RC Electronic by EMCOTEC
DPSI systems & LONGGO batteries

DPSI BMS

Dual Power System Interface
Battery Monitoring System

English

Operating Manual

Contents

1. Preface

With the **DPSI BMS** (**D**ual **P**ower **S**ystem **I**nterface – **B**attery **M**onitoring **S**ystem) you purchased a high quality and reliable measuring system for battery power supplies. We thank you for your faith in EMCOTEC GmbH and assure you that you have made the right decision! Years of experience in development and manufacturing of electronic systems went into the **DPSI BMS.** All products are manufactured completely in house at EMCOTEC GmbH in Germany. In-house manufacturing, careful quality assurance and a 100% test of all shipped systems assure you of the highest reliability and functionality.

Please read this operating manual carefully in order to use all functions of the **DPSI BMS** optimally**.** We wish you continued success and enjoyment with this high quality product!

2. Features

The **DPSI BMS** (**D**ual **P**ower **S**ystem **I**nterface – **B**attery **M**onitoring **S**ystem) is the first monitoring and displaying system for batteries of twin power supplies for use in large model airplanes.

For operation, the **DPSI BMS** is simply put in between both batteries and the already mounted battery switch. Switching on and off occurs fully automatically as soon as current is drawn (when equipment turned on) or no current is drawn (when equipment turned off).

The **DPSI BMS** displays all relevant measured values in plain text. Besides the battery voltages and currents of the connected consumers (minimum / average / actual / maximum values), withdrawn capacity as well as turn on time is displayed.

Due to the manifold information indicated by the **DPSI BMS**, malfunctions in the receiver set can be detected:

- Sticky control rods or defective servos can be diagnosed due to higher current consumption.
- Eventual malfunction of a battery or in the battery switch (e.g. inbalanced discharge of the batteries) can be detected as well.
- Programming of end stops of servos is simplified where no optical control is possible (e.g. throttle servo), because the increasing current will indicate mechanical end stop.

As a specialty, both battery circuits in the **DPSI BMS** are galvanically separated! This means, no electrical connection between each other exists. This allows you to use one battery for the ignition system and another one for the receiver set and operate both without any influence. Due to the galvanic separation, it is also possible to operate the **DPSI BMS** in connection with all battery switches currently available on the market.

The measured values are derived from high precision 12 bit A/D converters. Due to this elaborate design, constant currents of 10 amps are permissible for each channel. Peak currents of up to 30 amps per channel are permissible, thus allowing the usage of the **DPSI BMS** even in big model airplanes where many servos are in use.

In case only one battery is to be monitored, a single channel version of the **DPSI BMS** is available. Here, just one battery is connected and its parameters (voltage, current, capacity, etc.) are displayed.

Three printed circuit boards, equipped on both sides with most modern parts allow for optimal space usage and are integrated into a stable and ergonomic housing. Usage of pin-and-socket connectors allow for simple exchange of connector cables and guarantees maximum flexibility.

DPSI BMS: intelligent solutions ergonomically packaged!

Summary:

The **DPSI BMS** allows for full control of two independent batteries. This means:

- ❍ Two independent batteries connectable (galvanically separated)
- ❍ Two 12 bit A/D converters for high precision data acquisition
- ❍ Automatic On/Off switching; therefore only single switch necessary
- ❍ LC-Display with indication of voltage, current, capacity, operating time of each battery or both batteries together with min./max.- and average values
- ❍ 1 channel version and 2 channel version available

3. Properties of the DPSI BMS

- ❍ Displaying system for two separate batteries in battery switches or other applications
- ❍ Easily fitted between battery and consumer
- ❍ Discharges the battery with only 10 µA in turned off state
- ❍ Automatically switches On/Off without additional switch
- ❍ 2-4 cell LiIon / LiPo batteries usable
- ❍ 5-12 cell NiCad / NiMH batteries connectable
- ❍ Up to 10A constant current per channel permissible
- ❍ Up to 30A peak current durable
- ❍ Programmable user language (German / English)
- ❍ Wireless system, i.e. all leads is pluggable and therefore exchangeable at any time
- ❍ High-quality plastic housing including bracket for the battery connectors

