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(54) **BATTERY MANAGEMENT SYSTEM AND METHOD FOR TRANSFERRING DATA WITHIN THE BATTERY MANAGEMENT SYSTEM**

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See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,390,841 A	6/1983	Martin et al.	
5,578,915 A	11/1996	Crouch, Jr. et al.	
5,606,242 A	2/1997	Hull et al.	
5,644,212 A	7/1997	Takahashi	
5,652,502 A	7/1997	Van Phuoc et al.	
5,654,623 A *	8/1997	Shiga et al.	320/106
5,658,682 A	8/1997	Usuda et al.	
5,694,335 A	12/1997	Hollenberg	
5,701,068 A	12/1997	Baer et al.	
5,714,866 A	2/1998	S et al.	
5,739,670 A	4/1998	Brost et al.	
5,796,239 A	8/1998	van Phuoc et al.	
5,825,155 A	10/1998	Ito et al.	
5,936,385 A	8/1999	Patillon et al.	
6,016,047 A	1/2000	Notten et al.	

(Continued)

FOREIGN PATENT DOCUMENTS

JP 9243716 A 9/1997

(Continued)

OTHER PUBLICATIONS

International Search Report dated Jul. 25, 2005 for International Application No. PCT/KR2004/003103.
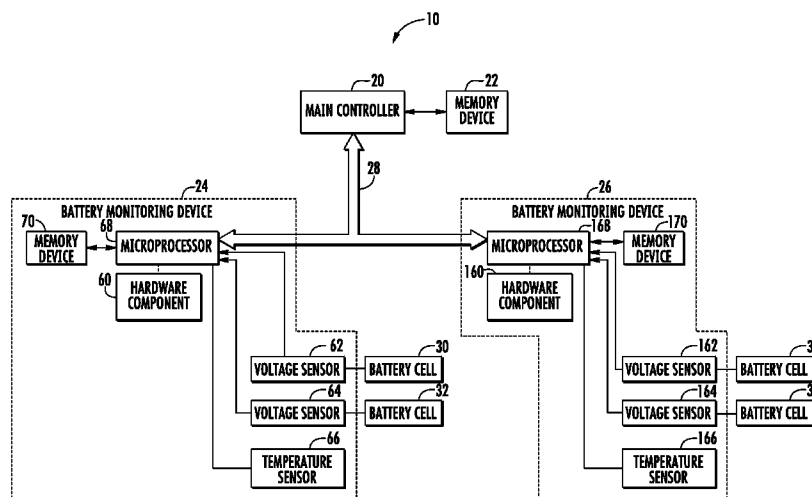
(Continued)

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(57) **ABSTRACT**

A battery management system is provided. The system includes a battery monitoring device having a microprocessor and a hardware component. The microprocessor identifies a non-modifiable node ID from the hardware component. The microprocessor also obtains operational parameters associated with the at least one battery cell. The microprocessor computes a network ID for the battery monitoring device based on the non-modifiable node ID. The system further includes a main controller that communicates with the battery monitoring device via a communication bus utilizing the network ID.

