Application Note
ADI BMS Master

Version	0.1
Status	Draft
Date	23-March-2022

CONTENTS

Figures

Tables

1 DOCUMENT DETAILS

1.1 Document History

Version	Author		Reviewer		Approver	
	Name	Date (DD-MM-YYYY)	Name	Date (DD-MM-YYYY)	Name	Date (DD-MM-YYYY)
Draft 0.1	Srikanth Reddy Ramidi	23-March-2022	Tejendra Joshi	30-March-2022		

Version	Description Of Changes
Draft 0.1	Newly Created

Table 1: Document History

1.2 Definition, Acronyms and Abbreviations

Definition/Acronym/Abbreviation	Description
BMS	Battery Management System
GPIO	General Purpose input/output
I2C	Inter-Integrated Circuit
UART	Universal Asynchronous Receiver-Transmitter
SPI	Serial Peripheral Interface
USB	Universal Serial Bus
CAN	Controlled Area Network
PC	Personal Computer

Table 2: Definition, Acronyms and Abbreviations

2 INTRODUCTION

The main function of a BMS is to keep the different cells of the battery pack inside their safe operating area. The ADBMS1818 solution described in this application note features the ADBMS1818, an Analog Devices, Inc., cell monitoring IC.

This application note introduces the ABMS1818 multicell battery stack monitor and the evaluation platform, which consists of the BMS master unit (see Figure 1: BMS Master Unit) and the ADBMS1818 slave unit (see Figure 2: EVAL-ADBMS1818 Slave). This application note also describes the system setup from a hardware and software perspective. Refer to the ADBMS1818 data sheet and the master unit documentation linked in the References section while using this application note.

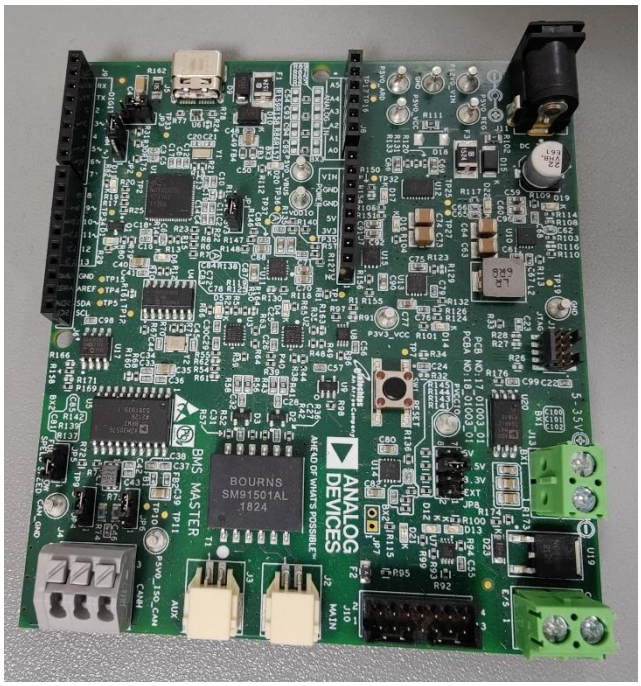

Figure 1: BMS Master Unit

Figure 2: EVAL-ADBMS1818 Slave

3 BMS SYSTEM SETUP

This section describes the evaluation of the ADBMS1818 platform and lists the required steps for both hardware and software setup.

Figure 3: BMS Master Block Diagram shows the main elements and interconnections of the BMS system. The implementation (the number of slave units, the size of the battery) depend on the user application and specifications.

