

# **Revision 2 FACTSTAR Specifications.**

**Document revision 2.2B**

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# FACTSTAR Specifications

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## 1. INTRODUCTION

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### 1.1. PURPOSE

This specification defines the minimum requirements for the FACTSTAR Battery Monitoring System and remote data access capabilities.

### 1.2. DESCRIPTION

The Factstar shall be used to monitor and record battery float, charge/discharge and ripple currents, total string and optionally up to 4 segment voltages and ambient or pilot jar temperature. The Factstar shall continuously calculate battery used capacity (charge level) and generate alarms on high temperature, high float current, open string, high ripple current conditions, optionally alarm can be triggered based on segment voltage abnormalities (outside predefined limits).

One/ optionally two alarm contacts shall be operator configurable(programmable). Configuration data shall be stored in the device non-volatile memory.

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## 2. SYSTEM COMPONENTS

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### 2.1. Basic Elements

- **Factstar** - The Factstar V2 (**FS2**) collects data on the battery and triggers a contact closure when an alarm condition is encountered
- **Core** – current transducer, installs around DC current bus. The distance between core and FACTSTAR unit can be extended up to 10 meters.
- **External Temperature Sensor** – the sensor leads can be extended up to 10m for monitoring pilot jar temperature.
- **Voltage sensing clips** - 2 per total voltage sensing + 3 for additional four segments, installed at the battery terminal. Current limiting resistor is built into the clip. Sensing wire from the sensing clip to the FS2 terminal block is supplied by installer.
- **The Local Alarm Enunciator** – Connected to the alarm contact, signals the alarm either audibly or visually upon closure of the alarm contact (provided by user).
- **Modem** – Pre-configured by Polytronics external modem (optional).
- **Communication module** – modem or ethernet converter (optional).

## 3. SYSTEM SPECIFICATIONS

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### 3.1. Measurements

- DC Float current:  
Range: 0 – 2.5A / 5 A<sup>1</sup>  
Resolution: 1 mA  
Accuracy: 0.5%  
Temperature drift: less than 0.1% per degree C  
Memory effect: less than 10 mA after 1 minute
- DC Current :  
Range A: 10 – 100/400/1000 A<sup>2</sup>  
Resolution: 0.1 A  
Accuracy: 2%
- Total voltage:  
Range: Configurable (48 – 600Vdc)  
Resolution: 0.2%  
Accuracy: 0.5%
- 4 segment voltages<sup>3</sup>: **(Optional)**  
Range: Configurable (48 – 600Vdc)  
Resolution: 0.2%  
Accuracy: 0.5% (of total voltage)
- AC Ripple:  
Range: 0 – 30 Aac (@ 180Hz)

<sup>1</sup> Maximum float current range shall be determined by the size of the core

<sup>2</sup> Maximum current range shall be determined by the size and material of the core

<sup>3</sup> The voltage in sensing wires is limited to 60Vdc maximum by proper terminating resistors at the battery terminal

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- Resolution: 0.5%
- Accuracy: 2% (@ 180 Hz)
- Ambient or Pilot jar temperature:
  - Range: -30° – 60° C
  - Resolution: 0.2° C
  - Accuracy: 2%

## 3.2. Input/Output

### 3.2.1. Alarm Enunciators

- The Factstar shall be equipped with one mechanical relay.
  - The mechanical relay contacts shall be rated to 1A @ 30Vdc or 0.5A @ 125 Vac.
  - Option for second relay shall be available.
  - The contact(s) closure conditions shall be configurable, by default the second Optional contact closes when discharge or sensing core malfunction is detected.

### 3.2.2. Analog Output

The Factstar device shall have **optional** 1 analog voltage output which is proportional to measured current up to the configured limits:

Low current range: 0 – 1.50V equivalent to current 0 – L A,  
Where L is preset value (1 – 10 A)

High current range: 1.60 – 3.0V equivalent to current L – U A,  
Where U is preset value (11 – 600 A) and L is defined by  
low current range

Analog output granularity: 0.1 %  
Analog output accuracy: 2 %

### 3.2.3. User Interfaces

The Factstar shall have **optionally** 16x2 alpha-numeric LCD and four button membrane switch to access device data locally.