- ❍ Proof recognition of erroneous linkages (through increased current consumption)
- ❍ Proof recognition of defective or decrepit batteries
- ❍ Three double side populated printed circuit boards for highest packing density and therefore small dimensions
- ❍ Each system 100% tested

3.1. LC-Display

The LC display shows all information in plane text using 2 lines, 8 characters each:

- Actual voltage battery 1 and battery 2
- Actual current battery 1 and battery 2
- Minimum voltage battery 1
- Minimum voltage battery 2
- Maximum voltage battery 1
- Maximum voltage battery 2
- Maximum current battery 1
- Maximum current battery 2
- Average current battery 1
- Average current battery 2
- Maximum current battery 1 + battery 2
- Average current battery 1 + battery 2
- Withdrawn capacity battery 1
- Withdrawn capacity battery 2
- Withdrawn capacity battery 1 + battery 2
- Flight time (Operating time in minutes)

The withdrawn capacity (in mAh) and the operating time (in minutes) can be reset on demand.

4. Packing Contents

Included in delivery of the **DPSI BMS**

- **DPSI BMS** basis device
- Screwing frame for M3 stop nuts
- 2 pieces of screws M3x20 with stop nuts
- Bracket for securing the MPX connectors
- Operating manual
- EMCOTEC sticker
- Carrying case

5. Optional Accessories

5.1. DPSI BMS Accessory Set

The **DPSI BMS** accessory set contains two connector cables, 30 cm (11.8”) each, which are put in between the **DPSI BMS** and the battery switch (1 cable for the 1 channel version). Therefore, no soldering work is necessary if MPX connectors are already in use (from the battery to the battery switch).
The accessory set also contains a bracket (for spare) which serves as a lock for the MPX connectors.

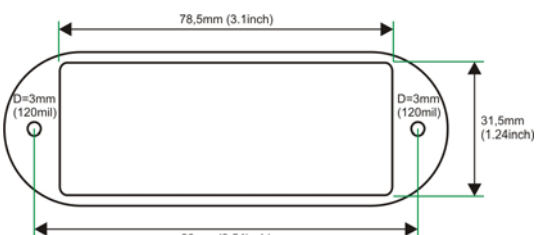
6. Mounting Instructions

6.1. Mounting of the DPSI BMS

The **DPSI BMS** is designed as a cockpit instrument and therefore can be mounted as such (especially interesting for scale models). Of course, mounting on a small board inside the fuselage is also possible. The mounting place should not be exposed to extreme vibrations (as is the case at a fuselage's side wall without a strengthening frame). The **DPSI BMS** is solid mounted by the accompanying frame which serves as a counter bearing. By the way, the frame can serve as a positioning device for the cutout of the **DPSI BMS**.

The screwing connection is accomplished with the delivered M3 screws and stop nuts, which do not get loose even when exposed to vibrations.

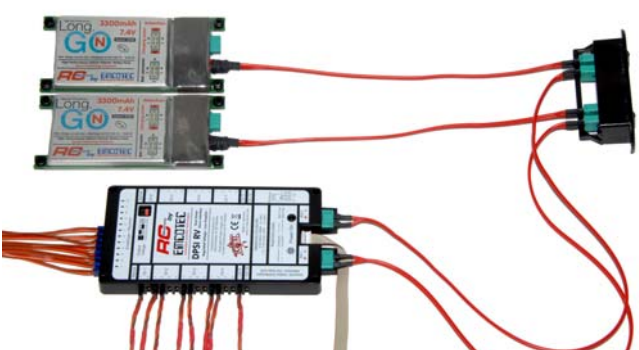
Dimensions for mounting:



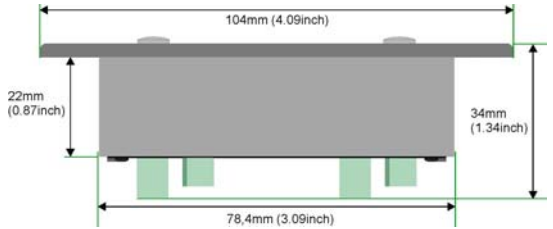
After mounting, the connector cables can be put into their corresponding plugs/sockets. In order to avoid loosening of the connections caused by vibrations, the accompanied bracket is fed in between the positive and negative pole of the connection cable and locked at the sides of the housing of the **DPSI BMS**. Herewith, the connectors are secured against vibrating loose.