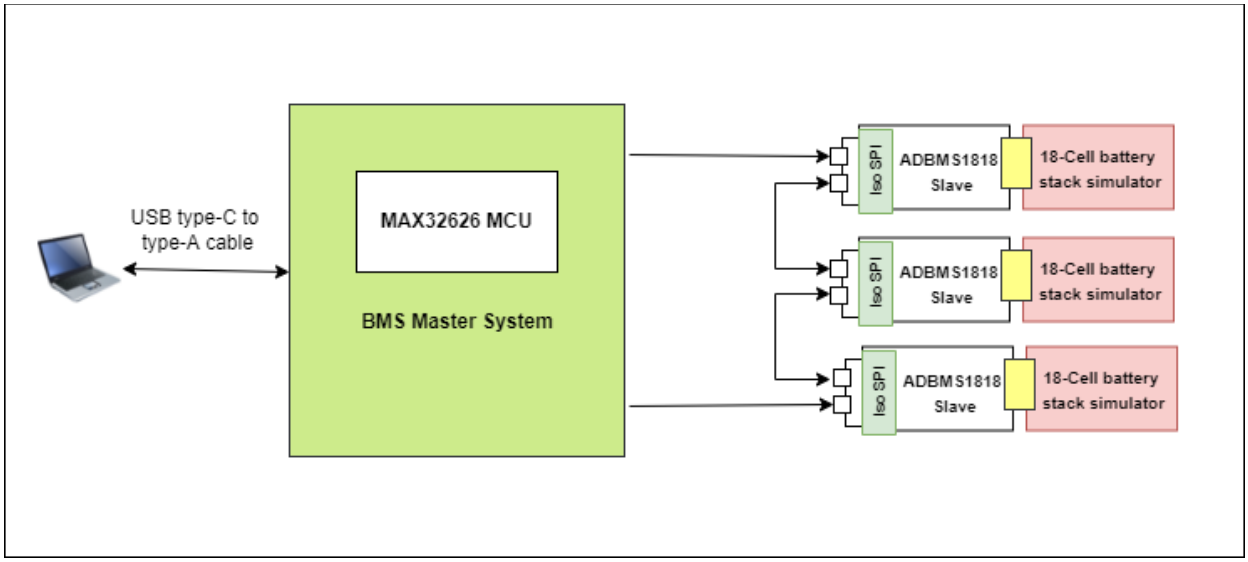

Figure 3: BMS Master Block Diagram

3.1 SOFTWARE SETUP

The software, documentation, and workspace required for software setup and use are all open source and free to download (see the References section).

C-code files must be compiled to generate the firmware (the binary file) with which the microcontroller max32626 on ADI BMS Master board is flashed.

BMS Master Software	Name	Function
Maxim's Software Toolchain	ARMCortexToolchain	This tool chain install's maxim's Eclipse IDE with required plugins
Integrated Development Environment	Eclipse	This component is used for compiling the whole project consisting of C/C++ files

Table 3:BMS Master System Software Components

Installation of Eclipse IDE.

- Download & install ARM Cortex Toolchain from "ARMCortexToolchain.exe " and the version is 1.2.0 or above.
- Run the above downloaded ARM Cortex Toolchain.

- While installing it will ask to select the plugins. select all. It consists of Eclipse CDT, GNU Tools etc.., which are required for the project.
- After Installation is done, in the installed folder under Maxim directory eclipse bat script will be available, run that script for using eclipse IDE.

For building the project, follow the steps mentioned below.

- Download the BMS Firmware and extract the zip file.
- Run Eclipse IDE.
- Create a folder for workspace and select it as workspace location in Eclipse IDE.
- Import the extracted project.
- Add a run configuration in Eclipse IDE with required details such as **elf** location("**build\BMS_Master.elf**") in C/C++ application field of Main tab, set the executable field with "**openocd"**, config options with "**-s ${env_var:TOOLCHAIN_PATH}/share/openocd/scripts -f interface/ftdi/olimex-arm-usb-tiny-h.cfg -f target/MAX32625.cfg"** of Debugger tab.
- Run the project on IDE.
- After running the project, the BMS board has successfully programmed. It can be verified by manually examining "Status LED" on BMS board.

Running GUI:

- Download BMS Master GUI zip and extract it.
- Open the extracted BMS Master GUI folder and over there open the application named ADI_BMS_Master
- After opening in the PC/Host configuration Tab set the required configuration data like OV, UV thresholds, COM port, baud rate, number of boards.
- Check the GUI user guide for detailed information, check References for link

