

FRIWO

FRIWO Gerätebau GmbH
Von-Liebig-Straße 11
48346 Ostbevern
Tel. 02532 81-0 | hello@friwo.com



AUTHORIZED DISTRIBUTOR

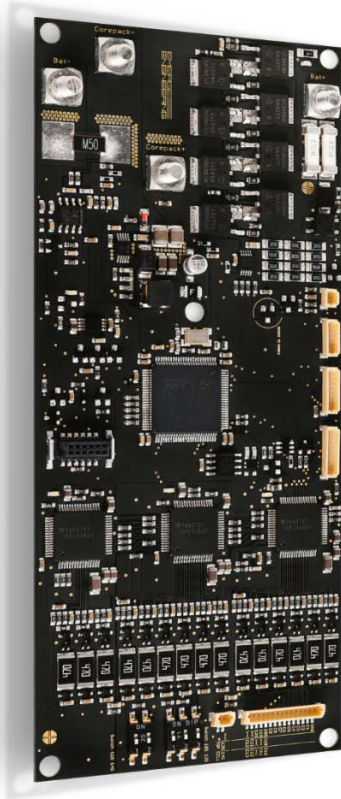
BATTERY MANAGEMENT SYSTEM (BMS)

HANDBOOK

For more information and orders please
contact Tamuz Electronics Hayozma St. 3,
Industrial Zone, Kfar-Saba 4442216, Israel
Info@tamuz-ele.com | 972-9-7633000
www.tamuz-ele.com

Emerge BMS 2K – Batterie Management System

Battery Management System with advanced connectivity



- Applications
 - 10S – 14S Lithium Battery Packs
 - 50A cont. / 65A peak (in closed compartments)
 - Certified in different Projects according to CE, UN
 - NEW: Certified according to UL (with redundant cell-voltage check and chemical fuse)
- Interfaces / Connectivity
 - CAN: Automotive CAN-Bus
 - USB: Enable-Tool Interface
 - On/off input
 - Configurable LED-Display
 - Kill-switch input
 - 12V-Output (1.7A, separate from 48V Output)
- Features
 - NEW: Grid-capability: To connect up to 50 battery-packs in parallel (e.g. for storage applications)
 - Precise state of charge (SOC) and state of health (SOH) calculation
 - Pre-Charge function
 - Current and voltage limits via CAN-bus
- Safety Features
 - Temperature monitoring for cells, power-stage and controller
 - Redundant overcurrent protection
 - On-board fuses

Emerge BMS 2K – Batterie Management System

Main electrical parameters		
Number of Cells (Serial / Parallel)	-	10 .. 14S / 30P
Max. Pack Voltage	V	60
Continuous Charge / Discharge Current (No heatsink / in closed compartment)	A	50
Peak Charge / Discharge Current (No heatsink / in closed compartment)	A	65 (8 minutes starting at 20° C)
Standby Current (Deepsleep)	µA	78
Idle Current (Active State)	mA	20
Powerstage topology	-	Combined Charge-/ Discharge terminal with back to back highside FET ¹
Switching the BMS output (combined charge / discharge terminal) on and off		
To activate the combined charge / discharge terminal the BMS there are several configurable ways to use the BMS		
Long press on enable button	Mode 0	BMS output can be toggled with a push button long press. Any error event during discharge disables the output until the push button is pressed again
Key-mode (permanent connection from enable-signal to GND)	Mode 2	Use a key-switch or any other device that connects the enable-signal with GND, to activate the BMS output
Connect a charger		BMS detects the charger and starts charging automatically
To enter the deepsleep		Press the push button for more then 3 seconds (super long press)
CAN-Bus remote control		Selectable Modes: <ul style="list-style-type: none"> - Charge (48V active) - Discharge (48V active) - Standby / 12V active - Deepsleep

¹ Interrupts charge and discharge current completely. Absolutely no current going in or out of the battery pack

