RC Electronic by EMCOTEC®
embedded controller technologies

DPSI TWIN Mini

Receiver Switch

Operating Instructions

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1. Preface

With the **DPSI TWIN MINI** you purchased a high grade, modern and secure product for your valuable radio controlled model. We appreciate your trust and assure you that you made the right choice!

Long lasting experience for years in development and manufacturing of electronically systems as well as the knowledge of the world's best model airplane pilots has influenced the development of the **DPSI TWIN MINI** systems. All products are manufactured at EMCOTEC GmbH in Germany on our own production line. Extensive optically and electronically end tests for every system, which leaves our house, assure that you, our customer, acquire an absolute reliable product which considerably increases the reliability of your valuable RC-Model.

Of course, the **DPSI TWIN MINI** not only has been tested extensively in the laboratory, but also went through intensive flight-testing. Like done in the automobile industry an FMEA (**f**ailure **m**ode and **e**ffect **a**nalysis) reduces the possibility of damage and malfunction on operating errors to a minimum.

Hint:
We kindly ask you to read these instructions carefully and to observe the installation hints. Thus, errors can be avoided in advance.

We are all ears for your wishes and questions. Challenge us!

Bobingen, September 2007

The Staff of EMCOTEC GmbH

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2. Characteristics

2.1. Functional Description

The **DPSI TWIN Mini** provides a kind of "Receiver diversity". Two receivers can be connected. The receiver with undisturbed radio reception provides for the servos signals. If this receiver fails, the signals for the servos are provided from the other undisturbed receiver by automatic switch over. Therefore, the model remains fully controllable if a receiver fails. In summary, 16 channels are switched completely. The **DPSI TWIN Mini** can be operated stand-alone or in conjunction with the battery-switches from then EMCOTEC's DPSI product range.

Several applications are possible with the **DPSI TWIN Mini:**

1. Failsafe-Function "A":
(Two identical receivers using same frequency)
If one receiver fails, all (!) servos are switched to the second receiver. The pilot can continue his flight without disturbances or adverse effects. The receivers should feature a failsafe function (e.g. PCM). Even by using two PPM (or IPD) receivers without failsafe capability, switching of the servo signal can occur caused by a disturbed (or missing) servo signal.

2. Failsafe- Function "B":
(Two receivers using different frequencies, e.g. using the EMCOTEC HF TWIN)
If one receiver fails OR channel double-allocation occurs, all servos are switched to the second (backup) receiver.

3. Pilot-Backup:
(Two receivers and two transmitters using different frequencies)
If the receiver OR the transmitter of the pilot fails, all servos are switched to the second (backup) pilot. He can then land the model safely.

4. Teacher-Student-Function:

(Two receivers and two transmitters using different frequencies)

The teacher switches between his and the students radio back and forth by using a switching channel of his transmitter. The student can now take over all functions of the model with his transmitter (passing single functions to the student are not possible). The teacher can gain full control with one single switching event in critical situations. Herewith, each model-pilot can fly his friend's model (which has installed the **DPSI TWIN MINI**) with his own radio using his own stick assignment. He just must program the model parameters into his radio.

5. Autopilot for Drones (UAV´s):

(Regular remote radio control and an autopilot)

The pilot switches between the receiver and the autopilot by using a switching channel on his radio. The drones therefore can takeoff and land under control of a regular remote control and be switched to the autopilot on demand to fly its corresponding program.

Additional Functions:

Additionally, the **DPSI TWIN Mini** works as data logger, i.e. all operation relevant data of the last flight are stored in non volatile memory. The data can be read by a PC afterwards. The cause of an eventual crash (failsafe signals, number and duration of receiver disturbances) can be evaluated from the stored information.

Two built in bicolor LED's indicate optically the operational state of the **DPSI TWIN Mini.** In order to receive additional information about the status of the entire system, the optional **DPSI ICE** (Information Center), an external LED or the **DPSI LCD** can be connected to the **DPSI TWIN Mini.**

2.2. Safety Considerations & Quality

Exclusively highly modern electronically parts are used in the **DPSI TWIN Mini.** Electronics are built in as safe as possible in all areas of the product. All vendor parts such as PCB's, cables, connectors, etc. are provided by German companies. The elaborated manufacturing of the housing provides for best EMC safety, which is especially important for drones usage. The 4-multilayer PCB allows for highest packing density and therefore for smallest dimensions and low weight.

Maximum safety is also guaranteed by elaborated software quality assurance. Individual measuring systems were developed for qualification, which were used for signal conditioning and analysis. Thinking about quality continues all the way through manufacturing. Each step in production is monitored and each system is tested for all its functions before leaving the house.

Quality over Quantity!

Hint:
The following parameters are factory programmed:
Operating Mode: Failsafe
                         Fail-Position = 1200µs (ca. –75% of Servo Channel)
                         Pass-Position = 1800µs (ca. +75% of Servo Channel)
 	
If other parameters are desired, programming is in order (see programming instructions). The default values best correspond to the +100% and -100% settings of the failsafe channel of the receiver. Reprogramming of these values is therefore not mandatory.

