

# EMCOTECH<sup>®</sup>

embedded controller technologies



## PowerSmoke 740 PowerSmoke 740 HV

English

Smokepump with metal gears



### Operating Instructions



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## 1. General

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With this **PowerSmoke 740 (HV)** you purchased a high grade accessory for your model airplane. **PowerSmoke** pumps are the most innovative and most high grade pumps with significant advantages over other systems on the market.

Best flow rate and optimal flow pressure at any time thanks to high precision metal toothed wheels, highest manufacturing quality and electronics optimized into the ultimate detail and totally manufactured in Germany – providing untroubled fun for an extraordinary hobby!

As with its predecessor, the PowerSmoke 600, it is possible to connect an electrical back pressure valve which is controlled by the pump electronics. We offer appropriate magnetically valves in our accessory program.

The **PowerSmoke 740 HV** ("HV" stands for Head Valve) integrates a back pressure valve. This is unique in the fields of smoke pumps! This back pressure valve makes the pump 100% leak proof and does not allow leaking for unwanted smoke oil to pass – to benefit the environment and your model!

Please read these instructions carefully. We do not assume liability for damages caused by ignoring the operating instructions, as well as for damages caused by operating the **PowerSmoke 740 (HV)**. The allowable usage of the **PowerSmoke** pumps is solely limited to smoke oil flow in unmanned airplanes.

**Hint:**

PowerSmoke pumps are not applicable for Bio-Diesel! Be careful with smoke oils including additives (aroma add-ons). Please read chapter 8!

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## **1.1. Differences to PowerSmoke 600 / XL**

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The new smoke pumps **PowerSmoke 740** and **PowerSmoke 740 HV** replace the older PowerSmoke 600 / PowerSmoke XL.

Electronics are completely redesigned and even smaller and more space saving. Control of the pump motor is improved and the software supplemented by reasonable features. The motor turns for the fraction of a second full speed during power on to generate a better starting torque.

A stronger motor is built into the new **PowerSmoke** pumps which allows for more flow rate. It can be directly powered by 2S Lipo batteries without problems. The **PowerSmoke 740 HV** can be powered by 3S LiPo batteries because this pump has a wider suction hose connector. The **PowerSmoke 740** can only be supplied by up to 2S LiPo batteries. At higher voltages this pump tends to cavitate.

The **PowerSmoke 740 HV** has a self purging passive check valve. The cutoff valve and the self purging valve are integrated smartly into the pump head. By using this valve it is assured, that the pump is absolutely leak proof and that no smoke oil can pass when disadvantageously mounted underneath the tank level. Furthermore, exact on and off of the smoke is possible. Longer or permanent smoking with a powered off pump is inhibited by usage of this passive valve.

Of course, both pumps allow for usage of an electronically lock valve, i.e. both pumps have a switching output, which controls an external valve.

**Hint:**

During long pauses (> 1 day) the smoke oil tank should be drained completely.

**PowerSmoke 740****PowerSmoke 740 HV**

Picture shows **PowerSmoke 740 HV** with mounting brackets.

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## 2. Specifications

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### 2.1. PowerSmoke 740

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Dimensions: 61mm x 27mm (Length x Diameter)  
 Quiescent Current: approx. 30mA (with powered receiver set)  
 Weight: 78g  
 Max. Flow Pressure: approx. 5.5 bar

**Table1** - maximum suction hose length for inner diameter 2.5mm / 4.0mm is dependent on amount of flow rate.

Hose ID	250ml/min	500ml/min	750ml/min	1000ml/min
Ø 2.5mm	600mm	300mm	---	---
Ø 4.0mm	1500mm	1000mm	750mm	600mm

Include length of pendulum in feed line length.

**Table 2** – flow rate, current consumption

Supply-Voltage [V]	Flow Rate [ml/min.]	Current Consumption [mA]
3.7	330	900
4.8	430	1100
6.0	550	1300
7.4	700	1400
9.6	900	1800
11.1	1100	2100

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## 2.2. PowerSmoke 740 HV (HeadValve)

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Dimensions: 67mm x 27mm (Length x Diameter)  
 Quiescent Current: approx. 30mA (with powered receiver set)  
 Weight: 96g  
 Max. Flow Pressure: approx. 4.5 bar

**Table1** - maximum suction hose length for inner diameter 4.0mm is dependent on amount of flow rate. A suction hose with 2.5mm inner diameter cannot be used with the PowerSmoke 740 HV due to their bigger suction connector.

Hose ID	250ml/min	500ml/min	750ml/min	1000ml/min
Ø 4.0mm	1500mm	1000mm	750mm	600mm

Include length of pendulum in feed line length.

