

Makita 18V Battery – Datasheet

1. Datasheet of 18V 2Ah Makita Battery

1.1. Safe Usage of Lithium Batteries

All Lithium batteries have high risks as they store large amounts of energy. The risk of using Lithium-Ion batteries include: Fire Hazard, Electrocution, Chemical Poisoning, Explosions which can lead to fires, injury and even death.

Lithium batteries **should always be stored, charged and kept in Lithium safe bags or cabinets** that have adequate fireproofing for the size of the battery. Lithium batteries should always be used in well ventilated areas and never in confined places where a person or robot would be trapped alongside with a potentially defective battery.

Lithium-Ion Batteries **should always be used alongside with a BMS** (Battery Management System) such as the one that is inside name brand Makita 18V Batteries. This circuit balances the charge between the cells in series inside of the battery and protects the cells from misuse by the end-user.

Lithium-Ion Batteries **should always be charged using a properly rated CC-CV (constant-current constant-voltage) charger at a current suitable for the cells** inside of the battery. The USB-C device inside the microver.ch Power Receiver is an example of such a suitable CC-CV charger rated for a 5S Lithium-Ion Battery such as the Makita 18V battery. There should never be another device that charges our Makita batteries, for example using the DC Barrel Jack! As such devices have not been tested with our Makita Battery and could lead to a very real explosion and fire in the case of an over-charging situation.

1.2. Capabilities of the Makita 18V Batteries

1.2.1. Voltage

The Makita 18V 2Ah Li-ion batteries are meant to be used in the following voltage range:

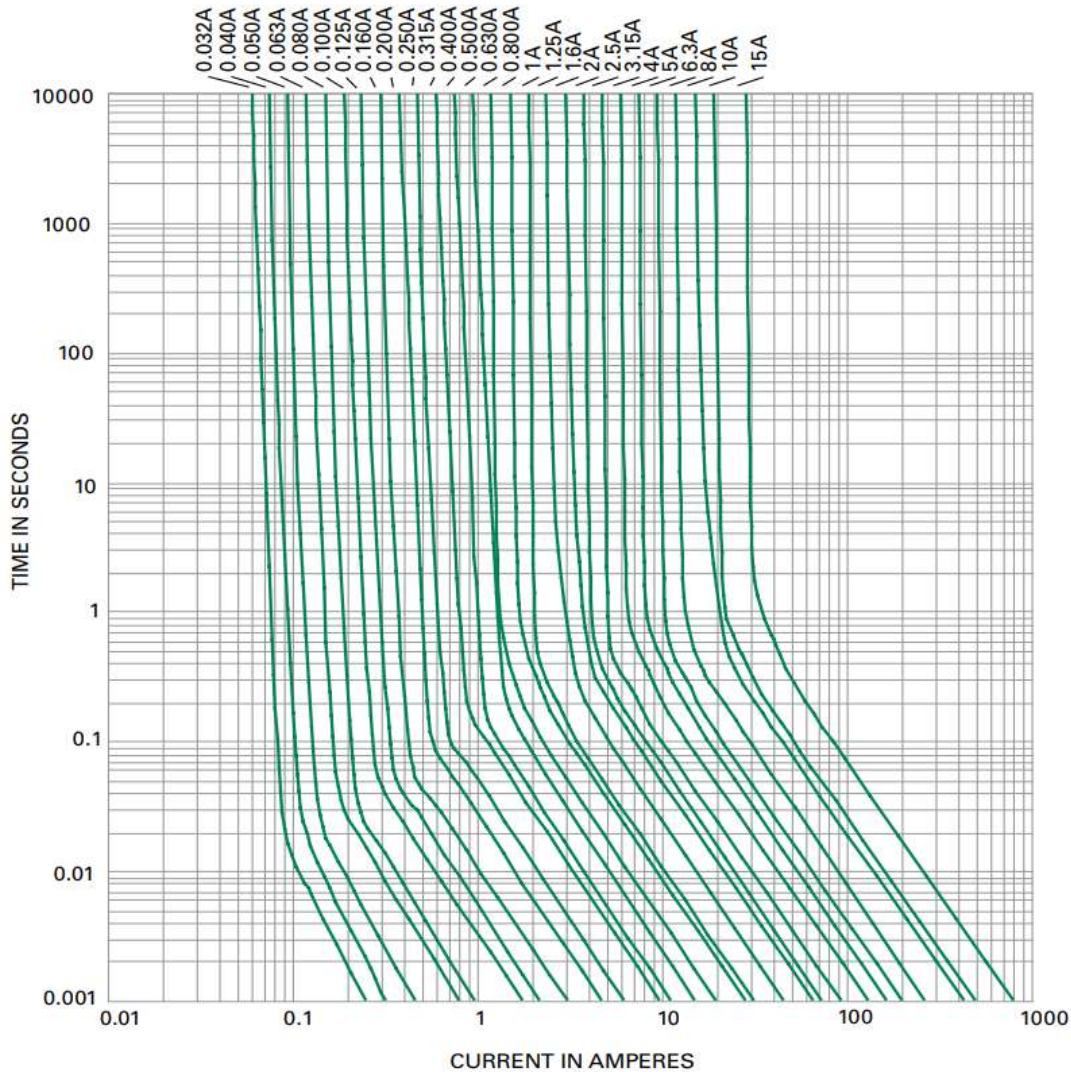
$$\text{Voltage Range: } 15.0[V] - 21[V]$$

