FACTSTAR SERIES BATTERY MONITOR MODBUS INTERFACE PROTOCOL

For F/W Rev. FS20E06A or higher

Meets PI-MBUS-300 REV J Specification

Revision 2.22
Date: 04-Aug-2011

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

Polytronics Engineering, Ltd.
Richmond Hill, Ontario, Canada

Revision History

Revision	Date	ID	Description of Changes
1.1	12/01/96	UR	Original Copy
1.1A	02/18/97	UR	Loopback Diagnostic Test, Communication Event Log
1.2	05/17/97	UR	Scan Cycle(initiated by Master),
1.2A	08/16/97	UR	
1.3	08/28/97	UR	
2.0	12/04/00	UR	Multi-string Support, Extended Register File
2.1	07/08/01	UR	Redefinition of registers for SCADA
2.11	10/09/01	UR/ZN	Redefinition of Analog Inputs as IEEE Floating points. Modifications to comply with EBI Open Interface (Modbus)
2.11A	10/15/01	UR	Error corrections and detailed alarm data definitions
2.12	12/17/02	UR	Modifications for SmartOpto/Modbus Interface No floating point.
2.13	03/22/03	UR	Correction of input registers
2.14 draft	07/17/04	UR	Modification for Factstar devices (Appendix A added)
2.14A draft	01/31/05	UR	Modification of Factstar Registers (Appendix C added).
2.14B draft	01/12/06	UR	Review and modification of register definition
2.15	11/14/07	ER	Update document to follow along with the firmware update and reformatted the document.
2.16	02/12/08	ER	Added Appendix A.
2.17	03/11/08	ER	Added default values read from the FS when powered up and not connected to a system (FW rev: FS20E0505A)
2.18	09/15/09	ER	Changed defaults
2.20	02/16/10	ER	Changed Register names (4x/3x)
2.21	07/12/10	ER	
2.22	08/04/11	ER	Corrections re: capacities and time left

Table of Contents

Factstar Battery Monitor

<u>Supported Data Types</u>

BTM 16-bit unsigned short integer
1 word register data (0 ~ 65534)
0x8000 – UNDEFINED VALUE

BTM 16-bit signed short integer
1 word register data (-32767 ~ +32767)
0x8000 – UNDEFINED VALUE

BTM 32-bit unsigned long integer
Addressable register (e.g. 30002) = AR and AR+1 contains 32-bit value:
V = AR*10000H | (AR+1)

<u>Introduction</u>

The maximum number of registers for multiple register read is 16. If it exceeds that number, a "Response Length Too Long" exception frame will be generated. All Polytronics devices support only RTU communication mode. The communication setup is defined as: 9600 baud, no parity, 8 data bits and 1 stop bit. Data is represented in big-endian format (LSB at higher 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 and http://www.modbus.org).

When assembling a Modbus command frame, the register address denotes offset into the register pool. Register description in this document follows the command frame register address.

The default values for the registers are contained in [].

Warning: Registers in red are stored on EEPROM. This memory has limited write/erase cycles and it is strongly recommended that the associated registers are not polled.

Note: Some registers will contain correct values only if the FactStar is properly configured. I.e. Time Left (30028) will show 0 when voltage limits are incorrect.

Factstar Battery Monitor

Read Input Registers (Function 4)

Request Format:

Slave Address	Function	Start Address Hi	Start Address Lo	# of Points Hi	# of Points Lo	CRC Hi	CRC Lo

Response Format:

Slave Address	Function	Byte Count	Data Hi	Data Lo	…	CRC Hi	CRC Lo

30001 – Slave Address (16 bit unsigned) [31]
This is the device ID of the Factstar it is used in Modbus as the slave address (the value must be between 1 and 254).

30002 – Factstar Serial Number (12 bytes unsigned)
The serial number is a unique identification of each Factstar. Each byte represents a character. If the end of this register is 00 then it is ignored as part of the serial number.

30008 – Factstar Firmware Revision (16 bytes unsigned)
This is the firmware revision being used by the Factstar device. Each byte represents a character. If the end of this register is 00 then it is ignored as part of the serial number.

30016 – Factstar Model Number (16 bit unsigned)
The model number of the Factstar can also indicate what the capability of it is.

30018 – String Status (unsigned short)
This register contains 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 recharging with small current (typically after charge) for prolonged time period
4 – Charging, battery recharge after discharge
5 – Discharging, battery string discharging, load is on battery

30019 – String Current (32 bit signed long)
This contains the string current being read by the Factstar (1 mA per bit).

30021 – AC Ripple Current (16 bit unsigned)
This register contains the measured AC ripple current where 1 bit = 0.1 A.

30022 – Temperature (16 bit unsigned)
The ambient Temperature is in degrees centigrade with 1 bit = 1/10 degree C.

30023 – Total String Voltage (16 bit unsigned)
String voltage has a resolution of 1 bit = 0.01V.

30024 – Segment #1 Voltage (16 bit unsigned)
This register contains the value of the first segment voltage where 1 bit = 0.01V.