Emerge BMS 2K – Batterie Management System

LED indications on a LED-bar with 5 LEDs		
Push button short press		SOC is displayed for a few seconds
During charging		LED stairs up to the current SOC, then holds SOC indication for a few seconds.
On Error event		LEDs flashing to indicate error
On entering deepsleep		LED stairs down to zero (goodbye)
Mechanical Parameters		
Size	mm	152 x 63
Height	mm	12.5
Weight	Gramm	72

Emerge BMS 2K – Batterie Management System

USB-Interface²

Enable-Tool Express **Setup wechseln** Logdateiname (* .c) **Aufzeichnung starten**
 Log interval [ms] **Stop Logging**

Check Pack_Settin... Cell_Settin... Finalize Last_Errors Log BMS Servi...

Parameter & Messwerte	Werte	Beschreibung
ERR_Errorcode	--	Errorcode ...
SM_State	Idle	State Machine State ...
BCF_Output_Voltage	0	Output voltage measured at the BMS output terminals [V] ...
BCF_DC_Current	-0.0290	Battery current [A] ...
CM_M_Num_Avail_Cells	14	Number of detected cells in stack ...
TEMP_Cell_Max	22.453	Highest cell temperature [°C] ...
TEMP_FET1	34.984	Temperature at the MOSFET [°C] ...
SOC_State_of_Charge	100	State of charge [%] ...
SOC_Full_Charge_Capacity	0	Full charge capacity [mAh] ...
SOC_MEM_Num_Charge_Loops	0	Number of full charge cycles ...

19-10-08 09:23:48: Verbunden mit Softwareversion 200004421

Snapshot erstellen Snapshot übertragen
 Speichern (Alt + S) Neustart (ALT + R)
 Firmware update

Auslesen von 10 Parametern und Messungen dauert 3 ms Verbindung aufgebaut

Intended Use-case

The enable-tool USB-interface is made to support the different stages of a product development

- a) Development: Allowing the motor-controller to be analyzed, measured and calibrated in real-time.
- b) Production: with reduced complexity, just allowing to write the production dataset and calibrate the system
- c) Aftersales: The look and feel of Enable-Tool can be customized and reduced to a "minimum level of complexity" to allow a quick and easy support.
- d) Dealer and Retailers: Setup your dealers and retailers to service your vehicles.

□ Enable-Tool provides functions that you would expect from professional automotive measurement and calibration tools, like encryption of datasets to share with the production and dealships, or encrypted and signed flash-datasets and encrypted-hex-files.

Supported OS

Windows 7 / Windows 8

² Parameter list depends on predefined user-packages and use-case

Emerge BMS 2K – Batterie Management System

CAN-Bus Interface

The CAN-bus interface is compliant with any standard automotive CAN-bus. The baudrate can be configured to from low-speed (125kbit/s) to high-speed (1000kbit/s). Messages are transmitted periodically (no remote request necessary).

This is an overview on the standard CAN-protocoll which is implemented by default.

You can get a CAN matrix in Vector Informatik's standard file-formar (*.dbc) on request.

Custom protocolls can be implemented on request.

