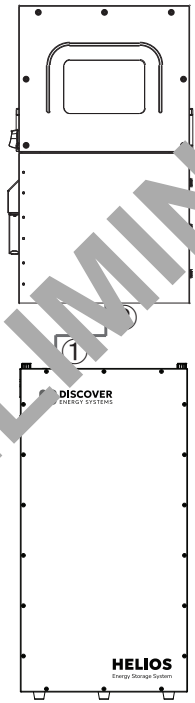


Figure 32. Grounding a Single Battery

1. Secure an appropriately sized grounding wire to the grounding screw on the battery. Refer to your applicable code and check with the authority having jurisdiction to confirm local requirements.
2. Pass the wire from the battery to the grounding port on the inverter.

9.7.2 Grounding Multiple Batteries

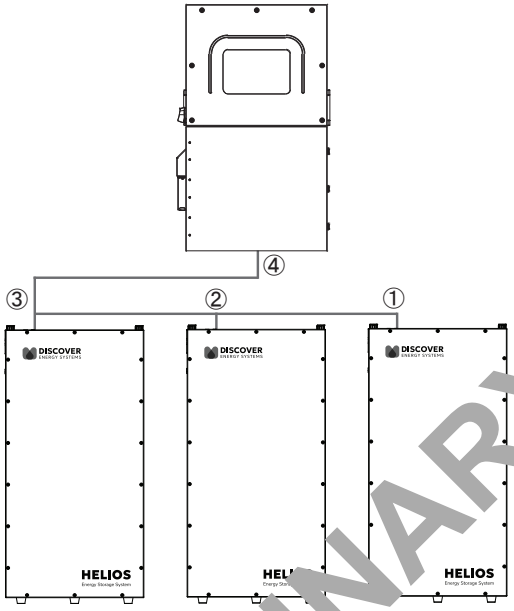


Figure 33. Grounding Multiple Batteries

1. **Grounding the first battery.** Secure an appropriately sized grounding wire to the grounding screw on the farthest battery. Refer to your applicable code and check with the authority having jurisdiction to confirm local requirements.
2. **Grounding the second battery.** Pass the wire from the first battery to the second battery and secure the wire to the grounding screw. Secure another grounding wire to the grounding screw on the battery. If this is the last battery in the system, jump to step 4. Otherwise, go to step 3.
3. **Grounding the third or more batteries.** Pass the wire from the previous battery and secure the wire to the grounding screw on this battery. Secure another grounding wire to the grounding screw on the battery. Repeat until all the batteries are wired.
4. **Ground to the inverter.** Pass the wire from the last grounded battery to the inverter's grounding port.

9.8 LYNK Network

9.8.1 Network Layout

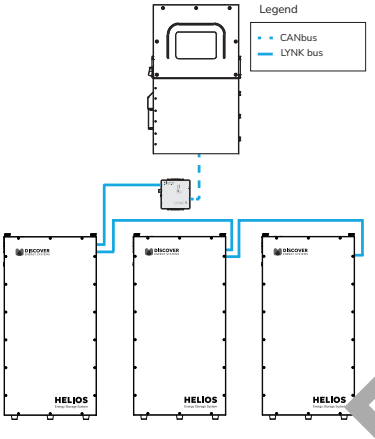


Figure 34. Inverter and Batteries Connected Through LYNK II Communication Gateway

9.8.2 Network Installation

Networking Guidelines:

- **Separate data and power cables**. Allow for separation between data and power cables. Avoid data interference by routing network cables separately from power cables.
- **Allow for LYNK Network cable slack**. Ensure that LYNK Network cables are slack and not in tension.
- **Isolate the LYNK Network.** Do not mix other networks with the LYNK Network.

NOTICE
Mixing the LYNK network with other networks may result in equipment malfunction and damage.

NOTE
• Termination resistors are not required when networking with the LYNK Network. • Refer to the LYNK II Installation and Operation Manual (805-0033) for information on setting up the LYNK II Communication Gateway for your particular inverter-charger.

