

User Manual Demo Kit

Li-Ion Battery Monitoring and Balancing IC

About this document

User Manual for multi-cell monitoring and balancing ICs TLE9012AQU & TLE9015QU evaluation kits designed for Li-ion battery packs used in hybrid electric vehicles (HEV), plug-in hybrid electric vehicles (PHEV), battery electric vehicles (BEV) as well as in stationary Lithium-Ion batteries.

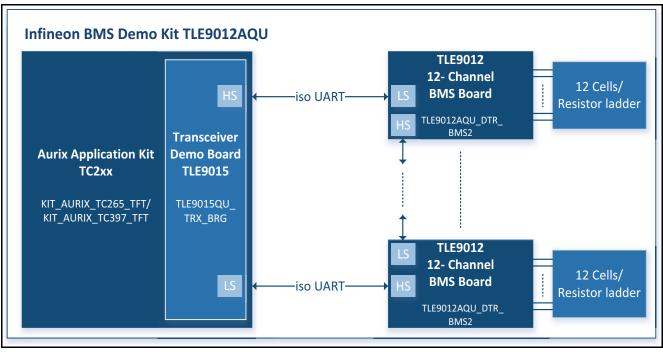


Figure 1 Demo Kit BMS



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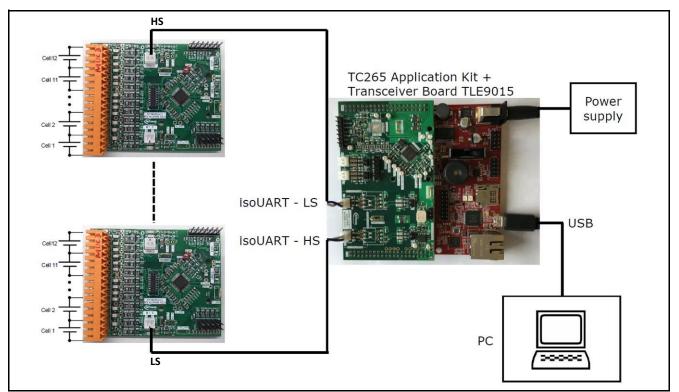
1 Getting started

1.1 Hardware elements of the Demo Kit

Note: All different versions of the evaluation boards are compatible to each other and can be used in the same daisy chain.

The following hardware is necessary to start with the TLE9012AQU Demo Kit:

- TLE9012AQU Demo Board
- at least 1x iso UART cable
- 1x resistor ladder (not necessary in evaluation board V5)
- TLE9015QU Transceiver Board
- AURIX[™] TC265 TFT Application Kit
- 12 V power supply
- USB cable
- Power supply for resistor ladder (5 V 60 V)
- optional: 12 Li-Ion cells (instead of resistor ladder)





1.2 Hardware connection

The hardware is connected as follow:

• The TLE9015QU transceiver board is plugged onto the AURIX[™] board (orientation as is **Figure 2/Figure 3**)



- Resistor ladder (cable with orange connector) is connected to the TLE9012AQU demo board (orange connector) as shown in **Figure 3** on the left side. In V5 of the evaluation kit, the resistor ladder is included on the PCB and connected through a solder bump.
- Supply the resistor ladder with a voltage between 5 V 60 V
- Supply the AURIX[™] board with the 12 V power supply and connector it via the USB cable with the PC
- Use the iso UART cable (blue/white) cable to connect the transceiver board with the sensing board as shown in Figure 3
- Note: The sensing IC board can be connected either to cells or to a power supply with provided resistor ladder (orange connector with red/black cable). If a resistance divider is used, an open load error is detected and the corresponding bit in the diagnostsis register (GEN_DIAG) is set (because of that also cell balancing cannot be activated). This is because the internal resistance of Li-Ion cells is much smaller than that of the resistors on the resistor divider. All other functions such as cell voltage measurement, temperature etc. are possible without restriction.

