

# UG10048

## HVBMSCT800BUN User Guide

Rev. 1.0 — 28 April 2023

User guide

### Document Information

Information	Content
Keywords	high voltage battery management system, HVBMS, battery management unit, BMU, cell monitoring unit, CMU, battery junction box, BJB
Abstract	This document aims to help getting started with the HVBMSCT800BUN HVBMS hardware reference design.



## Revision history

Revision history

Rev	Date	Description
1	20230428	Initial version

## 1 Introduction

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The RD-HVBMSCT800BUN is an ETPL-based High-Voltage Battery Management System (HVBMS) reference design bundle for 800 V applications. This bundle has been designed for evaluation and development purposes. The RD-HVBMSCT800BUN is composed of a hardware kit and several software packages.

This document details the first startup steps to visualize the measurements performed by the system in a graphical user interface (GUI).

## 2 Kit content

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The RD-HVBMSCT800BUN bundle contains the following items:

- **Battery Management Unit (BMU)**
  - 1 RD-K358BMU board
  - 1 power supply (12 VDC, 5 A)
  - 1 multipurpose cable
  - 1 USB-TTL cable
  - 1 Electrical Transport Protocol Link (ETPL) cable
- **Cell Monitoring Unit (CMU)**
  - 1 RD33774CNT3EVB board
  - 3 supply cables
  - 1 ETPL cable
- **Battery Junction Box (BJB)**
  - 1 RD772BJBTPL8EVB board
  - 1 power cable
  - 7 high-voltage measurement cables
  - 1 pair of thermal sensor cable
  - 1 chassis cable
  - 1 ETPL cable
  - 1 plexiglass cover
- **Battery emulation kit**
  - 1 BATT-18EMULATOR board
  - 1 power supply (5 VDC, 5 A)
- Links to the **Software** and **Safety kits**

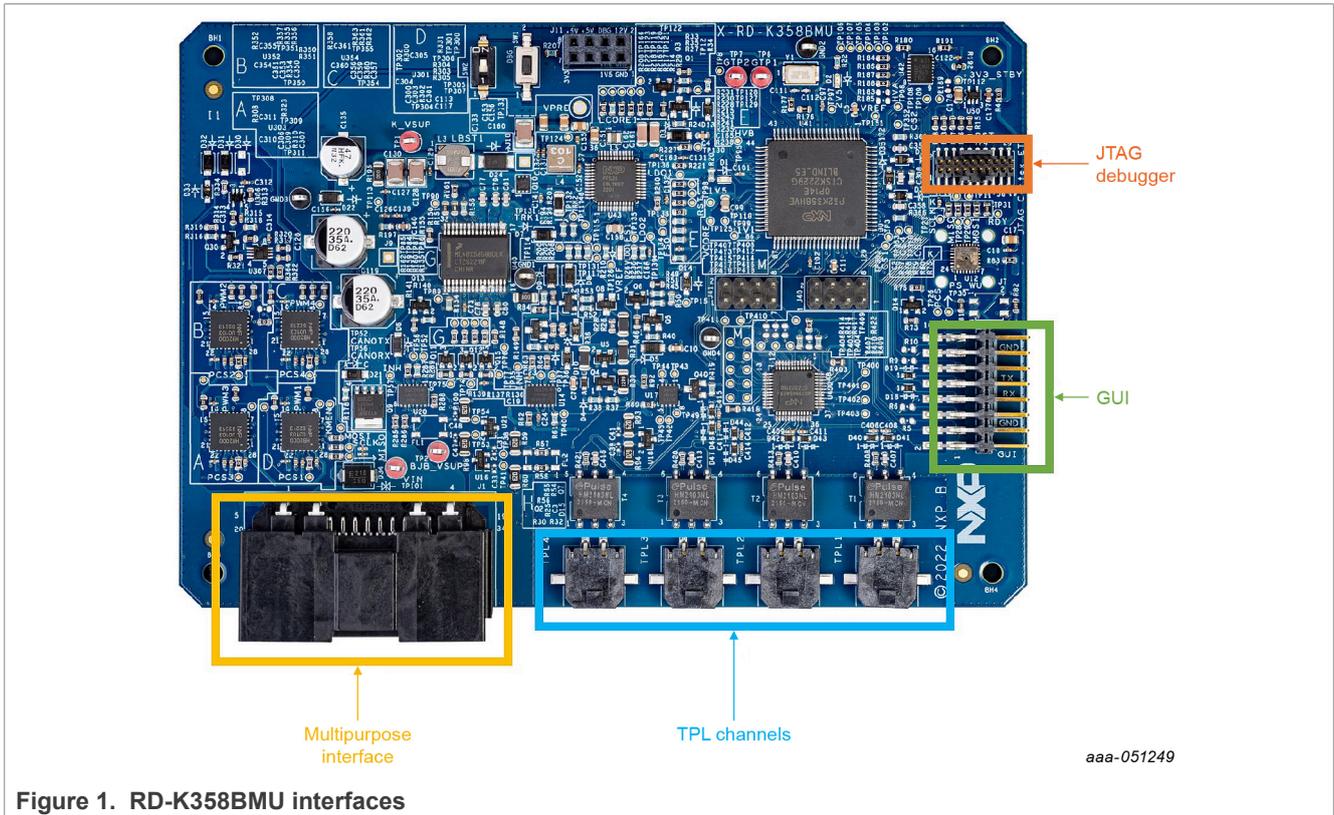
**Note:** An HVBMS Start-up interface is available on the [RD-HVBMSCT800BUN](#) website to visualize cell voltage measurements at first startup. This interface is a GUI running on FreeMASTER (NXP Run-Time Debugging Tool) matching with a binary file that is preflashed on the BMU.