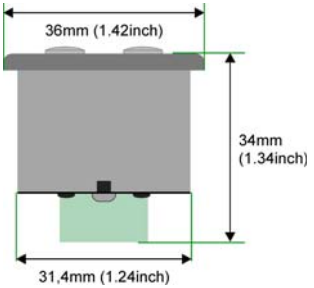
Connector clamping with bracket:

When using battery switches, the **DPSI BMS** is simply put in between the batteries and the battery switch. This means: both batteries are disconnected from the battery switch and connected to the inputs of the **DPSI BMS**. The **DPSI BMS** outputs are then connected to the twin power supply (e.g. a DPSI RV system) using appropriate patch cables (e.g. out of the accessory set).




EMCOTEC
Germany
36mm
(1.41inch)
104mm (4.09inch)

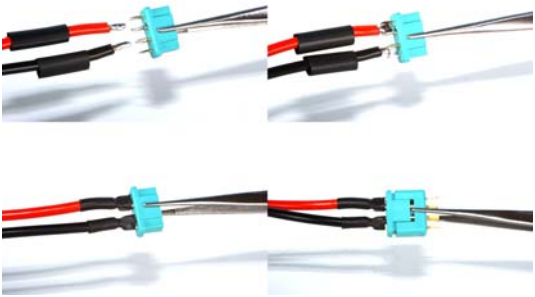

104mm (4.09inch)
22mm
(0.87inch)
34mm
(1.34inch)
78,4mm (3.09inch)


36mm (1.42inch)
34mm
(1.34inch)
31,4mm (1.24inch)

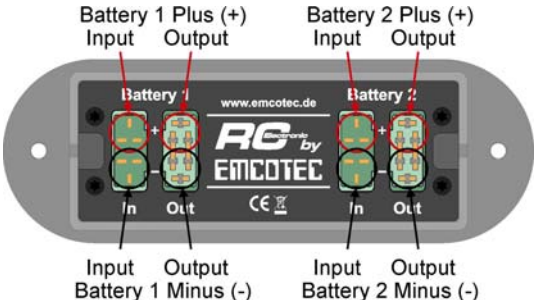
7. Soldering of the Battery Connectors

In case connector cables are manufactured by the user for connection to the **DPSI BMS**, correct implementation must be observed. The MPX high current connectors are marked + and – on their soldering side. This marking must be strictly observed! The cables are first stripped (approx. 5 mm / 0.2") and then tin-plated. Before soldering the cables to the connectors don't forget to put the shrink hoses to the cable ends. The cable is then soldered to all 3 pins, so it is located in their midst (see photo). When using thin cables, the 3 pins can be bend to their center (see photo). Sufficient tin has to be provided in order to connect the cable to all 3 pins. The shrink hoses are then shrunk using a heat gun.

Soldering Multiplex connectors:



Hint:
It is necessary to use one shrink hose per cable (see photo) for isolation and not to put a shrink hose over both cables! There must be enough space between the positive and negative wire to accommodate the bracket.



Hint:
Due to its design, the DPSI BMS is not polarity proof! Please make sure, that the batteries are always correctly connected, i.e. the red wire corresponds to positive and the black wire to negative. Better double check!

8. Charging Instructions for Batteries

If batteries are to be charged while they are connected to the **DPSI BMS** a second cable must be soldered to the batteries or the batteries must be connected by a V-cable (LongGo batteries already do have a charging connector integrated).