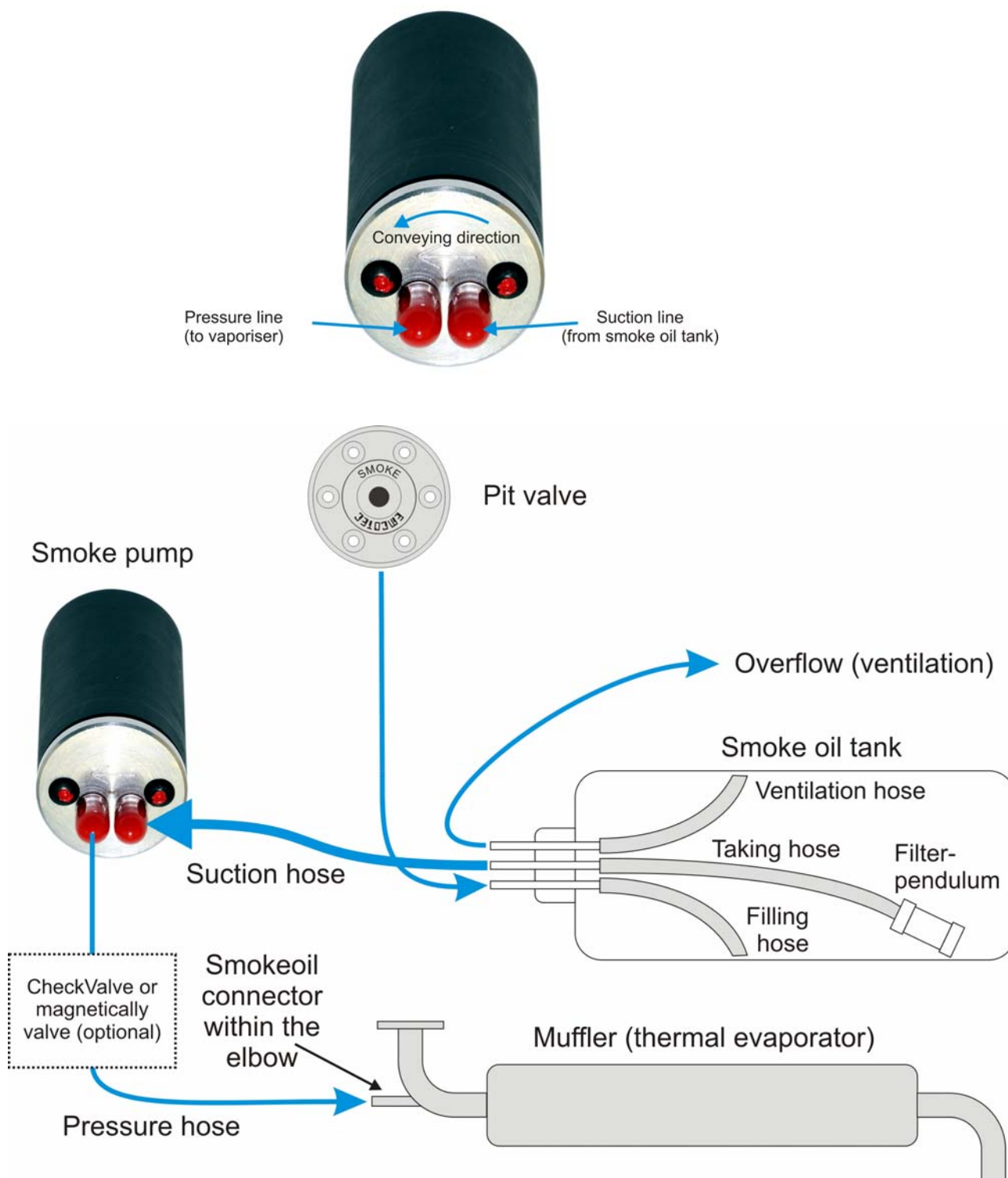
**Table 2** – flow rate, current consumption

Supply-Voltage [V]	Flow Rate [ml/min.]	Current Consumption [mA]
3.7	300	1000
4.8	400	1200
6.0	500	1400
7.4	650	1600
9.6	850	2000
11.1	1000	2300

