EMCOTEC®
embedded controller technologies

English

PowerSmoke600

Smokepump with metal gears

Operating instructions

Contents

1. General

With this **EMCOTEC APS PowerSmoke600** you purchased a high grade accessory for your model airplane. A specific advantage over common pumps is that you can connect an electrically back pressure valve which is controlled by the pump's electronics. We offer appropriate magnetically valves in our accessory program. Please read these instructions carefully. We do not guarantee for damage caused by ignoring these instructions; also we do not commit for damage which is caused by operation of the PowerSmoke600. Allowable usage of **EMCOTEC PowerSmoke600** is exclusively limited for smoke oil flow in unmanned aircrafts.

Hint:
This smoke pump is not applicable for Bio-Diesel! Beware of using smoke oils which include additives (exhalation add-ons). Please, reading chapter 8 is mandatory!

2. Technical Data

Dimensions: 85mm x 28mm (Length x Diameter)
Quiescent Current: 50mA (with powered receiver set)
Weight: 85g

Table1 - max. suction-hose length at inner ∅ 2.5mm / 4.0mm, dependant of flow-rate

	250ml/min	500ml/min	750ml/min
∅ 2.5mm	600mm	300mm	---
∅ 4.0mm	1500mm	1000mm	750mm

Incorporate the length of the pendulum into the length of the suction-hose.

Table 2- Weight, Flow-Rate, Current Consumption

	PowerSmoke600
Weight [grams]	85
Flow-Rate 4.8V [ml/min]	500
Flow-Rate 6.0V [ml/min]	625
Flow-Rate 7.2V [ml/min]	750
Current Consumption 4.8V [A]	1.25
Current Consumption 6.0V [A]	1.75
Current Consumption 7.2V [A]	2.25
Max. Flow Pressure [bar]	5

3. Installation

It is advantageous to position the pump higher than the tank. This is especially important if operating without a back pressure valve. When using a magnetically- or the check-valve, the mounting orientation is of no importance.

The area of the suction-hose is often uncared for. When conveying 500ml/minute or more, the suction-hose may not be arbitrarily long. Get the maximum suction-hose length and minimum diameter for your desired flow rate from table 1. Consider that the suction-hose length starts with the pendulum in the tank. Values in the data sheet refer to the total length; i.e. the pendulum counts.

Flow rates of many pendulums on the market, especially sinter- or felt-pendulums are too marginal. We recommend filters from our accessories program, which not only show a good filtering performance but also exhibit a low flow resistance.

Use a filtering pendulum if possible, then there is no additional filter necessary in the suction-hose (there is no need for a filter in the pressure line anyway).

When connecting the suction-hose and the pendulum, make sure that there is no dirt in the lines. If necessary, air-clean the lines and pendulum. Never refill the smoke oil tank via the suction-hose in order to inhibit contamination of the pump. The length of the pressure line is non critical and may be up to 1.5 meter in length.

Mounting of the pump is accomplished using the delivered mounting brackets. In case of aerobatic planes and / or strong vibrations, each of the brackets should be secured using a cable tie or O-ring.

Hint:
Avoid excessive vibrations because the pump contains massive parts. Continuous vibration can cause damage on electrical connections or electronically parts.

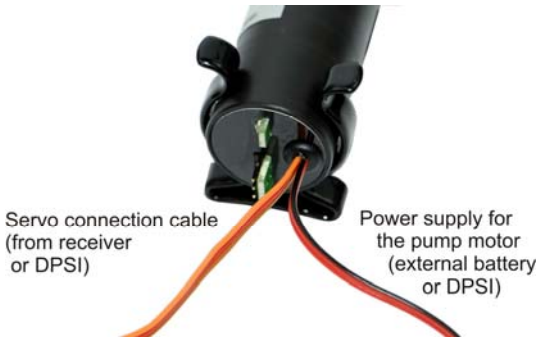
Mount the brackets in a distance of 45mm at the desired position (e.g. fuselage board) using the delivered sheet metal screws 2.9 x 9.5. Additional cable ties or O-rings serve for safe installation.

Observe the fact that the pump always remains in the plane and therefore is exposed to its vibrations. The pump could be placed into a large enough foam isolating hose (from the heating domain) which is glued into the fuselage or fixed by cable ties. Damage caused by vibration is excluded from warranty.

4. Electrical Connection

Connect the 3-wire cable (control cable) of the PowerSmoke600 with the corresponding receiver output (or an output of a battery switch such as a DPSI with servo current distribution) and assign a corresponding switch (servo channel) in the transmitter.
The 2-wire cable serves as supply for the pump-motor. This cable too, can be connected to a free receiver output. This way you can safe yourself an additional battery. Observe the current load by the pump-motor because in this case the power is derived via the printed circuit board lines of the receiver. In order to disburden the receiver, supply can be provided by a free channel of a battery switch with current distribution. A V-cable, parallel to the battery connection cable (directly connected to the receiver battery) is appropriate, too.
It is safer to operate the pump with a separate battery. Supply for the pump motor must not be switched, i.e. no additional switch is necessary.