### 3 Getting to know the hardware

#### 3.1 Battery management unit

The Battery Management Unit (BMU) is the control part of the Battery Management System (BMS). The BMU processes the data, makes decisions, and commands the system.

The RD-K358BMU is the HVBMS reference design BMU for 800 V applications. This BMU kit includes a power supply and three cables to interface with other parts of the HVBMS.



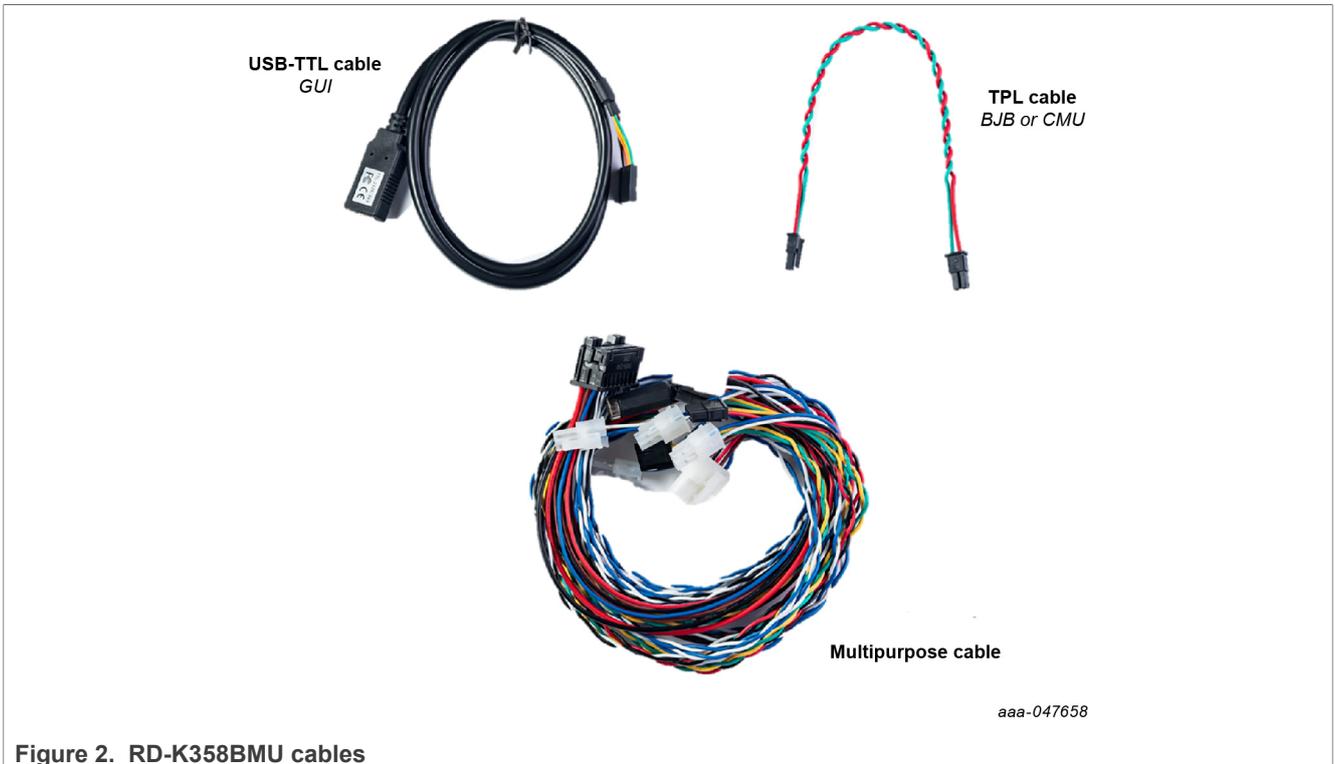


Figure 2. RD-K358BMU cables

To learn more about the RD-K358BMU, visit the website associated with this reference design, or read its [user manual](#).

### 3.2 Cell monitoring unit

The CMU is the cell-sensing part of the BMS. The CMU precisely monitors cell voltages and environmental temperatures to ensure safe battery operation. The CMU also enables fast cell-balancing.

The RD33774CNT3EVB is the HVBMS reference design CMU for ETPL-based architectures based on the MC33774A battery cell controller. This CMU kit includes four cables to interface with other parts of the HVBMS.