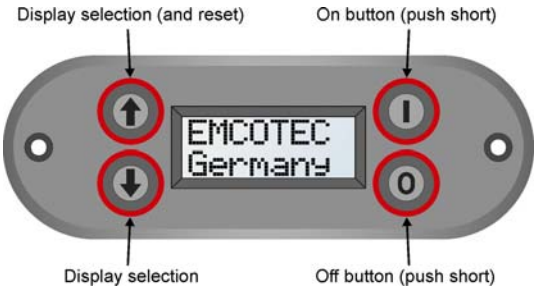
If in doubt, it is more reasonable and safer to disconnect the batteries from the **DPSI BMS** for charging. Here, the bracket has to be released (if mounted).

Hint:
Batteries, which are connected to the **DPSI BMS** during charging and having an additional charging input (e.g. V-cable or charging connector), must be charged separately, if the **DPSI BMS** is connected to a battery switch! Please observe the operating manuals of the corresponding manufacturer of the battery switch.

Hint:
If the batteries are connected to the **DPSI BMS** during charging, a charger has to be used which output voltage (charging voltage) never exceeds 20 volts (=> limited step up converter). This is the case for all chargers of "ORBIT Electronic". Using an unlimited step up converter can cause damage to the **DPSI BMS**. Ask your charger's manufacturer if in doubt!

Hint:
Because batteries do not have any electrical connection among each other if connected to the **DPSI BMS**, they can be of totally different types and can supply their own consumers. Thus, a 2 cell LiPo battery can supply a receiver set and a 5 cell NiMH battery can be used to supply the ignition system for a gasoline engine.

9. Initial Operation



Initial operation, On/Off, Status Display:

The **DPSI BMS** is simply put in between battery and consumer (e.g. between two LongGo batteries and a DPSI RV system).

Turning On/Off can take place in two different ways:

- Automatically turning On/Off
- Manually turning On/Off

9.1. Automatically Switching On/Off

Automatically turning on of the **DPSI BMS** always works. As soon as the connected consumer (e.g. a receiver set connected to a battery switch) draws current from battery 1 which exceeds approx. 100 to 150 milli amps, the **DPSI BMS** turns on automatically. Current drawn by a receiver set using several servos usually clearly exceeds more than 150 milli amps per battery.

However, automatic turning on only functions if current flows from battery 1! If battery 1 is not loaded (but battery 2), the **DPSI BMS** is not turned on.

Hint:
Whenever the current from battery 1 exceeds 100 to 150 milli amps, the **DPSI BMS** automatically turns on. If the current is less (e.g. only a receiver without servos is connected), the **DPSI BMS** does not turn on.

As soon as the current from battery 1 **and** battery 2 drops below 100 to 150 milli amps, the **DPSI BMS** turns off after approx. 10 seconds!

Hint:
As soon as the receiver set is turned off and the current from battery 1 drops below approx. 100 to 150 milli amps, the **DPSI BMS** turns off automatically after approx. 10 seconds.

Hint:
If the **DPSI BMS** turns itself on due to a short current pulse and the current immediately drops below 100 to 150 milli amps, the **DPSI BMS** does not necessarily turn off automatically, because the internal logic does not know where the turn on command came from (automatic or push button).

Hint:
Current consumption of the **DPSI BMS** when turned off is just several µA. Connected batteries therefore are not discharged!

9.2. Manually Switching On/Off

In order to control the voltages of the batteries without turning on the receiver set or the consumers (e.g. in winter), the **DPSI BMS** can be turned on by a pushbutton (button "I"). A **DPSI BMS** turned on by the button stays on until turned of by the off button (button "O").

Hint:
If the **DPSI BMS** is turned on by the on button it stays on until turned off by the off button.
An automatically turned on **DPSI BMS** can be turned off using the off button (but will immediately turn on again if the current is higher than 150 milli amps).

9.3. The DPSI BMS in Operation

Hint:
For operation, battery 1 has to be connected because the electronics of the **DPSI BMS** are supplied by battery 1. The micro controller and the LC display get their voltage from battery 1!

As soon as the **DPSI BMS** is turned on, "EMCOTEC Germany" is displayed for approx. 2 seconds in the LC display. Thereafter, both voltages of the batteries are displayed (BMS 2 channel version) and the **DPSI BMS** is in normal operating mode. The 1 channel version displays the actual voltage as well as the actual withdrawn current of the battery (battery 1).