DPSI TWIN Mini

Front view

16 Servo outputs (or patchcables to a DPSI)

Channel 1   Channel 15   Failsafe

External bus for
- LC display
- Powerunit
- Sensors
Left = plus = red wire

Connector for DPSI ICE
or external power supply
with 2x JR battery cables
(e.g. from a DPSI BIC,
DPSI LR or a DPSI Micro)

Serial PC interface (COM)

External control LED
(two-colored)

External power supply when
the servos will be connected
directly (without DPSI system)
(4.8V ... 8.4V), e.g. with the
DPSI TWIN Mini Power

Back view

Failsafe input   Channel 15   Channel 1

Mounting plate

Main receiver (RX1)
15 channels + failsafe

Backup receiver (RX2)
15 channels + failsafe

2.3. Connections

Rear View:

You find pin-connectors at the rear for both receivers (or receiver and autopilot). There are 16 connectors each for the "main"-receiver as well as 16 connectors for the "backup"-receiver or autopilot respectively. The connectors are JR/UNI compatible.

The 16th connector functions as the failsafe-input at the same time ("FS1" or "FS2"). The failsafe signals of the connected receivers are evaluated by the **DPSI TWIN Mini** internally for switch-over. As long as the signals value is larger than 75% (percentage of the corresponding servo channels) the receiver is considered error free. As soon as the signal drops down to less than 75%, the **DPSI TWIN Mini** recognizes an error condition (failsafe) and switches all 16 servo signals to the error free receiver.

If the failsafe pulses are totally missing or are out of specification, this is recognized as an error condition too. The 75% values are factory set and can be reprogrammed at any time.

The receivers are connected to the **DPSI TWIN Mini** using the accompanying patch cables.

Hint:
Both connected receivers are supplied by the DPSI TWIN MINI via the patch cables. The battery connectors of the receivers ALWAYS remain unused!

Front View:

You find the pin connectors of the outputs in the upper row (connections to servo current distribution or to the servos directly).

When using a DPSI RV system the patch cables are here connected to the DPSI. Servos can be directly connected if an optional current supply is available.

You find in the lower row (from left to right):

<u>AUX1 and AUX2:</u> here, optional products from the EMCOTEC product range can be connected (LC display, bridging PCB for the DPSI power part, external sensors for RPM, temperature, height, velocity, etc.).

<u>B1 and B2:</u> connection for the optional DPSI ICE. Furthermore, an external power supply can be connected, if the **DPSI TWIN Mini** is to be used stand-alone (without current distribution), i.e. the servos are directly connected. For instance, a DPSI BIC, a DPSI LR or a DPSI Micro can be used as power supply.

<u>EXT:</u> connection for an optional external bicolor LED, which can be mounted in the fuselage's sidewall, providing information about the current status of the **DPSI TWIN Mini** (see error indications).

<u>COM:</u> connection for the RS232 interface cable to a PC (COM interface) or using an optional USB convert on an USB port of the PC. Using the PC software, the parameters of the **DPSI TWIN Mini** can be programmed and the data logger can be read. Furthermore, new firmware can be downloaded.

<u>Opt. Bat:</u> here, an external power supply can be connected if the **DPSI TWIN MINI** is being used in the stand-alone version and if the servos are directly connected. If many servos are to be used, this connection is to be preferred over the B1 B2 connections. 15A continues current is possible. The external power supply can be an optional DPSI power part (contacting a bridging PCB) or a current source ranging from 4.8 volts up to 8.4 volts. Servos and receivers are supplied with this voltage. Voltages of 5.2 volts up to 6.0 volts are reasonable.

Hint:
If an external voltage is supplied to "B1" / "B2" or "opt. Bat", the DPSI TWIN MINI must not be connected to a servo current distribution!

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3. Properties of the DPSI TWIN Mini

- ❍ Failsafe operation with automatic switching between two receivers with up to 16 channels each
- ❍ Teacher student operation with manual switching between two receivers using a switching channel on radio
- ❍ "Pilot-Backup" using two separate frequencies possible (2 transmitters, 2 receivers)
- ❍ Receiver/autopilot switching for drones
- ❍ All control functions fully available after switching from one receiver to the other
- ❍ Failsafe positions freely programmable
- ❍ Integrated PC interface for reading and programming of the data and for software updates of the firmware
- ❍ Data logger, i.e. important parameter of the last 22 (!) flights are stored and can be read later by a PC
- ❍ 2 x 16 receiver channels
- ❍ Integrated bicolor LED's indicate status of the system
- ❍ Two failsafe channels for evaluation of receiver function
- ❍ Cable free system, i.e. all connections are pluggable and therefore replaceable
- ❍ Special grounding concept for flawless operation and highest safety
- ❍ Future-proof concept achieved through extendibility (DPSI ICE, DPSI LCD, DPSI Power, external sensors etc.)
- ❍ Each system 100% tested prior to delivery

3.1. Data Logger

The integrated data logger ("black box") stores all relevant operational data of 22 turn-on cycles (flights). Each time, the **DPSI TWIN Mini** is turned on, a counter is incremented and the data logger advances one entry. All data of the last 22 flights remain stored and a possible crash can be analyzed even after some time (or after several turning on cycles). Usually, one tests the radio right after a crash. This means, the set is turned on and off several times, before the data is read off of the data logger at home using the PC.

