



EMCOTEC[®]
embedded controller technologies

DPSI-2001

Dual Power Servo Interface



Directions for use

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Specifications

By purchasing the DPSI-2001 you acquired a highly progressive electronical product, that was developed and produced in Germany. Developing it, our top priorities were on **highest quality, functionality and reliability**. Recommendations and requests of worlds best RC-Pilots were considered and taken into account during the development of the product. Optical and technical final inspections at a large scale ensure that you as a customer receive an absolutely reliable product, which will tremendously increase the safety in operation of your RC-model.

Naturally, the DPSI-2001 went through intensive flight testing, in which all circumstances were taken into consideration.

We would recommend to you, to read these directions of use thoroughly and to consider the installation advice. That way many mistakes can be prevented in advance.

The DPSI-2001 serves as a redundant power supply and distribution for receiver and servos (steer actuators) in RC-models. The redundancy is reached by two connected 5-cell batteries (with 6 volt rated voltage). If one battery fails, the safety in operation is ensured by the second battery. Under normal conditions, both batteries are discharged at the same time.

Because the supply voltage turns on electronically (the switch doesn't turn on current, just the start-up signal) no losses, contact failures or transition resistances occur. This internal electrical switch is also highly secure. In this manner, a turned on DPSI-2001 **stays** turned on - even if, for instance, the turn on/off switch is disconnected or interrupted. This way an outstanding security is reached for the turn on/off switching operation already.

Intentionally electronical switching from one to the other battery was abstained from, because this would mean a higher risk of operation failure. Both batteries of the DPSI-2001 always discharge at the same time.

Thereby a recovery diode voltage drop has to be put up with, but for the DPSI-2001, due to the top quality components, this only amounts 0.22V (at 3A) - 0.28V (at 19A).

However, the main advantage of the DPSI-2001 lies within the possibility, that all connected servos can be supplied with the full power of the battery and that every servo receives the maximum of possible electric current, without putting a strain on the damageable receiver.

This way, up to 26 servos (!), resulting from 10 receiver channels, can draw a constant current of together 19A and peak current up to 70 A out of the DPSI-2001 - and that with negligible losses! Every servo obtains the full power of the connected batteries. By that means, the maximum floating speed and the highest regulating power of the servos are guaranteed.

The receiver is supplied by a regulated, stable voltage of 5.0V from the DPSI-2001 (according to the manufacturer, a maximum voltage of 5.3V for secure operation of most receivers is permitted).

In order to increase security even more, every servo of the DPSI-2001 has a highly effective T-filter looped-in into the signal network. This way RF jamming „caught“ by long servo-cables are reduced up to 90%! Ferrite rings, which were used till now, can be omitted; this reduces weight and costs.

Furthermore, an interference elimination of the DPSI-2001 is considerably more effective than interference elimination by ferrite rings. As a matter of course, with the inserted filters a troublefree operation with the new digital servos is possible also.

In order to supply every servo with optimumply processed control pulses from the receiver, the control pulses are amplified electronically. Normally, the pulse is weakened in case of a parallel connection of the servos (V cable), and therefore becomes more interference-proned. With the DPSI-2001 the impulse is preserved **completely**, even if four servos are connected at one channel.

In order to enable an optical switch-control, two light-emitting diodes (LEDs) were built-in the DPSI-2001. The light-emitting diodes shows, whether both batteries are connected; the third light-emitting diode signals whether the receiver is supplied with 5V.

For the purpose of achieving external monitoring of the batteries, the switch-cable of the DPSI-2001 contains a LED in addition. This LED is switched on even if both batteries are connected and the DPSI-2001 is switched on.

The DPSI-2001 doesn't need to be disconnected from the batteries during longer break periods (for instance during the winter e.g.), because the self-discharge of the batteries is much higher than the current consumption during breaks, which is practically not measurable.