Messages

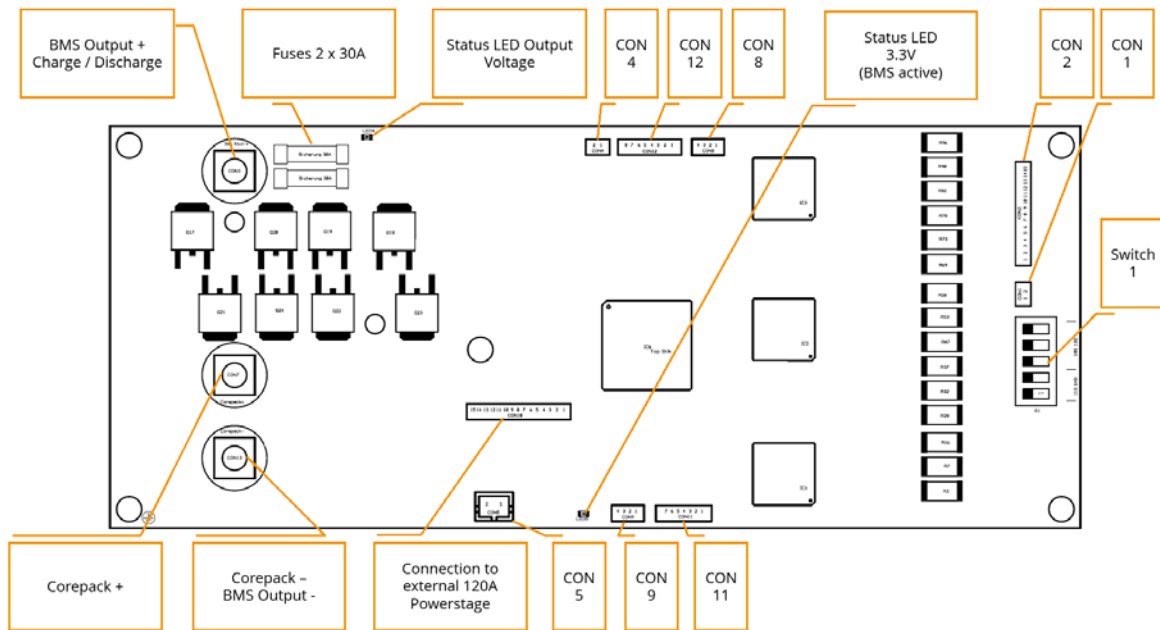
Name	ID	ID-Format	DEC.	Schleart	Zykluszeit	Sender	Kommentar	Nm.	Gen.	AnsMessage	GenMsgZL	Gen.	Gen.	Gen.	GenMsgGen.	
~ BCM_BMS...	0x160	CAN Stand.	8	Cyclic	100	EE_BCM		1*	0*	no*	Yes*	0*	300	0*	0*	Cyclic
~ EMS_Balancing...	0x171	CAN Stand.	8	Cyclic	10	EE_BMS		1*	0*	no*	Yes*	0*	10	0*	0*	Cyclic
~ EMS_Balancing...	0x172	CAN Stand.	8	Cyclic	1000	EE_BMS		1*	0*	no*	Yes*	0*	3000	0*	0*	Cyclic
~ EMS_Balancing...	0x173	CAN Stand.	8	Cyclic	100	EE_BMS		1*	0*	no*	Yes*	0*	300	0*	0*	Cyclic
~ EMS_Balancing...	0x174	CAN Stand.	8	Cyclic	100	EE_BMS		1*	0*	no*	Yes*	0*	300	0*	0*	Cyclic
~ EMS_Balancing...	0x175	CAN Stand.	8	Cyclic	100	EE_BMS		1*	0*	no*	Yes*	0*	300	0*	0*	Cyclic
~ EMS_Balancing...	0x176	CAN Stand.	8	Cyclic	1000	EE_BMS		1*	0*	no*	Yes*	0*	3000	0*	0*	Cyclic

