



C8000 Li Protection Circuit Testing

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ABSTRACT

The C8000 is an advanced programmable battery testing system. The C8000 offers four independent channels, tests batteries ranging from 50 mAh to 100 Ah, provides manual and automated service and can work in standalone or with PC software. The ability to set up custom programs for the C8000 is a key feature of the system. This application note looks at one such program designed to test the operation of a Li protection circuit of a cell phone battery.

Contents

1.	Customer Requirement	2
2.	Test Overview	2
4.	Results	4
5.	Termination Data	5
6.	Summary	5

List of Figures

Figure 1 - C-code.....	2
Figure 2 - Li Protect Program	3
Figure 3 - Li Protect Charge Cycle Graph.....	4
Figure 4 - Termination Data	5

1. Customer Requirement

A customer in the cellular industry required a method to test the protection circuit of single-cell lithium-ion batteries.

2. Test Overview

The protection circuit test involved charging the battery at a constant current up to and beyond the battery maximum charge voltage of 4.2V. The customer was interested in measuring the time difference between the battery reaching its maximum charge voltage and the time the protection circuit kicked in.

3. C8000 Test.

C-code

A c-code was created that set the maximum charge voltage above the trip point for the battery protection circuit. A voltage of 4.59V was used. See figure 1 below. All of the other values in the c-code are the defaults for this chemistry.

C-Code Definition
Modify C-Code Definition

Chemistry	Li		Mili-ohms pass/fail point	150	
Number of cells	1		Min. safe operating voltage	2.500	v
Rating	1.000	Ah	Max. safe operating voltage	4.500	v
Charge rate	1.000	A	Max. safe operating charge current	2.000	A
Discharge rate	1.000	A	Max. safe operating discharge current	2.000	A
Low temperature limit	0	deg C	Max. safe operating temperature	60	deg C
High temperature limit	45	deg C			
Delta T (dT)	1	deg C/min			
Maximum charge voltage	4.499	v			
End of discharge	3.000	v			
Standby voltage	4.050	v			
Charge termination point	0.050	A			
Rapid charge voltage	3.000	v			
Target capacity	80	percent (%)			
Perform automatic ohmtest	No				
Charge timeout (0 = off)	150	C-minute			
Discharge timeout (0 = off)	150	C-minute			

C-Code Name:

OK Cancel

Figure 1 - C-code

Program

A program was written that would test the functionality of the protection circuit.