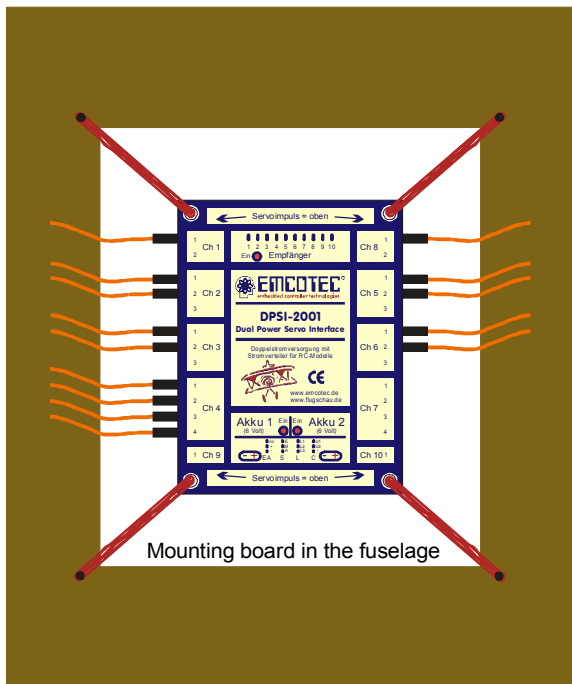
Short circuits on the servos stepping line, no matter versus the negative or positive pole of the servo cable, do not lead to the destruction of the DPSI-2001. Every other servo on this channel stays fully functional. Even a reverse battery of the servos doesn't damage the DPSI-2001.

In that fashion, mistakes of use and external influences can not lead to the destruction of the DPSI-2001. As a means to increase the safety in operation, the number of piece parts actually involved in the switching operation is intentionally as small as possible. In order to avoid problems originated by piece part failure and any occurring RF emission, the use of a microcontroller was abstained from while developing the DPSI-2001. Our philosophy: „Sometimes less can be more“.

In order to be able to connect all commercially available receivers, the DPSI-2001 is delivered with different servo cables (to the receiver), depending on the specific demand. Normally, gold-plated JR-contacts are used.

Assemblage of the DPSI-2001

The easiest way is to glue the receiver directly on or under the DPSI-2001 with double-sided gluey cellular rubber (5-10mm thick). Because the DPSI-2001 is mostly used in big models, it makes sense to fasten the complete package (DPSI-2001 with receiver) with four small rubber rings free-swinging towards four sides in the fuselage as demonstrated in the chart.

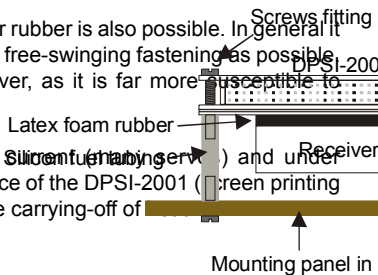


Also a bedding on four silicon-hose pieces is well tried. Thereto the complete package is fastened vibration reduced on four „elevated piles“ (as demonstrated in the chart).

Alternative fastening 1

Naturally, a fastening on thick cellular rubber is also possible. In general it is important to pay attention to an as free-swinging fastening as possible. This applies especially to the receiver, as it is far more susceptible to vibrations than the DPSI-2001.

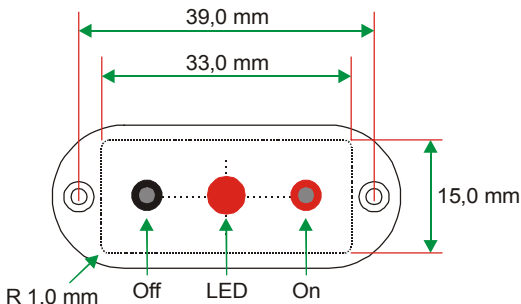
In case of very high amounts of silicon (enabling service) and under competitive conditions, the top surface of the DPSI-2001 (green printing foil) should remain free to enable the carrying-off of