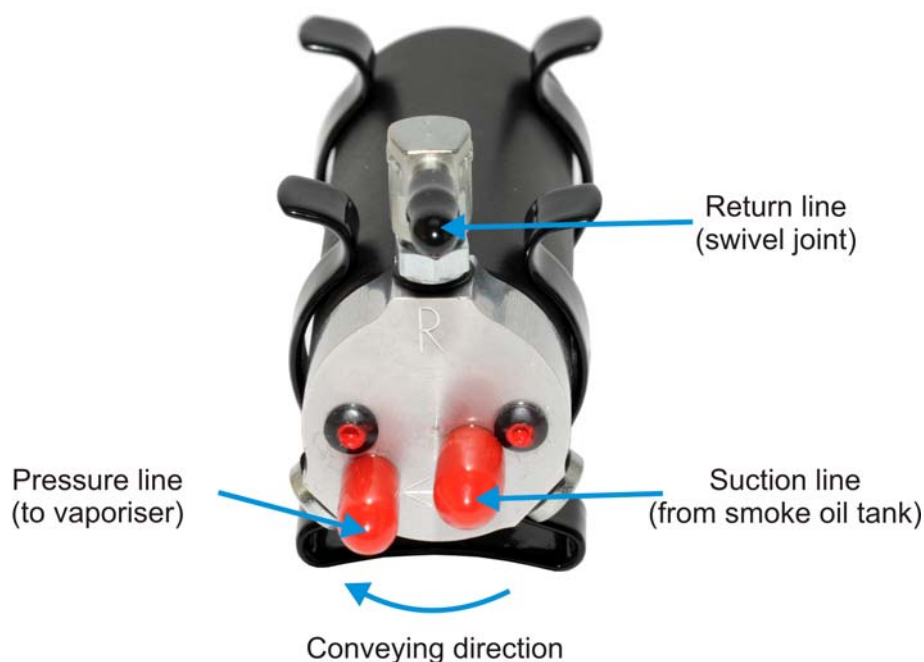


### 3. Mounting

It is advantageous to mount the pump higher than the tank. This is especially true for the **PowerSmoke 740** if not using the check valve. When using a magnetically valve or the check valve, the mounting position does not matter.



The **PowerSmoke 740 HV** has an integrated valve and can therefore be even positioned lower than the tank.



Flow direction is marked by an arrow. The "R" marked connector (swing fixture) is to be routed back to the tank. Back flow is approx. 35ml/min. In order not to install a separate connector to the tank, a delivered T-piece can be looped into the tanking hose. Here, the back flow is to be connected.

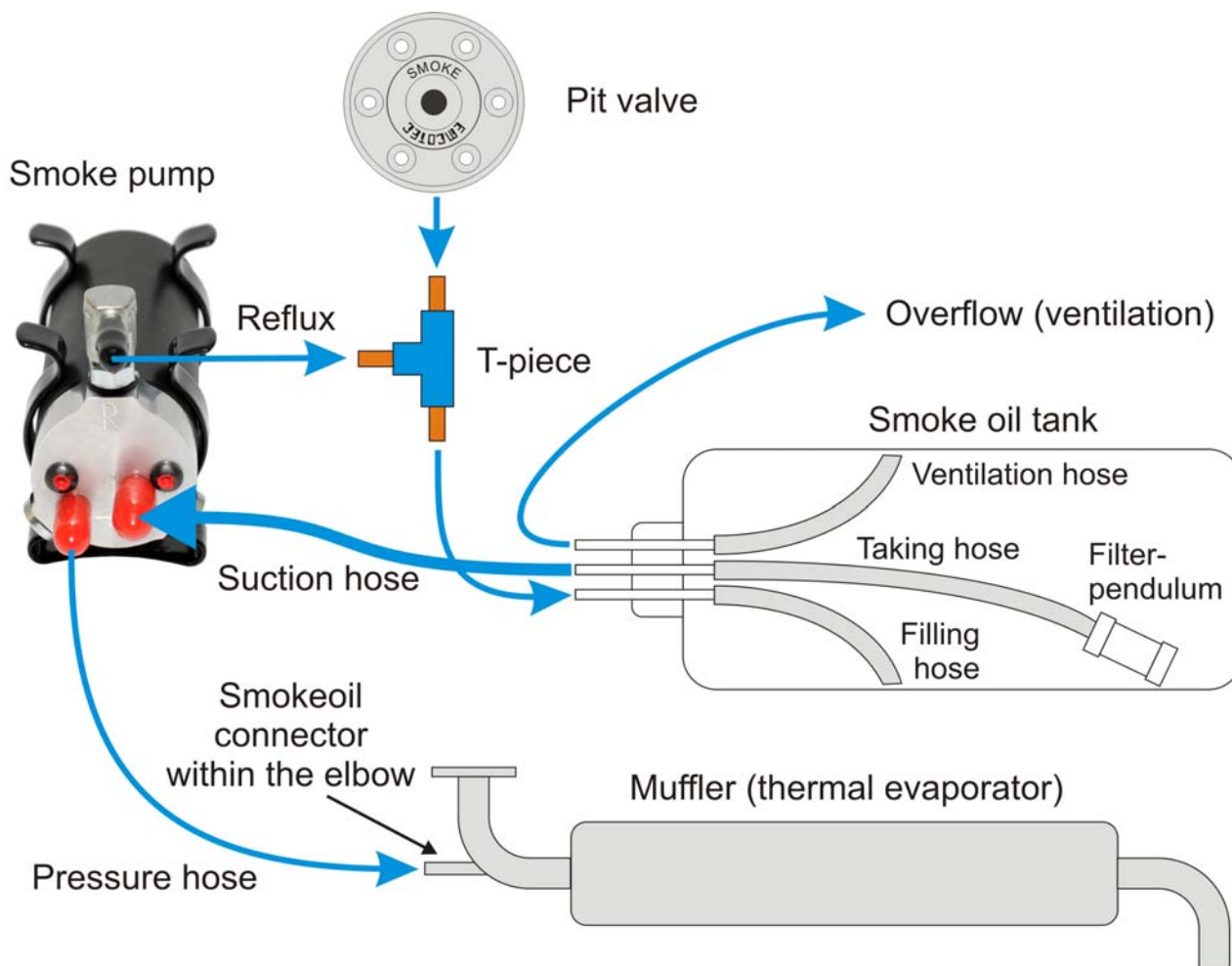
#### Hints for the filtering pendulum:

Flow rates of many pendulums in the market are too low (especially sinter and felt pendulums). We recommend pendulums from our accessories store which have low flow resistance besides good filtering capabilities.