Hint:
Do not use ignition- or turbine batteries as supply. Considerable drawbacks for the receiving set can result. When finishing the connection cable, be aware of a power-on current of up to **6 amps**.



5. Connecting to Filling System

The smoke oil pump is protected against contamination by fastener fittings. These are not needed any more. Flow direction of the pump is indicated by an engraved arrow on the pump housing.

Hint:
Flow direction can not be reversed electrically!

At the suction side of the ***PowerSmoke600*** a hose of 2.5mm inner diameter can be used. We recommend a suction-hose of 3.5mm or 4.0 mm inner diameter for all pumps (simply connected by an adapter piece – see photo). Get the maximum suction-hose length as well as pendulum implementation from table 1.

Our connection set for the smoke pump contains all parts in order to guarantee optimal flow rates.

At the pressure side, we recommend our 2.5mm plastic hose or Tygon-hose; at least up to the exhaust system (available as accessory). We also recommend switching as late as possible (closest to the connector to the muffler) from the plastic- or Tygon-hose to a heat resistant Viton-hose (see also paragraph 6). Dependant on pressure-hose length, injection form, flow rate and counter pressure, pressure up to 4 bar (4 x 14.5 psi) can arise. The pressure line must withstand this pressure.

In order to push the plastic hoses into their connectors, it is advantageous to put some oil onto them or carefully warm up their ends using a lighter. After mounting, they can not be removed by just pulling. If removing becomes necessary somehow, cut the hoses using a side cutter; remaining pieces on the connectors must be removed using a side cutter as well. Do not use a knife, the connectors could be “tarnished” and possibly not 100% sealed any more. Beware of plastic particles entering the pump.

6. Connecting to Exhaust System

Push a heat resistant hose (available as accessory) directly onto the metal nipple at the muffler or exhaust manifold. Please do not use a plastic- or Tygon-hose! In case of turbines, the last part of the hose must be metal (stainless steal-, titan- or brass-pipe, but not an aluminum pipe). We recommend to transition to a plastic- or Tygon-hose only at some distance from all heat sources.

If a pipe with 3mm outer diameter is used, the hose can be directly pushed on (secured by a small bracket or wire). You get fitting hose adapters for 4mm outer diameter from our shop. Adapters for 3mm Tygon-hoses are available as accessory as well.

Please be alerted that soldered pipes, especially in piston-engine operated planes, do not allow for long distances (max. 6mm) due to preprogrammed vibration cracking.

In case of longer pipes, an additional support is in order which must be mounted to the same part as the pipe itself. Do not support at fuselage if the pipe is soldered to the exhaust manifold.

7. First Operation / Teach-in of the Pump

Hint:
The smoke oil pump should be tested after installation and connection and should be taught-in.
In general, always conduct a range test after installation of an electrical auxiliary device; in this case with a powered pump. Do not operate the pump during these adjustments or range checks in a "dry" manner!

For first tests or range checks it is advisable to feed the pressure line back into the smoke oil tank (e.g. by pushing the pressure-hose onto the filling nipple and therefore pumping in a circle).

First refill the smoke oil tank (about half full). In order to reach optimal regulation, no amplitude limiting should be programmed. But it is possible to use only "half" the servo amplitude, in order to utilize the other "half" for other functions. Corresponding to the amplitude adjustments of your transmitter teach-in the ***PowerSmoke600***:

For this purpose:

- set the actuator (servo output) to maximum flow rate.
- afterwards short the round contact points at the pump's back side (by powered receiver set) using a screw driver (LED turns on).

- set the actuator (servo output) to minimum (stop) and short the contact points again (LED turns off, on and off again) – ready.

The contact points for teaching-in the radio control are seated on the PCB in front of the LED. Short them using e.g. a screwdriver or a pair of tweezers. A pushbutton (including cable) can be soldered onto – this way teach-in for difficult to reach areas is possible without further aids.

Optimum flow rate is best assessed during flight monitoring the generated amount of smoke. Adjustment is done by transmitter function “servo amplitude”. Experts have the option to program the flow rate depending on the throttle. The pump offers this possibility based on electronically controllability. If no oily residues are left on the fuselage flow rate is correctly set, reduce the rate in case of large residues.

Hint:
After turning the receiver set on, the “actuator” in the transmitter must be set to “pump off” (no flow). Only now can the pump be turned on and off as desired. This way, inadvertent operation of the pump and uncontrolled filling of the muffler can be avoided after powering the receiver set.

8. Hints for daily Operation

The smoke oil pump is free of maintenance and very long living. The heart of the pump is a high quality gear wheel pump. Gear wheel pumps are not applicable for running dry by design. Periods of dry runs must therefore as short as possible.

Hint:
When new, 60 seconds of dry operation of the PowerSmoke600 can be too long already and damage the pump!

Get accustomed to not to empty the smoke oil tank totally. It is advantageous to start a stop watch when powering the smoke oil pump (and of course stopping it after power off), signaling when to stop the pump. In hectic rush, turning the pump off can be forgotten very easily. In order to inhibit unintentional powering-on a “main switch” can be installed in the power supply (e.g. EMCOTEC MPS – Magnetic Power Switch).