9.8.3 Installation Procedure

1. Before beginning a network installation, mount the devices according to their instructions.
2. Attach a CAT6 or higher cable to the LYNK port (COM3/COM4) on a battery.
3. Connect the other end of the cable to the LYNK port (COM3/COM4) of the following battery.
4. Repeat until all batteries are connected.
5. Network with other devices and accessories, such as the inverter and LYNK II Communication Gateway, as needed.

9.8.4 Testing and Verification of the LYNK Network

Perform network verification with the **LYNK II Communication Gateway (950-0025)**.

- If the LYNK Network Bus indication LED is illuminated, power and communication for the LYNK network are active.
- Use LYNK ACCESS software through a computer to confirm the number of batteries in the LYNK network.
- Use LYNK CLOUD to remotely monitor and troubleshoot the batteries.

10. OPERATION

The BMS prevents battery operation outside of specified operating conditions. Understand each of these protections and how to set up the system accordingly. Refer to Table 3-5, HELIOS ESS Protection Specifications.

NOTICE
Intentional bypassing of the BMS to operate the battery outside maximum and minimum limits void the warranty.

10.1 Low Voltage Cut-Off

As controlled by the application, program the low voltage cut-off at or above the Low Voltage Disconnect in Table 3-1, HELIOS ESS Electrical Specifications. This action disconnects the load before the BMS enters low voltage protection.

10.2 State of Charge

A voltage-based battery meter designed for lead-acid batteries will not provide an accurate state-of-charge (SOC) for lithium batteries. The LYNK II Communication Gateway (950-0025), available from Discover, can be used to communicate an accurate state of charge to other devices.

NOTICE
Storing or leaving the battery at 0% SOC will lead to irreversible damage and void the warranty.

10.3 Charging

Each electrical system will have different characteristics and balance-of-system components. Charger settings may require modifications to optimize system performance.

NOTICE

- Confirm that the charging device cannot produce transient spikes that exceed the published terminal voltage limits for the battery.
- Confirm the charging curve meets the battery's charging requirement.
- Never charge a visibly damaged or frozen battery.
- If the battery is stored in a cold environment, it may become frozen and may not accept a charge. Be aware of the supported Charge Temperature range (refer to Section 3.3 Environmental Specifications) for your battery and recharge before it approaches 0% SC.

10.3.1 Closed-Loop Charging

Closed-loop charging is a method whereby the battery communicates with a charger and requests a specific charge voltage. Closed-loop charging reduces charge time and increases balancing efficiency compared to open-loop charging.

The HELIOS ESS battery can communicate over a CAT6 or higher cable to support closed-loop charging with the inverters listed in 6.6.2 Closed-Loop Communication Without LYNK II (Straight Cable). By using customized wire pin outs for the RJ45 connectors of a CAT6 or higher cable, the HELIOS ESS battery can communicate with the inverters listed in 6.6.3 Closed-Loop Communication Without LYNK II (Create Your Own Cable).

The HELIOS ESS supports closed-loop charging with many other inverter-chargers when combined with the LYNK II Communication Gateway. Refer to the appropriate Application Note available from discoverenergysys.com for the set up of closed-loop parameters and integration with specific brands of solar inverter-chargers and solar charger controllers.

10.3.2 When to Charge the Battery

- **Opportunity charging is OK.** Charging the battery after every use will not reduce its life.
- **Partial State-of-Charge is OK.** If the battery SOC is greater than 10% at the end of discharge, it does not require an immediate charge. However, do not continually leave the battery in a partial state of charge as that will reduce its performance as battery cells will become unbalanced.

  Every 4 cycles, fully charge the battery so the inverter-charger reaches the charge termination criteria. This ensures the battery cells are balanced and that each battery cell is fully charged.
- **Charge if below 10% SOC.** If the battery has been discharged below 10% SOC, it must be charged within 24 hours to avoid permanent damage to the battery. Otherwise, irreversible damage to the battery cells will occur in a very short period of time.

- **Low charge current extends life.** Charging at 50% of nominal current or lower helps extend the battery cycle life.
- **Charge within the proper temperature range.** Ensure that charging is within the charge temperatures specified in Table 3-4, HELIOS ESS Environmental Specifications.

