

**FACTSTAR Series BATTERY MONITOR  
(MODBUS based) INTERFACE PROTOCOL.  
For F/W Rev. 1.7.FA or higher (BTM)  
For F/W Rev. FS2.x or higher**

**Meets PI-MBUS-300 REV A Specs**

**Revision 2.14B**

**Polytronics Eng. Reserves the right to change this protocol without notification.**

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## Registers and Functions supported by FACTSTAR device

### NOTES.

The maximum number of registers for multiple register read is dependent on the particular device. If request frame specifies higher number of registers to read, **RESPONSE LENGTH TOO LONG** exception frame will be generated.

**BtmGlobal** – maximum allowed by Modbus Protocol

**BtmNode** - Factstar V2 and Btm Communication Module,  
Maximum number of registers is limited to 64.

All Polytronics device support only RTU communication mode.

BTM 32-bit long integer is represented as high order value in odd register number, low order value in even register number. The even register number (low order value) is listed in this document. Hence high order value for any BTM 32-bit long resides at N-1 register, N is defined in this document (as 32-bit long register).

Data is represented in big-endian format (MSByte at lower address).

Please refer Modicon Modbus Protocol Reference Guide (PI-MBUS-300, Rev.J) or derivative document for detailed description of the protocol itself.

([http://www.eecs.umich.edu/~modbus/documents/PI\\_MBUS\\_300.pdf](http://www.eecs.umich.edu/~modbus/documents/PI_MBUS_300.pdf) and  
<http://www.modbus.org>)

In this document

input registers are defined from 30001,

holding registers are defined from 40001.

When assembling a Modbus command frame, the register address denotes offset into either Input (Function 4) or Holding (Function 3, 6 and 16) register pool.

Register description in this document starts from 1, while in command frame register address (offset) starts from 0.

## 1. Read Input Registers (Function 4)

**30001 – Reserved**

**30002 – Average System scan time** (in 0.1 sec per bit) **(unsigned short)**

Content of this register defines the minimum interval between data polling from FS device

**30004 – Current Device Time** in seconds since reference data **(unsigned long)**

**NOTE. System time register returns device time in seconds from midnight on reference date. Reference date is stored in device non-volatile memory and can be accessed using registers 40005 and 40006 (see below).**

**30008 - Event duration (32-bit unsigned long)**

Duration of current string event (status) in seconds.

The timer value can be constructed as follows:

Value = (unsigned long)register0007 \* 0x10000L | ((unsigned long)register0008 & 0x0FFFFL)

**30009 – Number of stored data samples**

Reading this register will advance the record pointer to the next available record if data storing function is activated, otherwise no change.

**30010 – String status (event) (unsigned short)**

This register will contain one of the following values:

- 0: UNKNOWN, unknown status (typically error or system start up)
- 1: OPEN, battery string at Open condition (charger not connected or malfunctioning, main breaker open)
- 2: FLOATING, battery string floating (normal)
- 3: FLOAT-CHARGING, battery recharge with small current (typically after charge) for prolonged time period
- 4: CHARGING, battery recharge after discharge
- 5: EQUALIZING, battery at equalization potential (Equalizing), typically after recharge
- 6: DISCHARGING, battery string discharging, load is on battery (most important event)

This register should be read as frequently as possible (but not sooner than register 0002/10 seconds).

**30011 – String pending alarm (bit mapped) (unsigned short)**

This register may contain the following: (several bit-mapped alarm conditions can be or-ed together)

### **Critical Alarms: Immediate Action Required**

0001H: String Exhausted, battery capacity drained, pending load loss (string voltage during discharge below set limit)

0002H: String Open, possible charger malfunction, breaker open, possibly no support to load

0004H: String near exhaustion. Used capacity is more than preset percent (95% default) of effective capacity. Effective capacity is compensated for load current and temperature, optionally, battery age and number of discharges detected.

### **Notification of Abnormal/Changed Condition(s) on the battery, some action required during regular maintenance.**

0010H: Segment voltage below set limit

0020H: Segment voltage above set limit

0040H: String float voltage below set limit

0080H: String float voltage above set limit

0200H: High AC ripple current

0400H: Ambient/Pilot cell Temperature outside limits

### **Warning on Changes in battery status (Notification, no action required)**

1000H: discharge warning, load is on the battery

2000H: equalization warning

4000H: charge warning, battery is being charged

**30012 – Values changed since last scan, if non-storing data access**

**Values changed in buffered data record (if buffering enabled)**

This register is bit-mapped and several bits can be or-ed together .

- 0x0001 - floating current changed
- 0x0002 - string voltage changed
- 0x0004 - temperature changed
- 0x0008 - ac ripple current changed
- 0x0020 - pending alarm changed
- 0x0040 - string status/event changed
- 0x0100 - minimum values changed
- 0x0200 - maximum values changed
- 0x8000 - stored data record (if bit set)

**30014 - Sample Time (32-bit unsigned long)**

**NOTE.** If data storing is enabled then the sample time registers return the value of the system time when the data was stored (not the current system time).