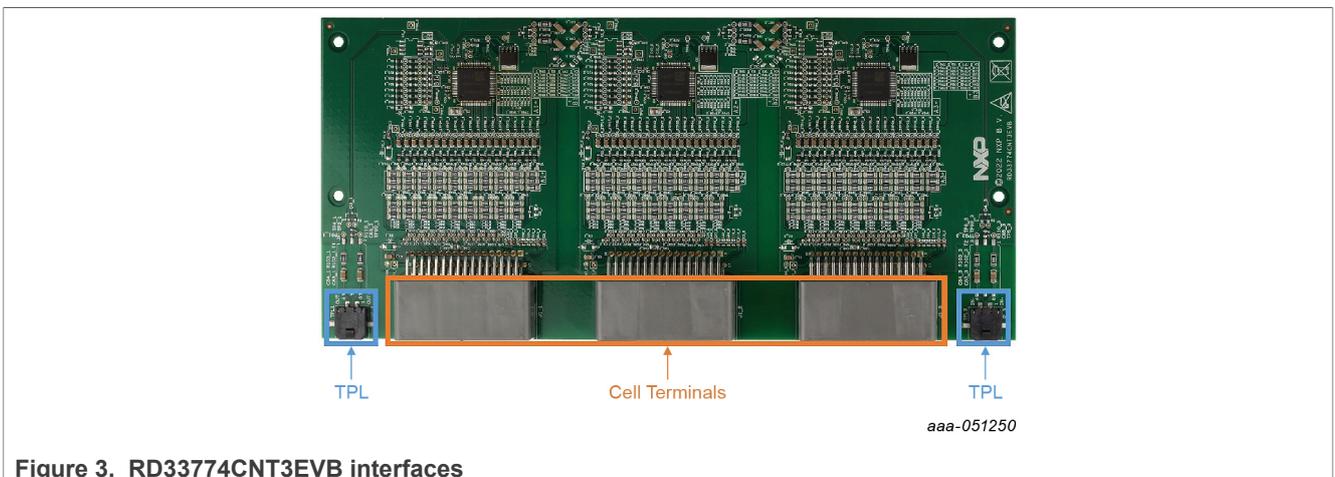


Figure 3. RD33774CNT3EVB interfaces

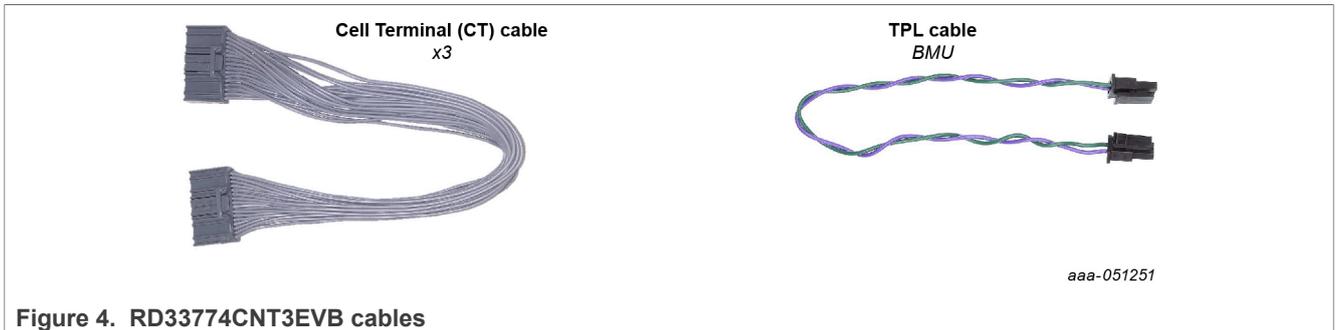


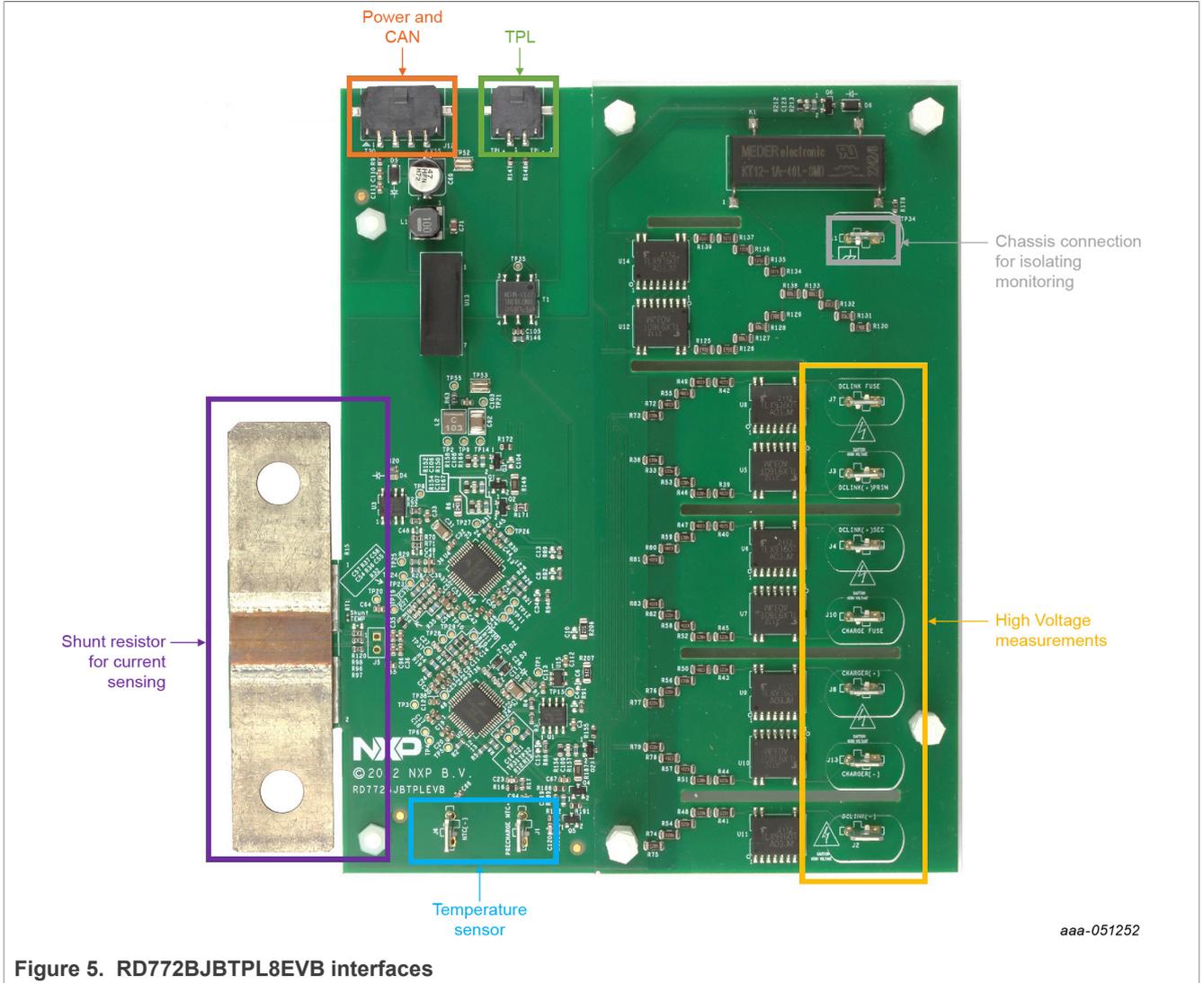
Figure 4. RD33774CNT3EVB cables

To learn more about the RD33774CNT3EVB, visit the website associated with this reference design, or read its [user manual](#).