Signals

Name	Len.	Bytes	Werttyp	Int.	Fakt.	Off.	Min.	Max.	Ein.	Wertel.	Kommentar	MM-Mod.
~ BCM_BMS_State_Fld	8	Integer	Unsigned	0	1	0	0	6	-	<->no	Requested battery state (0 = invalid, 1 = discharge, 2 = charge, 3=12V mode, 6 = deep sleep)	<+>A*
~ EMS_Balancing_Dev2	8	Integer	Unsigned	0	1	0	0	255	-	<->no	Shows in bit-coded style which cell of the referring device is being balanced	<+>A*
~ EMS_Balancing_Dev1	8	Integer	Unsigned	0	1	0	0	255	-	<->no	Shows in bit-coded style which cell of the referring device is being balanced	<+>A*
~ EMS_CellVoltage_01	8	Integer	Unsigned	0	0.03L	0	0	5	V	<->no	actual cell-voltage, cell might not be installed depending on pack configuration	<+>A*
~ EMS_CellVoltage_02	8	Integer	Unsigned	0	0.03L	0	0	5	V	<->no	actual cell-voltage, cell might not be installed depending on pack configuration	<+>A*
~ EMS_CellVoltage_03	8	Integer	Unsigned	0	0.03L	0	0	5	V	<->no	actual cell-voltage, cell might not be installed depending on pack configuration	<+>A*
~ EMS_CellVoltage_04	8	Integer	Unsigned	0	0.03L	0	0	5	V	<->no	actual cell-voltage, cell might not be installed depending on pack configuration	<+>A*
~ EMS_CellVoltage_05	8	Integer	Unsigned	0	0.03L	0	0	5	V	<->no	actual cell-voltage, cell might not be installed depending on pack configuration	<+>A*
~ EMS_CellVoltage_06	8	Integer	Unsigned	0	0.03L	0	0	5	V	<->no	actual cell-voltage, cell might not be installed depending on pack configuration	<+>A*
~ EMS_CellVoltage_07	8	Integer	Unsigned	0	0.03L	0	0	5	V	<->no	actual cell-voltage, cell might not be installed depending on pack configuration	<+>A*
~ EMS_CellVoltage_08	8	Integer	Unsigned	0	0.03L	0	0	5	V	<->no	actual cell-voltage, cell might not be installed depending on pack configuration	<+>A*
~ EMS_CellVoltage_09	8	Integer	Unsigned	0	0.03L	0	0	5	V	<->no	actual cell-voltage, cell might not be installed depending on pack configuration	<+>A*
~ EMS_CellVoltage_10	8	Integer	Unsigned	0	0.03L	0	0	5	V	<->no	actual cell-voltage, cell might not be installed depending on pack configuration	<+>A*
~ EMS_CellVoltage_11	8	Integer	Unsigned	0	0.03L	0	0	5	V	<->no	actual cell-voltage, cell might not be installed depending on pack configuration	<+>A*
~ EMS_CellVoltage_12	8	Integer	Unsigned	0	0.03L	0	0	5	V	<->no	actual cell-voltage, cell might not be installed depending on pack configuration	<+>A*
~ EMS_CellVoltage_13	8	Integer	Unsigned	0	0.03L	0	0	7.96	V	<->no	actual cell-voltage, cell might not be installed depending on pack configuration	<+>A*
~ EMS_CellVoltage_14	8	Integer	Unsigned	0	0.03L	0	0	5	V	<->no	actual cell-voltage, cell might not be installed depending on pack configuration	<+>A*
~ EMS_Charge_Flag_Detection	2	Integer	Signed	0	1	0	0	3	-	<->no	1=flag detected	<+>A*
~ EMS_ERR_AnalogOvervoltage	1	Integer	Unsigned	0	1	0	0	1	-	<->no	Overvoltage detected (analog)	<+>A*
~ EMS_ERR_CanTimeout	1	Integer	Unsigned	0	1	0	0	1	-	<->no	CAN Timeout detected	<+>A*
~ EMS_ERR_ChargeCurrent	1	Integer	Unsigned	0	1	0	0	1	-	<->no	Charge current above limits	<+>A*
~ EMS_ERR_CM_Alert	1	Integer	Unsigned	0	1	0	0	1	-	<->no	Alert from cell monitoring	<+>A*
~ EMS_ERR_CellOvervoltage	1	Integer	Unsigned	0	1	0	0	1	-	<->no	Overvoltage on one or more cells detected by cell monitoring	<+>A*
~ EMS_ERR_CellUnderVoltage	1	Integer	Unsigned	0	1	0	0	1	-	<->no	Undervoltage on one or more cells detected by cell monitoring	<+>A*
~ EMS_ERR_CM_CRC	1	Integer	Unsigned	0	1	0	0	1	-	<->no	CRC-error in cell-monitoring communication to host controller	<+>A*
~ EMS_ERR_CM_Fault	1	Integer	Unsigned	0	1	0	0	1	-	<->no	Fault from cell monitoring	<+>A*
~ EMS_ERR_Cur_Flow_Passive_State	1	Integer	Unsigned	0	1	0	0	1	-	<->no	Current flow detected when no current should flow	<+>A*
~ EMS_ERR_Cur_Sensor_Offset	1	Integer	Unsigned	0	1	0	0	1	-	<->no	Offset of current measurement out of range	<+>A*
~ EMS_ERR_DischargeCurrent	1	Integer	Unsigned	0	1	0	0	1	-	<->no	Discharge current above limits	<+>A*
~ EMS_ERR_DischargeVoltage	1	Integer	Unsigned	0	1	0	0	1	-	<->no	Lowest cell voltage below minimum discharge limit	<+>A*
~ EMS_ERR_EEPROM	1	Integer	Unsigned	0	1	0	0	1	-	<->no	Error in EEPROM	<+>A*
~ EMS_ERR_ExtTemp_Sensor	1	Integer	Unsigned	0	1	0	0	1	-	<->no	External outdoor signal inputs (output activation)	<+>A*
~ EMS_ERR_CycleVoltage_High	1	Integer	Unsigned	0	1	0	0	1	-	<->no	Voltage at charge/discharge terminal above limits	<+>A*
~ EMS_ERR_Overtemp_Charge	1	Integer	Unsigned	0	1	0	0	1	-	<->no	Temperature while charging above limits	<+>A*
~ EMS_ERR_Overtemp_Discharge	1	Integer	Unsigned	0	1	0	0	1	-	<->no	Temperature while discharging above limits	<+>A*
~ EMS_ERR_PackVoltage_Max	1	Integer	Unsigned	0	1	0	0	1	-	<->no	Sum of cell voltages (pack voltage) above max	<+>A*
~ EMS_ERR_PackVoltage_Min	1	Integer	Unsigned	0	1	0	0	1	-	<->no	Sum of cell voltages (pack voltage) below min	<+>A*
~ EMS_ERR_Powerstage	1	Integer	Unsigned	0	1	0	0	1	-	<->no	Fault signal from powerstage driver	<+>A*
~ EMS_ERR_PriCharge	1	Integer	Unsigned	0	1	0	0	1	-	<->no	Error during PreCharge, Reduct load!	<+>A*
~ EMS_ERR_Temp_Powerstage_1	1	Integer	Unsigned	0	1	0	0	1	-	<->no	Temperature at powerstage sensor 1 above limits	<+>A*
~ EMS_ERR_Temp_Powerstage_2	1	Integer	Unsigned	0	1	0	0	1	-	<->no	Temperature at powerstage sensor 2 above limits	<+>A*

