

Power M2 Modules

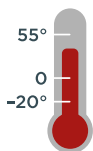
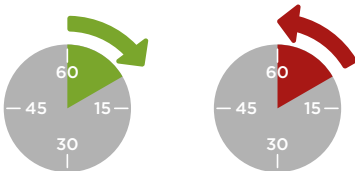
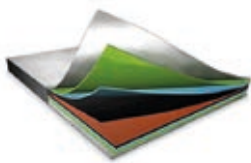
(LTO, 34Ah)



The M2 Series is a family of lithium-ion battery modules with scalable capacity and voltage, suitable for road, marine and other transport applications.

Leclanché is a Swiss-German company with 110 years of experience providing battery systems and energy storage solutions with high precision and reliability.

The **Lithium Titanate Series (LTO)**



The heart of any storage device is the cell. Its quality determines the performance of the entire storage system. Leclanché's Lithium Titanate cells are vastly superior to conventional lithium-ion cells with regard to performance, reliability, service life and load cycles.

■ Industry Leading Safety and Reliability

The already high levels of safety found with LTO cells is further enhanced in Leclanché cells by the addition of a ceramic separator integrated with the unique bi-cell design. All IEC61233 and UNDot 38.3 tests have been passed by this cell including: overcharge, external short circuit, puncture and crush.

■ 15,000 Full Cycles

Rated at more than 15,000 full cycles and a 20 year calendar life, Leclanché's LTO cells set a benchmark for durability and performance. These battery packs can be optimized and fast-charged repeatedly while still delivering a long operational life. This dramatically improves the long-term value proposition. This long cycle life can be further lengthened to 20,000 cycles for 80% DoD applications..

■ 6C Charge/6C Discharge

6C charge means that the battery can be charged to 80% SOC within 10 mins, more than 15,000 times with 80+% of the original capacity left at the end. This is mirrored in discharge where 6C allows a relatively small battery to generate a lot of power repeatedly such as in a hybridized drivetrain.

■ 100% Depth of Discharge

The 100% depth of discharge (DoD) capability of the Lithium Titanate cell considerably increases the efficiency of the storage system. The DoD remains stable over the 15,000 charge/discharge life of the cells.

■ Wide Operational Temperature Range (-20°C to 55°C)

Unlike other Li-ion chemistries, LTO type cells can be safely charged at low temperatures (down to -20°C). LTO can also be safely operated at higher temperatures (up to 55°C) than other Li-ion chemistries, without the accelerated degradation seen in other Li-ion chemistries such as LMO.

■ Water-Based Cell Manufacturing

Leclanché is the only company currently capable of manufacturing water based (solvent free) electrodes. This technology is both environmentally responsible and provides an increased resistance to gassing allowing a longer battery life.

With industry leading lithium-ion technology, we customize battery solutions for power and energy intensive applications.

The M2 Modules



Leclanché pouch cells represent the highest quality, safety and cycle life. The M2 modules provide convenient access to the exceptional performance of the cells while providing:

- Faster pack assembly – Less time connecting individual cells and integrating battery management.
- Choice of capacity, voltage and size.
- Better thermal management – Each module is designed using careful thermal analysis to ensure even temperature distribution and heat sink across all cells in the module.
- All modules have built-in battery management electronics to simplify installation.

There are 38 separate LTO configurations based on 14 module sizes (see table). Parallel string connections are also supported for higher pack capacities. Modules can be liquid cooled using conformal cooling plates.

The Advanced Battery Manufacturing Facilities



- Leading edge manufacturing technology with multiple patents and a fully automated, large-scale production line.
- Production capability of >1 million large format, prismatic pouch cells annually – up to 200 MWh.
- External testing and certification performed by renowned laboratories, including VTT Technical Research Centre of Finland, ENEL, TÜV Rheinland and Landshut University of Applied Sciences.
- Leclanché has considerable experience and field data from its Li-ion battery products, with thousands of battery packs in operation worldwide.

The Leclanché Advantage

Engineered to rigorous standards in Switzerland, our cells are manufactured in a state-of-the-art production facility in Germany. Our modules, packs and racks are produced in Switzerland. Leclanché battery products offer unrivalled safety, quality and durability.

The Leclanché Philosophy: Provide customers with the highest possible quality, reliability and service.

The M2 - LTO Battery Module for Mobility

Battery System

Cell chemistry
Cell voltages
Nominal cell capacity
Cycle Life
(4C/4C @23°C at 80% DoD)
Cycle Life
(4C/4C @23°C at 100% DoD)
Expected calendar lifespan (@23°C)

NCA/LTO
2.2V nominal
34 Ah
20,000 cycles*
15,000 cycles
20 years

Battery Management

Integrated Battery Management
System (BMS)
Monitored cells in series
Max. voltage
External communications (from BCU)
Isolation monitoring
Multi string configurations

Yes (CE, DNV-GL & RINA cert.)
732
1,000 V
2x CAN bus
Yes
Supported with external PLC