If storing is disabled, then the register returns current system time

*Example:*

Register 30013 contains value 3

Register 30014 contains value 1355.

This translates as: String data record has been sampled at 197963 (65536\*3 + 1335) seconds from reference date.

**30016 - String Used Capacity in Ampere Seconds (32-bit signed long).**

negative value means that so many, ASeconds have been removed

1 bit = 10 milliAmpere\*sec

**30018 - String Effective Capacity (in AHs) - (16-bit unsigned short, 1 bit = 1A\*Hrs)**

**(FUTURE RELEASE)**

Capacity Rating for the string under present load current, corrected for temperature and current values. This value is available after 3<sup>rd</sup> scan-cycle during discharge, otherwise it reads Battery Factory rating (configured during installation).

**30020 - String Current (32-bit signed long)**

This register contains value of measured string current ( negative current is discharging current) - 1 mA per bit.

**30021 - AC Ripple Current (16-bit unsigned int 1 bit = 0.1 A)**

This register contains value of measured ac ripple current

**30022 - AC Ripple Voltage, (16-bit unsigned int, 1 bit = 0.01V)**

**(FUTURE RELEASE)**

**30023 - Ambient T in C/F degrees, (16-bit signed int, 1 bit = 1/10 degree C)**

This register contains value of first segment voltage (unsigned entity)

**Registers Starting from 100, are grouped in junks of 300. Every group of 300 may present a parametric value for a monitored jar/segment.**

**For example first group contains monitored jar/segment terminal voltages. Maximum number of jars/segments per a string for this protocol is 298. Actually available number of jar/segments can be read from register 40010 (see below).**

**30101 - String Total Voltage (16-bit unsigned int 1 bit = 0.01 V)**

This register contains value of total string voltage (unsigned entity) in 10\*milliVolts.

**30102 - Segment #1 Voltage (16-bit unsigned int 1 bit = 0.01 V)**

This register contains value of first segment voltage (unsigned entity)

**30103 - Segment #2 Voltage (16-bit unsigned int 1 bit = 0.01 V)**

This register contains value of second segment voltage (unsigned entity)

**30104 - Segment #3 Voltage (16-bit unsigned int 1 bit = 0.01 V)**

This register contains value of third segment voltage (unsigned entity)

**30105 - Segment #4 Voltage (16-bit unsigned int 1 bit = 0.01 V)**

This register contains value of fourth segment voltage (unsigned entity)

**This group is reserved for Internal Resistance measurements.**

**30401 - String Parametric Value (16-bit unsigned int 1 bit = 0.01 V)**

**30402 - Segment #1 Parametric Value (16-bit unsigned int 1 bit = 0.01 V)**

**30403 - Segment #2 Parametric Value (16-bit unsigned int 1 bit = 0.01 V)**

**30404 - Segment #3 Parametric Value (16-bit unsigned int 1 bit = 0.01 V)**

**30405 - Segment #4 Parametric Value (16-bit unsigned int 1 bit = 0.01 V)**

**Higher groups are reserved for future use.**

## 2. Read Holding Registers (Function 3 ) general format 4x

### 40004 – System Time,in seconds (32 bit unsigned long)

Seconds since midnight at reference date

### 40006 – Reference Date (32 bit unsigned long)

Reference date is in BCD format as follows:

00MMDDYY, where

MM is calendar month (starting from 1)

DD is month day(starting from 1)

YY is 2 digits of the year

### 40008 - Buffering function status

0 – buffering disabled

non-zero – buffering enabled

### 40009 - Total of buffered data records or 0 if buffering disabled.

Reading this register will advance buffer pointer to the next stored data record and decrement the count.. If end of stored data is reached, register reads 0. If no buffered data is available, then present set of readings is returned.

### 40010 – Number of segments configured (0 – 4)

### 40100 – maps device internal configuration memory, reads its content

## 3. Preset Holding Registers(Function 6)

### Preset Multiple Holding Registers (Function 16)

Difference between func. 6 and 16 is that the later allows more than 1 consecutive registers to be modified.

### 40004 – Initialize system time in seconds (32 bit unsigned long)

New seconds value.

### 40006 – Initialize Reference Date (32 bit unsigned long)

New reference date value.

Reference date is in BCD format as follows:

00MMDDYY (as above)

### 40008 - Enable/Disable buffering/ data storing

Non-zero value enables data storing based on the control-bits written into this register, as described below (several bits can be or-ed together):

0001H – store record on delta Voltage

0002H – store record on delta Current

0004H – store record on delta Temperature

0008H – store record on delta AC ripple current

0020H – store record if alarms changed

0040H – store record if string status/event changed

1000H – store record if time period elapsed

### 40009 - Total of buffered data records or 0 if buffering disabled.

Writing 0 to this register will clear stored data set.

### 40100 – maps device internal configuration memory, modifies its content