8 Claims, 3 Drawing Sheets

U.S. PATENT DOCUMENTS

6,064,180	A	5/2000	Sullivan et al.
6,160,376	A	12/2000	Kumar et al.
6,232,744	B1	5/2001	Kawai et al.
6,285,163	B1	9/2001	Watanabe et al.
6,329,823	B2	12/2001	Blessing et al.
6,353,815	B1	3/2002	Vilim et al.
6,359,419	B1	3/2002	Verbrugge et al.
6,362,598	B2	3/2002	Laig-Horstebrock et al.
6,441,586	B1	8/2002	Tate, Jr. et al.
6,515,454	B2	2/2003	Schoch
6,534,954	B1	3/2003	Plett
6,563,318	B2	5/2003	Kawakami et al.
6,583,606	B2	6/2003	Koike et al.
6,608,482	B2	8/2003	Sakai et al.
6,646,421	B2	11/2003	Kimura et al.
6,661,201	B2	12/2003	Ueda et al.
6,724,172	B2	4/2004	Koo
6,794,849	B2 *	9/2004	Mori et al. 320/107
6,829,562	B2	12/2004	Sarfert
6,832,171	B2	12/2004	Barsoukov et al.
6,876,175	B2	4/2005	Schoch
6,892,148	B2	5/2005	Barsoukov et al.
6,919,952	B2	7/2005	Kruit
6,927,554	B2	8/2005	Tate, Jr. et al.
6,943,528	B2	9/2005	Schoch
6,967,466	B2	11/2005	Koch
6,984,961	B2	1/2006	Kadouchi et al.
7,012,434	B2	3/2006	Koch
7,039,534	B1	5/2006	Ryno et al.
7,061,246	B2	6/2006	Dougherty et al.
7,072,871	B1	7/2006	Tinnemeyer
7,098,665	B2	8/2006	Laig-Hoerstebrock
7,109,685	B2	9/2006	Tate, Jr. et al.
7,126,312	B2	10/2006	Moore
7,136,762	B2	11/2006	Ono
7,138,775	B2	11/2006	Sugimoto et al.
7,197,487	B2	3/2007	Hansen et al.
7,199,557	B2	4/2007	Anbuky et al.
7,228,447	B1 *	6/2007	Day 713/340
7,233,128	B2	6/2007	Brost et al.
7,250,741	B2	7/2007	Koo et al.
7,253,587	B2	8/2007	Meissner
7,315,789	B2	1/2008	Plett
7,317,300	B2	1/2008	Sada et al.
7,321,220	B2	1/2008	Plett
7,327,147	B2	2/2008	Koch
7,394,394	B2	7/2008	Lockhart et al.
7,400,115	B2	7/2008	Plett
7,424,663	B2	9/2008	Mehalel
7,446,504	B2	11/2008	Plett
7,518,339	B2	4/2009	Schoch
7,521,895	B2	4/2009	Plett
7,525,285	B2	4/2009	Plett
7,558,701	B2 *	7/2009	Andarawis et al. 702/183
7,576,518	B2	8/2009	Sanders et al.
7,583,059	B2	9/2009	Cho
7,589,532	B2	9/2009	Plett
7,593,821	B2	9/2009	Plett
7,710,073	B2 *	5/2010	Yamauchi et al. 320/128
2003/0015993	A1	1/2003	Misra et al.
2003/0184307	A1	10/2003	Kozlowski et al.
2005/0100786	A1	5/2005	Ryu et al.
2005/0127874	A1	6/2005	Lim et al.
2006/0017582	A1	1/2006	Lockhart et al.
2006/0100833	A1	5/2006	Plett
2007/0118301	A1 *	5/2007	Andarawis et al. 702/33
2007/0120533	A1	5/2007	Plett
2008/0071473	A1 *	3/2008	Choi 701/211
2008/0094035	A1	4/2008	Plett
2008/0143543	A1	6/2008	Vandensande et al.
2008/0180106	A1 *	7/2008	Gorbold 324/434
2008/0249726	A1	10/2008	Plett
2010/0097034	A1 *	4/2010	Shu et al. 320/126
2010/0241377	A1 *	9/2010	Kagawa 702/63
2011/0154084	A1 *	6/2011	Vandwalle et al. 713/324

FOREIGN PATENT DOCUMENTS

JP	9312901 A	12/1997
JP	11003505 A	1/1999
JP	11023676 A	1/1999
JP	11032442 A	2/1999
JP	11038105 A	2/1999
JP	2002228730 A	8/2002
JP	2002319438 A	10/2002
JP	2002325373 A	11/2002
JP	2003516618 A	5/2003
JP	2003249271 A	9/2003
JP	2003257501 A	9/2003
JP	2004031014 A	1/2004
JP	2004521365 A	7/2004
JP	2006516326 A	6/2009
KR	19970024432 A	5/1997
KR	20020026428 A	4/2002
WO	WO0067359 A1	11/2000

OTHER PUBLICATIONS

International Search Report dated Mar. 31, 2005 for International Application No. PCT/KR2004/003332.