### 3.3 Battery junction box

The Battery Junction Box (BJB) is the pack-level sensing part of the BMS. The BJB measures high voltages. This measurement allows monitoring connections of the contactors to the inverter and the charger. The BJB also precisely measures the system's current, and monitors the battery to chassis isolation.

The RD772BJBTPL8EVB is the 800 V HVBMS reference design BJB for ETPL-based architectures. This BJB kit includes eleven cables to interface with other parts of the HVBMS.



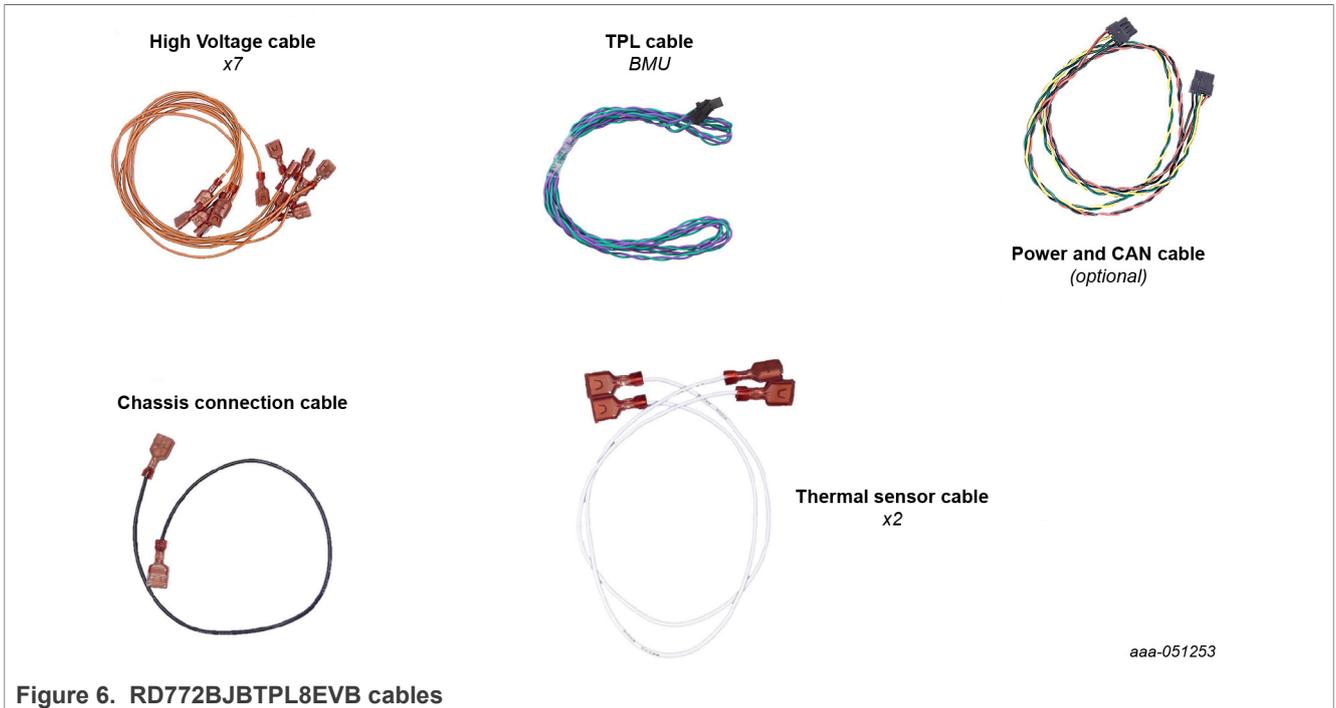


Figure 6. RD772BJBTPL8EVB cables

To learn more about the RD772BJBTPL8EVB, visit the website associated with this reference design, or read its [user manual](#).