If you do not want to integrate a switch the pump can also be disconnected (servo cable).

We advise you that especially dry operation is not covered by warranty.

Adjustment of the pump in respect to the transmitter signal can change over time. This is especially due to the run-in of the pump and pump motor.

Consequences can be, that the flow rate can change over time (in general it increases) if the pump is not fully regulated. You can easily compensate by adjusting the “servo amplitude”.

When using **smoke oils with additives** corrosion can occur in the pump during longer pauses (especially during winter). There are usually smoke oils with odorous substances (e.g. smoke oil containing strawberry or banana smell). These additives are often acidic and very hygroscopic; therefore they attack the gear wheels of the pump. Such smoke oils also drop out emulsions (water-oil connections). These are recognizable as brown spots in the canister. If you do not want to abandon from usage of such oils, you must conserve the pump in case you plan for a longer pause. Fill acid free oil into the tank (e.g. sewing machine oil or low viscosity machine oil) and operate the pump until it safely sucked in.

Hint:
At this point we alert you that corrosion damage is not covered by warranty!

9. Using Back Pressure Valves

In principal, there are no pumps which are blocking in direction of flow. Even not if some providers promise or pretend. This means, a pump can only increase volume flow rate but never totally block. Even best pumps tend to pass more or less smoke oil, even in powered off state, without additional blocking.

If the tank volume expands e.g. caused by heat effects, smoke oil can reach and over flow the muffler. This can be avoided with check valves which however need to be spring-loaded and be operated with at least a minimum of pressure. Unfortunately, dry running pumps only generate low pressure, even if of good quality. This means, that a spring-loaded check valve hinders or even inhibits intake of a pump. A new pump possibly can open such a valve, but not anymore after some operating hours.

Therefore, we recommend using an additional back pressure valve exclusively in the pressure line.

9.1. PowerSmoke Check-Valve (Utility Patent protected)

This in house developed valve is a cost effective alternative to a magnetically valve. It can be integrated in between the pump and the muffler without problems. A vent pipe (feed back line) toward the tank is necessary. Using this valve makes sure, that the pump can not pass smoke oil inadvertently. Exact turning on and off of the smoke is now possible. Longer “after smoke” or permanent smoking when the pump is turned off, is inhibited by this passive valve. Flow rate is only decreased by about 5% when using this valve.

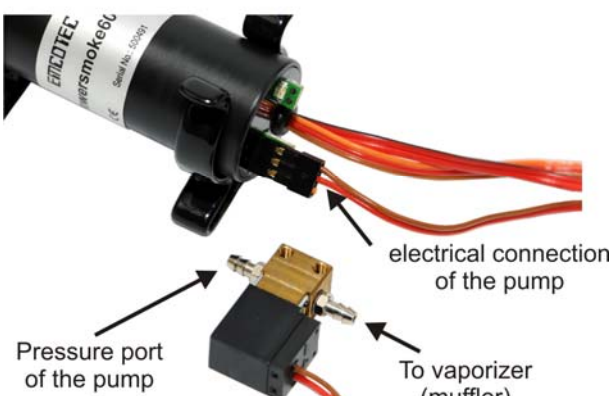
Check-Valve (back pressure valve) 1-cylinder:

Check-Valve (back pressure valve) 2-cylinder:

9.2. Magnetically Valve

There is a very comfortable possibility to integrate a magnetically valve into the pressure line. The pump electronics offer the possibility to connect and control such a valve. Theoretically, any magnetically valve with 5 volts supply and maximum current consumption of 0.3 amps can be connected. Of course, such a magnetically valve must exhibit a sufficient wide cross section in order to inhibit over load of the pump motor or electronics. Appropriate valves are available as accessories in house. For valves with 3-wire connection cables, usually only brown (negative) and red (positive) are utilized. Under no circumstances, use a valve with its own electronics.

Magnetic valve:



10. Technical Data

Operating Voltage Range	4.8V 8.4V
Supply Input Pump	4 cells NiCad/NiMH (4.8V) up to 2 cells LiPo (7.4V)
Current Consumption	Approx. 50mA for electronics, up to 2.25A for the pump
Quiescent Current Pump Motor	Approx. 170µA (system switched off)
Servo Signal Level Input	Starting from approx. 2V amplitude
Allowable Servo Pulse Length	+/-100% (1.10ms .... 1.90ms)
Maximum Pressure	Approx. 5bar (5 * 14.5psi)
CE-Test	According to 2004/108/EC
Temperature Range	0°C .... +70°C
Dimensions	Approx. 85mm x 28mm (Length x Diameter)
Weight	Approx. 85grams
Warranty	24 month

Technical modifications and errors excepted!

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11. Warranty

EMCOTEC GmbH shall issue a 24-month warranty on the **EMCOTEC PowerSmoke600**. 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 **EMCOTEC PowerSmoke600**. 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 € 20.
- In all other respects, the general business terms and conditions of EMCOTEC embedded controller technologies GmbH shall apply for any items not listed.

Legal information:

Trademarks:
The following names are registered trademarks:

- EMCOTEC
- DPSI - Dual Power Servo Interface
- 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 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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