International Search Report dated Dec. 1, 2006 for International Application No. PCT/KR2006/003305.

S. Moore, P. Schneider; A review of Cell Equalization Methods for Lithium Ion and Lithium Polymer Battery Systems; 2001 Society of Automotive Engineers; Jan. 2001; pp. 1-5.

G. Plett; Advances in EKF SOC Estimation for LiPB HEV Battery Packs; Powering Sustainable Transportation EVS 20; Nov. 15-19, 2003; Long Beach, CA; pp. 1-12.

G. Welch, G. Bishop; An Introduction to the Kalman Filter; SIGGRAPH 2001 Course 8; Los Angeles, CA; Aug. 12-17, 2001; http//info.acm.org/pubs/toc/CRnotice.html, pp. 1-80.

E. Wan, A. Nelson; Dual Extended Kalman Filter Methods; Kalman Filtering and Neural Networks; 2001; pp. 123-173.

Yon et al.; Dynamic Multidimensional Wavelet Neural Network and its Application; Journal of Advanced Computational Intelligence and Intelligant Informatics; 2000; vol. 4, No. 5; pp. 336-340.

Fletcher et al; Estimation from Lossy Sensor Data: Jump Linear Modeling and Kalman Filtering; IPSN Apr. 26-27, 2004; Berkeley, California; pp. 251-258.

G. Plett; Extended Kalman Filtering for Battery Managements System of LiPB-based HEV Battery Packs—Part 1 Background; Journal of Power Sources 134; 2004; pp. 252-261.

G. Plett; Extended Kalman Filtering for Battery Managements System of LiPB-based HEV Battery Packs—Part 2 Background; Journal of Power Sources 134; 2004; pp. 262-276.

G. Plett; Extended Kalman Filtering for Battery Managements System of LiPB-based HEV Battery Packs—Part 3 Background; Journal of Power Sources 134; 2004; pp. 277-283.

G. Plett; Kalman-Filter SOC Estimation for LiPB HEV Cells; The 19th International Battery, Hybrid and Fuel Electric Vehicle Symposium and Exhibition; Oct. 19-23, 2002; Busan, Korea; pp. 1-12.

G. Plett; LiPB Dynamic Cell Models for Kalman-Filter SOC Estimation; The 19th International Battery, Hybrid and Fuel Electric Vehicle Symposium and Exhibition; Oct. 19-23, 2002; Busan, Korea; pp. 1-12.

S.C. Rutan; Recursive Parameter Estimation; 1990; Journal of Chemometrics; vol. 4; pp. 103-121.

P. Maybeck; Stochastic models, estimation and control, vol. 1; 1979; Academic Press Inc., 32 pp.

T. Hansen, C.J. Wang; Support vector based battery state of charge estimator; Journal of Power Sources, 2004; 6391; pp. 1-8.