Using both arrow keys (left side of housing) different information can be retrieved.

If in sequence the ⬇ button is pressed, values are displayed as follows.

9.4. LC-Display Indications for the 2 Channel DPSI BMS

This standard display in normal operating mode shows the actual voltages of both connected batteries.

If battery 2 is not connected or its voltage is too low, the value "< 4.0V" is displayed.

If the voltage of one connected battery exceeds 20 volts, "> 20V" is displayed. CAUTION: only a max. of 16 volts are allowed!

Display of actual current withdrawn from battery 1 and battery 2.

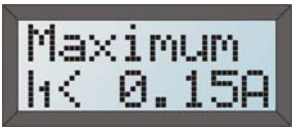
If the DPSI BMS is turned on (manually) for testing without any consumer, the display indicates a current of < 150 milli amps (0.15A).

Minimum battery voltage of battery 1 since last turned on.

Minimum battery voltage of battery 2 since last turned on.

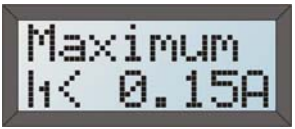
Maximum battery voltage of battery 1 since last turned on (maximum value 20.0V).

Maximum battery voltage of battery 2 since last turned on (maximum value 20.0V).



Maximum current from battery 1 since last turned on. If the value I is < 150mA this is indicated accordingly.

Maximum current from battery 1 since last turned on. This value indicates the peak current which was reached in the equipment and can reach up to 13.00 amps. Higher values are displayed as “> 13.00A”.



Maximum current from battery 2 since last turned on. If there is no current flow, the value “<0.15A” is displayed.

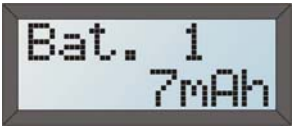
Average current from battery 1 since last turned on. If there is no (or very little) current flow from battery 1 the value “< 0.15A” is displayed.

Average current from battery 1 since last turned on. A value higher than 13.00A, is displayed as “>13.00A”.

Average current from battery 2 since last turned on.

Maximum current from both batteries since last turned on. This value indicates peak currents in the equipment and can reach up 26.00A. Higher values are displayed as “>26.00A”.

Average current from both batteries since last turned on.



Withdrawn capacity from battery 1 since last reset of the memory. If exceeding 9999mAh the value “>9999mAh” is displayed.

Withdrawn capacity from battery 2 since last reset of the memory. If exceeding 9999mAh the value ">9999mAh" is displayed

Withdrawn capacity from both batteries since last reset of the memory. If exceeding 9999mAh the value ">9999mAh" is displayed

Operating time (flight time) in minutes since last reset of the memory. Caution: only full minutes are saved! If turned off at 1:59, next turning on shows 1 minute. If exceeding 9999 min. the value ">9999min" is displayed.

From here on, display repeats, i.e. the voltages of the batteries are displayed.

Hint:
The indications of the LC display of the **DPSI BMS** is somewhat different, but the "logic" behind is the same.

9.5. LC-Display Indications for the 1 Channel DPSI BMS

The 1 channel version of the DPSI BMS indicates, as standard display, the voltage as well as the actual current of the connected battery.

Minimum battery voltage since last turned on.

Maximum voltage of battery 1 since last turned on (max. value 20.0V).

Maximum current from battery 1 since last turned on. Maximum current from battery 1 since last turned on. This value indicates the peak current which was reached in the equipment and can reach up to 13.00 amps. Higher values are displayed as “> 13.00A”.

Average current from battery 1 since last turned on. A value higher than 13.00A, is displayed as “>13.00A”.

Withdrawn capacity from battery 1 since last reset of the memory. If exceeding 9999mAh the value “>9999mAh” is displayed.