### 3.4 Battery emulation

To emulate cell voltages and temperatures, the RD-HVBMSCT800BUN contains a [BATT-18EMULATOR](#) battery emulator.

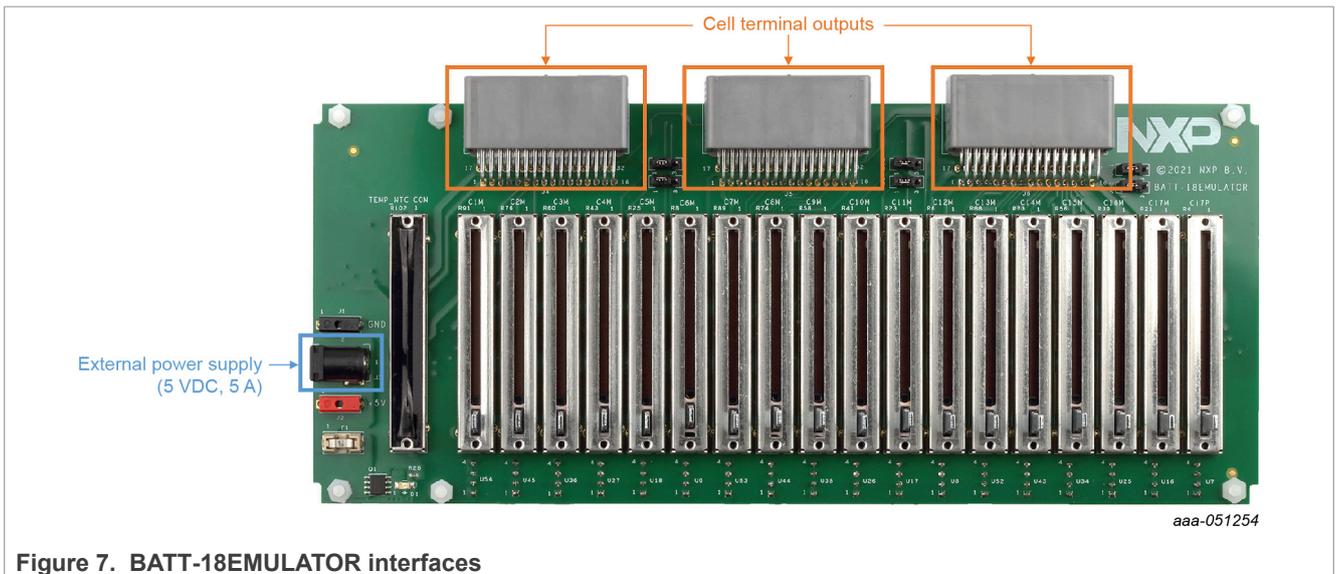


Figure 7. BATT-18EMULATOR interfaces

## 4 First start-up

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### 4.1 Hardware requirements

In addition to the kit contents, the following hardware is beneficial when working with this kit.

- A **PC**, to run the provided GUI and program the RD-K358BMU board
- A **JTAG debugger** to program the RD-K344BMU board. The recommended debugger is a PEmicro Multilink FX.

### 4.2 Software requirements

In addition to the kit contents, the following software is beneficial when working with this kit.

- [FreeMASTER 3.2](#), for measurement visualization using the HVBMS Start-up interface  
**Note:** *FreeMASTER is a user-friendly real-time debug monitor and data visualization tool that enables runtime configuration and tuning of embedded software applications, with integrated drivers for S32 Design Studio.*

### 4.3 Powering and connecting the system

To connect and power-up the system, complete the following steps.

- **Connections of the boards**
  - Unpack all boards and cables from the kit
  - Connect the multipurpose cable to the RD-K358BMU (J1)
  - Connect the CMU
    - Connect the first ETPL cable to the RD-K358BMU (J2) and the RD33774CNT3EVB (J2\_1)
    - Connect the second ETPL cable to the RD-K358BMU (J3) and the RD33774CNT3EVB (J2\_3)
    - Connect the three supply cables to the RD33774CNT3EVB (J1\_1, J1\_2, and J1\_3) and the BATT-18EMULATOR (J4, J5, and J6)
  - Connect the BJB
    - Connect the ETPL cable between the RD-K358BMU (J4) and the RD772BJBTPL8EVB (J9)
    - Connect the BJB supply cable between the RD-K358BMU (J1, 4-pin connector, pins 11 to 14) and the RD772BJBTPL8EVB (J12)

