



Operating Manual

B100F



Dear R/C model making enthusiast!

Congratulations for the purchase of the *B100F* jet engine. This is the ultimate engine for your R/C jet plane. Please read these instructions carefully after receiving your jet engine and before the first operation. Keep this manual for later consultation.

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1. Directions for safe operation

1.1. General safety instructions

Even though jet engines are different from piston engines, it is easy to safely operate and fly them when you follow some basic safety rules.

With this goal, the Gas Turbine Builders Association **GTBA** has created a Code of Practice, which can be found as an attachment to this manual. It is available in multiple languages and can be found on the GTBA website (www.gtba.co.uk/codes/german.htm).

It is mandatory to read this Code of Practice before mounting the jet engine and follow the recommendations when mounting and operating the engine.

The operation of any jet engine can be dangerous. This also holds true for the *B100F*. During operation, the jet wash and parts of the jet nozzle become very hot; the nozzle can reach up to 700 °C. In addition, the turbine fans do reach very high rotary speeds, which leads to extreme tensile loads and temperatures. Therefore, it cannot be excluded that parts of failing turbine fan wheels and broken fans will strike through the housing which can lead to damage and even injury or death.

Study the operation mode and the dangers of operation before using a jet engine. In case you have no experience with the operation of gas turbines and jet engines, instruction by an experienced person, especially before initial operation, is mandatory. Errors in mounting and operation of a jet engine can lead to damage, injury, or death.

Follow national laws concerning aircraft, the operation of jet engines, and the handling of combustible liquids and gases. You are exclusively responsible to have sufficient insurance when operating aircraft. You are also responsible to protect other persons from injury and danger. Operating personnel and their assistants must be in best physical and mental condition and pay full attention to the operation.

This engine must only be used for unmanned operation in R/C aircraft. The instructions in this manual must be exactly followed.

Follow the Safety Rules!

Non-adherence of the following safety rules can be fatal!

This device was manufactured to the highest current technological standards. It must only be used for the purpose it was designed for.

This device can, however, be a danger to people, animals and things when

- not operated according to the purpose it was designed for
- the instructions in the manual are not correctly followed
- it is changed or rebuilt

This manual introduces you to a safe operation of the device. Therefore, careful reading and thorough understanding of the manual is vital before operation the device.

Every person who is involved in the operation of this device must read this manual, especially the instructions for safe operation.

Furthermore one has to follow the laws and general rules of

- the avoiding of accidents
- technical safety, as generally valid and accepted
- the country one wants to operate the device in

Moreover,

- jet engines and turbines in general must only be operated with the highest diligence
- ear protection must be worn during operation to avoid hearing damage
- indoor operation is forbidden
- a fire extinguisher (CO₂) **must** be within reach!

1.2. Warning

Consider the basic differences between gas turbines and piston engines. Turbines will deliver power only at high rotation speeds. Then there will be a lot of power (see diagram).

Higher loads occur when driving an R/C aircraft model with a turbine compared to equally powerful drives like propellers or impellers.

This is a result of considerably higher air speeds caused by jet propulsion.

Maximum speeds under jet propulsion can exceed 400 km/h, depending on the model.

The resulting loads effect the whole structure, not only the rudders or the installation of the servo wires.

Models have to be constructed with jet aircraft specific stability. Please ask manufacturers about the current level of production standards for the models in question. Meanwhile, a large array of models built for jet propulsion is available by different manufacturers. Servos should be at least 1.5 times as strong as for comparable models with conventional engines.

During installation, seal the intake and nozzle, as well as propane and kerosene joints to keep dust and debris out of the engine.

Really make sure to:

- first inform, then buy
- have the fitting size model for your turbine
- select servos that are powerful enough
- construct servo wiring and rudder joints very carefully and reinforced
- seal the turbine during the installation process

1.3. Before starting the engine

- Tank system, pump, shut-off kerosene valves and turbine must be checked for correct alignments.
- Loose parts in the intake area must be fixed in a way they can never be sucked in. Loose parts or dirt can damage or destroy the turbine. We recommend the use of a protection screen.
- Have a fire extinguisher (CO₂) within reach!
- The kerosene system must not be leaking.
- Use only kerosene or Diesel with a 5% fraction of lubrication (fully syntethic 2-stroke mix oil or turbine oil).
- Take off must be against the wind.
- Hold the turbine with the nozzle facing downwards right

before take off so excess fuel can run off to avoid a hot start of the engine.

1.4. During operation

- Always keep in front of the turbine (intake facing), never **to the side** or in the **exhaust area** of the turbine.
- Also make sure that no other persons or animals are present in the mentioned dangerous areas.
- Keep your hands and every kind of object out of the area within 20 cm of the compressor (intake). The enormous suction can grasp everything within reach lead as quickly as a flash and lead to severe injury or damage.
- Never look into the jet exhaust. Severe burns can be the result.

1.5. After shutting off the engine

- Place model with the nose facing the wind. Wait until the cooling down process is completed.
- Be aware of the cooling process after engine shut down. During this process, the electric power supply of the receiver and the ECU must **not** be turned off. The cooling down process takes 1 – 2 minutes, depending on outside air temperatures.
- Do not touch the turbine during the cool-down because the danger of burning still exists.
- All tube connections must be inspected for leakage. The fuel tanks must be emptied in case of extreme outside temperatures or when there is no early operation planned (danger of explosion!).