V. Johnson et al.; Temperature-Dependent Battery Models for High-Power Lithium-Ion Batteries; Jan. 2001; NREL/CP-540-28716; 17th Annual Electric Vehicle Symposium Oct. 15-18, 2000.
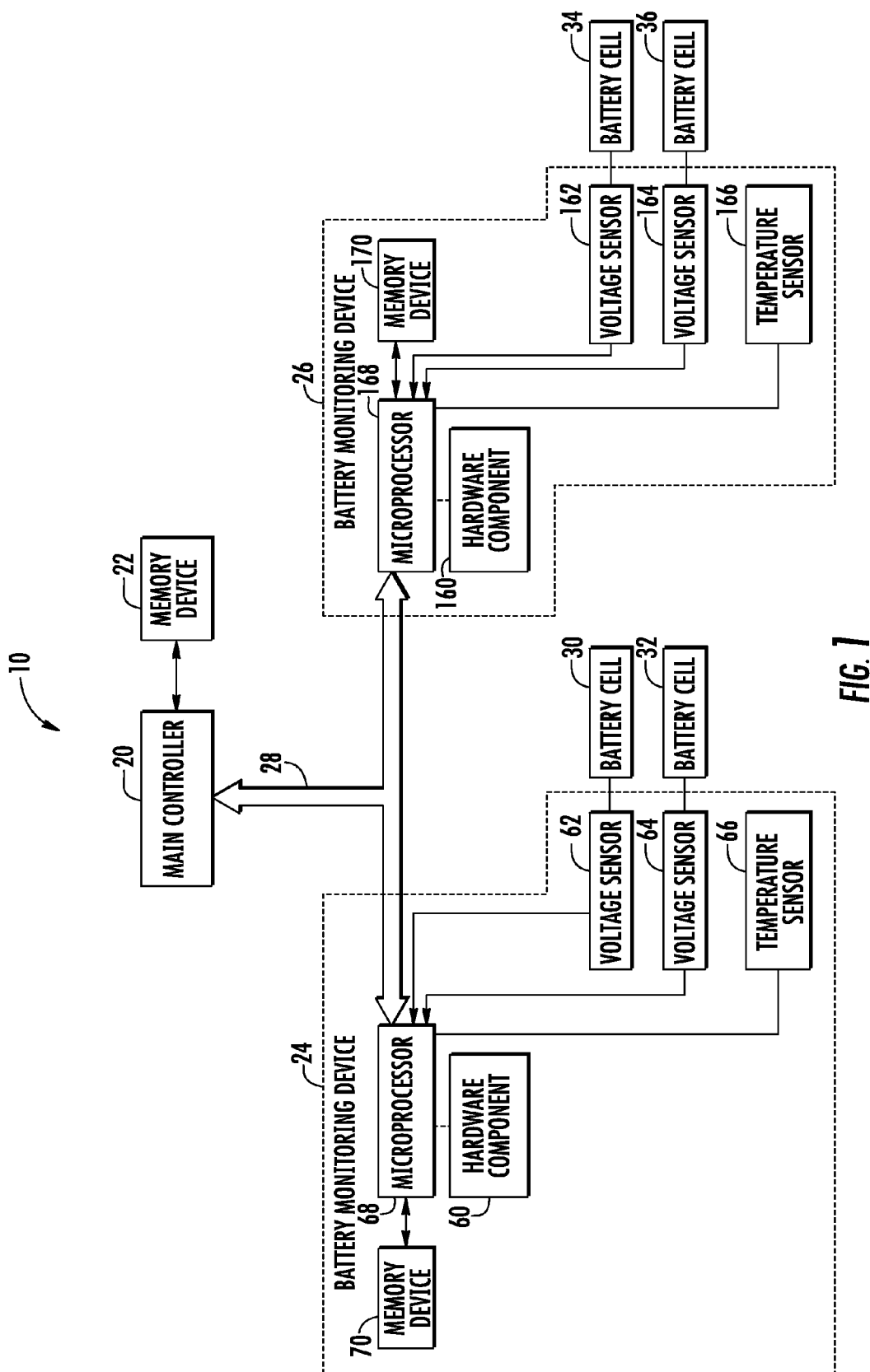
* cited by examiner

FIG. 1

200

DEVICE NO.	NODE ID	ENABLED MAP	DESCRIPTION xxTT TTVV VVV VVV
1	0x42	0x3FDE	0011 1111 1101 1110
2	0x44	0x3FDE	0011 1111 1101 1110
3	0x46	0x3FDE	0011 1111 1101 1110
4	0x48	0x3FDE	0011 1111 1101 1110
5	0x4A	0x3FDE	0011 1111 1101 1110
6	0x4C	0x1CDE	0001 1100 1101 1110
7	0x4E	0x3FDE	0011 1111 1101 1110
8	0x50	0x3FDE	0011 1111 1101 1110
9	0x52	0x3FDE	0011 1111 1101 1110
10	0x54	0x3FDE	0011 1111 1101 1110
11	0x56	0x3FDE	0011 1111 1101 1110
12	0x40	0x0000	0000 0000 0000 0000
			x = DON'T CARE
			T = TEMPERATURE
			V = VOLTAGE