Due to a turn-on counter, the number of cycles is known (since purchase of the **DPSI TWIN Mini**). This provides for the real number of flights of a model.
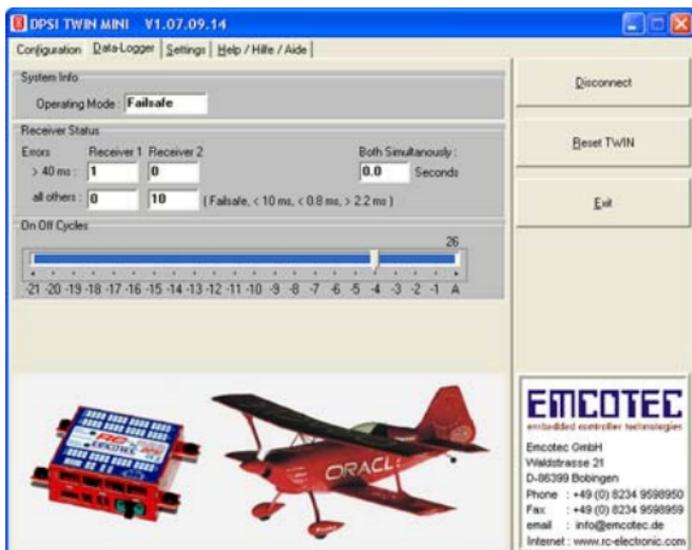
The following data is stored by the data logger:

O System-Information:
   - Operating Mode (Failsafe or Teaching)

O Receiver-Status:
   - Number of errors for each receiver (pulse gap greater than
     40ms => total malfunction of the receiver)
   - Number of errors for each receiver (failsafe, pulse gap
     smaller than 10ms, pulse width < 0.8ms, pulse width > 2.2ms
     (failsafe only for PCM))
   - Time in seconds, where both receivers were in an error condition
     simultaneously

The data can provide for exposure of an eventual crash. It is recorded,
if both receivers are failing SIMULTANEOUSLY for e.g. 5 seconds.
This probably causes a model to crash.

3.2. Functional Principal of the Switching

Because two separate receivers are used with the **DPSI TWIN Mini**, it
must be able to recognize the necessity to switch from the first receiver
("main") to the second receiver ("backup").

This happens based on any receiver output. This output is named
"failsafe output" in this document. For most PCM receivers (Graupner
JR PCM/SPCM as well as Futaba PCM1024), channels 1 through 8 are
failsafe capable. Usually, channel 8 is used. Sets from Multiplex do
not use PCM, but rather call it the IPD function. Here too, each IPD
capable channel can be used for failsafe. But even non PCM/IPD
systems can be used with the **DPSI TWIN Mini** because a total
qualification of the signals takes place and not just only the evaluation
of the failsafe threshold alone.

The failsafe outputs of both receivers connected to the **DPSI TWIN Mini** are constantly monitored for their signal quality. If an error occurs, this error is qualified after a certain time. A single "one off" does not lead to switching from one receiver to the other.

For better appreciation, it is helpful to understand how the signals are provided by the receivers. Most of the remote controls on the market as of today provide the servos a pulse length coded signal. All approx. 20ms (this is 50 times a second), the receiver sends a pulse to the servo. Depending on the desired position of the servo, the pulse length varies between 0.9ms and 2.1ms. In the center position, the pulse length is 1.5ms, for end positions 0.9ms or 2.1ms respectively. The **DPSI TWIN Mini** receives these pulses via the failsafe channels and evaluates them. The following events are recognized as errors:

Error qualification in **DPSI TWIN Mini**   qualification time

- ○ Pulse width is smaller than 0.8ms   (100ms)
- ○ Pulse width is greater than 2.2ms   (100ms)
- ○ Pulse gap is smaller than 10ms   (100ms)
- ○ Pulse gap is greater than 40ms   (400ms)
- ○ Pulse exceeded failsafe threshold   (100ms)

In brackets: error qualification time, i.e. time, after which switching takes places.

This shows, that also non-PCM-systems can be used, because not only a certain programmed position (failsafe position) causes a switch between the two receivers, but also an erroneous signal. If e.g. a receiver totally fails, it doesn't provide a signal on its outputs anymore. The pulse gaps would be greater than 40ms. This is recognized and switched to the other receiver after a qualification time of 400ms (if this one works error free).

If the receiver provides for totally wrong signals (e.g. pulse length greater than 2.2ms), this is also recognized and causes a switch over.

Switching only occurs, if the second (backup) receiver works error free. If an error exists in the second receiver as well, no switching occurs.

Hint:
Due to a special algorism, it is impossible that switching occurs rapidly in-between short intervals (which could lead to signal corruption). Each active receiver remains active for a minimum period of time before switching can occur (hysteresis).

Hint:
If switching occurred to the second receiver, this receiver remains active, even if the first one should become error free.

Hint:
Due to the design of the hardware it is assured, that the servos are NEVER supplied by both or none receiver. Only ONE receiver is connected to the servos at any point of time.

Hint:
In order to test switching of the receivers the corresponding failsafe connector can be pulled out from the DPSI.
If uncertain about the failsafe programming of the transmitter, you can connect a servo in parallel to the failsafe signal. Now you can monitor the correct adjustments immediately.

4. Packing Contents

Content of delivery of the **DPSI TWIN Mini**

- ❍ DPSI TWIN Mini base device
- ❍ 20 pieces receiver connection cables (17cm long)
  (patch cables with servo connectors on both sides)
  => additional cables available in e-shop
- ❍ Operating instructions (instructions in English language as
  PDF for download from RC-Electronic Homepage)
- ❍ EMCOTEC adhesive label

5. Mounting Details
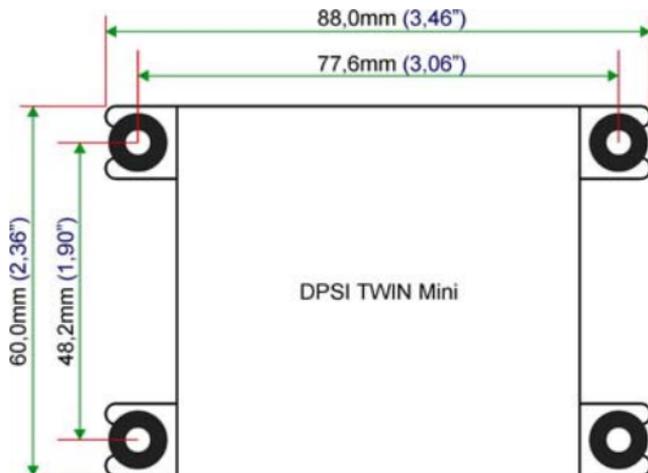
5.1. Mounting of the DPSI TWIN Mini

Mounting on 4 silicon hoses has proofed to be the best technical method. Mount the total packet onto 4 stilts in a shock absorbing manner.