30025 – Segment #2 Voltage (16 bit unsigned)
    This register contains the value of the second segment voltage where 1 bit = 0.01V.

30026 – Segment #3 Voltage (16 bit unsigned)
    This register contains the value of the third segment voltage where 1 bit = 0.01V.

30027 – Segment #4 Voltage (16 bit unsigned)
    This register contains the value of the forth segment voltage where 1 bit = 0.01V.

30028 – Time Left (32 bit unsigned long)
    This register contains the time in seconds to the point when battery becomes fully discharged. Time left is calculated assuming the battery will continue to be discharged with constant current.

30034 – String Used Capacity (32 bit signed long)
    This register contains the string capacity removed from the battery during discharge in 10 mAsec. Value in Ah is calculated as signed 32 bit long word divided by 360000.

30036 – String Effective Capacity (32 bit unsigned long)
    This register reads the effective capacity of the string in 10 mAsec, corrected for temperature and discharge current values. This value is available after 3rd scan cycle during discharge, otherwise it reads battery factory rating (configured during installation). Value in Ah is calculated as unsigned 32 bit long word divided by 360000.

30041 – System Time
    Seconds since midnight at reference date.

Higher groups are reserved for future use.

Read Holding Registers (Function 3)

Request Format:

Slave Address	Function	Start Address Hi	Start Address Lo	# of Points Hi	# of Points Lo	CRC Hi	CRC Lo

Response Format:

Slave Address	Function	Byte Count	Data Hi	Data Lo	…	CRC Hi	CRC Lo

40001 – Device ID (unsigned short) [31]
This is the device ID of the Factstar it is used in Modbus as the slave address (the value must be between 1 and 254).

40002 – System Time (32 bit unsigned long)
Seconds since midnight at reference date.

40004 – 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

40006 – Battery Capacity (16 bit unsigned short)
This value is an Ah rating of the battery being monitored.

40007 – Segment Voltage Slope (16 bit unsigned short)
This is the segment voltage slope for the total voltage and the segment voltages. Its value is stored in 1/1000 per bit.

40008 – Discharge End Voltage (16 bit unsigned short)
This is the low string voltage during discharge which is a voltage level at which the battery is fully discharged, in 0.01 V per bit.

40009 – Reserved (16 bit unsigned short)
This register reads as 0.

Higher groups are reserved for future use.

Factstar Battery Monitor

Preset Single Register (Function 6)

Request Format:

Slave Address	Function	Start Address Hi	Start Address Lo	Preset Data Hi	Preset Data Lo	CRC Hi	CRC Lo

Response Format:

Slave Address	Function	Start Address Hi	Start Address Lo	Preset Data Hi	Preset Data Lo	CRC Hi	CRC Lo

This function allows the same registers that are in function 3 to be changed.

60001 – Device ID
> This is the device ID of the Factstar it is used in Modbus as the slave address (the value must be between 1 and 254, the default is 31).

60002 – System Time (32 bit unsigned long)
> Seconds since midnight at reference date.

60004 – Reference Date (32 bit unsigned long)
> Reference date is in BCD format as follows:
> **00MMDDYY**
> Where:
> MM is calendar month (from 1 to 12)
> DD is the day (from 1 to 31)
> YY is 2 digits of the year

60006 – Battery Capacity (16 bit unsigned short)
> This value is an Ah rating of the battery being monitored.

60007 – Segment Voltage Slope (16 bit unsigned short)
> This is the segment voltage slope for the total voltage and the segment voltages. Its value is stored in 1/1000 per bit.

60008 – Discharge End Voltage (16 bit unsigned short)
> This is the low string voltage during discharge which is a voltage level at which the battery is dead, in 0.01 V per bit.

60009 – Reset Functions (16 bit unsigned short)
> This register is bit mapped to reset specific functionality of the Factstar. If multiple functions are needed to be performed, only do one each request. The following is a list of the mappings.
> 0x01 – Clear memory
> 0x02 – Reset capacity correction factor
> 0x04 – Reset amp-seconds used

Higher groups are reserved for future use.

Preset Multiple Holding Registers (Function 16)

Request Format:

Slave Address	Function	Start Address Hi	Start Address Lo	# of Registers Hi	# of Registers Lo	Byte Count	Data Hi
Data Lo	…	CRC Hi	CRC Lo				

Response Format:

Slave Address	Function	Start Address Hi	Start Address Lo	# of Registers Hi	# of Registers Lo	CRC Hi	CRC Lo

Available in future releases.

Factstar Battery Monitor

Exception Frame

Response Format:

Slave Address	Slave Address | 0x80	Exception Code	CRC Hi	CRC Lo

Exception Code can have the following values:

01 – Illegal Function
  The requested function is not defined for the Factstar.

03 – Illegal Data Value
  The value being written is out of the normal range for that value.

04 – Response Length Too Long
  Reading multiple registers where too many registers were requested the limit is 16.