Connecting the switch

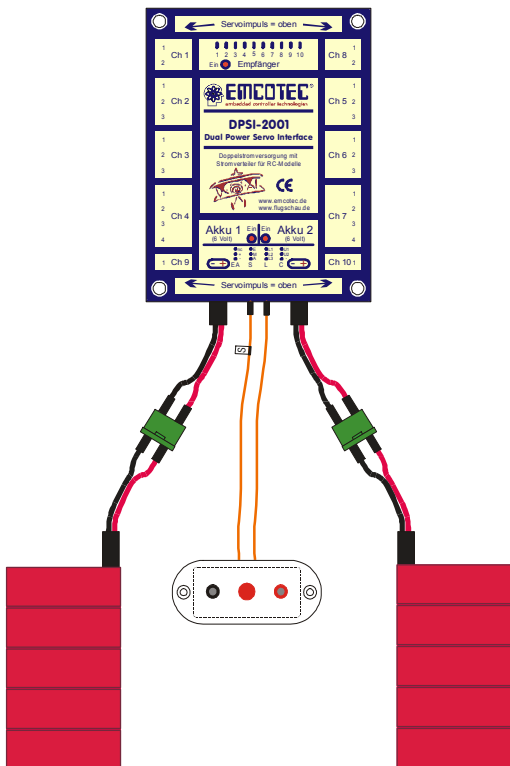
Mechanical switches involve the risk of failure. The vibrations at the fuselage wall of big models are quite high. Therefore failures of f.i. flip switches are seen quite often. In order to exclude any mechanical influence on a switch, the DPSI-2001 uses a pin to turn on/off the receiving station. It is a 2mm gold-plated plug pin, which, if set into the „on“ jack (red), turns on the DPSI-2001 and if set into the „off“ jack (black) turns it off. Even if the pin should get lost during a flight (which does hardly seem possible due to the strong mainstay), the DPSI-2001 stays turned on. The DPSI-2001 can only be turned off, if the pin is set into the „off“ jack. Of course one mustn't set a pin into both jacks, even though that doesn't damage the DPSI-2001. If that was the case, the DPSI-2001 would stay turned off while the batteries would discharge slowly with approximately 12mA. During on-period conditions the pin should always remain in the „on“ jack.

If the pin should get lost, you can make do with a 2mm wire or a 2mm screw, which can be set into the respective pin jack.



The on/off switch can be placed anywhere (for instance at a fuselage sidewall). The labeled cable „S“ is connected to the pin-plug labeled with „S“. The orange wire of the cable points towards the top surface and the brown wire points towards the lower side of the DPSI-2001.

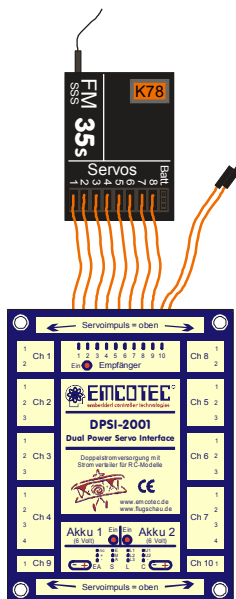
The second cable is responsible for the light-emitting diode within the switch. It is connected to the plug labeled as „C“. Here the orange cable is turned upwards and the brown cable downwards as well.



If the optical control with these LEDs doesn't suffice, also commercially available voltage indicators for the batteries (for instance JR Voltspy, JR NC-Akku-Controller 4/7) can be connected. With these, the exact voltage of the particular connected battery is controllable (please pay attention to the fact, that these potential indicators for the batteries are tuned at 5 cells). These devices can be connected directly to the DPSI2 switch (backside of the switch labeled with "B1" for battery 1 and "B2" for battery 2).

Connecting the receiver

While connecting the receiver, not every one of the 10 inputs of the DPSI-2001 has to be connected. This way, receivers with less than 10 channels can be connected to the DPSI-2001, too. Every cable that leads to the receiver, can supply the receiver with 5V - due to that it does not matter, which cable is plugged in.



Free receiver cables of the DPSI-2001

The DPSI-2001 has 10 connecting cables which are usually plugged into the receiver. If not all of these cables are used (like if the receiver has less exits), these free cables must not be plugged into the servo exits of the DPSI-2001 **UNDER NO CIRCUMSTANCES!** This can lead to the destruction of the drive circuit.

Free cables can rather be insulated with electrician's tape and be fastened somewhere (for instance with a cable tie at the rubber rings, the DPSI-2001 is fastened at).