Emerge BMS 2K – Batterie Management System

Installation / Connection



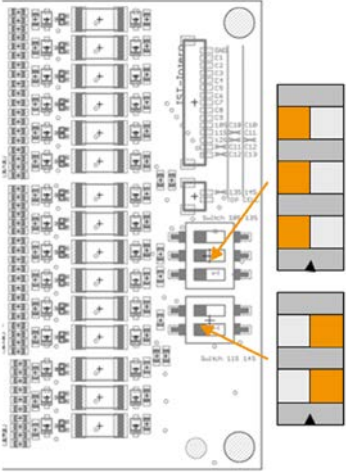
Connector	Pin	Function	Additional Info
CON 4 (BM02B-SRSS-TB)	1 2	ENA EXT GND	The BMS will inhibit the battery-voltage output if this pin is not connected to GND. The 12V supply is not affected by this pin. If not used, bridge pins
CON 5 (B2B-PH-SM4-TB)	1 2	GND 12V / 1.7A	Supply output. Not protected by a fuse. Short circuit forces BMS into deepsleep.
CON 8 (BM04B-SRSS-TB)	1 2 3 4	Cell Temp 2 Cell Temp 2 Cell Temp 1 Cell Temp 1	NTC 10 kOhm (103AT)
CON 9 (BM04B-SRSS-TB)	1 2 3 4	Push Button GND Charge Detect GND	Push Button and Charge Detect detect connection to ground. The input is edge triggered, so the BMS can change to deepsleep even while this pin is actively connected to GND