NOTICE

- The battery must be charged within 24 hours if discharged below 10% SOC. Otherwise, irreversible damage to the battery cells will occur in a very short period of time and void the warranty.
- Do not continually leave the battery in a partial state of charge as that will unbalance the battery cells. Fully charge the battery every 4 cycles so each battery cell is fully charged. If the end of charge criteria is not regularly performed, multiple balancing charges may be required to fully charge each battery cell.
  The following are two ways to perform a balancing charge.
  - Reduce charge termination to 100 mA and maintain 54.4 V for 20 hours.
  - Charge in a closed-loop configuration.

NOTE

When the HELIOS ESS battery cells are between -25°C (-13°F) and 5°C (41°F) and either connected to a charging source or SOC is 50% or more, energy is diverted to the internal heater until the battery cells reach 8°C (46.4°F). If the ESS triggered the Under-temperature in Charge protection, the battery will not allow charging until the cell temperature is 4°C (39.2°F).

10.4 Charging Profile

The Power Conversion device will require setting up a charging profile even if you use closed-loop charging. Using the controller of the Power Conversion device, set up a charging configuration with a lithium charge profile that matches the charge and discharge settings. Refer to Table 3-1, HELIOS ESS Electrical Specifications, for charging parameters.

Refer to the appropriate Application Note from discoverenergysys.com for setting up closed-loop parameters and integrating inverter-chargers and battery chargers.

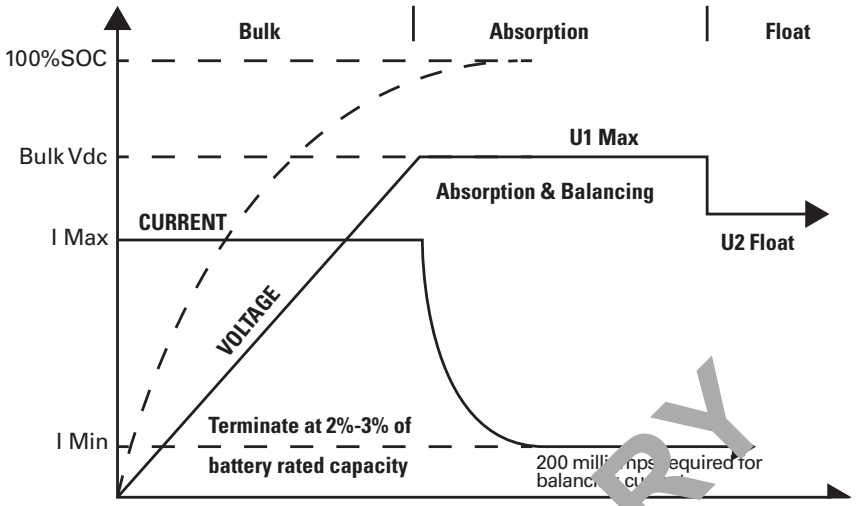


Figure 35. Charge Graph

NOTICE

- Charge with a Lithium charge profile matching the specifications of the HELIOS ESS battery.
- Do not charge using a lead-acid charge profile. Charging using a lead-acid profile will void the warranty.

NOTE

Charging at 50% of nominal current or lower will extend the battery cycle life.

10.4.1 Bulk Charge

Bulk phase. The Bulk charge is the first phase of the charging process, called the constant current phase. This phase is when the charger's maximum current is directed to the battery until reaching the desired voltage. The Bulk phase will recharge the battery to approximately 90-95% SOC.

A single-stage charge may be appropriate if the charging source is a generator or other charge source that is inefficient at low output current. A single-stage charge will only complete the Bulk phase portion of the charge curve. This method should return the battery to 90-95% SOC.

Refer to Table 3-1, HELIOS ESS Electrical Specifications, for charging parameters.

10.4.2 Absorption Charge

Absorption phase. The second phase of the charging process is Absorption Charge, also called the constant voltage phase. In this phase, the charger reduces current accordingly to maintain the desired voltage.

Refer to Table 3-1, HELIOS ESS Electrical Specifications, for charging parameters.

10.4.3 Equalization Charge

⚠ CAUTION

FIRE AND BURN HAZARD

Do not perform an equalization charge on the HELIOS ESS battery.

Failure to follow these instructions may result in injury.