Free receiver cables of the DPSI-2001 when using JR-receiver

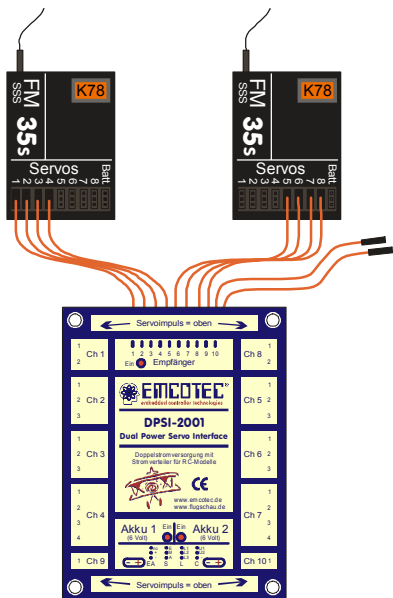
Several Graupner/JR receiver have an own plug labeled as "Batt." which is normally used to connect the battery. (for instance "Servo 1 to 9" and "Batt.") **THIS PLUG (Batt.) MUST NOT BE USED!** Even if it would seem neat to "stow away" the tenth cable of the DPSI-2001 this way, it **MUST NOT** be connected there at any case! (see also the corresponding chart).

The consequence would be strong movements of all servos, that could also lead to damages at the servos or the mechanism. Usually, this applies to other receivers as well, except, if the plug "Batt." positively permits the operation of an additional servo (please read the directions of use of the receiver, whether this is the case).

Using two receivers

It is also possible to use two receivers. The particular designated DPSI-servo cables are connected to the receiver they are needed at. In case of operation with two receivers, servos should not be connected directly to the receivers (limited current).

Here the left receiver supplies the channels 1 to 4, the right receiver supplies the channels 5 to 8. Channel 9 and 10 of the DPSI-2001 remain free and unused.



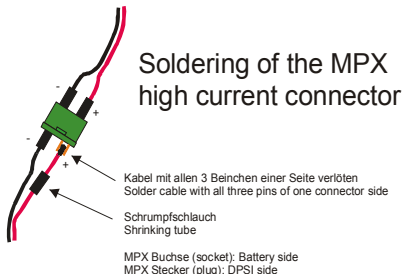
Connecting the batteries

Commercially available batteries with a rated voltage of 6V can be used (for instance 5 cell NiCd or NiMH storage batteries, but also 6V lead batteries (where they are necessary) or Lilon batteries). The rated voltage of the batteries mustn't be higher than 6V (fast loading NiCd sometimes have momentarily up to 8V after charging, this is naturally permitted) and please take care, that the current the batteries can possibly deliver suffices for the number of connected servos.

Use of 4-cell NiCd batteries

In general, the operation with only 4 NiCd cells is possible (4.8V rated voltage). In this case a small 6V battery (preferably a 800mAh Lilon battery or, respectively a battery, whose voltage is not higher than up to 6.4V after charging) should be used to supply the receiver (see also "*Remarks on using Lilon batteries*"). This is necessary, so that the receiver is operated with rated voltage. Due to the slight voltage drop within the DPSI-2001 the voltage at the receiver with just four NiCd cells amounts to approximately 4.40V (if the total load of the DPSI-2001 sums up to 10A) respectively 4.48V (if the load is 5A).

In case of doubt it should be controlled in which voltage range the receiver can be operated. If secure operation is possible till app. 3.8V, an additional receiver battery is not necessary.



Battery capacity

In general the possible current load and the capacity of the used batteries should be observed. For example, 2 storage batteries with 450mAh are way too small for a T.O.C.-Model with 16 servos. In this case, at least two "1400s" that can be discharged with 10C should be used. (C is the rating of storage battery in Ah => this means an battery with 1.4Ah can at 10C be loaded with $10 \cdot 1,4A = 14A$). Especially when using digital servos, a raised current consumption has to be expected. On an average, a T.O.C.-Model with digital servos draws approximately 1.6Ah to 2.2Ah during 30 minutes flight time. The dimensioning of the batteries should be proceeded carefully! In cases of doubt please ask the model manufacturer.