Which is the regular voltage range of the individual Li-ion cells $3.0[V] - 4.2[V]$ multiplied by the total number of cells in series: 5 *cells*, each at $3.6[V]$ nominal giving us a nominal total voltage of $18.0[V]$.

Discharging your battery past the 15.0[V] can lead to permanently killing the battery as it will not be recognized by the charger anymore or it could kick in the Makita internal safety system that will permanently disable the battery (possible but yet to happen in testing).

1.2.2. Current

The Makita 18V 2Ah Li-ion batteries can easily handle 10 Amps for about 12 minutes until they pass their 15.0[V] over-discharge limit. The external 5x20mm glass fuse included in the microver Power Receiver is rated for 10 Amps to protect the battery from short-circuits leading from misuse by the end-user. These should blow following the current-blow time graph as shown below:



1.2.3. Temperature

The Makita 18V 2Ah Li-ion Batteries should not be subjected to extreme temperatures leaving the following range:

$$\text{Temperature Range: } 0^{\circ}\text{C} - 40^{\circ}\text{C}$$

1.2.4. Humidity and Water

The Makita 18V 2Ah Li-ion Batteries should not be subjected to extreme humidity or water slashing/submerging as they are not sealed and will be destroyed by a dip underwater. Light water splashing should be avoided but will not always kill the battery right-away.

1.3. Makita Battery Light Indicator

1.3.1. Disclaimer

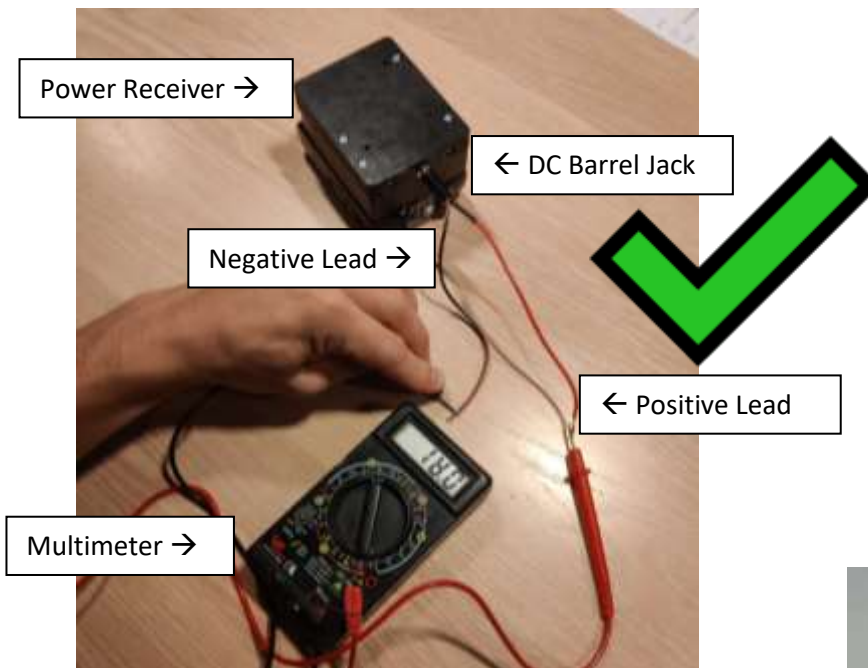
The Makita Battery Light indicator is set and reset by the original Makita name brand charger device.