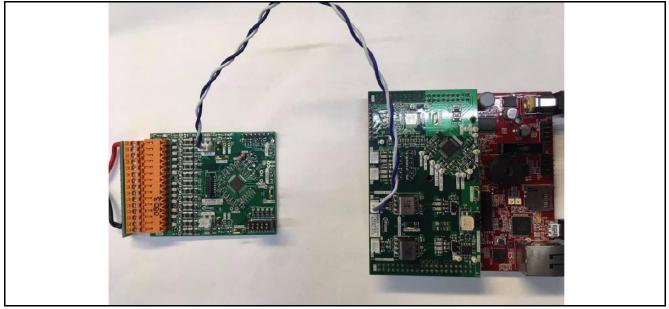


Figure 3 Hardware setup

1.3 13 wire setup

The BMS sensing board can be used in a 13 wire or 15 wire setup (see details in App Note HW). For a 13 wire setup, solder R13 and R29 with a 0 Ω resistor (0603 package) as described in **Figure 4**.



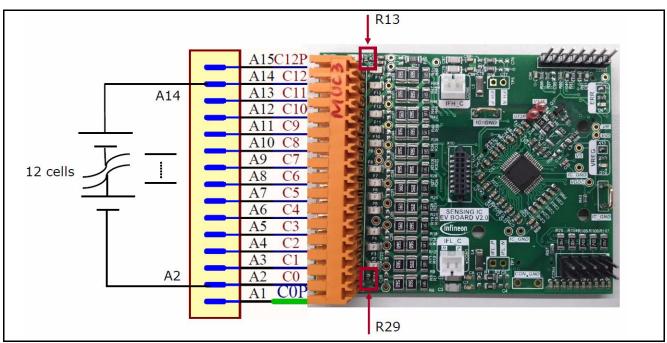


Figure 4 13 wire setup

1.4 Flashing the AURIX[™] hardware kit

The following steps are required to setup the frameword for the Demo Kit.

1.4.1 DAS tool

The DAS tool is a USB driver software provided by Infineon. It is required to connect the AURIX[™] hardware kit to the PC environment.

The latest version v7.1.8 can be found here:

Link to DAS tool

To start the installation, administrator privileges are requirement and the terms of use need to be accepted. After successful installation of DAS, the PC should be able to detect the AURIX[™] kit under the com port settings in the device manager.

1.4.2 Memtool

The Memtool is a software from Infineon for on-chip flash programming.

The latest version v4.8.1 can be found here:

Link to Memtool

Click "Accept & Open" to download the software and run the installation afterwards.

1.4.3 Flash the AURIX[™]

The AURIX[™] kit needs to be connected to a 12 V power supply. A USB cable connects the board to the PC.



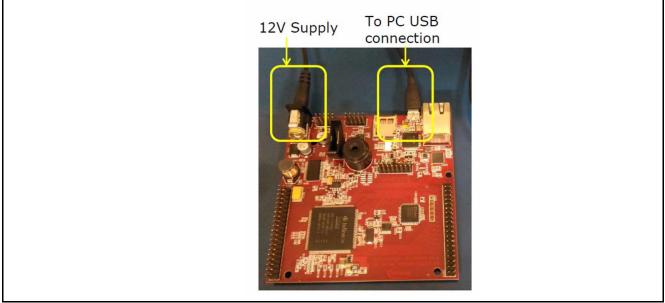


Figure 5 AURIX[™] power supply and USB connection

Press "START" button to initialize.

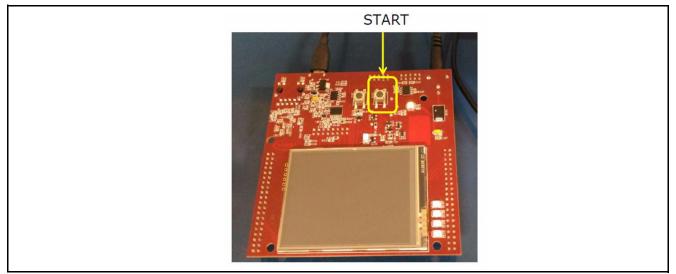


Figure 6 AURIX[™] initialize

Open the device manager and expand "Universal Serial Bus controllers". Right click on "Infineon DAS JDS COM" to open the properties. Select the tab "Advanced", check "Load VCP" and click "OK".



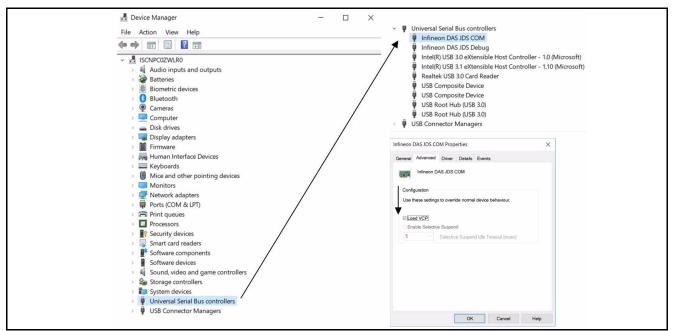


Figure 7 Configuration of the COM port

Disconnect the USB cable and power supply and reconnect. After pressing "START", check the COM port number in the device manager by expanding "Ports (COM &LPT)". A port number is assigned to the AURIX[™] kit.