Use filtering pendulums when ever possible; you don't need additional filters in the suction hose (there is no filter necessary in the pressure line anyway).

Pay attention not to contaminate the hoses when connecting the suction hose and pendulum hose. Possibly clean the hoses and the pendulum using pressurized air prior to installation.

Never fill the smoke oil tank via the suction hose in order to avoid contamination of the pump. Length of the pressurized hose is not critical and may be up to 1.5 meters.



The suction hose is often an unattended area. For a flow rate of 740ml/min. or more, the suction hose must not be arbitrarily long. Retrieve the maximum suction hose length and minimum diameter from table 1 for your desired flow rate. Observe that the suction hose starts with a pendulum in the tank. Values in the table refer to the total length which includes the pendulum length.

Mounting of the pump is accomplished by using the delivered brackets. For aerobatic airplanes and or heavy vibrations secure each bracket by an additional cable tie or an O-ring.

Mount the clamps in a distance of 45mm at the desired position (e.g. board inside of fuselage) with sheet metal screws 2.9x9.5 (delivered). Additional cable ties or O-rings provide for additional support.

Remember, the pump remains always in the airplane and is exposed to vibrations. The pump might be put into an appropriate foam insulation hose (heating isolation material) which is glued into the fuselage or fixed by cable ties. Damage caused by vibration is excluded from warranty.

**Hint:**

Keep the pump clear from heavy vibrations because of its mass intensive parts (pump). Damage by continuous vibrations can be encountered at electrical connections or electronically parts.

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## **4. Electrical Connection**

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All connectors are polarity proof using the Futaba coding. Of course, JR connectors are appropriate, too.

The connector which is marked "RX" is provided a 3-pol patch cable (control line) and then connected to the desired receiver output (or output of a dual power supply, e.g. DPSI with servo current distribution); a corresponding switch (servo channel) is to be selected in the transmitter. No current flows practically to the receiver by this patch cable.

The actual pump motor is separately supplied current by the connector "BAT".

The connector "BAT" should be separated from the battery by a switch; the quiescent current could discharge the battery otherwise.

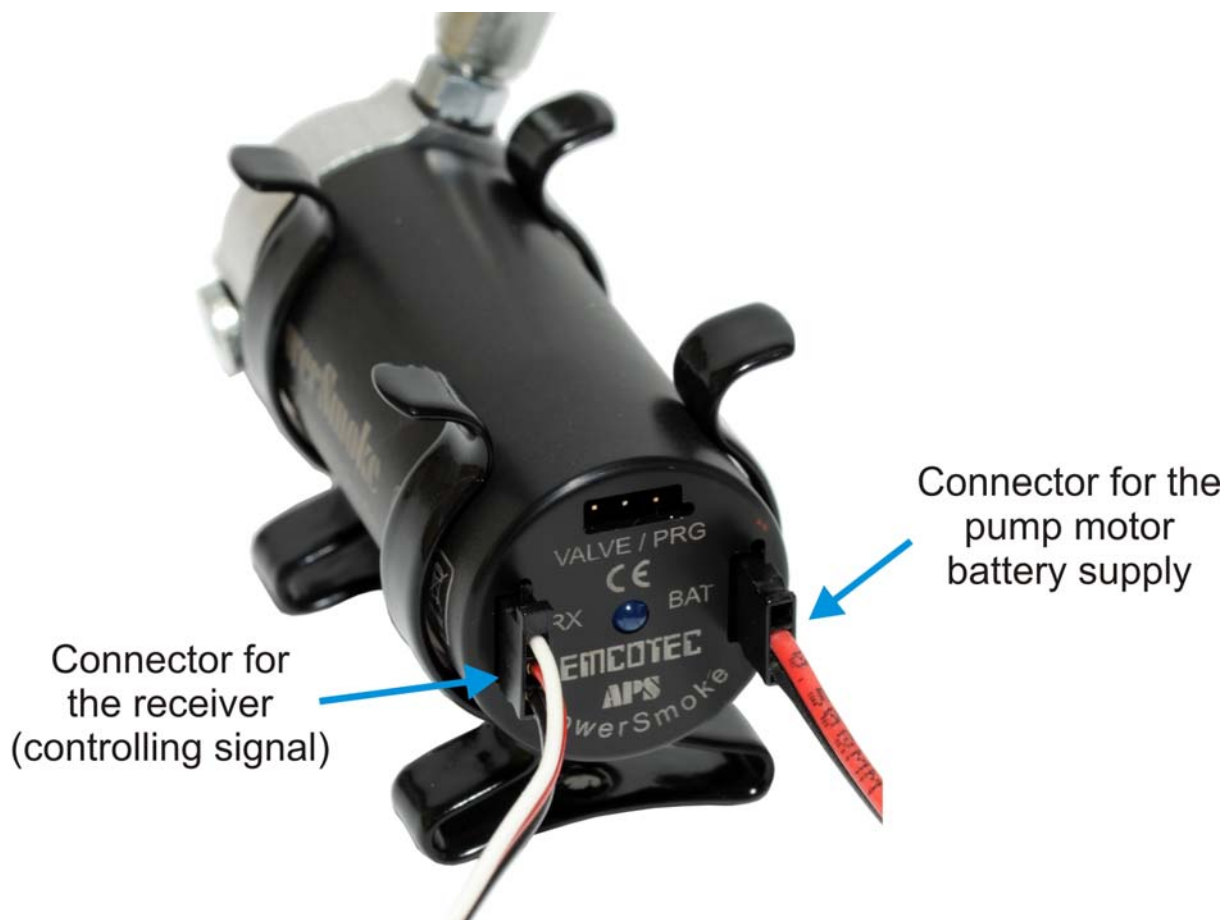
Supply for the pump motor could be provided by a free receiver output also. This saves an extra battery. Observe the current consumption of the pump motor because the current loads the printed circuit board tracks of the receiver.