The batteries used in the Microver Initiative are charged by a non-namebrand USB-C charger device controlled by a PMIC (Power Management Integrated Circuit) made for the purpose of charging any standard 5S Lithium-Ion batteries and not specifically Makita's proprietary batteries. For this reason, the **battery indicator light is not functional** as it will get stuck in some certain state and never be reset by a charger. Therefore, **it should not be used as a way to gauge the amount of charge left in the battery.**

This is a known behaviour flaw of using Makita batteries for an application outside the realm of their hand-tools. To measure the remaining state of charge of the batteries, it is up to the user to measure the voltage at the terminals of the Power Receiver using a voltmeter.

1.3.2. Measuring State of Charge using a Voltmeter

The simplest way to measure the state of charge of the batteries is to plug a DC Barrel Jack into one of the three ports on the microver Power Receiver (with the battery plugged in) and to probe both terminals of the Barrel Jack with a voltmeter set on voltage measurement mode. The following table should give a good idea of how much charge there is left in the battery.

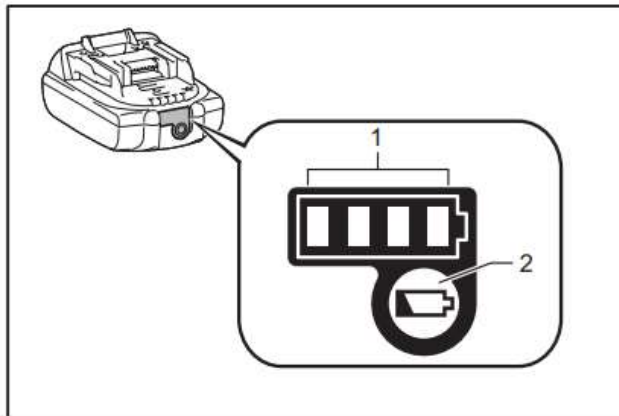


Voltage [V]	Charge Left [%]
21.0	100%
20.5	97%
20.0	78%
19.5	69%
19.0	57%
18.5	45%
18.0	33%
17.5	23%
17.0	13%
16.5	9%
16.0	6%
15.5	4%
15.0	0%

Be careful of never probing the battery terminals as this bypasses the safety fuse installed in the Power Receiver and could lead to an unprotected battery short circuit!



1.3.3. Official Makita Datasheet of Indicator Lamps



Indicator lamps			Remaining capacity
Lighted	Off	Blinking	
■	■	■	75% to 100%
■	■	□	50% to 75%
■	□	□	25% to 50%
■	□	□	0% to 25%
▬	□	□	Charge the battery.
■	□	□	The battery may have malfunctioned.
□	□	■	

NOTE: Depending on the conditions of use and the ambient temperature, the indication may differ slightly from the actual capacity.

1.3.4. Makita Indicator Lamps from Various Testing

Battery Charge Indicator	Battery Voltage	Actions
0 lights	/	Battery needs to be plugged into name-brand Makita charger to enable it
1 light blinking	< 15.0 [V]	Battery is over discharged, immediately stop using it and charge it
1 light steady	15.0[V] – 17.0 [V]	Battery has 25% capacity left
2 lights steady	17.0[V] – 18.5 [V]	Battery has 50% capacity left
3 lights steady	18.5[V] – 19.5 [V]	Battery has 75% capacity left
4 lights steady	19.5[V] – 21.0 [V]	Battery has 100% capacity left
alternating 2 lights left 2 lights right	Undetermined	Battery is unhappy and has put itself in safety mode, Original Makita Charger will not charge it, microver.ch Power Receiver should charge it, be careful!

Most batteries will default to the “alternating 2 lights left, 2 lights right” situation after 2-4 charging cycles with the USB-C circuit on the Power Receiver. This is because Makita does not want the user to use their batteries with anything else than name brand Makita power tools and chargers.

According to our testing (more than 10 consequent full power (8A) charge-discharge cycles without any issues), this should not impact the functionalities of the battery. Just be weary of undervoltage on the battery due to a continued usage past the 15.0V limit voltage!