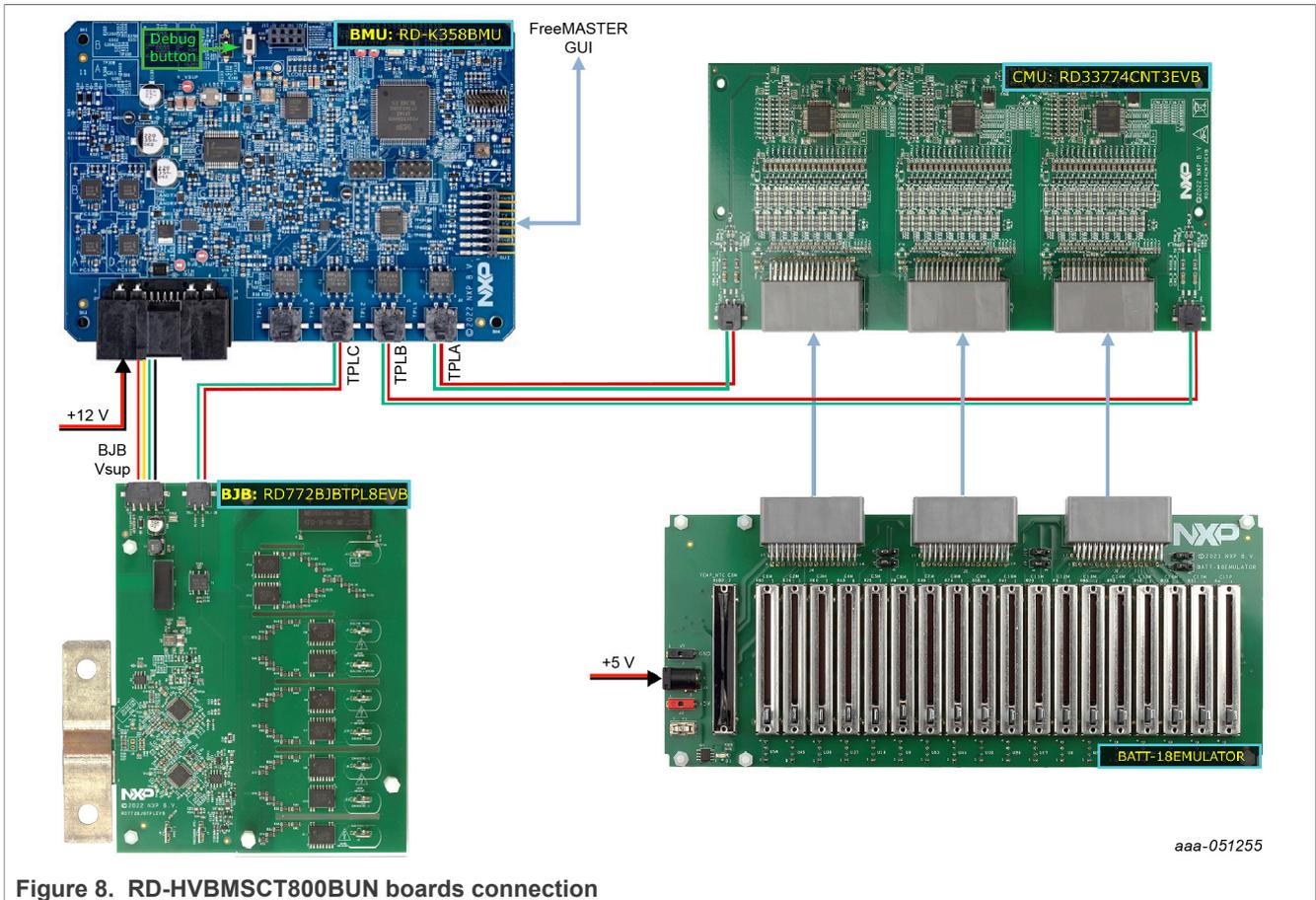


Figure 8. RD-HVBMSCT800BUN boards connection

- **Powering the boards**
  - Power the CMU by powering the BATT-18EMULATOR using the provided power supply (J3)
  - Power the BMU by connecting the provided power supply to the multipurpose cable end
- **Monitoring the system using the HVBMS Start-up interface**
  - Open the HVBMS Start-up FreeMASTER project (*HVBMS\_800\_StartUp\_FreeMASTER.pmpx*)
  - Connect the provided USB-TTL cable to the RD-K358BMU (J8), ensuring the black wire is on GND, yellow is on TX, and orange is on RX.