In order to unburden the receiver, the supply can also be applied by a free channel of a battery switch with servo current distribution (e.g. DPSI Mini, DPSI RV or DPSI 2001 RV). Here too, observe the maximum possible current, especially, when the selected output voltage of the dual power supply is lower than the voltage of the connected battery.

It is safer to supply the pump with a separate battery. The supply of the pump motor should contain a switch because even when the pump is inactive, a small quiescent current (180µA) discharges the battery slowly. Alternatively, the battery can be simply disconnected.

**Hint:**

Do not use batteries for ignition systems or turbines as supply. Hereby, immense disturbances of the receiver set are possible. Be aware, that up to **6 amps** of power on current can occur.



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## 5. Connecting to Tanking System

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The smoke oil pump is protected by locking nipples against contamination. They are not needed anymore. Flow direction is indicated by an engraved arrow.

**Hint:**

Flow direction is not reversible by electronics!

On the suction hose side of the **PowerSmoke 740** a hose with an inner diameter of 2.5mm can be used. We recommend for all pumps a suction hose with 3.5mm or 4mm inner diameter (simply connectable by adaptor instead – see photo). Retrieve maximum suction hose length as well as pendulum type from table 1. The **PowerSmoke 740 HV** has a bigger suction connector where a 2.5mm suction hose cannot be adapted (only the bigger hoses with 4mm e.g.).



Our connection set includes all parts in order to allow for optimal flow rates.

On the pressure side we recommend 2.5mm plastic hoses (PUN) or Tygon hoses, at least near the exhaust system. We recommend changing from the plastic or Tygon hose to a heat resistant Viton hose (close to the muffler) at late as possible (see chapter 6).

Dependant on pressure hose length, injection form, flow rate and counter pressure a pressure of up to 4 bar can arise in the flow hose. The pressure hose must support this pressure. In order to connect the plastic hoses it is advantageous to put some oil onto the connectors or heating up the hoses carefully. After the hoses are connected, they will not fall lose themselves anymore. If it is necessary to remove hoses, they must be cut lose by a side cutter, the same technique is to be used for removing remaining pieces. Do not use a knife, the connectors get "scratched" and are possibly not 100% leak proof anymore. Make sure, no plastic parts enter the pump.

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## ***6. Connecting to Exhaust System***

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A heat resistant hose (available in our shop) is to be put onto the metal nipple of the muffler or manifold. **Please do not use a plastic or Tygon hose!** For turbines, the last piece must be of metal material (stainless steel-, Titan- or brass pipes, **but no aluminum pipe**). We recommend switching to plastic or Tygon hoses in appropriate distance to all heat sources.

If a pipe of 3mm outer diameter is used, the hose can be directly put on (secure with a small bracket or wire). You find fitting hose adapters for 4mm outer diameters in our shop. Also adapters for 3mm Tygon hoses are available as accessories.

Please be aware that soldered pipes, especially with model airplanes powered by piston engines, do not allow for long distances (max. 60mm) because vibration breakages are preprogrammed.

An additional support is in order for longer pipes which must be mounted to the same part as the pipe itself; this means, do not mount the support to the fuselage if the pipe is soldered to the manifold.

### Contents of delivery **PowerSmoke 740 HV**





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## ***7. Initial Operation / Teach-in of Pump***

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***Hint:***

After mounting and finishing connections it is advisable to test and possibly program (teach in) the smoke oil pump.

