PROTECTION (SAFETY) CIRCUIT FOR LITHIUM ION / LITHIUM POLYMER BATTERIES & PACKS

Master Instruments are now able to supply a complete solution for the assembly of lithium ion and lithium polymer cells and batteries complete with Protection Circuit Module and additional safety devices as required.

Much emphasis is placed on the safety of rechargeable lithium technology due to the hazardous nature of the Li-Ion battery if provoked. High case temperature resulting from the abuse of a Li-Ion cell assembly can cause damage to equipment and/or physical injury. This is why a designated protection circuit is required on nearly all Li-Ion battery assemblies. Safety circuits are designed to constantly monitor the condition of the Li-Ion battery during charge & discharge. This design involves the safety circuit shutting off the current to prevent cell damage if the voltage or current goes outside of acceptable parameters.
When the voltage and/or current return to acceptable levels, the safety circuit automatically resets allowing normal operation of battery assembly.

Sanyo UF553450F cell fitted with PCM

Sanyo 2/UR18650F in parallel fitted with PCM and SRP175 polyswitch

The Safety Circuit is usually attached to the battery as a separate module and is commonly referred to as the PCM (Protection Circuit Module). The purpose of a PCM on rechargeable lithium ion and lithium polymer batteries is twofold.

Lithium ion and lithium polymer batteries require a PCM to prevent explosion of these otherwise possibly hazardous technology batteries. The PCM will make the battery open circuit in the event of a wrongful condition arising such as short circuit.

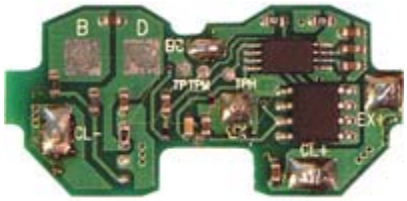
For long useful service life and maintenance of maximum useable capacity the PCM is incorporated into single cells as well as multiple cell batteries in either series, parallel or a series/parallel combination. Lithium Ion and Polymer batteries will lose capacity and cycle life if overcharged, overdischarged or too high a charge or discharge current is asked of these battery chemistries.

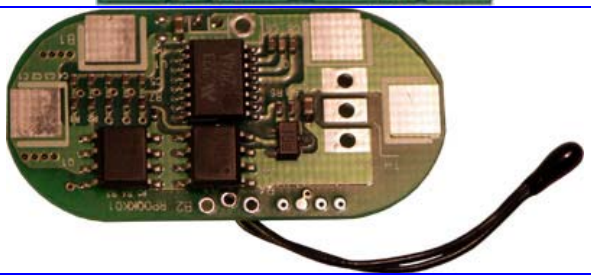
- The PCM prevents the battery from going below a certain voltage point on discharge.
- The PCM prevents the battery voltage rising over its recommended maximum voltage on charging.
- The PCM limits the maximum charge and discharge current entering or leaving the battery.
- It is recommended by all major manufacturers of lithium ion and lithium polymer cells are not used with a PCM being incorporated.
- When selecting a lithium ion or polymer cell it should be considered the maximum discharge current should not exceed 2.0C* (twice the rated capacity of the battery) with the end voltage point not being lower than 2.5 volts per cell.

- Lithium Ion cells should never be used without a safety circuit (PCM) being incorporated. Some newer developments of lithium ion cells from leading edge manufacturers such as Sanyo are using less hazardous materials with a PTC device built in which will may reduce protection circuit requirements or components. These are usually aimed small current devices which use low capacity.
- Lithium Polymer cells are used in some applications with relative safety without a PCM, however, the risk of overcharge/overdischarge is greater & this is likely to drastically reduce the service life of the battery. We recommend use of safety circuits for Li-Polymer batteries.
- Lithium Ion and lithium polymer specific chargers must be used for these type of batteries. Do not use chargers designed for any other chemistries.
- If you plan to use your own charger or built in charge circuit, samples will have to be submitted for approval before supply of batteries can take place. This approval process can take many months to be finalised with cell manufacturers.

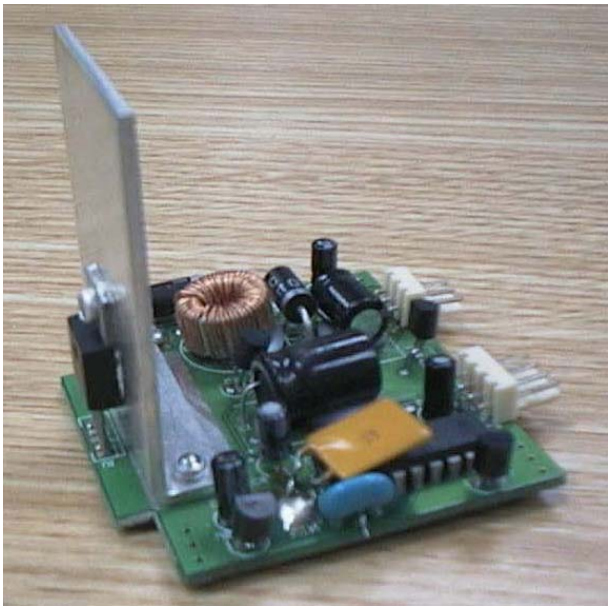
*Some lithium polymer cells are manufactured for discharge currents of up to 10C. These are aimed primarily at the RC Hobby market & are used generally without a PCM. Under such conditions failure rate may rise and cycle life reduced considerably. We do not recommend use of these cells in this manner for other applications.

Below is a table of the PCM's currently on offer. Other types are available on request. Complete data sheets are available for each PCM on request.

Model Number	Image	Description	Maximum charge or discharge current	Comments
MI PCM-2SXP2A		2 cell in series with one or multiple cells in parallel	2 amps	OCP2A (over current protection)
MI PCM-1SXP3A		1 cells in series with one or multiple cells in parallel	3 amps	OCP3A (over current protection)
MI PCM-2SXP2.7A		2 cells in series with one or multiple cells in parallel	2.7amps	Specifically designed for 2 columns of 18mm diameter cylindrical cells OCP2.7A (over current protection)
MI PCM-2SXP4A		2 cells in series with one or multiple cells in parallel	4 amps	OCP4A (over current protection)
MI PCM-3XSP2A		3 cells in series with one or multiple cells in parallel	2 amps	OCP2A (over current protection)

MI PCM-4SXP5A		4 cells in series with one or multiple cells in parallel	5 amps	OCP5A (over current protection)
MI PCM-4SXP10A		4 cells in series with one or multiple cells in parallel	10 amps	OCP10A (over current protection)
Images are not to scale.				

UNIVERSAL CHARGE CONTROL MODULE WITH PROTECTION (SAFETY) CIRCUIT FOR LITHIUM ION / LITHIUM POLYMER BATTERIES & PACKS

Model Number	Image	Description	Comments
MI CCM-1SXP		**Battery Charger Spec:** • Input: 8V~30Vdc. • Charging Voltage: 4.2V+ 1%. • Charging Current: 0.3A~2.5A. • Charging Method: CC/CV Constant current followed by constant voltage charge. Top up charging after battery full. • Protection: Able to detect defect battery. Maximum Charge Time Control. • Dimension: 60x55x55mm Both charging voltage and charging current can be adjusted as per design requirement. Following pictures show the actual PCBA. Please be noted that the heat-sink can be changed as per requirement.	OEM requirements only.