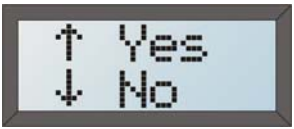
Operating time (flight time) in minutes since last reset of the memory. Caution: only full minutes are saved! If turned off after 1:59, next turning on shows 1 minute. If exceeding 9999 min. the value ">9999min" is displayed.

10. Resetting the Memorized Values

The values for operating time (flight time in minutes) and withdrawn capacity (in mAh) can be reset. This occurs after charging of the batteries. Because the batteries carry full capacity after charging, the **DPSI BMS** starts counting from 0 after reset.

For reset of the saved values, press the ⬆ button and turn on the DPSI BMS. Press the ⬆ button for approx. 5 seconds.

If the ⬆ button is pressed for 5 seconds during turning on, this display appears. Releasing the ⬆ button changes to the next display:



Reset can be confirmed by the ⬆ button or denied by the ⬇ button. If neither button is pressed, the DPSI BMS changes to the normal operating mode after a time out of 5 seconds.

Confirmation of the reset of the values. After deletion of the values a reset occurs and the DPSI BMS starts up in the normal operating mode.

11. Programming the DPSI BMS

Some options of the **DPSI BMS** can be adjusted through simple programming. In addition to the selection of the displayed language, battery 2 can be shown or hidden (available only for the 2 channel version).

For programming, both ⬆ and ⬇ buttons are pressed simultaneously during turning the **DPSI BMS** on. Keep the ⬆ and ⬇ buttons pressed. After approx. 5 seconds, programming mode is entered which works as follows.

If both arrow keys were pressed for 5 seconds during turning on, programming mode starts. After releasing, the next display appears:

Indication of the LC display can take place in German or English. After 2 seconds, display changes to the selection of the language:

Press the ⬇ button for German, for English press the ⬆ button. If there is no key pressed at all, the next programming option is displayed (without change of the currently selected language).

This menu allows for the activation or deactivation of battery 2. Only available for the 2 channel version!

After selecting the battery-2 activation / deactivation, the new configuration is saved and the DPSI BMS is restarted after an internal reset.

12. Safety Instructions

- In general, all connection cables should not be installed in a way that they interfere with moving or hot parts in the model (e.g. servos, servo wires or mufflers).
- Protect the **DPSI BMS** from wetness and humidity.
- Improper usage of the **DPSI BMS** can cause severe property damage or personal injury!
- Always double check all connections in your model before any usage! All connections must be of the correct polarity, have a clean contact and be secured. Loose cables pose a potential hazard!
- Under no circumstances use power sources which exceed the denoted voltages.
- Current leading contacts must not be shorted. Otherwise shorted cables can heat up or even melt.
- The **DPSI BMS** must not, under any circumstances, be taken apart or technically altered. There are no parts at all within the DPSI **BMS**, which could be maintained or repaired by the user.
- Never use the **DPSI BMS** for reasons other than for RC modeling in the hobby area. Especially the application in manned machines is specifically prohibited.

- Always pay attention to fully charge batteries when operating your model. Empty batteries lead inevitably to the breakdown of the RC components and therefore to the loss of the model.
- Do not expose the **DPSI BMS** to extremely hot or cold temperatures, wetness or humidity. Here, there is danger of malfunction, damage or reduced performance.
- Only use our accessories in conjunction with the **DPSI BMS** (e.g. on/off switch).