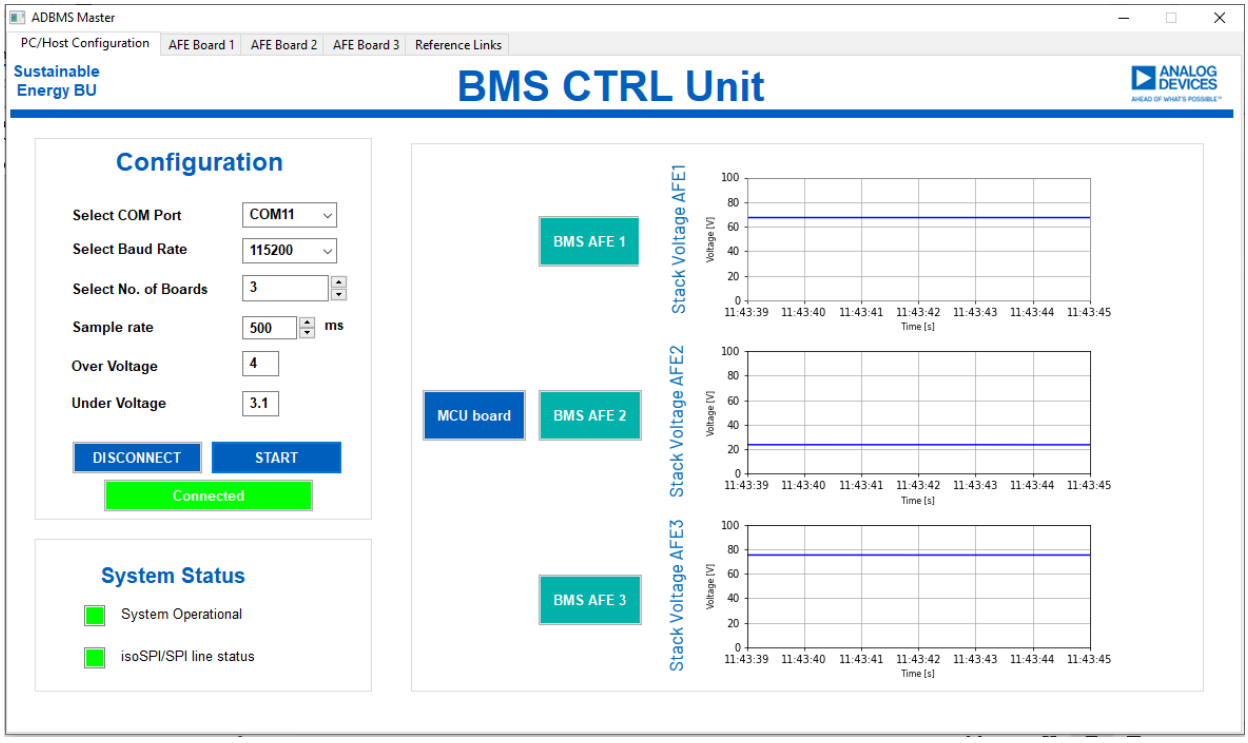

Figure 4: BMS Master GUI

3.2 HARDWARE SETUP

This section focuses on the main elements that intercommunicate in the system. Check **Error! Reference source not found.** for the required hardware.

Equipment	Manufacturer	Part Number
BMS Master	Analog Devices	ADI BMS Master
EVAL-ADBMS1818 Slave board	Analog Devices	EVAL-ADBMS1818Z
JTAG Debugger	Olimex	ARM-USB-TINY-H
Battery Simulator Board	Analog Devices	DC2472A

Table 4:BMS Master System Hardware Components

BMS Master:

The BMS master unit is comprised of the following main components:

- BMS Master consists of Microcontroller MAX32626ITK+ is present with ARM Cortex-M4 FPU Processor.
- USB Interface is available on the board for communication as well as power supply source.
- 2 IsoSPI ports and 2 Standard SPI(FRC) are available for communication with EVAL-ADBMS1818 slaves
- Onboard EEPROM is provided, connected via I2C.
- Arduino Shield connectors are available for extending the functionality of board.
- Isolated CAN Interface is provided using a SPI to CAN controller.

JTAG Debugger:

JTAG Debugger and programmer is used for flashing the firmware on to the board through a 10-pin connector.

EVAL-ADBMS1818 Slave board:

The ADBMS1818 is a multicell battery stack monitor that measures up to 18 series connected battery cells with a total measurement error of less than 3mV. The cell measurement range of 0V to 5V makes the ADBMS1818 suitable for most battery chemistries. All 18 cells can be measured in 290µs, and lower data acquisition rates can be selected for high noise reduction.

Multiple ADBMS1818 devices can be connected in series, permitting simultaneous cell monitoring of long, high voltage battery strings. Each ADBMS1818 has an isoSPI interface for high speed, RF immune, long-distance communications. Multiple devices are connected in a daisy chain with one host processor connection for all devices. This daisy chain can be operated bidirectionally, ensuring communication integrity, even in the event of a fault along the communication path.

The ADBMS1818 can be powered directly from the battery stack or from an isolated supply. The ADBMS1818 includes passive balancing for each cell, with individual PWM duty cycle control for each cell. Other features include an onboard 5V regulator, nine general purpose I/O lines and a sleep mode, where current consumption is reduced to 6µA.