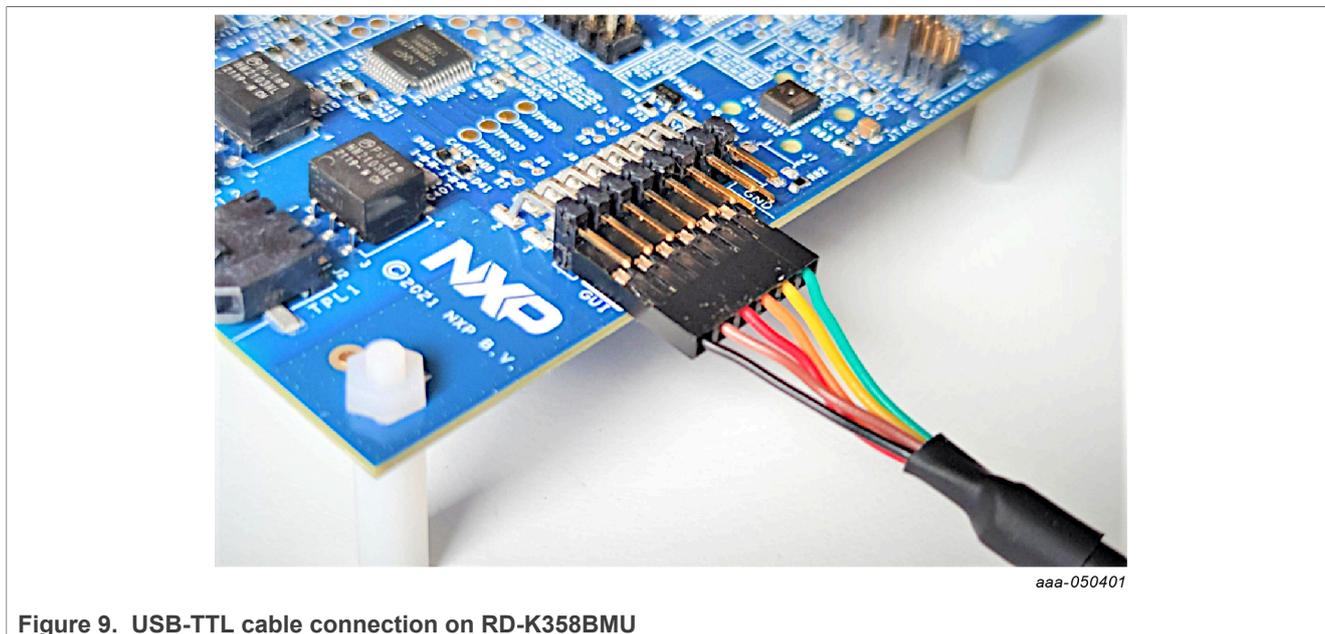


Figure 9. USB-TTL cable connection on RD-K358BMU

- Configure the USB connection on FreeMASTER
  - In the FreeMASTER menu, click **Tools** and then **Connection Wizard...**
  - In the Connection Wizard window:
    - Click **Next**
    - Select **Use direct connection to onboard USB port** and click **Next**
    - Select the correct USB serial port and select **115200** as baud rate to probe and click **Next**
    - Select **Yes, use the detected port settings and start using FreeMASTER tool** and click **Finish**
  - In the FreeMASTER menu, click **Go!** or click **Connect** in the interface
- **Programming the system**

To install the development setup and start programming with the HVBMS reference design, refer to the Software section of the [RD-HVBMSCT800BUN](#) website.

## 5 References

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- [1] **RD-K358BMU** Battery management unit website: [RD-K358BMU](#)
- [2] **RD33774CNT3EVB** Cell monitoring unit website: [RD33774CNT3EVB](#)
- [3] **RD772BJBTPL8EVB** Battery junction box website: [RD772BJBTPL8EVB](#)
- [4] **BATT-18EMULATOR** Battery cell emulator webpage: [BATT-18EMULATOR](#)
- [5] **RD-HVBMSCT800BUN** Bundle webpage: [RD-HVBMSCT800BUN](#)

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