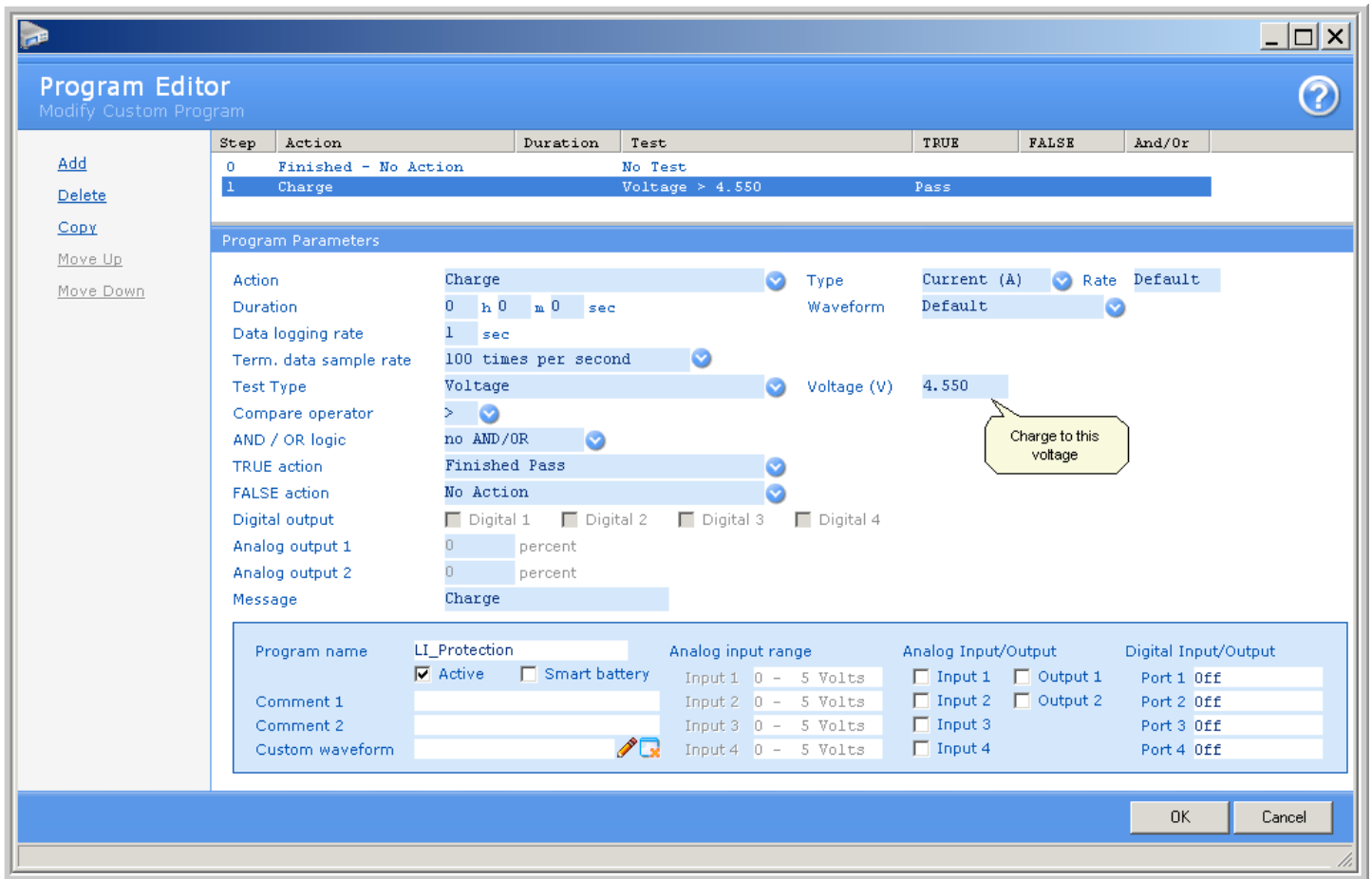


Figure 2 - Li Protect Program

Only one program step is required. The battery will charge until a voltage of 4.55V is reached. The charge rate is defined in the c-code in figure 1 (1.000 A).

4. Results

The results file contains a graph of the charge cycle. The graph resolution is set to once per second in the custom program via the Data Logging Rate field.

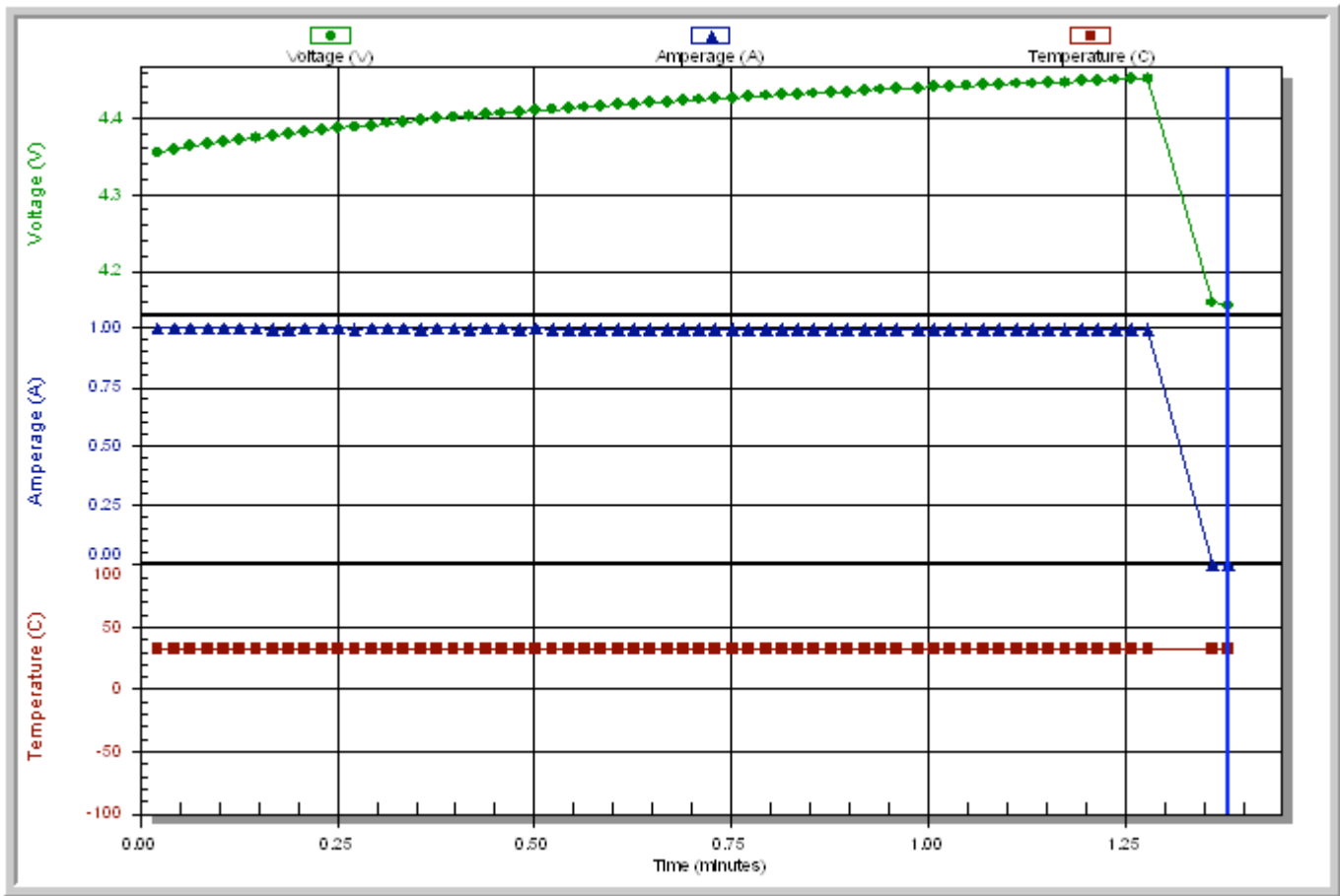


Figure 3 - Li Protect Charge Cycle Graph

5. Termination Data

The test results file also contains termination data that shows in greater detail how the cycle ended. Note that the termination data is exported to Excel where it is then graphed.