Using the DC2472A 18-Cell Simulator Demo Board:

The DC2472A USB powered board provides a simple battery stack simulator and can be used to mimic up to 18 cells connected in series. The number of output rails (cells) can be reduced and adjusted using the jumpers. This board simulates 1V5 and 4V2 per cell, which is suitable for several battery chemistries

Test Setup and Evaluation Results:

Make connections of the BMS Master boards with EVAL-ADBMS1818 boards as shown in Figure 3: BMS Master Block Diagram and then launch the GUI application and fill in the required details.

After having started the GUI with configuration data, In first tab(PC/Host Configuration) stack voltage vs time graphs as plotted for each board as shown in Figure 5: GUI - PC/Host Configuration Tab

In board tabs, real time cell voltages, gpio voltages are filled. The graph is plotted for the selected cells as shown in Figure 6: GUI - Board Tab

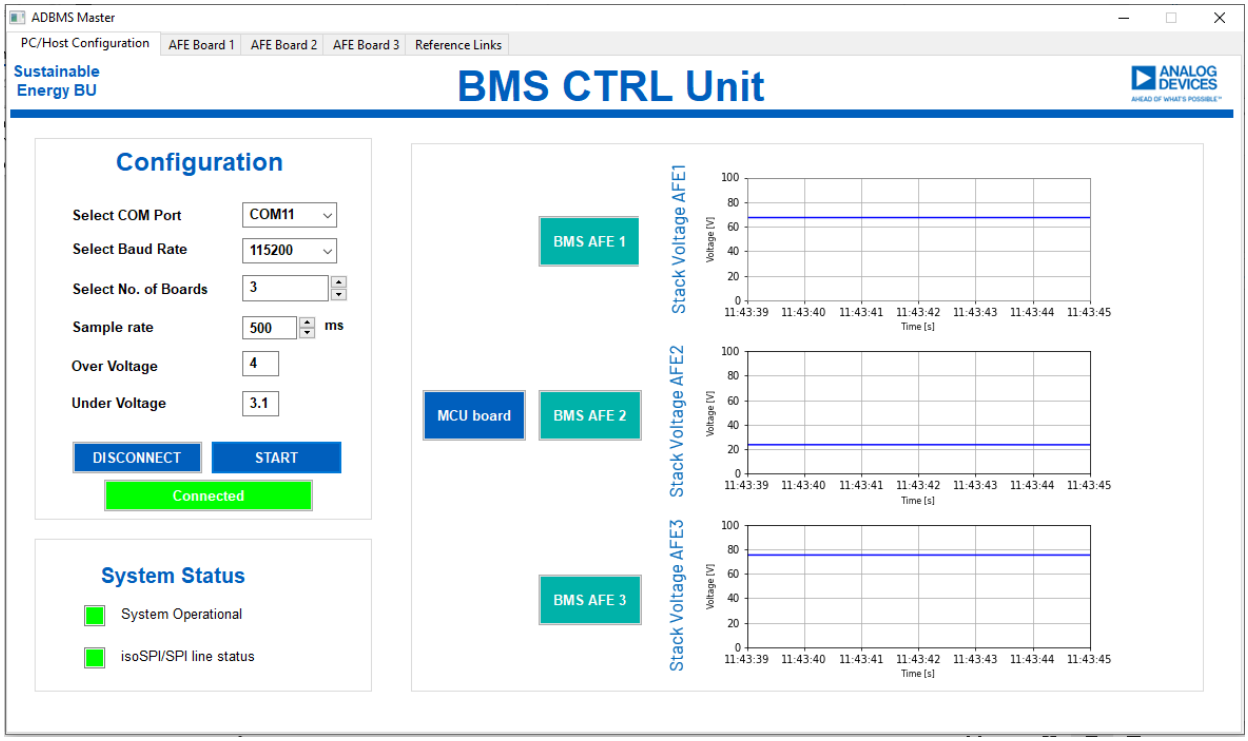

Figure 5: GUI - PC/Host Configuration Tab

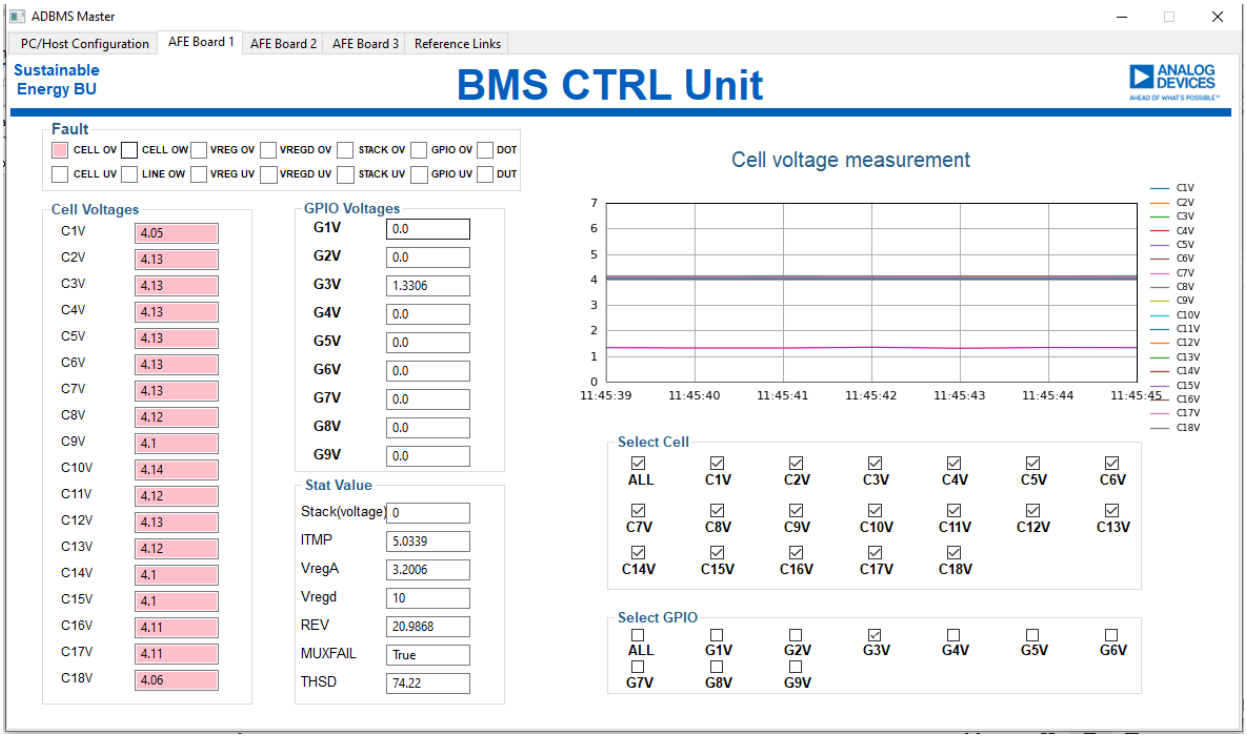

Figure 6: GUI - Board Tab

4 REFERENCES