* Expected

Module type	# of cells	Nominal Capacity	Nominal Energy	Max. Voltage	Nominal Voltage	Min. Voltage	Width	Height	Length	Weight
11s3p	33	102 Ah	2,5 kWh	30,8 V	24,2 V	16,5 V	175mm	334mm	537mm	49,5 kg
16s2p	32	68 Ah	2,4 kWh	44,8 V	35,2 V	27,2 V	175mm	334mm	522mm	48,2 kg
8s4p	32	136 Ah	2,4 kWh	22,4 V	17,6 V	12,0 V	175mm	334mm	522mm	48,2 kg
4s8p	32	272 Ah	2,4 kWh	11,2 V	8,8 V	6,0 V	175mm	334mm	522mm	48,2 kg
15s2p	30	68 Ah	2,2 kWh	42,0 V	33,0 V	22,5 V	175mm	334mm	493mm	45,5 kg
6s5p	30	170 Ah	2,2 kWh	16,8 V	13,2 V	9,0 V	175mm	334mm	493mm	45,5 kg
5s6p	30	204 Ah	2,2 kWh	14,0 V	11,0 V	7,5 V	175mm	334mm	493mm	45,5 kg
14s2p	28	68 Ah	2,1 kWh	39,2 V	30,8 V	21,0 V	175mm	334mm	463mm	42,7 kg
7s4p	28	136 Ah	2,1 kWh	19,6 V	15,4 V	10,5 V	175mm	334mm	463mm	42,7 kg
4s7p	28	238 Ah	2,1 kWh	11,2 V	8,8 V	6,0 V	175mm	334mm	463mm	42,7 kg
24s1p	24	34 Ah	1,8 kWh	67,2 V	52,8 V	36,0 V	175mm	334mm	404mm	37,3 kg
12s2p	24	68 Ah	1,8 kWh	33,6 V	26,4 V	18,0 V	175mm	334mm	404mm	37,3 kg
3s8p	24	272 Ah	1,8 kWh	8,4 V	6,6 V	4,5 V	175mm	334mm	404mm	37,3 kg
8s3p	24	102 Ah	1,8 kWh	22,4 V	17,6 V	12,0 V	175mm	334mm	404mm	37,3 kg
6s4p	24	136 Ah	1,8 kWh	16,8 V	13,2 V	9,0 V	175mm	334mm	404mm	37,3 kg
4s6p	24	204 Ah	1,8 kWh	11,2 V	8,8 V	6,0 V	175mm	334mm	404mm	37,3 kg
22s1p	22	34 Ah	1,6 kWh	61,6 V	48,4 V	33,0 V	175mm	334mm	375mm	34,6 kg
11s2p	22	68 Ah	1,6 kWh	30,8 V	24,2 V	16,5 V	175mm	334mm	375mm	34,6 kg
7s3p	21	102 Ah	1,6 kWh	19,6 V	15,4 V	10,5 V	175mm	334mm	360mm	33,2 kg
3s7p	21	238 Ah	1,6 kWh	8,4 V	6,6 V	4,5 V	175mm	334mm	360mm	33,2 kg
20s1p	20	34 Ah	1,5 kWh	56,0 V	44,0 V	30,0 V	175mm	334mm	345mm	31,9 kg
10s2p	20	68 Ah	1,5 kWh	28,0 V	22,0 V	15,0 V	175mm	334mm	345mm	31,9 kg
5s4p	20	136 Ah	1,5 kWh	14,0 V	11,0 V	7,5 V	175mm	334mm	345mm	31,9 kg
4s5p	20	170 Ah	1,5 kWh	11,2 V	8,8 V	6,0 V	175mm	334mm	345mm	31,9 kg
16s1p	16	34 Ah	1,2 kWh	44,8 V	35,2 V	24,0 V	175mm	334mm	286mm	26,4 kg
8s2p	16	68 Ah	1,2 kWh	22,4 V	17,6 V	12,0 V	175mm	334mm	286mm	26,4 kg
4s4p	16	136 Ah	1,2 kWh	11,2 V	8,8 V	6,0 V	175mm	334mm	286mm	26,4 kg
14s1p	14	34 Ah	1,0 kWh	39,2 V	30,8 V	21,0 V	175mm	334mm	257mm	23,7 kg
7s2p	14	68 Ah	1,0 kWh	19,6 V	15,4 V	10,5 V	175mm	334mm	257mm	23,7 kg
12s1p	12	34 Ah	0,9 kWh	33,6 V	26,4 V	18,0 V	175mm	334mm	227mm	21,0 kg
6s2p	12	68 Ah	0,9 kWh	16,8 V	13,2 V	9,0 V	175mm	334mm	227mm	21,0 kg
4s3p	12	102 Ah	0,9 kWh	11,2 V	8,8 V	6,0 V	175mm	334mm	227mm	21,0 kg
3s4p	12	136 Ah	0,9 kWh	8,4 V	6,6 V	4,5 V	175mm	334mm	227mm	21,0 kg
11s1p	11	34 Ah	0,8 kWh	30,8 V	24,2 V	16,5 V	175mm	334mm	212mm	19,6 kg
10s1p	10	34 Ah	0,7 kWh	28,0 V	22,0 V	15,0 V	175mm	334mm	198mm	18,3 kg
5s2p	10	68 Ah	0,7 kWh	14,0 V	11,0 V	7,5 V	175mm	334mm	198mm	18,3 kg
8s1p	8	34 Ah	0,6 kWh	22,4 V	17,6 V	12,0 V	175mm	334mm	168mm	15,5 kg
4s2p	8	68 Ah	0,6 kWh	11,2 V	8,8 V	6,0 V	175mm	334mm	168mm	15,5 kg

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