

**Modbus Protocol  
for  
BDS-60 and BDS-256**



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## 1. Modbus™ Protocol (ASCII Frame)

**Frame:** Colon, Address (H), Address (L), Function (H), Function (L), Data, LRC (H), LRC (L), CR, LF

**ASCII Character:** Every field in the frame is sent in ASCII character. For example, if function 03H is sent out, we have to convert to 30H (ASCII code of high 4 bits of 03H) and 33H (ASCII code of low 4 bits of 03H).

**Address:** Device address is defined as:

BDS-60:	Battery 1	01H
	Battery 2	02H
	....	
	Battery 16	10H
BDS-256:	Battery 1	01H
	Battery 2	02H
	....	
	Battery 5	05H

**Error Control:** LRC (If correct, send requested data back; if error is found, do nothing.) The following binary bytes in the frame are checked:

Address  
Function  
Data

### Notes:

1. In the above frame, the first byte (colon) is counted as byte 0 in this document.

2. Asynchronous serial communication:

BDS-60	9600 bps baud rate, 8 data bit, 1 stop bit, no parity bit.
BDS-256 version 5.33 or earlier	9600 bps baud rate, 8 data bit, 1 stop bit, no parity bit.
BDS-256 version 5.34 or later	9600 bps baud rate, if no parity bit - 7 data bit, 2 stop bits; if odd/even parity - 7 data bit, 1 parity bit, 1 stop bit.

## 2. Register List for Function 03H (Data Address: 0000H - 06FEH)

Category	Name	Reference	Data Address
Cell Voltages	Cell Voltage 1	40001	0000H
	Cell Voltage 2	40003	0002H
	....	....	....
	Cell Voltage 256	40511	01FEH
Cell Resistances	Cell Resistance 1	40513	0200H
	Cell Resistance 2	40515	0202H
	....	....	....
	Cell Resistance 256	41023	03FEH
Intercell Resistance	Intercell Resistance 1	41025	0400H
	Intercell Resistance 2	41027	0402H
	....	....	....
	Intercell Resistance 60	41143	0476H
Other Registers	Overall Voltage	41537	0600H
	Current 1	41539	0602H
	Current 2	41541	0604H
	Ground Fault	41543	0606H
	Temperature 1	41545	0608H
	Temperature 2	41547	060AH
	....	....	....
	Temperature 10	41563	061AH
	Intertier Resistance 1	41565	061CH
	Intertier Resistance 2	41567	061EH
	....	....	....
	Intertier Resistance 10	41583	062EH
	.....	.....	.....
	System Status	41789	06FCH
	Alarm Status	41791	06FEH

**Notes:**

- BDS-60 does not have the following registers:
  - Cell Voltage 61 to 256
  - Cell Resistance 61 to 256
  - Temperature 3 to 10
  - Intertier Resistance 9 to 10

**Notes (continued):**

2. BDS-256 does not have the following registers:

- Intercell Resistance
- Current 2
- Ground Fault

3. Every register is a 16-bit register. The high byte is transmitted before the low byte.

4. System Status register is defined as

- High byte: 0
- Low byte: Minute of PC that runs BDS software

5. Alarm Status register is defined as (=1: alarm; =0: no alarm)

- Bit 0: High overall voltage alarm
- Bit 1: Low overall voltage alarm
- Bit 2: High cell voltage alarm
- Bit 3: Low cell voltage alarm
- Bit 4: High float current alarm
- Bit 5: Low float current alarm
- Bit 6: Ground fault alarm
- Bit 7: High temperature 1 alarm
- Bit 8: Low temperature 1 alarm
- Bit 9: High temperature 2 alarm
- Bit 10: Low temperature 2 alarm
- Bit 11: High cell resistance alarm
- Bit 12: High intercell resistance alarm
- Bit 13: High intertier resistance alarm
- Bit 14: Resistance test in progress
- Bit 15: Discharge in progress

**3. Function and Data Fields of Commands Sent by Master**

Function			Data	
Name	Byte 3	Byte 4	Values	Byte #
Read Holding Registers (03H)  (Get parameters shown in memory mapping)	30H	33H	First byte of starting address (H)	Byte 5
			First byte of starting address (L)	Byte 6
			Second byte of starting address (H)	Byte 7
			Second byte of starting address (L)	Byte 8
			First byte of number of points (H)	Byte 9
			First byte of number of points (L)	Byte 10
			Second byte of number of points (H)	Byte 11
			Second byte of number of points (L)	Byte 12

**Notes:**

1. The starting address, number of points, and data values that are to be set each have 2 bytes. The first byte is the high byte; the second byte is the low byte.
2. (H) indicates the ASCII code of high 4 bits of hex number; (L) indicates the ASCII code of low 4 bits of hex number.