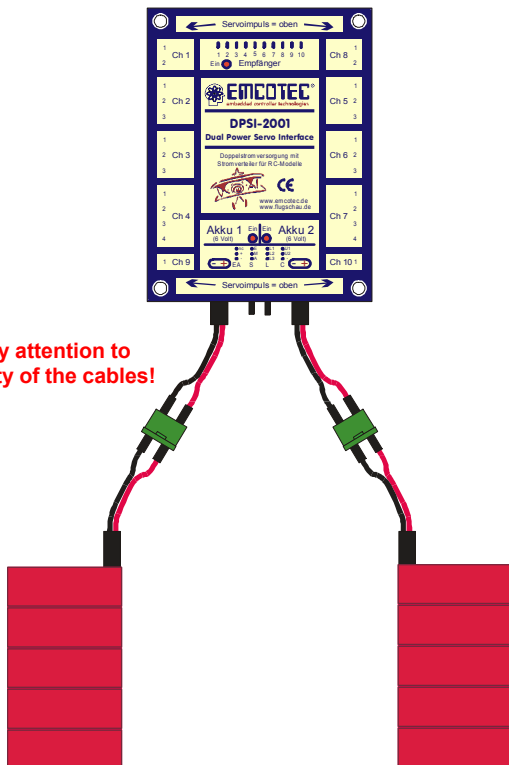
When choosing the right battery, keep an eye on the fact, that the connecting cables of the batteries are thick enough. If an battery with a 0.25mm² square mil is used, the advantage of the DPSI-2001 comes close to nothing, because losses originate in the thin cable.

There to the following calculation:

A highly flexible Cu-cable with 0.25mm² square mil and of approximately 25cm length has a resistance (back and forth) of app. 0.05Ohm. The power handling capacity of such a cable amounts at most 2.5A. Assuming a current of 10A, the voltage drop in this cable already comes to 0.5V. Instead of the 6V only 5.5V arrive at the DPSI-2001!

By that means, for example battery cables for T.O.C.-Models should at least have a square mil of 1.0 to 1.5mm². The battery connecting cable should be soldered up with the delivered green Multiplex high current connectors, in order to be compatible with the DPSI-2001. A heat-shrinkable tube to insulate the soldered joint usually comes along with the delivery also. If the batteries are placed far away from the DPSI-2001 (so that the connected cables are quite long), it would make sense to twist the cables of the batteries.

Connecting the batteries



Due to the special construction, the DPSI-2001 does not have a reverse battery protection! Thus, please pay attention, that the batteries are always connected correctly. This means, that the red cable is always on plus and the black cable is always on minus. Please verify this rather too many than too few times!

The DPSI-2001 switches battery Plus, this means both batteries are, if they are connected to the DPSI-2001, interconnected with Minus (Ground). If every battery should be connected by a V-cable, (which would make charging of this connected battery possible, if it is connected to the DPSI-2001 at the same time), then it should be observed, how the battery charger works, when both batteries ought to be charged at the *same time*.

In this manner it makes generally sense and is safer, if the batteries are disconnected from the DPSI-2001 while charging. If the green Multiplex high current connectors are used that came along with the delivery, it should be no problem, to quickly disconnect the batteries in order to charge them. The gold-plated contacts enable a secure connection even after many plug-ins and outs. That way, also the additional weight of the V-cable is saved as well as the work of making them.

In order to meet the demand of many pilots to configure their system according to their individual needs, the Multiplex connectors were not soldered up with the cables of the DPSI-2001. This way, you can accommodate the cable length according to your needs. Please pay attention, that the **jack** is soldered up with the battery cable and that the **plug** is soldered up with the DPSI-2001 cable. Please do not omit, to put the heat-shrinkable sleeve over cable ends before soldering. Please work carefully and pay attention to the polarity of the cables.

Notice: If NiCd batteries are charged quickly, they usually have a much higher voltage than if charged regularly. When turning on directly after charging, it is possible, that the used servos tremble. If that should be the case, it is better to wait with flying for 15 minutes after quick-charging, till the voltage state of the batteries is halfway normal again.

Connecting the servos

The DPSI-2001 distributes the 10 servo exits of the receiver at altogether 26 servo connections. Here a distribution was chosen, that makes a big number of combinations possible.

This example shows the connected servos from a T.O.C.-model with the use of a JR radio control. Naturally you can adapt the servo distribution as well as the receiver distribution to your special needs and ideas.