Ports (COM & LPT)
Infineon DAS JDS COM (COM5)

Figure 8 Infineon DAS JDS COM port

Open the Memtool got to "Target" -> "Change...".

Br	ect Target Conf owse						
	older to browse :						
Γ	older to browse .					▼	
A	dditional Filter:						
F	iles in folder :	1			Show	descriptions	
	Application Kit	with TC267D B-S	Step (DAS)				
-	- pp						
	Default	New	Сору	Edit	Remove		
	Default		Сору	Edit	Remove		

Figure 9 Select Target Configuration

Click on "New" and select "Use a default target configuration". Expand "TriCore Aurix" -> "Application Kits (DAS)". Select "Application Kit with TC267D B-Step(DAS)" as shown in **Figure 10**.



(Create or use default X	
	Create or use default Create or use default Create a new target configuration step by step Use a default target configuration Create a new target configuration step by step Create a new target configuratin step by step Create a new target configuratin step by s	
	< Back Finish Cancel Help	

Figure 10 Create or use default

Click "Finish" and save the target configuration file then select "OK". After selecting the target configuration, click on "Connect". If connection is successful, you will be able to see this message "ready for Memtool Command". Click on "Open File ...".

Open File Index Statt End Size Erase Select All 0 0x4000000 0x40003F 16K Program Program Add Sel.>> 3 0x4000000 0x4000FF 16K Verify Verify all Save As 5 0x4001000 0x4001Fr 16K SW Protect Read 7 0x4001000 0x4001Fr 16K UCBs 9 0x4002000 0x4003Fr 32K Info State 11 0x40038000 0x4003Fr 18K SW Protect Fase Remove All Remove Sel State State State	File :		TP - Memory De H0: 1 MByte On		FLASH (notr	eady)	•	🔽 Enable
Select All 1 0xA0004000 0xA0007F 16K Program Program Image: Constraint of the state of the sta	Оре					^	Erase	
Add Sel.>> 3 0xA000C000 0xA000FF 16K Verify Verify all Save As 5 0xA0010000 0xA0013F 16K SW Protect Read 7 0xA0010000 0xA001FF 16K UCBs 9 0xA0020000 0xA002FF 32K Info Edit 10 0xA003000 0xA003FF 32K State	Se	lect All	0xA0004000	0xA0007F	16K		Program	Program all
Save As 5 0xA0014000 0xA0017F 16K SW Protect Read 6 0xA0018000 0xA001FF 16K UCBs Edit 9 0xA002000 0xA0027F 32K Info 10 0xA003000 0xA003FF 32K State 11 0xA003000 0xA003FF 32K State	Add	I Sel. >> 3	0xA000C000	0xA000FF	16K		Verify	Verify all
Read 7 0xA001C000 0xA001FF 16K UCBs Edit 9 0xA0028000 0xA002FF 32K Info Info 10 0xA003000 0xA003FF 32K Info Info Info 11 0xA003000 0xA003FF 32K State Info	Sav	/e As 5	0xA0014000	0xA0017F	16K	- 51	SW Protect	
Edit 9 0xA0028000 0xA002FF 32K Info 10 0xA003000 0xA0037F 32K 11 0xA0038000 0xA0037F 32K 12 0xA0038000 0xA003FF 32K State 12 0xA004000 0xA0047F 32K 14 1	R	ead 7	0xA001C000	0xA001FF	16K		UCBs	
11 0xA0038000 0xA003FF 32K 12 0x∆0040000 0x∆0047F 32K ✓ State	E	dit 9	0xA0028000	0xA002FF	32K		Info	
Remove All Remove Sel. Setup		11	0xA0038000	0xA003FF	32K	~	State	
		Rem	ove All Re	move Sel.			Setup	
3.								