Mounting using 4pcs. M4 screws with pieces of fuel hoses:

In general, always watch for vibration free mounting. Vibration damping is especially important for the receivers, because they are much more sensitive to mechanically vibrations than the **DPSI TWIN Mini**.

Holes spacing for mounting:

5.2. Connecting the Receiver

Although the **DPSI TWIN Mini** provides especially for connecting two receivers, operation with one receiver (main) is possible. In this case, the channel connections of the backup receiver will remain unused. The **DPSI TWIN Mini** indicates an error for receiver two (backup receiver) and will show this failure with the build-in LED in this case.

The actual purpose of the device is to connect two receivers. Because the **DPSI TWIN Mini** can handle 16 channels, receivers with up to 16 channels can be connected. The failsafe channel is also "fed through" and therefore is also available for additional functions.

Of course, not all inputs of the **DPSI TWIN Mini** must be used. If only 5 channels are needed, 5 patch cables suffice for connecting the **DPSI TWIN Mini** to the corresponding receiver (plus failsafe channel).

Hint:
When connecting a second (backup) receiver, all servo outputs must be identical to the first (main) receiver. This means, no servo outputs must be swapped.
BOTH failsafe inputs of the DPSI TWIN Mini must always be connected, because error recognition of the corresponding receiver takes place here.

Hint:
If the DPSI TWIN Mini is used in conjunction with an autopilot, the autopilot is connected instead of the backup receiver. Servo connections must be identical to the main receiver's assignment.


5.3. Arranging the Antennas

When defining the positions of the antennas, make sure not to mount the antennas in parallel. Best is a rod aerial for the mail receiver. Guide the antenna first in parallel to the fuselage from the receiver, than in 90° to the rod aerial. Don't change the total length of the antenna. If the rod aerial is 20 cm / 8", shorten the receiver's antenna wire by 20 cm / 8".

The antenna of the second receiver can either be wired to the elevator, wired inside the wing (not recommendable due to the plug-in-tube) or also ending in a rod aerial (eventually down wards). The distance between the antennas should be as large as possible.

Due to the airstream the antenna 1 bends in flight direction.
Therefore the antennas are not in parallel.
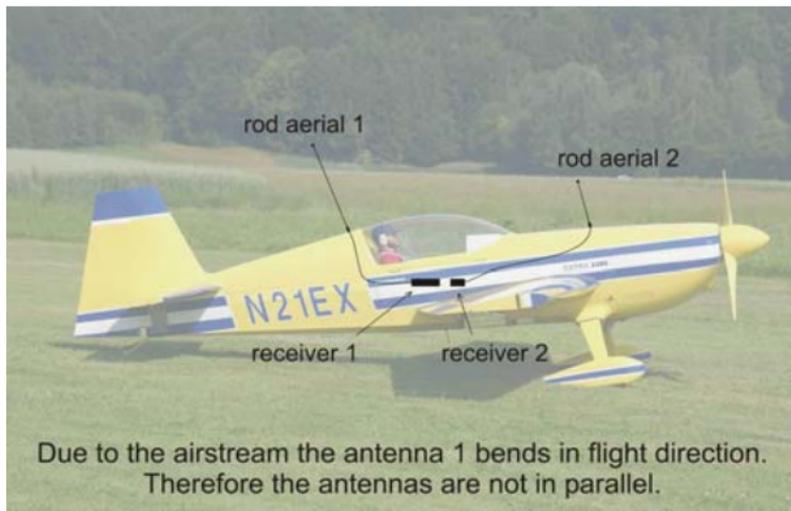
5.4. Current Supply and Servo Connections

There are several ways to provide power to the equipment. This depends on connecting the servos directly to the **DPSI TWIN Mini** or if the **DPSI TWIN Mini** is to be used in conjunction with a current distribution unit (e.g. a DPSI RV).

The most reasonable solution is to use a current distributor (e.g. DPSI RV Mini 5 or Mini 6, DPSI RV, DPSI 2001 RV or other vendor's products).

DPSI TWIN Mini in connection with **DPSI RV Mini 5**:

In this example, the DPSI RV Mini is used as a current distributor. The **DPSI TWIN Mini** serves just as receiver switch and is supplied with voltage by the DPSI RV Mini 5 via the patch cables. Both receivers are supplied from the **DPSI TWIN Mini** via their patch cables.