13. Technical Data of the DPSI BMS

Current Sources	all available battery types (NiMH, NiCad, LiPo etc.)
Operating Voltage Range	5.5V.... 16.8V
Nominal Input Voltage	6.0V.... 16.0V
Turn On Procedure	Automatically @ I1>150mA or by button
Turn Off Procedure	Automatically @ I1<150mA or by button
Quiescent Current (Turned Off State)	Approx. 12µA battery 1 / approx. 7µA battery 2
Current Consumption (Turned On)	Approx. 30mA battery 1 approx. 16mA battery 2
Max. Constant Current per Channel	10A (Flow Rate)
Max. Peak Current per Channel (10ms)	30A (Flow Rate)
Voltage Drop @ 5A	100mV
Galvanically Separation	Both batteries totally decoupled
CE-Test	According to 89/336/EWG
Environmental Conditions (Operating)	+14°F.... +122°F
Permissible Temperature Range	-13°F.... +185°F
Display Range Battery Voltage	4.0V ... 20.0V (or >20.0V)
Display Range Battery Current	0.15A ... 13.00A (or >13.00A)
Display Range Battery Capacity	0mAh ... 9999mAh (or >9999mAh)
Display Range Battery Flight Time	0min ... 9999min (or >9999min)
Non Volatile Memory (resetable)	Withdrawn Capacity, Flight Time (Turn On Time)
Dimension (Width x Height x Depth)	4.1” x 1.4” x 1.2” 4.1” x 1.4” x 1.5” (incl. bracket)
Screw Diameter for Mounting	2x 0.12” (for M3 screws with Stop nuts)
Hole Spacing for Mounting	3.5”
Hole Cutout for Mounting	3.1” x 1.25”
Weight	Approx. 2 oz.
Housing Material	ABS impact resistant
Warranty	24 month

13.1. Measuring Parameters of the DPSI BMS

Voltage Display	2% / 1 Digit / Resolution 0.1V
Current Display	1% / 1 Digit / Resolution 0.01A In Range of 0.15A to 10.00A
Capacity Display	1% / 1 Digit / Resolution 1mAh
Operating Time	1% / Resolution 1min
Sampling Rate A/D Converter	500Hz
Peak Value Data Acquisition	arithmetically Average over 20msec

Technical modifications and errors excepted!

Hint:
A usual digital multi meter is considerable slower in peak value data acquisition than the **DPSI BMS**, thus, very short current peaks are not recognized. The extremely fast measurement of the **DPSI BMS** provides information about the real peak values which the equipment reaches in short times.

14. Warranty

EMCOTEC shall issue a 24 month warranty on the "**DPSI BMS"**. The guarantee period shall begin with delivery of the equipment by the retailer and shall be not extended by any guarantee repair or guarantee replacement.

During the period of guarantee, the warranty shall cover the repair or replacement of any proven manufacturing or material defects at no charge. There shall be no specific entitlement to repair work. In case of a guarantee claim, the manufacturer shall reserve the right to exchange the equipment for a product of equal value if repair of the item is not feasible for economic reasons. There shall be no assumption of liability for consequential damages that are brought about by a proven defect during operation of the "**DPSI BMS**". There shall be no extended claims for damages.

- All transportation, packaging and travel expenses are the responsibility of the purchaser.
- No liability shall be assumed for any damages during transport.
- If repair is needed, the equipment must be sent to the appropriate service center of the respective country or directly to EMCOTEC GmbH.
- The guarantee shall only be valid when the following conditions are met:

  The guarantee document (original invoice) must include the delivery date, the Company stamp, the serial number and signature of the retailer.

  No Intervention in the equipment may have been undertaken.

  It must have been operated in accordance with our operating instructions.
  Only the power sources and other accessory devices and components that were recommended by us may have been used.
- The guarantee document, the original invoice and other pertinent Information regarding the malfunction (a Short description of the defect) must be included with the transmittal.
- The equipment must still be the property of the initial purchaser.
- If equipment is sent in that later proves to be functional following an initial inspection, we shall impose a flat processing fee of € 15.
- In all other respects, the general business terms and conditions of EMCOTEC embedded Controller technologies GmbH shall apply for any items not listed.

(P) Version 1.0 from October, 21st 2006 Robert Hussmann

Legal Information:

Trademarks:
The following names are registered trademarks:

- EMCOTEC
- DPSI
- DPSI RV

Other product names mentioned in this manual may also be trademarks or registered Trademarks of their respective owners.

Manual Note:
EMCOTEC GmbH reserves the right to make changes to this manual and to equipment described herein without notice. Considerable effort has been made to ensure that this manual is free of errors and omissions. We shall not assume responsibility or liability for any errors that may be contained in this manual nor for any incidental, concrete or consequential damage that may arise from the provision of this manual, or the use of this manual in operating the equipment, or in connection with the performance of the equipment when so operated.

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