### 3.2.4. Data Interface

The FS2 device shall communicate as DCE equipment using

1. Serial asynchronous communication interface (standard):

OPTION A:

*EIA/TIA-232 (RS-232C)* standard (non-isolated or optically isolated options):  
EIA/TIA-574 connector (DB9-female)

Or

*EIA/TIA-485 full duplex standard (non-isolated or optically isolated):*

EIA/TIA-561 connector (RJ45 type modular connector) or 4 pin terminal  
block

OPTION B:

Based on TTL level serial asynchronous communication over fiber-optical loop  
(HV isolation)

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## 3.3. Power

The FS2 device shall be powered from unipolar 12 – 15 V dc well regulated source as a standard. Option to power directly from a battery (10 – 48V, **60V absolute maximum**) shall be available.

The continuous current drain on the power source shall not exceed 120 mA in average, 600 mA at peak. The power connection shall be polarity sensitive and clearly marked.

Power consumption: dependent on implemented modules/options.

## 3.4. Mechanical

The magnetic core shall be a solid round core with inner diameter of 2 inch (5.5 cm) at least.

The terminal block shall be built in for following connections:

DC power supply inputs(2), alarm1, common, alarm2, current sensor (2), temperature sensor(2), voltage inputs (2, optionally 6), analog voltage outputs (2), battery power inputs (optional 2).

The Factstar shall have the following mechanical characteristics:

- Dimension: 7.5" x 5.5" x 1.75" (190 x 140 x 45 mm)
- Weight: 0.9 lb. (400 gr)
- Color: Dark blue
- Packaging: plastic.
- Round Core : inner diameter 2" (52 mm)  
outer diameter 3.5" (90 mm)  
weight: 0.9 lb. (400 gr)
- Current direction marking: A sticker located on the transducer core shall indicate: "Towards charger positive" to ensure it is installed in the correct polarity to detect float current<sup>4</sup>.

## 3.5. Environmental

The Factstar shall operate under the following environmental conditions:

- An ambient temperature ranging from -30 to 50°C
- A relative humidity ranging from 0 to 75% (non-condensing)
- An altitude up to 2100m (7000 feet)

## 3.6. Calibration

The calibration shall be done by Polytronics Engineering.

## 3.7. Installation

Installation shall not require any special tools.

The Factstar shall adapt for installation on many installation schemes since VRLA batteries come in various sizes, configurations, shapes, orientation and connections.

<sup>4</sup> Since transducer is sensitive to battery current polarity.

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## 4. SYSTEM CAPABILITIES

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### 4.1. Event Detection

The Factstar device shall detect and record following string events

- **Open** -Float current not present or below threshold value
- **Floating** -Float current is positive, less than maximum permitted value
- **Charging** -Current is positive and greater than maximum permitted float current and the event has lasted less than 12 hours.
- **Discharging** - String current is negative and greater than threshold value
- **Float Charging** – battery current is positive but less than maximum permitted float current threshold value, battery capacity not at 100%

### 4.2. Alarm Detection

The standard Factstar model shall detect and record following string alarms

- **High Float Current** - Float current exceeds limit for longer than 24 (configurable) hours after 72(configurable) hours from last charge/equalize.
- **String Open** – open string status detected
- **High Temperature** - Temperature exceeds user configured threshold value
- **High Ripple** – Ripple current value exceeds user configured threshold value
- **Segment voltage abnormalities** – segment voltage is above or below limit value (while string is at float or at discharging state), if segment voltage option is selected.
- **String exhausted** – 90% string capacity has been used during discharge
- **Discharge warning** - load is on battery
- **Memory Near Full** – more than 80% memory has been used for profile data

The Factstar model shall implement software or optional hardware clock for time stamps.