Do not equalize charge the HELIOS ESS battery. Equalization charging is intended only for lead-acid batteries. An equalization charge is a purposeful overcharge that targets a voltage above the standard charge voltage to remove sulphate crystals that form on lead-acid plates over time.

10.4.4 Float Charge

Float phase. Float charge, the third phase of charging, is optional. During this stage, the battery is maintained at 100% SOC for extended periods, counteracting any self-discharge or parasitic loads.

- **Not necessary.** Float charging is not required.

Refer to Table 3-1, HELIOS ESS Electrical Specifications, for float parameters if needed.

11. ROUTINE INSPECTION

⚠ CAUTION

ELECTRIC SHOCK HAZARD

- Do not touch the energized surfaces of any electrical component in the battery system.
- Before servicing the battery, follow all procedures to fully de-energize the battery system.
- Follow 1.4 Safe Handling Procedures when working with the battery.

Failure to follow these instructions may result in injury.

Periodically inspect the battery:

1. Ensure that all DC cables are secure and fasteners are torqued properly.
2. Inspect and clean network and battery connectors of dirt and debris.
3. Ensure all networking cables and connectors are secure and tight.
4. Ensure that the installation location is clean and free from debris.
5. Inspect for cracks or bulging in the battery case.
6. Replace any damaged batteries.
7. Replace any damaged cables.

12. STORAGE

Leaving the battery connected to a trickle load or power electronics will cause the battery to discharge during storage. Without any load, the battery will self-discharge by approximately 3.5% per month while in storage. After storage, charge the battery to 100% SOC and perform at least one full discharge and charge cycle before returning the battery to service.

1. **Store at 95% SOC or more.** To store the battery for up to 6 months, store the battery at 95% SOC or more. It must remain disconnected from all loads and power electronics during storage.
2. **Switch OFF the battery.** Set the battery to OFF.
3. **Check SOC every six months.** Recharge the battery to above 95% SOC every six months.
4. **Proper storage temperature.** Ensure storage is within the temperatures specified below.
   - 1 Month storage temperature -20°C to 55°C (-4°F to 131°F)
   - 6 Month storage temperature -10°C to 30°C (14°F to 86°F)

NOTICE

- Leaving the battery connected to a load or power electronics during storage may subject the battery to discharge, resulting in irreversible damage and voiding the warranty.
- Storing the battery outside specified temperature will result in irreversible damage and void the warranty.

NOTICE

- Storing or leaving the battery at 0% SOC will result in irreversible damage and void the warranty.
- If the battery is stored in a cold environment, it may become frozen and may not accept a charge. Be aware of your battery's supported Charge Temperature range (refer to Section 3.3 Environmental Specifications) and recharge before it approaches 0% SOC.
- Allowing the battery to self-discharge below an open-circuit voltage of 3.0 VPC will cause irreversible damage and void the warranty.

13. BATTERY FIRMWARE AND DATA LOGS

Always ensure the battery is using the latest firmware.

Connect **LYNK ACCESS** software for 64-bit Windows 10 / 11 to either the **LYNK II Communication Gateway** (USB Type B connector) or to the HELIOS ESS battery's USB Type C port (see Figure 4. HELIOS ESS Battery Components, Item #13) to update the battery firmware and to download data logs from the battery.

LYNK II Communication Gateway devices are available from Discover dealers and distributors. Get the latest **LYNK ACCESS** software and battery operating firmware from the Discover website at discoverenergysys.com.

14. TROUBLESHOOTING

Accurate troubleshooting and warranty claims require data logs from each battery.

To share data logs **LYNK ACCESS** software for 64-bit Windows 10 / 11 is required to download data logs from each battery in the system:

- Connect to the **LYNK II Communication Gateway** through a USB connection with the **LYNK II Communication Gateway** device to download the data logs from all the batteries in the system.
- When the system does not use the **LYNK II Communication Gateway** device, connect to the USB Type C port on the HELIOS ESS battery to download the data logs from that one battery. If the system includes multiple batteries, download the data logs from each battery, one by one.

15. RELATED INFORMATION

For warranty information, refer to 885-0098 Discover HELIOS ESS Battery Warranty Policy, available from the Discover website at discoverenergysystem.