Emerge BMS 2K – Batterie Management System

Connector	Pin	Function	Additional Info
CON 11 (BM07B-SRSS-TB)	1	LED1+	
	2	LED2+	
	3	LED3+	
	4	LED4+	
	5	LED5+	
	6	Push Button	
	7	GND	
CON 12 (BM08B-SRSS-TB)	1	USB ID	
	2	USB DP	
	3	USB DM	
	4	USB 5V	
	5	USB GND	
	6	CAN High	
	7	GND	
	8	CAN LOW	

Emerge BMS 2K – Batterie Management System

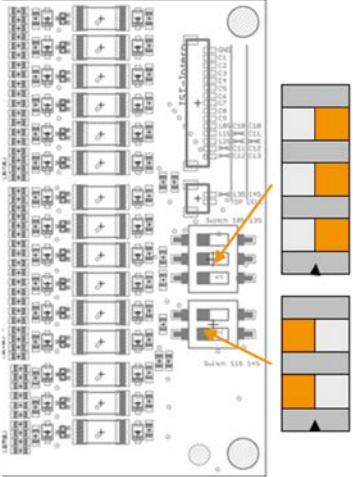
Cell Connection Terminals 10S Configuration³

Connector	Pin / Color	Function	Additional Info
CON 2 (BM15B-SRSS-TB)	15 14 13 12 11 10 9 8 7 6 5 4 3 2 1	Cell 1- / GND Cell 1+ Cell 2+ Cell 3+ Cell 4+ Cell 5+ Cell 6+ Cell 7+ Cell 8+ Cell 9+ Cell 10+ - - - -	<p>Setup for 10S (10 serial cells). Set switch 1 before connection CON 2 and CON 1!</p> 
CON 2 (BM02B-SRSS-TB)	2 1	- Cell 10+	Additional connection from TOP-cell to Pin1 to power the BMS

³ Connect CON 2 first, then connect CON 1

Emerge BMS 2K – Batterie Management System

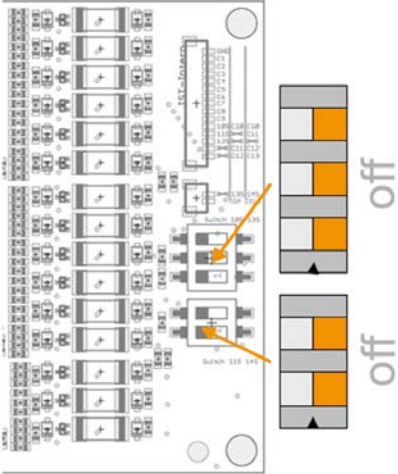
Cell Connection Terminals 11S Configuration⁴

Connector	Pin / Color	Function	Additional Info
CON 2 (BM15B-SRSS-TB)	15 14 13 12 11 10 9 8 7 6 5 4 3 2 1	Cell 1- / GND Cell 1+ Cell 2+ Cell 3+ Cell 4+ Cell 5+ Cell 6+ Cell 7+ Cell 8+ Cell 9+ Cell 10+ Cell 11+ - - -	<p>Setup for 11S (11 serial cells). Set switch 1 before connection CON 2 and CON 1!</p> 
CON 2 (BM02B-SRSS-TB)	2 1	- Cell 11+	Additional connection from TOP-cell to Pin1 to power the BMS