Generally, after mounting any electrical add-on device, a range test with powered pump should be conducted. Don't let the pump run dry during these adjustments or a range checks!

For the first tests or range checks it is best to reroute the pressure pipe back to the smoke oil tank (e.g. by putting the pressure hose of the smoke oil pump back onto the fuel nozzle in order to pump the oil in a circle). First fill the smoke oil tank (approx. half full). In order to achieve optimal regulation no travel limit should be programmed at the transmitter. It is possible to only use one half of the servo travel range to use the other "half" for a different function. Corresponding to the travel range adjustments of your transmitter the **PowerSmoke740 (HV)** can be programmed (taught in).

For programming of the **PowerSmoke740 (HV)** a programming jumper, a functioning radio control (or servo tester) as well as sufficient power supply are necessary.

***Hint:***

As long as the PowerSmoke (HV) is in programming mode the pump motor is not driven, i.e. the device can not accidentally pump and therefore is in a safe mode.

## Actual Programming:

- Prior to power up the pump or receiver set put the programming jumper into the corresponding socket, then power the receiver set up.
- After power on, the blue LED of the **PowerSmoke 740 (HV)** is lit permanently. This indicates activated programming.
- First setup minimum servo position where the pump should not run.
- Now remove the programming jumper. The LED blinks 5 times per second now.
- Now setup maximum servo position where the pump should have their maximum flow rate.
- If maximum servo position is recognized by the PowerSmoke the blue LED is lit steadily again.
- Now select minimum servo position again. Only when minimum servo position is recognized, programming will be left.



**Hint:**

If the programming jumper is recognized being plugged in after finishing programming the blue LED flashes 10 times per second until the programming jumper is removed.

**Hint:**

If after removal of the programming jumper no valid servo signals are received, programming is interrupted immediately without changing the configuration.

**Hint:**

Servo travel range between the off-position and the maximum flow rate must be at least 30%.

The following servo travel ranges are allowed:

-100% to +100% (=200%)

-10% to +30% (= 40%)

Invalid range:

0% to +20% (= 20%)

**Preprogrammed values at delivery:**

1.1ms (-100%) start position (no flow rate – pump off)

1.9ms (+100%) end position (maximum flow rate)

**Hint:**

For safety reasons the pump turns on only above 10% of the start position and then runs with a minimum flow rate of 20%.

An optimum flow rate is best assessed in flight based on the generated amount of smoke. Adjustment is done e.g. via "servo travel" of the transmitter. Experts could also program the flow rate depending on the throttle position. The pump allows that thanks to its electronically regulation features.

The flow rate is correctly adjusted if there are no oily remains on the fuselage; the flow rate is to reduce when a lot of remains are encountered.

**Hint:**

After powering the receiver set on the actuator on the transmitter must be set to "pump stop position" first. Only then the pump can be arbitrarily turned on or off. This inhibits an erroneous running of the pump and e.g. uncontrolled filling of the muffler when turning the system on.

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## ***8. Hints for Daily Operation***

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The smoke oil pump is free of maintenance and very long lasting. The heart of the smoke oil pump is a high grade toothed wheel pump. As a matter of principals this type of pumps is not applicable for running dry. Periods of running dry must be kept as short as possible.

**Hint:**

Especially when new 60 seconds of running dry could be already too long for the PowerSmoke 740 (HV) and damage the pump!

Do not fully empty the smoke oil tank during flight. It is advantageous to start a stop-watch when starting the pump (and stopping the watch when stopping the pump); this indicates on-time when to stop the pump. If for any reason hectic comes up powering the pump off could be easily forgotten. In order to avoid unwanted powering on of the pump a "main switch" should be looped into the power supply (e.g. EMCOTEC MPS).

If you do not want to use a switch disconnect the pump from the battery.

We point out that especially damages caused by running dry are not covered by warranty.

The adjustment of the pump in respect to the transmitter signal can change over time. This is especially caused by the "running in" of the pump and the motor.

The result could be that the flow rate changes over time (in general somewhat increasing) when the pump is not running full speed. You can correct this by changing the "travel range" easily. Alternatively the pump can be newly taught in.

If not used for a longer time (especially in winter time) and when **smoke oils with additives** are in use corrosion can occur. In general these are smoke oils with odorous substances (e.g. smoke oils with strawberry or banana aroma). These additives are often acidic and heavily hygroscopic and therefore attack the toothed wheels of the pump. Such smoke oils also deposit Emulsions (water oil combinations). These are recognizable as brown spots in the canister. If you do not want to resign from using such oils you must conserve the pump before pausing a longer time. Fill the smoke tank with acid-free oil (e.g. sewing machine oil or low viscosity machine oil) and then run the pump until consistently flooded by oil.

**Hint:**

Generally its senseful to flood the pump with acid-free oil during long pauses (e.g. winter). This also will extend the life time of the pump.

**Hint:**

We point out that damage caused by corrosion is not covered by warranty!