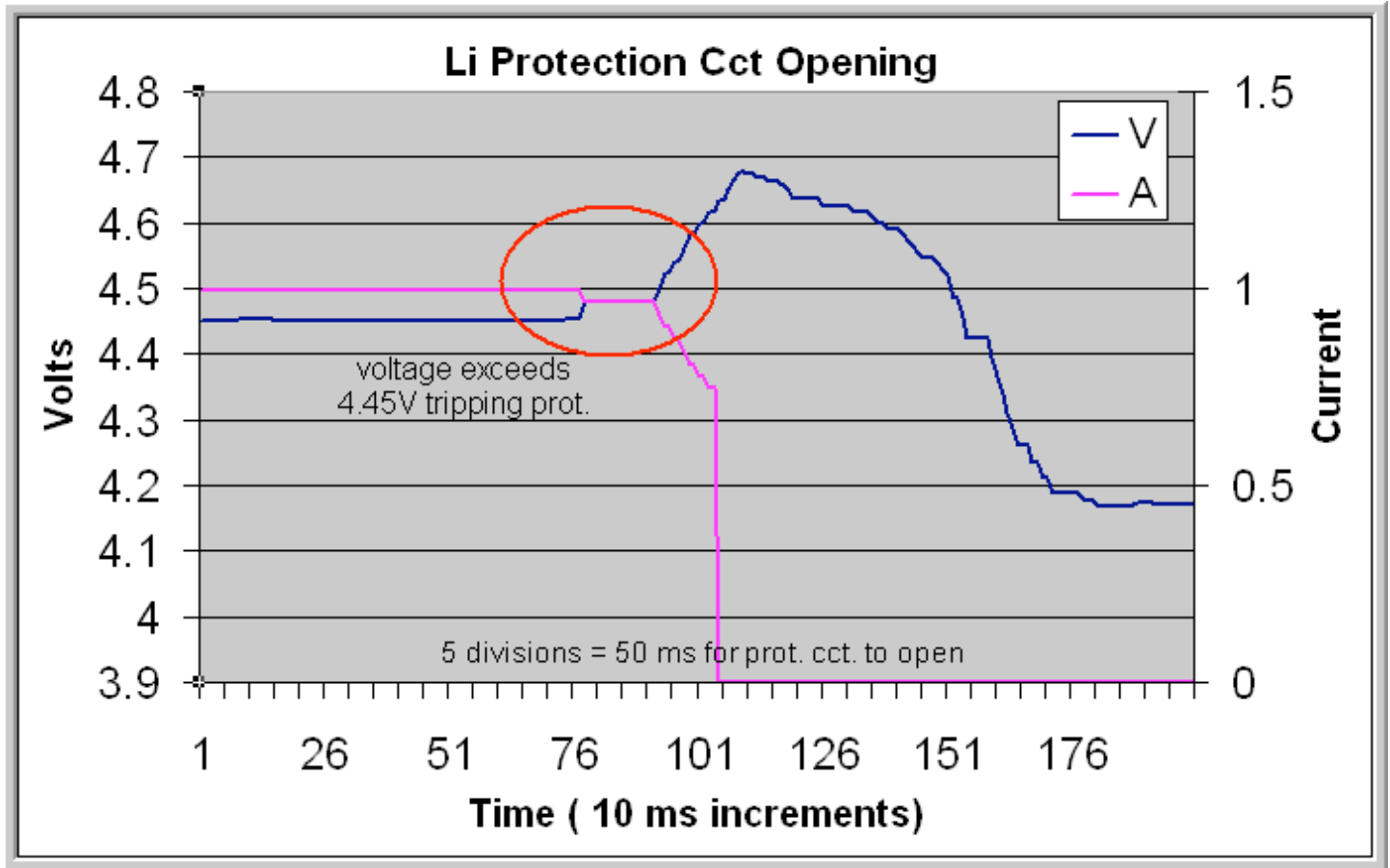


Figure 4 - Termination Data

6. Summary

The C8000 with the accompanying BatteryLab software is well suited for testing the operation of safety circuits of Li batteries.

The customer was able to set a safe upper limit above the safety circuit threshold but within a manageable voltage in the event the safety circuit failed. The software allowed the customer to see in detail the performance of the safety circuit at the time of termination and measure the time required for the safety circuit to activate.