MACCOR
BATTERY & CELL TEST EQUIPMENT WORLDWIDE

White Paper

Advanced Multiple Level Pulsing

Advanced Multiple Level Pulsing (AMLP)

Introduction

Battery-powered devices have grown increasingly sophisticated, with modern electronics operating at speeds once considered purely theoretical. As a result, the batteries that power these devices are subject to greater performance demands, requiring more precise selection, evaluation, and testing of energy sources.

One critical factor that emerged from early GSM development is the impact of pulse load profiles on battery cycle life and runtime. These insights have led to a heightened focus on replicating real-world load conditions during battery testing. Accurate load profile simulation—alongside precise current and voltage measurement—is now essential for evaluating battery performance under dynamic conditions.

To meet these evolving challenges, Maccor has developed **Advanced Multiple Level Pulsing (AMLP)** technology. This advanced functionality, now standard in the new **Series 660x** product line, enables the creation and execution of complex, high-speed pulse profiles with ease, accuracy, and reliability.

Features

- **Modes:** Supports constant current, constant power, and constant resistance (discharge only).
- **Duration:** Programmable from 100 µs to 15 seconds with 1-µs increments.
- **Samples:** Report intervals from 100 µs to 15 seconds with 1-µs increments.
- **Levels:** Up to 15,000 levels possible.
- **Profiles:** Multiple AMLP profiles can be included in a single test procedure.
- **End Conditions:** up to two voltage end conditions.

Operational Overview

Creating a Pulse Profile

An Advanced Multiple Level Pulse is implemented as a **Step Type** within a test procedure. The first step in configuring AMLP is to create a pulse profile (*.amlp file). Maccor provides the **MacAMLP.exe** application for this purpose.

This application allows users to define custom pulse profiles in an ASCII, tab-delimited format that includes a header and associated data values. Due to its simple structure, profiles may also be created using a spreadsheet application, as long as the file is saved as tab-delimited text and adheres to the required formatting.

MacAMLP.exe Application Features

To ensure profile accuracy and compatibility, MacAMLP.exe includes the following tools:

- **Syntax verification** for valid formatting
- **Validation of step durations and sample intervals**
- **Memory usage monitoring**, showing percent of allocated memory utilized
- **Parameter checking** against test channel specifications to ensure valid operation

Test Configuration Requirements

Proper integration of an AMLP step into a test procedure requires specific step framing. This involves two supporting steps known as the **Front Porch** and **Back Porch**.

Front Porch (Preceding Step)

- **Step Type:** Constant Current (Charge or Discharge)
- **Current Range and Mode:** Must match the first pulse level in the AMLP profile
- **Duration:** Greater than one second
- **End Condition:** Step Time only
- **Report Type:** Time, with a resolution greater than 100 µs

Back Porch (Following Step)

- **Step Type:** Constant Current (Charge or Discharge)
- **End Condition:** Step Time only, with a duration of 2–5 seconds
- **Report Type:** Time, with a resolution greater than 100 µs

In addition, AMLP steps can be terminated based on measured voltage. When using voltage-based end conditions, the test can branch to any subsequent step—provided the destination conforms to the **Back Porch** requirements listed above.

Application Examples

AMLP profiles are versatile and can simulate a variety of real-world applications such as:

- Mobile communications (e.g., GSM, LTE load patterns)
- Wearable electronics and IoT devices
- High-speed digital processing loads
- Electric vehicle subcomponents

[Charts or example figures would typically be included here to illustrate profile usage.]

Conclusion

Maccor's **Advanced Multiple Level Pulsing** technology delivers high-speed, accurate, and flexible pulse testing, enabling engineers to better understand how batteries will perform under dynamic conditions. This powerful feature simplifies the evaluation process and increases confidence in selecting the optimal battery for modern high-performance devices.

The AMLP functionality, now standard on the Series 660x platform, sets a new benchmark in pulse-based battery testing—supporting today's complex designs and anticipating tomorrow's demands.