FIG. 2

230

NODE ID	STARTING NETWORK ID
0x42	0x210
0x43	0x218

FIG. 3

FIG. 4

BATTERY MANAGEMENT SYSTEM AND METHOD FOR TRANSFERRING DATA WITHIN THE BATTERY MANAGEMENT SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to U.S. Provisional Patent Application No. 61/324,788 filed on Apr. 16, 2010, the entire contents of which are hereby incorporated by reference herein.

BACKGROUND

Battery systems typically have components that monitor a voltage of a battery cell. However, when the components are in a distributed network, typically DIP switches have been utilized to select addresses of the components. However, an inherent problem with the foregoing technique for selecting an address of a component is that a person may inadvertently select an incorrect address, or select an address that is already assigned to another component. Further, the DIP switch can become degraded or damaged which could result in an incorrect address being utilized by a component.

Accordingly, the inventors herein have recognized a need for an improved battery management system.

SUMMARY

A method for transferring data within a battery management system in accordance with an exemplary embodiment is provided. The battery management system has a battery monitoring device, a communication bus, and a main controller. The method includes identifying a non-modifiable node ID associated with the battery monitoring device from a hardware component of the battery monitoring device, utilizing a microprocessor of the battery monitoring device. The method further includes computing a network ID for the battery monitoring device based on the non-modifiable node ID, utilizing the microprocessor. The method further includes measuring operational parameters associated with at least one battery cell, utilizing the battery monitoring device. The method further includes transmitting data corresponding to the measured operational parameters from the microprocessor through the communication bus to the main controller, utilizing the network ID.

A battery management system in accordance with another exemplary embodiment is provided. The battery management system includes a battery monitoring device having a microprocessor and a hardware component. The microprocessor is configured to identify a non-modifiable node ID from the hardware component. The microprocessor is further configured to obtain operational parameters associated with the at least one battery cell. The microprocessor is further configured to compute a network ID for the battery monitoring device based on the non-modifiable node ID. The battery management system further includes a main controller configured to communicate with the battery monitoring device via a communication bus.

These and other advantages and features will become more apparent from the following description taken in conjunction with the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram of a battery management system in accordance with exemplary embodiment;

FIG. 2 is a diagram of a table utilized by the battery management system of FIG. 1;

FIG. 3 is a diagram of another table indicating a network ID;

FIG. 4 is a flowchart of a method for transferring data within the data management system of FIG. 1.

DETAILED DESCRIPTION

Referring to the FIG. 1, a block diagram of a battery management system 10 for monitoring battery cells and controlling operation of the battery cells in accordance with an exemplary embodiment is provided. The battery management system 10 includes a main controller 20, a memory device 22, battery monitoring devices 24, 26, a communication bus 28, and battery cells 30, 32, 34, 36. An advantage of the battery management system 10 is that the battery monitoring devices 24, 26 can each self assign a non-modifiable node ID and network ID for communicating through the communication bus 28 with the main controller 20.

The term "non-modifiable node ID" means a node identifier associated with a battery monitoring device that is set at the time of manufacture of the battery monitoring device and cannot be changed thereafter. The term "network ID" is an identifier associated with a device communicating over a communication bus.

The main controller 20 is provided to receive data corresponding to measured operational parameters associated with the battery cells 30, 32, 34, 36 from the battery monitoring devices 24, 26 for monitoring the battery cells and controlling operation of the battery cells. The main controller 20 is operably coupled to a memory device 22 that can store data corresponding to the received operational parameters and other data and software routines. The main controller 20 is further operably coupled to the communication bus 28 for communicating with the battery monitoring devices 24, 26. In one exemplary embodiment, the main controller 20 is implemented utilizing a computer or a microprocessor.