16. GLOSSARY OF TERMS, ABBREVIATIONS, AND ACRONYMS

AFB Arc Flash Boundary	**LFP** $LiFePO_4$, Lithium Iron Phosphate
BMS Battery Management System	**RMS** Root Mean Square
DMM Digital Multimeter	**SOC** State of Charge
DOD Depth of Discharge	**VPC** Volts Per Cell
IBF Bolted Fault Current	

APPENDIX

A.1 HELIOS ESS Commissioning Checklist

Use this checklist to confirm the correct installation and function of the HELIOS ESS during the commissioning of the complete energy storage system. This checklist is only for the installation and operation of the HELIOS ESS . Further system-level functionality checks and tests must be performed once the full system is interconnected with the HELIOS ESS to complete commissioning.

Battery Installation

PROCEDURE	CHECK
1. Ensure that the battery is securely anchored to the Wall-Mount Bracket. Verify that:	
• All FOUR screws are tight	
• The battery and Wall-Mount Bracket are secure and the wall shows no signs of losing integrity.	
2. Check the battery cable connections on the inverter. Verify that:	
• The positive battery cables (RED) are fastened to the correct positive terminal on the inverter and secured using the torque as recommended by the inverter manufacturer.	
• The negative battery cables (BLACK) are fastened to the correct negative terminal on the inverter and secured using the torque as recommended by the inverter manufacturer.	
3. Check the battery cables and connections to the battery. Verify that:	
• The positive battery cables are connected to the correct positive battery terminals.	
• The negative battery cables are connected to the correct negative battery terminals.	
• Each battery terminal connection is latched in place. Note: You should not be able to pull off the connector without pressing the release button on the side of connector.	
4. If applicable, check the Conduit Box. Verify that:	
• The conduit box, installed between the inverter and battery, is secure and not loose.	
• The cables passing through the conduit box are not rubbing against any sharp edges.	
• The cables are not overly bent or curled as a result of passing through grommets and conduit.	

PROCEDURE	CHECK
5. Equipment is bonded as required per the local installation code. Verify that:	
• A suitable-sized bonding wire is connected from the ground terminal on the battery to a marked bonding terminal.	
6. Additional disconnects and overcurrent protection required by the installation code are installed and suitably rated. Verify that:	
• Overcurrent protection is suitably rated for min 60 Vdc, 300 A per DC output.	
• Disconnect is rated for min 60 Vdc, and for operating under load of 200 A per DC output.	

Battery Operation Verification

Verify the items below to confirm that the protection functions for the batteries are working correctly.

PROCEDURE	CHECK
1. Confirm that each battery breaker is CLOSED, and turn on each battery using the ON/OFF push button. Verify that:	
• The battery status LED turns a solid GREEN NOTE: • If the LED does not turn ON, there is an issue with the battery. Contact Technical Support. • If the LED flashes, a fault has occurred. Use LYNK Access software to find details about the fault.	
2. Repeat step 1 for all the batteries in the system.	

A.2 Decommissioning Checklist

This checklist is only for the battery energy storage system; further system-level decommissioning procedures on the full system may be required. Refer to the manuals of connected DC loads, power conversion equipment, and other components in the system.

Disassemble, Recycle, and Dispose

PROCEDURE	CHECK
1. Open disconnect devices to ensure there is no electrical connection to any externally connected Power Conversion Equipment.	
2. Turn off each battery one by one using the battery ON/OFF push buttons.	
3. Use a multimeter to verify there is no voltage on the battery terminals.	
4. Disconnect and remove battery cables from the inverter and batteries.	
5. Disconnect and remove CAT6 or higher communication cables.	
6. If using conduit box:	
• Disconnect and remove conduit.	
• Remove cable glands and grommets.	
• Remove the conduit box.	
7. Remove the screws holding the battery to the Wall-Mount Adapter.	
8. Using a two or three-person lift or mechanical aid, detach the battery from the Wall-Mount Adapter.	
9. Remove the Wall-Mount fasteners and detach the Wall-Mount Bracket.	
10. Recycle all recyclable components.	
11. Dispose of unrecyclable components following local waste disposal guidelines.	