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## **9. Using a Back Pressure Valve**

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By principal there are no pumps which lock in normal flow direction; even not when some provider promise or pretend. This means that a pump only can increase a volume but never totally lock it. Even the best pumps tend to pass more or less smoke oil without additional locking means when powered off.

Through expansion of the tank volume by e.g. heat smoke oil can reach and flood the muffler. This can be avoided by back pressure valves which are spring loaded and therefore need some minimum pressure in order to open at all. Unfortunately even toothed wheel pumps of good quality generate only low pressure when running dry. This means a spring loaded back pressure valve of a pump makes intake more difficult or even inhibits it. It is possible that a new pump can open such a valve but does not manage it after some hours of operation anymore.

Therefore we recommend usage of the **PowerSmoke 740 HV** with integrated back pressure valve or an additional check valve in the pressure line of the **PowerSmoke 740**.

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### **9.1. PowerSmoke Check-Valve**

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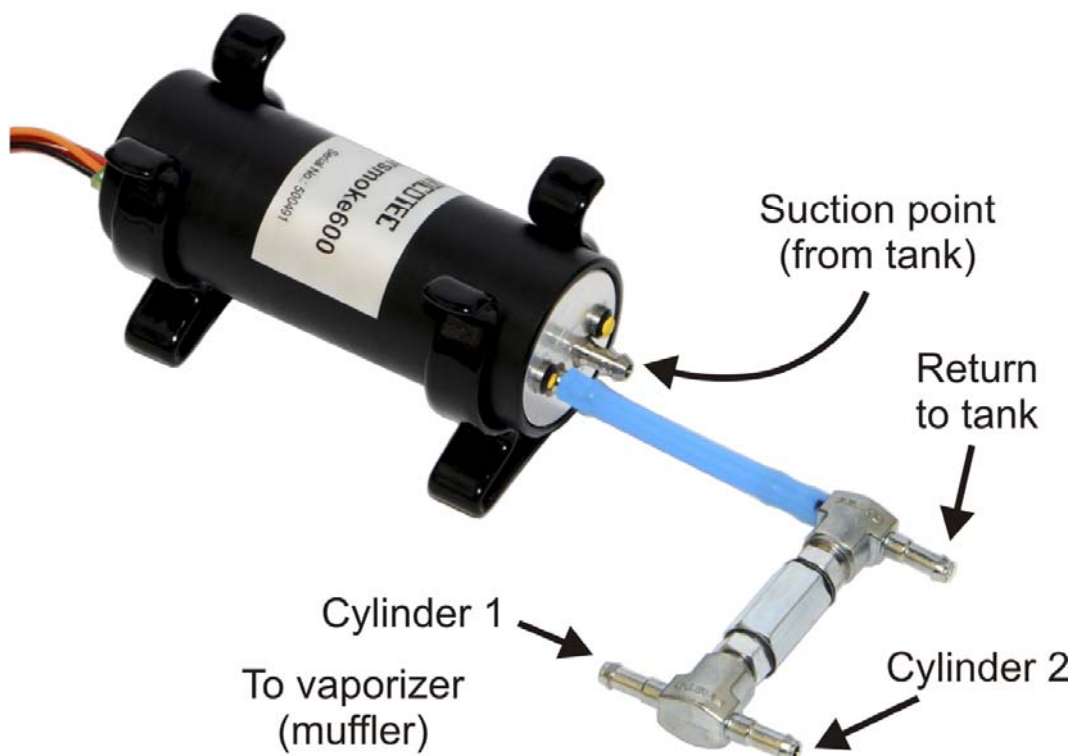
Our in house developed valve is a cost saving alternative to a magnetically valve. It can be looped in between the pump and the muffler without problems. A vent pipe (return pipe) to the tank is necessary. By using this valve you make sure that the pump does not pass smoke oil unintentionally. Exact turning on and off is assured. Longer or permanent smoking when the pump is turned off is inhibited by this passive valve. Flow rate is only reduced by 5% when using this valve.