#### 4. Function and Data Fields of Response Sent by Slave

Function			Data	
Name	Byte 3	Byte 4	Values	Byte Number
Read Holding Registers (03H)  (Get parameters shown in memory mapping)	30H	33H	Byte count (H)	Byte 5
			Byte count (L)	Byte 6
			First byte of value 1 (H)	Byte 7
			First byte of value 1 (L)	Byte 8
			Second byte of value 1 (H)	Byte 9
			Second byte of value 1 (L)	Byte 10
			.....	.....

#### 5. Using the Commands

In the communication frames, only integer numbers can be transmitted. The transformation between integer number and decimal number is necessary when the computer receives and sends the data.

##### Data Transformation

Parameters	Transformation	
	Before Send	After Receive
Cell Voltage	× 1000	÷ 1000
Overall Voltage	× 10	÷ 10

Two examples are given below.

##### Read a Single Register

Here is an example of a frame to obtain Overall Voltage of Battery 2. The master should send the following frame to the slave:

:020306000001 <LRC> CR LF

The slave should respond with the following frame:

:020302 <OV Raw Value (2 bytes)> <LRC> CR LF

Thus,

$$\text{Overall Voltage} = \text{OV Raw Value} \div 10$$

##### Read Multiple Registers

Here is an example of a frame to obtain Cell Voltage 1 to 30 of Battery 1. The master should send the following frame to the slave:

:01030000001E <LRC> CR LF

The slave should respond with the following frame:

:01033C <CV1 Raw Value> <CV2 Raw Value> . . .  
<CV30 Raw Value> <LRC> CR LF

Thus, for Cell x (x = 1, 2, . . . , 30),

$$\text{Cell Voltage } x = \text{CV}_x \text{ Raw Value} \div 1000$$

## **6. Using the Test Software**

This section explains how to use the Modbus Protocol test software.

### **6.1. Running the Test Software**

The test software is named PCPC.EXE. Just like the BDS software, it can be installed to any directory that will be used for testing the communication and Modbus software. The configuration file config.bds must be installed in the directory ALBER\BDS\SETUP. To test all the cases designed in the test software, every battery should have 60 cells. To run this software, type the following on the DOS command line:

```
PCPC <Enter>      (if COM1 is used for the test computer)
PCPC -2 <Enter>   (if COM2 is used for the test computer)
```

When the test software starts, it checks the connection between the two computers. If the connection is good, a message is displayed. Press any key to continue. If the connection test fails, an error message appears on the screen. Either try again or quit the software.

The PCPC.EXE file may be downloaded from the Web. See the References section of this document.

### **6.2. Cell Voltages, Overall Voltage (OV), Current, Ground Fault and Temperature**

Open the Current Cell Data Display screen, then press a function key to test the protocol in four cases:

Press F4 to get OV, Current 1, Temperature 1 and Ground Fault.

Press F5 to get the voltages of cells 10 to 19.

Press F6 to get the voltages of cells 40 to 49.

Press F7 to get all cell voltages.

Press F8 to clear all the above data displayed on the screen at any time.

### **6.3. Cell Resistances**

Open the Internal Cell Resistance Data Display screen, then press a function key to test the protocol in three cases:

Press F5 to get the resistances of cells 20 to 39.

Press F6 to get all the cell resistances.

Press F7 to get all the intertier resistances.

Press F8 to clear all the above data displayed on the screen at any time.

### **6.4. Intercell Resistances in BDS-60**

Open the Intercell Resistance Data Display screen, then press a function key to test the protocol in three cases:

Press F6 to get the resistances of intercells 10 to 19.

Press F7 to get all the intercell resistances.

Press F8 to get all the intertier resistances.

Press F9 to clear all the above data displayed on the screen at any time.

### **6.5. Alarm Status**

To get Alarm Status, at the Main Menu, press F2, then, in the View Data Menu, press F2. The status list of all alarms, discharges, and resistance tests is displayed. Press F1 to get the status of the next battery, or press F2 to get the status of the current battery again.

## **7. References**

The PCPC.EXE file and this document may be downloaded from the Albécorp Web site under the file name PCPC.ZIP. The zip file can be found in the Software Updates section. This document, without the exe program file, also may be found in the Technical Library/Modbus Register Maps section under BDS-60. Access Albécorp on the Web at: <http://www.alber.com>

Consult the following sources for assistance with the Modbus protocol:

Modicon Modbus Protocol Reference Guide. Modicon, Inc., Industrial Automation Systems, 1 High Street, North Andover, MA 01845

Modicon, Inc. is on the Web at: <http://www.modicon.com>