DPSI TWIN Mini in connection with **DPSI 2001 RV**:


Servo connectors

Servo connectors
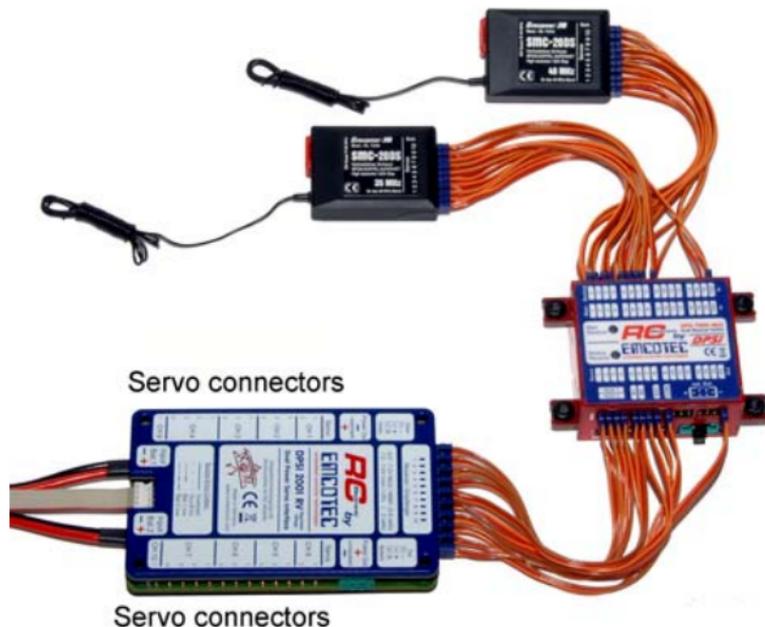
Here too, the **DPSI TWIN Mini** serves as pure receiver switch and is fully supplied by the DPSI 2001 RV's patch cables. The DPSI 2001 RV distributes 10 receiver-outputs to 26 servos. The SPCM receivers in this example have 10 channels.

Channels 1 through 7 are connected to the corresponding channels of the **DPSI TWIN Mini**. Channels 8 (failsafe capable!) of the receivers are plugged into the failsafe inputs of the **DPSI TWIN Mini**. Connect the failsafe output of the **DPSI TWIN Mini** to channel 8 of the DPSI 2001. It is (partially) available as servo output, too.

Channels 9 and 10 are therefore connected to inputs 9 and 10 of the DPSI 2001 RV respectively.

DPSI TWIN Mini in connection with **DPSI RV**:

Servo connectors

Servo connectors
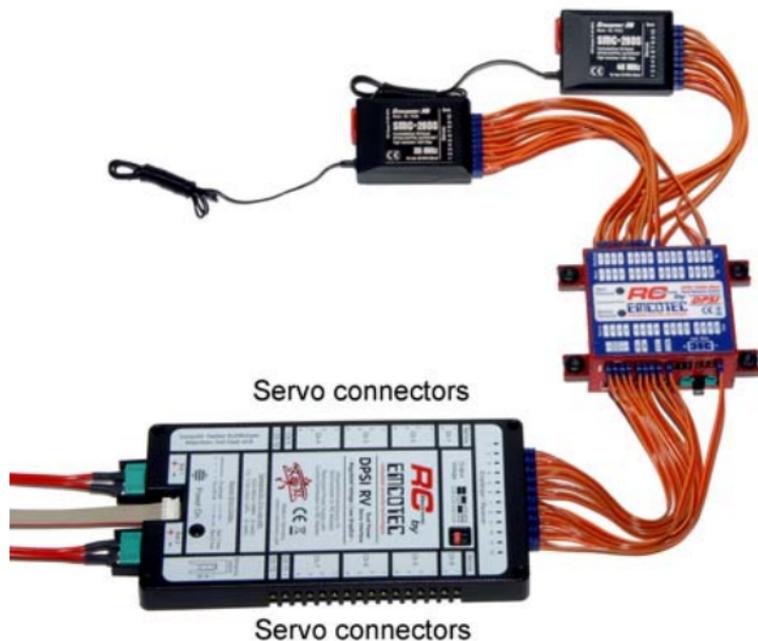
The DPSI RV serves also as current source for the **DPSI TWIN Mini** and both receivers. Because the DPSI RV provides 12 inputs, receivers with 12 channels can be utilized (e.g. Futaba G3).

DPSI TWIN Mini in connection with **DPSI RV Mini 6** and additional servos:
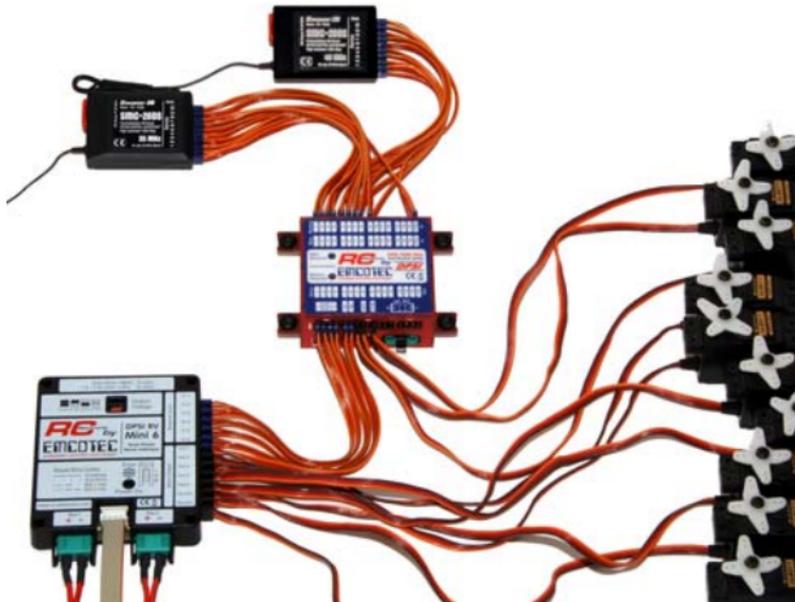
If, in the case of using a DPSI RV Mini 5 (or Mini 6) in combination with a **DPSI TWIN Mini**, 8 (or 7) servo connections of the DPSI RV Mini are not sufficient, additional servos can be connected directly to the **DPSI TWIN Mini.**

In this example, all 10 receiver channels are used. 6 channels lead to the DPSI RV Mini 6, which controls 7 servos (the most loaded servos, like elevator, aileron, rudder, etc.). Additional 3 servos (e.g. throttle, choke and landing gear) are directly connected to the **DPSI TWIN Mini.** Now, 9 channels are fully usable, the 10th channel serves as failsafe connection.