### 4.3. Data recording

The standard Factstar model shall record following data:

- Average current value per time period and per event
- Average temperature per time period and per event
- Average ripple current per time period and per event
- Average string voltage per time period and per event
- Average segment voltages per time period and per event
- Time stamp (software clock)
- The profile recording shall be based on timer and/or current change (delta)
- The profile recording shall be based also on segment voltage delta (configurable), if segment voltage sensors connected

Time period and significant change shall be configurable.

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## 4.4. User Interface Functionality

Factstar model shall have **optionally** following interfaces:

- Alpha-numeric LCD display ( 2x16 characters)
  - String status and current measurement display
  - Detected alarms and Total voltage display
  - Segment voltages display
  - Segment voltage ripple display
  - Ripple current and ambient/pilot temperature display
  - Cycle information display
  - Event duration and used capacity display
  - Memory usage display
- 4-button membrane switch
  - Navigation through all display
  - Data memory clear function activation

## 4.5. Device Configuration

The FACTSTAR shall have following user configurable parameters :

- String capacity (for float-current and used capacity level calculations)
- High temperature limit
- High ripple current limit
- Time value (date and time) for software clock
- Minimum floating current value (for string Open detection)
- Maximum floating current value (for charge detection)
- Open string detection time
- High float current detection time
- High float current alarm time after last charge/equalize event
- Float current averaging factor
- Data recording period
- Low Floating Voltage limit per segment
- High floating voltage limit per segment
- Discharge end voltage per segment
- Float current delta for recording
- Segment voltage delta for recording
- Significant current delta values
- Alarm action for every alarm type

## 4.6. Data Interface

The FACTSTAR shall have following data interface:

- RS232C or RS485 interface port (with optical isolation option):  
Supporting 19.2 kBaud signaling rates.  
Unidirectional (modem to device) flow control (hardware and XON/XOFF based) shall be supported.  
Fiber optical port:  
Supporting 19.2 and 9.6 kBaud signaling rates.
- Data shall be transmitted as proprietary ASCII text stream (CSV-format) with or without software handshake.

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- Polytronics proprietary BTM protocol shall be supported for interfacing with Polytronics Battery Monitoring Systems.
- Multiple (maximum of 34) FACTSTAR devices can be interfaced to a single Communication Module using RS485 communication standard.

## **4.7. Data Access**

All Factstar models data shall be accessible locally or remotely using FACTSTAR Utility Software. The software shall operate under WindowsXX OS and shall have following built-in functions:

- Communication port configuration
- Modem control
- Multiple device support
- Direct data access
- Basic data management based on device ID string
- Device and software configuration utilities
- Data shall be converted into ASCII Table (export to a spread-sheet program )

Data shall also be available (in streaming mode) using standard windows Hyperterminal software. For data polling, third-party software shall be required. In streaming mode, data is presented in ASCII CSV format.

## **5. SYSTEM PERFORMANCE**

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### **5.1. Data Sampling**

The FACTSTAR shall sample data:

- At operator configurable rate:
  - 2 – 8 seconds per float current sample
  - 10 – 1000 ms per segment voltage and peak ripple current sample

### **5.2. Storage Capacity**

As a standard, the Factstar device shall record :

- Up to 250 alarm records
- Up to 470 data records
  - Option to increase memory capacity up to 3x470 records shall be built in.
- The device shall record data for average of 40 days of unintended operation (if configured properly)
- Data recording shall be triggered by timer and change in current/voltage

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## 6. QUALITY CONTROL AND WARRANTIES

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The battery monitoring system shall be completely factory tested and calibrated prior to shipment.

### 6.1. Factory acceptance test

- **Examination of the product** - A complete examination to determine compliance with specification and drawings with respect to materials, workmanship and marking.
- **Functional test** – As a minimum, the unit will undergo a 24-hour component burn-in test under near real operating conditions.

### 6.2. Warranty

The equipment shall be guaranteed free of defects in operation and workmanship. The supplier shall replace, free of charge any parts showing defects which are not due to misuse or neglect and which develop within one year from the date of purchasing.

### 6.3. Spare parts.

As recommended by the manufacturer.