No.	Document	Path
1	Firmware Code	https://analog-my.sharepoint.com/:f:/r/personal/amina_bahri_analog_com/Documents/Energy%20BU/BMS/Project_with_ARROW/EIC_Arrow_ADI%20BMS%20Master/Software/Release%201.2?csf=1&web=1&e=Ung23h
2	GUI Source Code	https://analog-my.sharepoint.com/:f:/r/personal/amina_bahri_analog_com/Documents/Energy%20BU/BMS/Project_with_ARROW/EIC_Arrow_ADI%20BMS%20Master/Software/Release%201.2?csf=1&web=1&e=Ung23h
3.	GUI User Guide:	https://analog-my.sharepoint.com/:f:/r/personal/amina_bahri_analog_com/Documents/Energy%20BU/BMS/Project_with_ARROW/EIC_Arrow_ADI%20BMS%20Master/Software/Release%201.2?csf=1&web=1&e=Ung23h
4	GUI Application:	https://analog-my.sharepoint.com/:f:/r/personal/amina_bahri_analog_com/Documents/Energy%20BU/BMS/Project_with_ARROW/EIC_Arrow_ADI%20BMS%20Master/Software/Release%201.2?csf=1&web=1&e=Ung23h
5	BMS Master Schematics:	https://analog-my.sharepoint.com/:f:/r/personal/amina_bahri_analog_com/Documents/Energy%20BU/BMS/Project_with_ARROW/EIC_Arrow_ADI%20BMS%20Master/Software/Release%201.2?csf=1&web=1&e=Ung23h

Table 5: Reference links