DPSI TWIN Mini with direct connection of servos and external power supply:
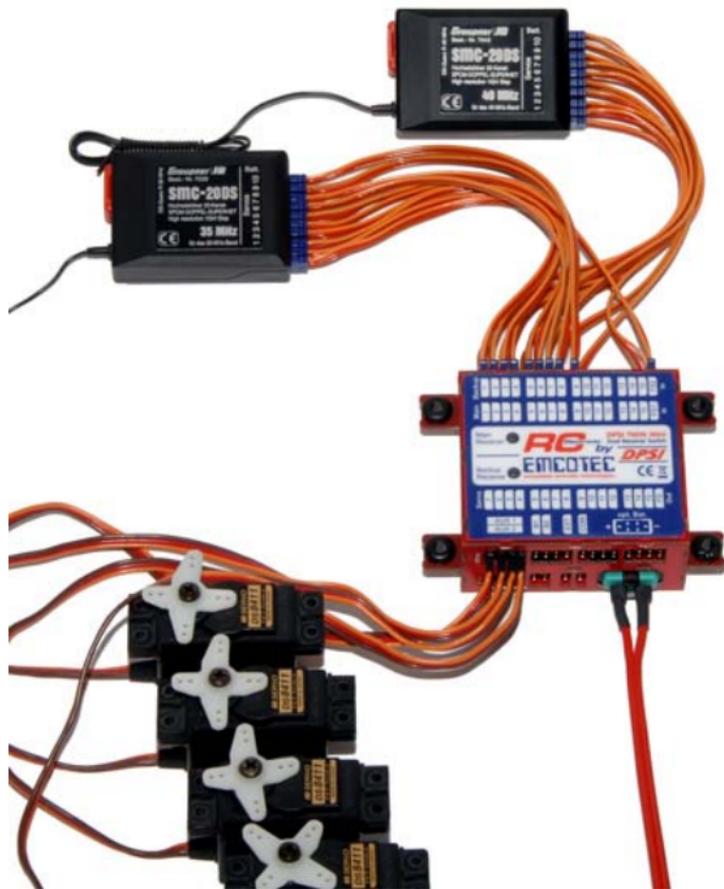
In this example, the **DPSI TWIN Mini** is used in the stand-alone version, i.e. without current distribution. The supply is realized via the optional battery connector (MPX connection cable). Current source can be e.g. a DPSI LR, DPSI BIC or a DPSI Micro. A direct connection of a 5-cell NiMH battery is possible (or any other current source with 4.8 volts up to 8.4 volts).

5.5. Failsafe Channel

The failsafe channel (channel "FS1" or "FS2" of the **DPSI TWIN Mini**) is also switched when changing to the error free receiver. Therefore, it can also be used partially as remotely controlled channel.

If settings in the **DPSI TWIN Mini** are not reprogrammed, a receiver will be recognized as error free, if the failsafe signal is greater than 1.8ms (+75% servo movement). The receiver is considered erroneous, if the failsafe signal is lower than 1.2ms (-75% servo movement). The range in-between is considered as "grey area".

A receiver switch over therefore only occurs, if the failsafe signal is less than 1.2ms (-75% servo movement). The failsafe position on the transmitter therefore must be smaller than -75% (e.g. -80% or -100%).

The range between -75% and +75% is freely usable, because no switching occurs here. If the failsafe channel is used, the servo must only be operated in range from -75% up to +150%. It must be made sure, that the servo path is not mechanically limited when reaching the failsafe threshold.

6. Beginning of Operation

After turning on, the **DPSI TWIN Mini** passes the following phases (5 seconds duration):
- ❍ Advancing the data logger entry and incrementing the turn-on-counter
- ❍ Polling the COM interface whether a PC communication is desired (diagnosis mode or firmware update)

After a successful self-test, the **DPSI TWIN Mini** changes into normal mode after 5 seconds. The built-in LED's indicate the current status, i.e. the "Main"-LED turns to green (see error indications). From now on, the COM interface is inactive.

7. Error Indications

There are two indicator LED's built into the **DPSI TWIN Mini** ("Main"-receiver and "Backup"-receiver). They are bicolor LED's, which can shine green as well as red (or mixed as kind of yellow).

In case of errors, the error indication is repeated approximately every 12 seconds. The integrated LED's indicate the current status of the **DPSI TWIN Mini** as follows:

System State	LED "Main"	LED "Backup"
Main-receiver active	green	---
Backup- receiver active	---	green
Error in Main- receiver (e.g. failsafe)	red LED blinks: 1x = 1 error 2x = 2 errors 9x = 9 errors constantly = more than 9 errors *Example: 5x blinking means "5 receiver errors occurred"*	green
Error in Backup- receiver (e.g. failsafe)	green	red LED blinks: 1x = 1 error 2x = 2 errors 9x = 9 errors constantly = more than 9 errors
PC communication	red	red
firmware update	Quick alternating blinking red/green	

Always, the receiver whose green LED is lit, is "active", i.e. the receiver's servo signals are wired to the servo connectors (as well as the failsafe channel!).