⁴ Connect CON 2 first, then connect CON 1

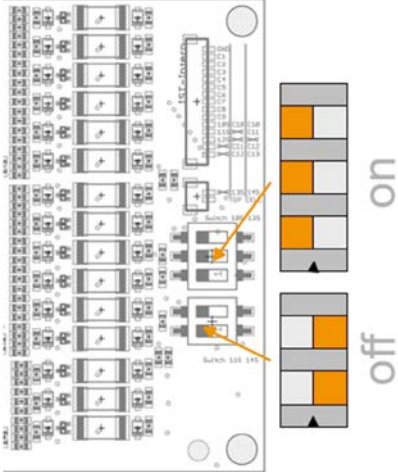
Emerge BMS 2K – Batterie Management System

Cell Connection Terminals 12S Configuration⁵

Connector	Pin / Color	Function	Additional Info
CON 2 (BM15B-SRSS-TB)	15 14 13 12 11 10 9 8 7 6 5 4 3 2 1	Cell 1- / GND Cell 1+ Cell 2+ Cell 3+ Cell 4+ Cell 5+ Cell 6+ Cell 7+ Cell 8+ Cell 9+ Cell 10+ Cell 11+ Cell 12+ - -	<p>Setup for 12S (12 serial cells). Set switch 1 before connection CON 2 and CON 1!</p> 
CON 2 (BM02B-SRSS-TB)	2 1	- Cell 12+	Additional connection from TOP-cell to Pin1 to power the BMS


⁵ Connect CON 2 first, then connect CON 1

Emerge BMS 2K – Batterie Management System

Cell Connection Terminals 13S Configuration ⁶			
Connector	Pin / Color	Function	Additional Info
CON 2 (BM15B-SRSS-TB)	15	Cell 1- / GND	Setup for 13S (13 serial cells). Set switch 1 before connection CON 2 and CON 1! 
	14	Cell 1+	
	13	Cell 2+	
	12	Cell 3+	
	11	Cell 4+	
	10	Cell 5+	
	9	Cell 6+	
	8	Cell 7+	
	7	Cell 8+	
	6	Cell 9+	
	5	Cell 10+	
	4	-	
3	-		
2	Cell 11+	Additional connection from TOP-cell to Pin1 to power the BMS	
1	Cell 12+		
CON 2 (BM02B-SRSS-TB)	2	Cell 13+	Additional connection from TOP-cell to Pin1 to power the BMS
	1	Cell 13+	

⁶ Connect CON 2 first, then connect CON 1

Emerge BMS 2K – Batterie Management System

Cell Connection Terminals 14S Configuration ⁷			
Connector	Pin / Color	Function	Additional Info
CON 2 (BM15B-SRSS-TB)	15	Cell 1- / GND	Setup for 14S (14 serial cells). Set switch 1 before connection CON 2 and CON 1! 
	14	Cell 1+	
	13	Cell 2+	
	12	Cell 3+	
	11	Cell 4+	
	10	Cell 5+	
	9	Cell 6+	
	8	Cell 7+	
	7	Cell 8+	
	6	Cell 9+	
	5	Cell 10+	
	4	Cell 11+	
	3	-	
2	Cell 12+	Additional connection from TOP-cell to Pin1 to power the BMS	
1	Cell 13+		
CON 2 (BM02B-SRSS-TB)	2 1	Cell 14+ Cell 14+	

⁷ Connect CON 2 first, then connect CON 1

Emerge BMS 2K – Batterie Management System

Revision / History		
Version	Date	Change
V1.6	20170327	Updated features
V1.5	20150316	Images
V1.4	20150316	Enable-tool description
V1.3	20140601	Mechanical data
V1.2	20140301	Electrial data
V1.1	20130601	Initial document

FRIWO FRIWO Gerätebau GmbH
Von-Liebig-Straße 11
48346 Ostbevern
Tel. 02532 81-0 | hello@friwo.com



AUTHORIZED DISTRIBUTOR

For more information and orders please contact Tamuz Electronics Hayozma St. 3, Industrial Zone, Kfar-Saba 4442216, Israel
info@tamuz-ele.com | 972-9-7633000
www.tamuz-ele.com