Examples based on PowerSmoke 600

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

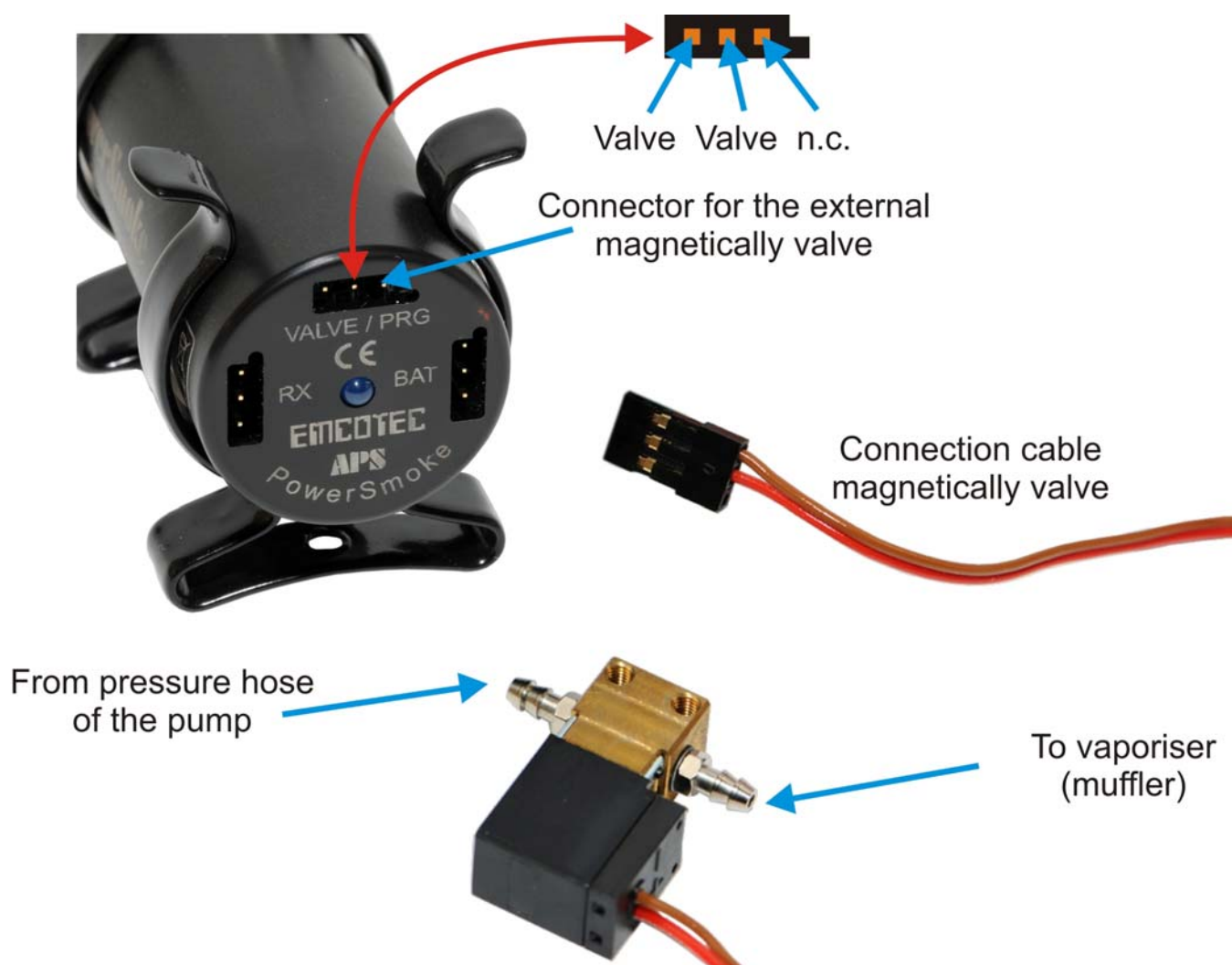


### Check-Valve (back pressure valve) 2-cylinder:



## 9.2. Magnetically Valve

A very comfortable possibility is to loop in a magnetically valve into the pressure line. The pump electronics of the **PowerSmoke 740 (HV)** allows for such a valve to be connected and controlled. Theoretically any magnetically valve with 5 volts and a maximum of 300mA current can be connected. Such a magnetically valve must have a sufficient wide diameter though; otherwise the pump motor or electronics might be over loaded. Fitting valves are available as accessories in our shop. Valves with 3-wire connection cables usually are only wired with brown (minus) and red (plus). Under no circumstances use valves which possess their own electronics.





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## 10. Technical Data

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<b>Operating Voltage Range</b>	4.8V .... 12V
<b>Current Connector Pump</b>	4 cells NiCd/NiMH (4.8V) up to 2 cells LiPo (8.4V) HV version: up to 3 cells LiPo (11.1V)
<b>Current Consumption</b>	approx. 30mA electronics, up to 2.3A pump approx. 180µA out of pump battery (connector "BAT")
<b>Servo Signal Level Input</b>	starting from approx. 2V amplitude
<b>Allowable Servo Pulse Length</b>	+/-100% (1.10ms .... 1.90ms)
<b>Maximum Pressure</b>	approx. 5bar
<b>CE-Test</b>	according to 2004/108/EC
<b>Temperature Range</b>	-0°C .... +70°C
<b>PowerSmoke 740</b>	
<b>Dimensions</b>	approx. 61mm x 27mm (Length x Diameter)
<b>Weight</b>	approx. 78g
<b>PowerSmoke 740 HV</b>	
<b>Dimensions</b>	approx. 67mm x 27mm (Length x Diameter)
<b>Weight</b>	approx. 96g
<b>Warranty</b>	24 month

Technical modifications and errors expected!

(C) EMCOTEC embedded controller technologies GmbH

(P) June 2011

Robert Hussmann

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## 11. Warranty

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EMCOTEC GmbH shall issue a 24-month warranty on the **PowerSmoke 740 (HV)**. 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 **PowerSmoke 740 (HV)**. 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



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