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Energy Management System MODBUS Interface Specifications

Hardware (physical layer)

This implementation will use serial RS-232 or RS-485 communication standards. The interface standard is selectable with a parameter in the configuration file, and the default format is RS232. Data will be transmitted at settable baud rate (see below), 8 bits, 1 stop bit, no parity. When the CPU is powered down, the transmitter will be in the high impedance state.

An input for logic signal detection will also be provided to detect an open or closed circuit.



Picture 1: MODBUS Interface (default RS232)

The connector on the interface will be a 5 pin Molex p/n 0705550004. The pin functions are as follows:

In RS485 Mode:

1: Data +; 2: Data -; 3: Ground (GND); 4: Relay; 5: Relay

In RS-232 Mode:

1: Transmit Data (TXD); 2: Receive Data (RXD); 3: Ground (GND); 4: Relay; 5: Relay

Pins 1-3 are output pins for MODBUS communication. Pins 4-5 are input pins for logical signal detection of an open or closed circuit.

MODBUS Data Format

The data format is from the MODBUS APPLICATION PROTOCOL SPECIFICATION V1.1b:

http://www.modbus.org/docs/Modbus_Application_Protocol_V1_1_b.pdf

The CPU will respond to one command: command 04 read input registers.

The following will be sent:

Command	1 byte (always \$04)
Starting address	2 bytes
Quantity of input registers	2 bytes
CRC	2 bytes

The register address defines what type of data will be transmitted. Up to 256 cells will be supported in the following ranges:

0000-00FF	Pack information and alerts
0100-01FF	Cell Voltages (in millivolts)
0200-02FF	Cell Temperatures (in degrees F, 2s complement encoded)

The voltage and temperature for the actual number of cells detected will be transmitted, with a maximum of up to 256 cells.

The quantity of input registers can only be a maximum of 124 in one command. To send more, send a second command. The values can range for 0x0000 to 0x007D. Registers outside the range of actual cells in a request will return 0x0000.

Response to Command:

Function code 1 byte Always 04
Byte Count 1 byte 2 * quantity of registers being transferred
Input Registers 2 * number of registers bytes

The first 18 registers shall contain a summary of the battery pack conditions

Pack Information

Addresses	Label	Description
1	Official Cell Count	The official cell count is either the specified cell count or the number of cells found by a scan of the strings.
2	Observed Cell Count	The Observed cell count is the actual number of cells found in a pack. This number is recalculated on each scan of the pack.
3	Aver Cell Temperature	The average cell temperature
4	Ave Cell Voltage	The average cell voltage
5	Max Cell Temp	The highest cell temp found on any cell
6	Max Cell Temp Index	The index of the cell with the highest temperature
7	Max Cell Voltage	The highest cell voltage
8	Max Cell Voltage Index	The index of the cell with the highest voltage
9	Min Cell Voltage	The lowest cell voltage
10	Min Cell Voltage Index	The index of the cell with the lowest voltage
11	Pack Voltage	The voltage of the entire pack as read by the CPU (not sense boards)
12	Pack Current	The pack current as read from the shunt. Positive current is discharge, negative current is charging.
13	Pack State of Charge	Pack state of charge 0-100%
14	Pack Alert	The current alert being presented on the display
15	Time Stamp	Time stamp of the last sample
16	Reserved	
17	Min Cell Temp	The lowest cell temperature
18	Min Cell Temp Index	The index of the cell with the lowest temperature

Registers 19 -31 will report 0x00

Register 32 will contain the Alerts. If no alerts are active, then address 32 will be sent with 01 in the data field. When one or more alerts are active, the respective bits will be set and bit 1 will be 0.

Alarm Table

Bit	Level	Description
0	info	Pack normal – no other alerts
1	alarm	Cell temp exceeds maximum temperature set point.
2	alarm	Cell voltage exceeds maximum voltage set point.
3	warning	Pack voltage exceeds display limits. This warning is active when the voltage is between the max display voltage and the max voltage set point. The setting is a function of the number of observed cells.
4	alarm	Cell voltage below minimum voltage setpoint
5	warning	Pack voltage below display limits. This warning is active when the voltage is between the min display voltage and the min voltage setpoint. The setting is a function of the number of observed cells.
6	alarm	Pack current above maximum current setpoint
7	warning	Pack current is above display scale and below max current set point
8	fault	Pack to chassis connection detected
9	fault	Sense board communication error. The number of sense boards detected does not agree with the official cell count.
10	fault	Undefined system error
11	alarm	Cell temperature below minimum temperature setpoint
12	(future)	(future)
13	warning	Logic state of open or closed circuit

Configuration Options:

The configuration file (part of the software stored in EEPROM- not user programmable) will contain the 3 parameters as follows:

1. Baud rate sets the serial transmission speed 1200 to 115200
2. Comm mode selects RS-232 or RS-485
3. MODBUS Slave Address which defaults to 1