Referring to FIGS. 1 and 2, the main controller 20 is configured to access a table 200 in the memory device 22 that identifies the battery monitoring devices operably coupled to the communication bus 28. In one exemplary embodiment, the table 200 includes three columns: Device No., Node ID, Enabled Map, and Description. Further, the table 200 includes 12 rows corresponding to 12 different battery monitoring devices. For purposes of simplicity, only two battery monitoring devices 24, 26 will be discussed in the illustrated embodiment of FIG. 1. Each Node ID value (i.e., node ID) in the table 200 is a distinct value identifying a specific battery monitoring device. Each Device Number (No.) is a distinct value indicating an ordinal or position of a node ID in the table 200. Each Enabled Map value is a value indicating whether a specific battery monitoring device output is enabled or disabled. In other words, the Enabled Map values allows the main controller 20 to determine which outputs of a battery monitoring device are actually connected and will be reporting an appropriate measured parameter. The Enabled Map allows for increased flexibility for packaging of battery modules containing numerous battery cells since each battery monitoring device can be manufactured to disable particular outputs that become inaccessible due to battery shape and/or configuration. Further, each Description in the table 200 is a binary value indicating whether specific battery cell voltages and temperatures will be measured by a specific battery monitoring device. In one exemplary embodiment, each battery monitoring device is capable of measuring and reporting 10

battery cell voltages and four temperatures per battery module containing the battery cells.

The communication bus **28** routes data bi-directionally between the main controller **20** and the battery monitoring devices **24, 26**. Of course, in alternative embodiments, additional battery monitoring devices could be operably coupled to the communication bus **28**. In one exemplary embodiment, the communication bus **28** is a CAN bus. Of course, in alternative embodiments, other types of communication buses known to those skilled the art could be utilized.

The battery monitoring device **24** is provided to measure operational parameters associated with the battery cells **30, 32** and to transmit data corresponding to the measured operational parameters to the main controller **20** via the communication bus **28**. The battery monitoring device **44** includes a hardware component **60**, voltage sensors **62, 64**, a temperature sensor **66**, a microprocessor **68**, and a memory device **70**.

The hardware component **60** has non-modifiable node ID information stored therein. In one exemplary embodiment, the hardware component **60** is a set of resistors coupled to the microprocessor **68** and some of which are further coupled to electrical ground. The microprocessor **68** can sample voltages across the resistors to determine a binary value corresponding to the non-modifiable node ID associated with the battery monitoring device **24**. In another exemplary embodiment, the hardware component **60** is a non-volatile memory device that has the non-modifiable node ID stored therein. The microprocessor **68** can read the non-volatile memory device to retrieve the node ID associated with the device **24**. Of course, in alternative embodiments, other types of devices known to those skilled in the art could be utilized to set the non-modifiable node ID associated with the device **24**.

The voltage sensors **62, 64** are provided to measure the output voltages of the battery cells **30, 32**, respectively. The voltage sensors **62, 64** transmit signals to the microprocessor **68** indicative of the measured output voltages of the battery cells **30, 32**, respectively.

The temperature sensor **66** is provided to measure a temperature level associated with the battery cells **30, 32**. The temperature sensor **66** transmits a signal to the microprocessor **68** indicative of a measured temperature level of the battery cells **30, 32**, respectively.

The battery cells **30, 32** are electrically coupled to the voltage sensors **62, 64**, respectively. In one exemplary embodiment, the battery cells **30, 32** are pouch type lithium-ion battery cells. Of course, in alternative embodiments, the battery cells **30, 32** could be any type of battery cell known to those skilled in the art.