Connection figure of the DPSI-2001

<i>Receiver channel</i>	<i>Number of servos</i>	<i>Funktion (JR)</i>	<i>Example-model</i>
1	2	<i>Throttle</i>	1 Servo
2	3	<i>AIL left</i>	3 Servos
3	3	<i>ELE left</i>	2 Servos
4	4	<i>RUDDER</i>	4 Servos
5	3	<i>AIL right</i>	3 Servos
6	3	<i>ELE right</i>	2 Servos
7	4	<i>free</i>	---
8	2	<i>Choke</i>	1 Servo
9	1	<i>Smoke</i>	1 Servo
10	1	<i>free</i>	---

In this example, altogether 17 servos are connected to the DPSI-2001. All servos have the pulse cable upwards (as indicated on the sticker). It is recommended, to plug in all servos *directly* at the DPSI-2001. That way the operation security is increased and all servos receive the full energy.

If two or more servos are soldered directly in the corresponding rudder and are guided with one cable to the DPSI-2001, this cable has to carry the current of both servos which can lead to voltage losses.

It is recommended to connect every single servo within the model to the DPSI-2001 in order to receive to full interference results. Should nevertheless one or two servos be plugged in directly at the receiver, the maximum possible current load should be payed attention to.

Because the receiver is supplied with stable voltage out from the DPSI-2001, which is drawn from a voltage regulator, the amount of drawable current is limited to 1A! We therefore recommend, not to connect a servo directly to the receiver.

Higher current loads could, due to resulting losses, in worst case actuate the overtemperature protection of the voltage regulator. If that was the case, the receiver would be no longer supplied and that would inevitably lead to a crash of the model!

Security of the cables connected to the servo

Some pilots have some misgivings, that the servo cables connected to the DPSI-2001 might whip and therefore lead to a failure. Up to this day nothing like this has been observed (even with strong vibrations).

Yet, to be on the safe side, every connected servo cable can be secured to the upper and/or lower board by a drop of hot-melt adhesive. This is well-tried in practice, too. Also, this connection is unproblematically detachable.

Operation

To turn on the DPSI-2001, the 2mm plug pin is taken out of the „off“ jack (black) and set into the „on“ jack (red). If both batteries are connected and charged, the three LEDs of the DPSI-2001 board are lighted (and also the LED within the switch, if connected). This way, operation is signaled. If only one LED is lighted, then maybe one battery is not connected. The orange wires of all cables always have to be topside! To turn off the DPSI-2001, the plug pin is placed into the black „off“ jack.

Should the plug pin get lost, you can also make do with a 2mm steel wire or a 2mm screw to turn on/off the DPSI-2001.

While charging the main batteries, it is recommended to disconnect these also from the DPSI-2001. Simultaneous charging of connected batteries is possible in theory, but it can lead to malfunctions of automatic battery chargers.

Security advice

- * In general, all connecting cables should be wired in a manner, that they do not come into contact with moving or hot parts of the model (like servos, gears or exhaust pipes).
- * The DPSI-2001 has to be protected against humidity and wetness.
- * Inexpert handling of the DPSI-2001 can lead to serious damage/hurt of equipment and/or people!
- * Generally, in advance of every operation, check all connections within your model! All plugs have to be correctly polarized and thoroughly contacted (firmly set in). Loose cables carry a high potential risk of danger!
- * In no case it is allowed to use sources of current which exceed the declared voltages! Preferably use 5 cell NiCd batteries.
- * The current-carrying contacts of the connecting plugs must not be short-circuited. In this manner, the short-circuited cables can be heavily heated and even melt.
- * Under no circumstances, the DPSI-2001 is to be taken apart or technically changed. There are no components within the DPSI-2001 that could be repaired or maintained by the purchaser.
- * Do not use the DPSI-2001 other than for purposes in recreational RC-model making. Especially the use within machines that transport or carry people is strictly forbidden.
- * Operate the DPSI-2001 exclusively with radiocontrol components intended for RC model making.
- * Pay attention to the fact, that the batteries are fully charged. Empty batteries inevitably lead to outage of the RC components and therefore to the crash of the model.