> **Hint:**
> The error indication of the "Main"-receiver only occurs in "failsafe"-mode. In "teaching"-mode (teacher/student operation) switching between receivers is desired, therefore no error is indicated from the „Main"-receiver. The "Backup"- (or student-receiver) can indicate errors if the failsafe signal indicates corresponding values.

In order to indicate errors, optional external indicators are available: the "DPSI ICE" (Information CEnter of DPSI TWIN), the "DPSI LCD" (3-line LC-Display with 3 buttons for changing display) as well as a bicolor LED, which can be mounted at the fuselages sidewall. Displaying capabilities of "DPSI ICE" and "DPSI LCD" are available from the corresponding operating instructions.

Error indications of the optional external LED:

State of LED	State of System
green	System is turned on (Power-On)
red 1x blinking	The Main-receiver was or is erroneous
red 2x blinking	The Backup-receiver was or is erroneous
red 15x blinking (fast blinks)	Supply voltage of the DPSI TWIN Mini is less than 4.8V. This is a critical range!

All of these errors are indicated until the power is turned off. Error output is repeated every 12 seconds. In case of multiple errors, these are output sequentially.

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8. Programming

In order to adapt the **DPSI TWIN Mini** to desired requirements, all relevant parameters can be programmed. The programming is non volatile, i.e. programmed values remain in memory even after turning the device off until eventual reprogramming occurs. Programming is accomplished using an external PC via the COM interface of the **DPSI TWIN Mini**.

Programming using the PC:
You need the *TWIN_MINI_ADMIN.EXE* software. This program runs
under the Windows operating system and can be downloaded from
www.rc-electronic.com or from http://shop.rc-electronic.com with no
charge. The program is self explanatory and has help-texts in German,
English and French.

Hint:

The connection cable for the serial interface of the PC is not included in the
delivery and must therefore be ordered separately.

When delivered, the **DPSI TWIN Mini** is programmed in *Failsafe-Mode*.
A correct receiver is recognized, if the failsafe-pulse is ≥ 1.8ms (greater
than approx. +75% servo path), where as an erroneous receiver is
recognized if the failsafe-signal is ≤ 1.2 ms (less than approx. -75%
servo path).

Operating mode and pass/fail values can be changed using the PC
software.

The following explanations apply:
In *failsafe mode*, a signal reaching the failsafe value causes a switch to
the other receiver. Because this switch happens undesired (caused by
a disturbance of the receiver) an error is indicated (by LED).

In *teaching mode*, the switching is desired (if the "teacher" switches to
or from the "student"). This switch is not indicated by an error.

For this reason, the **DPSI TWIN Mini** must be told, which operating
mode it is in.

Hint:
In order to allow for correct switching in failsafe operation, the corresponding channel (failsafe) in the transmitter (e.g. from Graupner JR) or at the receiver (e.g. from Multiplex) must be programmed to failsafe of course (not in hold mode)! Please see the operating instructions of your remote control.

Hint:
For programming of the pass/fail settings (or teacher/student settings), a switch should be installed in the transmitter for this task in advance.

If channel 8 is to be used as the failsafe channel, a switch (preferably a switch, which can not accidentally be toggled) in the transmitter must be programmed such, that a servo at receiver output 8 has a position greater +75% in the "pass" or "teacher" switch position and a position of less than -75% in switch position "fail" or "student". You can verify that easily in the transmitter's menu "servo position".

When programming the values for the **DPSI TWIN Mini** using the PC software, just bring the transmitters switch to the pass position. Then confirm the value. Now bring the switch into the other (fail) position programming the fail value.

8.1. Firmware-Update

The built-in micro controller allows for loading new software versions into the **DPSI TWIN Mini** ("Firmware-Update"). Here, a program named **TWIN_MINI_FLASH.EXE** is to be used (available on the homepage for download as well). Select the COM port first after starting the program. In order to establish a connection to the **DPSI TWIN Mini**, the connect symbol must be clicked within 5 seconds. Afterwards, the **DPSI TWIN Mini** locks out PC communication.

After a successful connection, the button "Get Hex File" appears. After clicking, the Windows Explorer opens. Here, select the previously (from the homepage) loaded firmware file with the ".hex" extension. If this file is loaded, the "flash" button can be clicked.

Now, flashing starts (first deletion, then programming, then verification). This event lasts about 3 minutes. Under no circumstances remove power from the **DPSI TWIN Mini** during this time!

Hint:
The supply voltage must be removed from the DPSI TWIN Mini during flashing (firmware update) in any circumstances! This leads to data loss, which can not be rolled back. If this happens, the device must be sent in to EMCOTEC.

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9. Application Examples

Teacher/Student operation or Autopilot operation

Task:
The **DPSI TWIN Mini** is to be used as a teacher/student system. Here, 2 transmitters and 2 receivers equipped with different channels are utilized. When using a drone control, only one transmitter and one receiver as well as the autopilot system are used.

Procedure:
Define a free output on the teachers transmitter (e.g. servo output or actuator 9) for switching from the teacher's transmitter to the student's transmitter. Assign a free mixer to actuator 9. Both switching positions of the switch are programmed in the transmitter according to the values for the teacher (e.g. +100%) or student (e.g. -100%). Both positions are to be verified by using the servo position display of the transmitter.