The microprocessor **68** is operably coupled to the hardware component **60**, the voltage sensors **62, 64**, the temperature sensor **66**, and the memory device **70**. As discussed above, the microprocessor **68** can sample or read the hardware component **60** to determine a node ID associated with the battery monitoring device **24**. Further, the microprocessor **68** is configured to determine a network ID associated with the device **24** based on the node ID to allow bi-directional communication between the device **24** and the main controller **20** via the communication bus **28**. In one exemplary embodiment, each node ID is an 8-bit or 1 byte number. Further, in one exemplary embodiment, the bus **28** is a controller-area network ("CAN") bus and each network ID associated with a battery monitoring device is a CAN ID. A standard CAN ID is 11 bits in size. A unique starting CAN ID can be computed for each battery monitoring device by performing an arithmetic shift of a respective node ID to the left by three significant digits to obtain a unique 11-bit number. Further, referring to FIG. **3**, an advantage obtained by utilizing the foregoing method for

determining the CAN ID is that there is an exclusive range of 8 unique CAN IDs that can be used for each battery monitoring device between two consecutive battery monitoring devices.

It should be noted that a copy of the table **200** is also stored in the memory device **70** and is accessed by the microprocessor **68**. The microprocessor **68** determines a device number (designated as Device No. in the table **200**) associated with the battery monitoring device **24** utilizing the determined node ID and the table **200**. It should be noted that in one exemplary embodiment, the main controller **20** to sends commands having a device number to the battery monitoring devices on the communication bus **28** and the battery monitoring device associated with the specific device number performs tasks in response to the command. For example, the microprocessor **68** can receive a command from the main controller **20** which requests measured operational parameters (e.g., voltage levels and a temperature level) associated with the battery cells **30, 32**. In response to the command, the battery monitoring device **24** measures the operational parameters and transmits data corresponding to the operational parameters to the main controller **20**.

The battery monitoring device **26** is provided to measure operational parameters associated with the battery cells **34, 36** and to transmit data corresponding to the measured operational parameters to the main controller **20** via the communication bus **28**. The battery monitoring device **46** includes a hardware component **160**, voltage sensors **162, 164**, a temperature sensor **166**, a microprocessor **168**, and a memory device **170**. The battery monitoring device **26** operates in a substantially similar manner as the battery monitoring device **24**, except that the battery monitoring device **26** measures the operational parameters associated with the battery cells **34, 36** and reports the associated operational parameters to the main controller **20**. Further, the battery monitoring device **46** utilizes a distinct device number, node ID and network ID associated with the battery monitoring device **46**, for bi-directional to communication with the main controller **20**.

Referring to FIG. **4**, a flowchart of a method for transferring data within the battery management system **10** will be described. Also, for purposes of simplicity, the following method will be discussed with respect to the battery monitoring device **24**.

At step **250**, the microprocessor **68** of the battery monitoring device **24** determines the non-modifiable node ID associated with the battery monitoring device **24** by sampling or reading the hardware component **60**.

At step **252**, the microprocessor **68** determines a network ID associated with the battery monitoring device **24** based on the node ID associated with the device **24**.

At step **254**, the microprocessor **68** determines an ordinal position of the node ID associated with the device **24** in the table **200** that lists the node IDs of the battery monitoring devices coupled to the communication bus **28**. In other words, the microprocessor **68** determines the device number associated with the device **24**.

At step **256**, the microprocessor **68** listens for a command sent to the battery monitoring device **24** from the main controller **20** via the communication bus **28**.

At step **258**, the microprocessor **68** processes a command sent to the battery monitoring device **24** by the main controller **20**. For example, the microprocessor **68** can receive a command from the main controller **20** which requests measured operational parameters (e.g., voltage levels and a temperature level) associated with the battery cells **30, 32**. In response to the command, the battery monitoring device **24**

measures the operational parameters and transmits data corresponding to the measured operational parameters to the main controller **20**.