- * Do not expose the DPSI-2001 to extremely hot or cool temperatures, wetness or humidity. These bear the risks of malfunctions, damages or reduced efficiency.
- * Only use additional sets in combination with the DPSI-2001, that are recommended by us. (turn on/off switch, external voltage controllers).

Technical data of the DPSI-2001

Batteries	2 x 5 cells (NiCd, NiMH, depending on current load) or lead battery with 6V or, should the occasion arise, 2 x 4 cells NiCd (see also description)
Operating voltage	4.8 V to 8 V
Quiescent current (turned off state)	not measurable
Quiescent current (turned on)	app. 35 mA totally
Max. constant current	19 A (both batteries together)
Max. pulse crest current	70 A (both batteries together)
Voltage drop due to recovery diodes	max. 280 mV totally
power loss at 10A	app. 3.4 W (from both batteries together)
Supply of the receiver	5.0 V / 1 A maximum
Number of servos	an amount of 26, distributed at 10 receiver channels
CE-approvals	according to 89/336/EWG
Measurements	97.6 mm x 74.7 mm x 13 mm (3.84 inch x 2.94 inch x 0.51 inch)
Weight	app. 165 g
Warranty	24 months

Characteristic features

- with nominal voltage ($\geq 6V$), the receiver is always supplied with 5.0V (by every single servo connection)
- Signal amplification of the servo pulses (short circuit-proof)
- RF antijamming of servo connectors (no ferrite rings needed any more)
- Built-in check LEDs for "battery 1 on", "battery 2 on", receiver on"
- External check LEDs within the switch ("battery 1 on", "battery 2 on", additionally "receiver battery on")
- Connection of external voltage indicators for every single battery is possible
- In case of switch failure, a turned on system stays turned on
- Two completely independent circuits - this way the operation with only one battery is possible too
- Operation with Lilon batteries possible (if also using an additional receiver battery)*
- Use of 2 receivers possible
- German quality product - developed and produced in Germany

Warranty

The EMCOTEC embedded controller technologies GmbH gives a warranty of 24 months on the DPSI-2001. The term of warranty starts with the delivery of the device by the dealer and does not extend by a possible warranty repair or warranty exchange.

The warranty operates, that fault in material or manufacturing are repaired free of cost during the warranty period. There is no claim on repair. In case of warranty, the manufacturer reserves the right to exchange the device for an equivalent product, if repairing is not justifiable for economical reasons. We disclaim liability for consequential damages that resulted from proven failures while operating the DPSI-2001. Broader claims are excluded.

- * Costs of transport and packing, as well as travel expenses are for the account of the purchaser.
- * For damages in transit no liability is assumed.
- * In case of repair the device has to be sent to the responsible service center of the particular country.

The Warranty applies only under the following conditions:

- * The warranty document must have the date of purchase, the business stamp, the serial number and the signature of the dealer on it.
- * The device must not have been manipulated in any way.
- * The purchaser must have followed our directions of use.
- * Only power sources and other additional units recommended by us must have been used. The transmittal has to contain the certificate of warranty, the original invoice, as well as relevant indications of the malfunction (short description of the failure).

- * The device has to be in ownership of the first purchaser.
- * Otherwise for not mentioned cases the general terms of business of the EMCOTEC embedded controller technologies GmbH apply.

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(P) March 2002

Robert Hussmann

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Further remarks

Operation of the DPSI-2001 with gyros

It is possible to operate the DPSI-2001 with gyroscopes. Then it has to be taken care, that the servo(s) is/are not connected to the gyroscope but, as described before, directly to the DPSI-2001. The gyroscope is rather looped-in between DPSI-2001 and the receiver. This way, the gyroscope is operated constantly with 5V.

Example:

The gyroscope (for example Fuzzy Airplane Gyro) is to be connected to the channels 2 and 5 of the receiver (for the ailerons). Thereto the gyroscope is, like usually, connected directly to the receiver (channel 2 and 5). The cables, that normally lead from the DPSI-2001 to the receiver, are now connected to the servo exits (plugs) of the gyroscope.

The Servos are connected to the DPSI-2001 as usual.

In general, it is important, that the power supply of the gyroscope is looped trough 1:1 from the receiver exit to the servo exit (maybe measure with multimeter => 0 from Positive to Positive and from Negative to Negative). This usually is the case.