

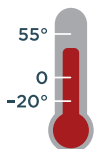
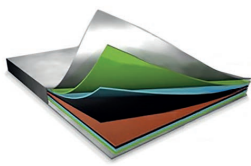
# Power M2 Modules (LTO)



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 21,000 cycles for 80% DoD applications.

### ■ 6C Charge/6C Discharge

4C 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 a 6C peak 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)

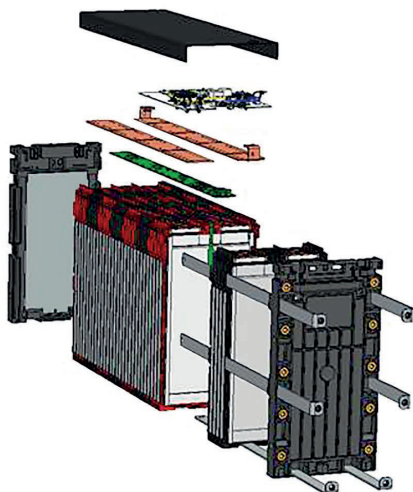
Unlike other Li-ion chemistries, LTO type cells can be safely charged at low temperatures (down to -20°C). LTO can also be safely operated at higher temperatures (up to 55°C) than other Li-ion chemistries, without the accelerated degradation seen in other Li-ion chemistries such as LMO.

### ■ 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 35 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 170 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  
Specified cycles  
(4C/4C @23°C at 80% DoD)  
Specified cycles  
(4C/4C @23°C at 100% DoD)  
Expected calendar lifespan (@23°C)

NCA/LTO  
**2.2V nominal**  
**30 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 detection  
Multi string configurations

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

Module type	# of cells	Nominal Capacity	Nominal Energy	Max. Voltage	Nominal Voltage	Min. Voltage	Width	Height	Length	Weight
11s3p	33	90 Ah	2.3 kWh	29,70 V	25,30 V	18,70 V	175mm	334mm	537mm	49,5 kg
16s2p	32	60 Ah	2.2 kWh	43,20 V	36,80 V	27,20 V	175mm	334mm	522mm	48,2 kg
8s4p	32	120 Ah	2.2 kWh	21,60 V	18,40 V	13,60 V	175mm	334mm	522mm	48,2 kg
4s8p	32	240 Ah	2.2 kWh	10,80 V	9,20 V	6,80 V	175mm	334mm	522mm	48,2 kg
15s2p	30	60 Ah	2.1 kWh	40,50 V	34,50 V	25,50 V	175mm	334mm	493mm	45,5 kg
6s5p	30	150 Ah	2.1 kWh	16,20 V	13,80 V	10,20 V	175mm	334mm	493mm	45,5 kg
5s6p	30	180 Ah	2.1 kWh	13,50 V	11,50 V	8,50 V	175mm	334mm	493mm	45,5 kg
14s2p	28	60 Ah	1.9 kWh	37,80 V	32,20 V	23,80 V	175mm	334mm	463mm	42,7 kg
7s4p	28	120 Ah	1.9 kWh	18,90 V	16,10 V	11,90 V	175mm	334mm	463mm	42,7 kg
4s7p	28	210 Ah	1.9 kWh	10,80 V	9,20 V	6,80 V	175mm	334mm	463mm	42,7 kg
24s1p	24	30 Ah	1.7 kWh	64,80 V	55,20 V	40,80 V	175mm	334mm	404mm	37,3 kg
12s2p	24	60 Ah	1.7 kWh	32,40 V	27,60 V	20,40 V	175mm	334mm	404mm	37,3 kg
3s8p	24	240 Ah	1.7 kWh	8,10 V	6,90 V	5,10 V	175mm	334mm	404mm	37,3 kg
8s3p	24	90 Ah	1.7 kWh	21,60 V	18,40 V	13,60 V	175mm	334mm	404mm	37,3 kg
6s4p	24	120 Ah	1.7 kWh	16,20 V	13,80 V	10,20 V	175mm	334mm	404mm	37,3 kg
4s6p	24	180 Ah	1.7 kWh	10,80 V	9,20 V	6,80 V	175mm	334mm	404mm	37,3 kg
22s1p	22	30 Ah	1.5 kWh	59,40 V	50,60 V	37,40 V	175mm	334mm	375mm	34,6 kg
11s2p	22	60 Ah	1.5 kWh	29,70 V	25,30 V	18,70 V	175mm	334mm	375mm	34,6 kg
7s3p	21	90 Ah	1.5 kWh	18,90 V	16,10 V	11,90 V	175mm	334mm	360mm	33,2 kg
3s7p	21	210 Ah	1.5 kWh	8,10 V	6,90 V	5,10 V	175mm	334mm	360mm	33,2 kg
20s1p	20	30 Ah	1.4 kWh	54,00 V	46,00 V	34,00 V	175mm	334mm	345mm	31,9 kg
10s2p	20	60 Ah	1.4 kWh	27,00 V	23,00 V	17,00 V	175mm	334mm	345mm	31,9 kg
5s4p	20	120 Ah	1.4 kWh	13,50 V	11,50 V	8,50 V	175mm	334mm	345mm	31,9 kg
4s5p	20	150 Ah	1.4 kWh	10,80 V	9,20 V	6,80 V	175mm	334mm	345mm	31,9 kg
16s1p	16	30 Ah	1.1 kWh	43,20 V	36,80 V	27,20 V	175mm	334mm	286mm	26,4 kg
8s2p	16	60 Ah	1.1 kWh	21,60 V	18,40 V	13,60 V	175mm	334mm	286mm	26,4 kg
4s4p	16	120 Ah	1.1 kWh	10,80 V	9,20 V	6,80 V	175mm	334mm	286mm	26,4 kg
14s1p	14	30 Ah	1.0 kWh	37,80 V	32,20 V	23,80 V	175mm	334mm	257mm	23,7 kg
7s2p	14	60 Ah	1.0 kWh	18,90 V	16,10 V	11,90 V	175mm	334mm	257mm	23,7 kg
12s1p	12	30 Ah	0.8 kWh	32,40 V	27,60 V	20,40 V	175mm	334mm	227mm	21,0 kg
6s2p	12	60 Ah	0.8 kWh	16,20 V	13,80 V	10,20 V	175mm	334mm	227mm	21,0 kg
4s3p	12	90 Ah	0.8 kWh	10,80 V	9,20 V	6,80 V	175mm	334mm	227mm	21,0 kg
3s4p	12	120 Ah	0.8 kWh	8,10 V	6,90 V	5,10 V	175mm	334mm	227mm	21,0 kg
11s1p	11	30 Ah	0.8 kWh	29,70 V	25,30 V	18,70 V	175mm	334mm	212mm	19,6 kg
10s1p	10	30 Ah	0.7 kWh	27,00 V	23,00 V	17,00 V	175mm	334mm	198mm	18,3 kg
5s2p	10	60 Ah	0.7 kWh	13,50 V	11,50 V	8,50 V	175mm	334mm	198mm	18,3 kg
8s1p	8	30 Ah	0.6 kWh	21,60 V	18,40 V	13,60 V	175mm	334mm	168mm	15,5 kg
4s2p	8	60 Ah	0.6 kWh	10,80 V	9,20 V	6,80 V	175mm	334mm	168mm	15,5 kg

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