Hint:
In teacher/student mode (or pilot backup) the receivers must have the corresponding crystal which fits the transmitter's channel. The student's transmitter (backup transmitter) <u>must</u> be programmed with the same model parameters as the teacher's transmitter, i.e. all servo-, mixer- and trim- settings. **Please verify all functions on ground IN ADVANCE!**

Failsafe-System with Graupner MC24 (receiver PCM)

<u>Task:</u>
A MC24 transmitter with two SMC20 receivers with the same channel is to be used.

<u>Procedure:</u>
Define a free output for failsafe switching on the transmitter (e.g. servo output or actuator 8). Assign a switch to actuator 8 using a free mixer. Both switching positions of the switch are programmed for pass (e.g. +100%) and fail (e.g. -100%) corresponding to their values respectively. Verify both positions using the servo position display of the transmitter. Change channel 8 in the transmitter using menu "failsafe settings" from "Halt" to "Pos". Toggle the switch to the failsafe position and store the value using "STO".

You find additional instructions about failsafe programming in the operating manuals of the corresponding manufacturers.

Hint:
For most radios, only channels 1 through 8 are capable of indicating failsafe in PCM mode. This means, one of these channels is to be selected for switching failsafe.

Hint:
In order to test the failsafe settings, it is reasonable to connect an additional servo to the failsafe output of the receiver ("Main" and/or "Backup"), e.g. using a V-cable. According to the servo position, you can immediately see, based on the position of the servo, whether the receiver outputs the correct failsafe signal in case of a failsafe (turn off transmitter or dual channel assignment).

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Hint:
The easiest way to test switching between the receivers is to pull off the failsafe patch cable from the failsafe pin connector of the **DPSI TWIN Mini**.

</div>

10. Safety Instructions

- ○ In general, all connecting lines should be run so that they do not come into contact with moving or hot parts of the model (such as servos, gears or mufflers).

- ○ The **DPSI TWIN MINI** must be protected from humidity and moisture.

- ○ The **DPSI TWIN MINI** must be located at a sufficient distance from neighboring surfaces to enable good heat dissipation of the cooling element in case of using the optional power supply unit.

- ○ Improper handling of the **DPSI TWIN MINI** can result in serious damage/injury to property or persons!

- ○ Carry out a general inspection of all connections in your model before each use! All plugs must be correctly polarized and have clean contacts (i.e. fit tightly). Loose cables present a potential hazard!

- ○ Under no circumstances may power sources that do not meet the specified voltages be used.

- ○ The current-conducting contacts of the connector plugs may not be short-circuited. If you fail to observe this warning, the short-circuited cables may overheat and even melt.

- ○ The **DPSI TWIN MINI** may not be taken apart or technically altered under any circumstances.

- ○ Never use the **DPSI TWIN MINI** for purposes other than for RC model making as a hobby. Above all, their use in passenger-carrying equipment is strictly prohibited.

- ○ Operate the **DPSI TWIN MINI** only with the remote control components provided for model making.

- O Always ensure that you have fully charged batteries when operating your model. Empty batteries inevitably lead to failure of the RC components, which cause the model to crash.
- O Do not expose the **DPSI TWIN MINI** to any extremely hot or extremely cold temperatures, moisture or humidity. This would lead to danger of malfunction, damage or decreased efficiency.

11. Technical Data of the DPSI TWIN Mini

Supply Voltage	4.8V … 8.4V
Nominal Input Voltage	5.2V ... 7.4V
Quiescent Current (when "On")	ca. 15 mA total (without external wiring)
Max. continuous current using "opt. Bat."	25A
Max. continuous current using "B1" and "B2"	8A
Number of Receivers	2 receiver with 16 channels each incl. failsafe-channel
Servo Pulse Width (nominal values)	0.8ms …. 2.2ms
Servo Pulse Width (error recognition)	< 0.8 ms or > 2.2ms or pulse spacing < 10ms or distance > 40ms
Number of Servos	16 servo outputs
Interface (Data)	RS232 compatible (optional USB adapter available)
CE-Test	according to 2004/108/EC
Environmental Conditions	-10°C / 14°F... +50°C / 122°F (operating)
Permissible Temperature Range	-25°C / 77°F.... +85°C / 185°F (storage)
Filtering (EMI)	for 16 servo outputs
Dimensions incl. Flanges	88mm x 60mm x 28mm (L x W x H) 3.46" x 2.36" x 1.10" (L x W x H)
Screw Size for Mounting	4 x 4.2mm / 0.16" for M4 screws
Hole Spacing for Mounting	77.6mm / 3.06" x 48.2mm / 1.9"
Weight	82 grams / 0.18 lb
Warranty	24 month

Technical modifications and errors excepted!

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12. Warranty

EMCOTEC GmbH shall issue a 24 month warranty on the **DPSI TWIN MINI**. 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 TWIN MINI**. There shall be no extended claims for damages.

- All transportation, packaging and travel expenses shall be borne by 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 September, 26 2007   Robert Hussmann
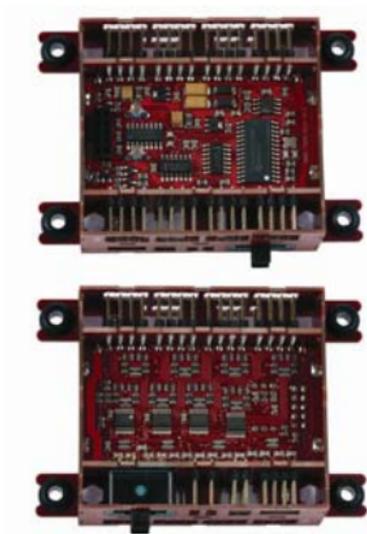
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- EMCOTEC
- DPSI
- DPSI RV

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