Figure 11 Memtool

Select the *.hex file "TLE9015QU_TLE9012AQU_Aurix1G_v3_Tricore.hex" stored on the USB stick. Click "Select All" and afterwards "Add Sel". To flash the AURIX[™] select "Program all". Once successful, you can see the message shown in **Figure 12**.



Current FLASH/OTP Device :
Verify A00F6000h - A00F60FFh
Result: success
Progress :
Start Exit Help

Figure 12 Execute Memtool command

Note: For further details or support on how to flash the AURIXTM TFT kit, please refer to **https://www.infineon.com/aurix**



Terminal

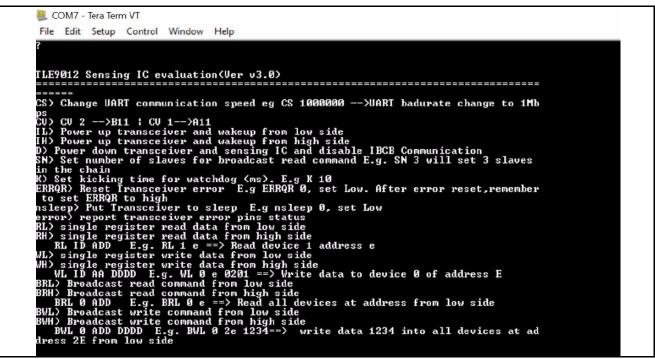
2 Terminal

A terminal program (e.g. TeraTerm) can be used to communicate with the BMS IC. The configuration of the serial port is shown in **Figure 13**.

Fera Term: Serial port set	tup	8	
Port	Сомз •	ΟΚ	
Baud rate:	115200 🔹		
Data:	8 bit 🔹	Cancel	
Parity:	none 🔹		
Stop:	1 bit 🔻	Help	
Flow control:	none 🔹		
Transmit delay		ec/line	

Figure 13 Serial port setup

After successful configuration, a user manual is available by sending "?".





There is the possibility to load a script into the terminal, which will perform several lines of commands. Drag & drop can be used to load the script in the terminal. A script, which reads out all the cell voltage is provided on the USB stick "TC265TFT_BMS_init_CVM_1_Slave_Terminal.txt".



Terminal

	—
LL'OR K 500	
n Sob Matchdog kicking time change to 500 ms	
NL 0 36 0801	
NL 0 36 00000b OK 8002	
wl 1 1 ØFFF	
WL 1 01 00000b OK 8002	
UL 1 405 4069090 OK 80800 F1 1 5	
RI 1 05 000002 OK 8000	
wl 1 18 ee21	
WL 1 18 000000 OK 8000	
rl 1 24	
RL 1 24 0055a7 OK 8000	
Hi 1 24 00554 OA 8000 Fi 1 23 Fi 1 23 005552 OK 8000 Fi 1 22 005566 OK 8000 Fi 1 21 Fi 1 21 005549 OK 8000 Fi 1 26 005549 OK 8000 Fi 1 28 005549 OK 8000 Fi 1 28 005594 OK 8000	
RL 1 22 005586 OK 8000	
r1 1 21	
RL 1 21 0055a9 OK 8000	
KL 1 20 005574 UK 8000	
RL 1 1 f 0055ad OK 8000	
RL 1 1e 00559c OK 8000	
RL 1 1 005580 OK 8000 F1 1 1E RL 1 10 005595 OK 8000 F1 1 1D RL 1 1d 005585 OK 8000	
RL 1 1d 00558b OK 8000	
RL 1 I C 005593 OK 8000 F1 1 15	
RL 1 1D 005556 OK 8000	
RL 1 1b 005556 OK 8000 Fl 1 1a	
RL 1 1a 0055ab OK 8000 Fl 1 19	
RL 1 19 0055a0 0K 8000	

Figure 15 Terminal script to read out all CVMs

The result registers can be copied into an Excel sheet to calculate the cell voltages (in mV) out of the hex register values. Therefore, the lines shown in **Figure 15** need to be marked and copied by selecting "Edit" -> "Copy table".

Based on the "C265TFT_BMS_init_CVM_1_Slave_Terminal.txt" file is an Excel sheet on the USB stick available to calculate the voltages in mV. The Excel sheet is shown in **Figure 16**.

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12		3	0,	0	0						
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Figure 16 TLE9012AQU_CVM.xlsx Excel sheet to calculate the cell voltages in mV



Revision History

3 Revision History

Revision	Date	Changes
1.0	2020-06-04	Initial User Manual

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