At step **260**, the microprocessor **68** broadcasts the result of the processed command to the main controller **20** using the network ID associated with the battery monitoring device **24**. In other words, the microprocessor **68** transmits data corresponding to the measured operational parameters to the main controller **20** via the communication bus **20**.

At step **262**, the microprocessor **68** makes a determination as to whether a shutdown command was received from the main controller **20**. If so, the microprocessor **68** shuts down the battery monitoring device **24**. If not, the method returns to the step **256**.

While the invention has been described in detail in connection with only a limited number of embodiments, it should be readily understood that the invention is not limited to such disclosed embodiments. Rather, the invention can be modified to incorporate any number of variations, alterations, substitutions or equivalent arrangements not heretofore described, but which are commensurate with the spirit and scope of the invention. Additionally, while various embodiments of the invention have been described, it is to be understood that aspects of the invention may include only some of the described embodiments. Accordingly, the invention is not to be seen as limited by the foregoing description.

We claim:

1. A method for transferring data within a battery management system, the battery management system having a battery monitoring device, a communication bus, and a main controller, the method comprising:

identifying a non-modifiable node ID uniquely assigned to the battery monitoring device and stored in a hardware component of the battery monitoring device, by using a microprocessor of the battery monitoring device which accesses the hardware component;

computing a network ID for the battery monitoring device based on the non-modifiable node ID, by using the microprocessor;

measuring operational parameters associated with at least one battery cell, by using the battery monitoring device; and

transmitting data corresponding to the measured operational parameters from the microprocessor through the communication bus to the main controller, by using the network ID.

2. The method of claim **1**, further comprising:

receiving, by the microprocessor, a command from the main controller which requests data corresponding to the operational parameters associated with the at least one battery cell; and

measuring the operational parameters of the at least one battery cell in response to the command by using the battery monitoring device.

3. The method of claim **1**, wherein the battery management system further comprises a memory which stores a table listing a device number of the battery monitoring device in association with the non-modifiable node ID thereof, the method the further comprising:

determining the device number by using the table based on the identified non-modifiable node ID.

4. A battery management system, comprising:

a battery monitoring device having a microprocessor and a hardware component, the microprocessor configured to identify a non-modifiable node ID uniquely assigned to the battery monitoring device and stored in the hardware component by accessing the hardware component, configured to obtain operational parameters associated with at least one battery cell, and configured to compute a network ID for the battery monitoring device based on the non-modifiable node ID; and

a main controller configured to communicate with the battery monitoring device via a communication bus by using the network ID.

5. The battery management system of claim **4**, wherein the microprocessor is further configured to transmit data corresponding to the measured operational parameters through the communication bus to the main controller by using the network ID.

6. The battery management system of claim **4**, further comprising:

a memory which stores a table listing a device number of the battery monitoring device in association with the non-modifiable node ID thereof, wherein the main controller is configured to determine the device number by using the table based on the identified non-modifiable node ID.

7. A method for transferring data within a battery management system, the battery management system having a battery monitoring device, a communication bus, and a main controller, the method comprising:

identifying a non-modifiable node ID associated with the battery monitoring device from a hardware component of the battery monitoring device, utilizing a microprocessor of the battery monitoring device;

computing a network ID for the battery monitoring device based on the non-modifiable node ID, utilizing the microprocessor;

calculating a device number associated with the battery monitoring device based on the non-modifiable node ID, utilizing the microprocessor of the battery monitoring device;

receiving a command from the main controller at the microprocessor, the command having the device number associated with the battery monitoring device, the command requesting data corresponding to the operational parameters associated with at least one battery cell;

measuring the operational parameters of the at least one battery cell in response to the command utilizing the battery monitoring device; and

transmitting data corresponding to the measured operational parameters from the microprocessor through the communication bus to the main controller, utilizing the network ID.

8. The method of claim **7**, wherein the microprocessor is configured to compute the network ID by performing an arithmetic shift of a plurality of bits of the non-modifiable node ID associated with the battery monitoring device.

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