2. Installation of the turbine

2.1. Attachment Options

- The attachment points of the bracket to the frame must be parallel (check before attachment). Otherwise bad tensions can lead to damage of the engine.
- Attach the turbine only with the provided bracket, screws und bushings.
- The ignition plug has to be facing upwards, at twelve o'clock when seen from the turbine front end.
- Should you have deviating wishes concerning turbine installation, **contact the manufacturer**.

2.2. Engine mounting rules

- The engine must be installed in a way that the ignition plug is in the 12 o'clock position. This is absolutely vital for a kerosene start of the *B100F* engine. Else, the start, i.e. the ignition, would fail and might even lead to engine damage.
- There must not be any combustible objects near the turbine. The turbine must not be touched by combustible objects.
- The nozzle and the whole area within reach of the jet exhaust must be clear of any objects.
- In case of a housed in installment of engine the rear end of the installation area and any parts which affected by the jet exhaust should be protected with non-combustible materials (**danger of fire!**). When an extension of the nozzle is necessary, it must be constructed and installed to the manufacturer's specifications.
- The turbine must be installed in a way that it can be cooled by a bypassing air stream.
- Combustible liquids and gases as well as tanks and tubes must be kept or installed in safe distance of the engine.
- The intake area (impeller / compressor) must be kept clear. Any wires, tubes, etc. must be installed and fixed in a way they cannot be sucked into the turbine. In general, there should not be any objects or installations close to the front end of the turbine.
- The intake section of the model should have at least twice the area of the impeller/compressor wheel.

- You must make sure that no objects, e.g. rocks, dirt, screws, etc., can be sucked into the turbine. It is a good idea to protect the turbine intake with a close meshed screen (accessories).
- The intake area must be absolutely kept clear.

2.3. Assembly of the complete system

- Please look at the installation scheme as well as the illustration.
- The optimum size of the fuel tank depends on the model but should be at least 1.7 liters. The optimum size for the *B100F* is 2 - 3 liters, which is enough for an average air time of 6 – 8 minutes, depending on your style of flying. For further information please see technical data, fuel consumption. There must be a felt pendulum in the tank. Use only the included felt pendulum.

The tank set up can be realized with a so called Hopper tank (please see installation scheme “engine fuel supply”. The felt pendulum must only be installed in the Hopper tank; there **must** be free passage from the other tanks of 3 mm (minimum).

Use yellow, highly flexible Tygon tube and attach it to the pump with a cable connector. Tank accessories, pendula, etc. can be found in the BF Turbines line up

- The fuel pump must be installed directly **after** the tank. Be careful to install the pump correctly (brass fitting = draw side). The electric wiring of the pump has to be done with the correct polarity (**+** / **-**). If the pump is not wired correctly, it will not work right and will transport no fuel
- Install the fine filter in the pressure tube **after** the fuel pump (out). After that, a Festo Y quick connector should follow; red and blue tube with 4mm diameter should be used there. There the kerosene supply is divided; the connection to the fuel valves is next. The flow direction is very important, it is marked with an **arrow**. The valves are marked with “**Kerosin**” and “**Ignition**”.

The electric connection is done at the ECU at the “**KERO-VALVE**” input. The fuel supply is connected to the turbine through the **Kerosene** connection.

The electric connection to the **kerosene burner** is done at the ECU at the input “**PROP-VALVE**”. The fuel supply is connected to the turbine via the **Ignition** input.

- **All FESTO quick connectors (blue head) are self-locking. They are connected and disconnected like this:** Insert tube strongly. There is no resistance for the first 6mm but for the next 6mm (approximately) resistance can be felt. Only then the tube is perfectly locked in. For release, push the blue cap in the direction of the metal piece and remove the tube by pulling.
- Now the turbine should be electrically wired to the ECU: Connect the turbine via high voltage wire to the ECU at the **Glow / Starter** output. Also connect the black data cable to the turbine and the **Sensors** input of the ECU.
- Then connect the **I/O Interface** with the **ECU** at the “**Terminal**” connection. Later the **EDT** (operation terminal) can be connected to the **I/O Interface**. The I/O Interface serves as control interface; it features acoustic and optic control. The control interface needs not necessarily be installed in the model.
- **Power supply:**
Rechargeable batteries of at least 2500mAh and with 8 Zellen must be used. For kerosene starts, we recommend a Lipo 3S with a minimum of 2000 mAh and a maximum of 12 volts. Connect the battery to the “**BATTERY**” input of the ECU. Disconnect the battery from the ECU when not in use to prevent discharge. Mind the right **polarity** at the high voltage plug! Longish battery wires should be **twisted!**
- At last, connect the receiver to your ECU. Now the cable is readily prepared. Only use original adaptor cables if other receiver plugs are necessary. The ECU is only operated by one input channel (engine power limiter).

3. Beginning of Turbine Operation

3.1. Initial Operation

- Fill the fuel tank with kerosene. Ensure a 5% fraction of oil.
- Make sure the tank breather is open!
- Filter your fuel already when filling up through the preceding fine filter.
- Make sure the electric power supply battery and the receiver battery are charged.
- Test the reach of your remote control with and without the ECU turned on.
- Place the model always with the nose against the wind so the direction of the jet exhaust equals the wind direction.
- Turn on the sender and the receiver unit.
- The Pro-Jet ECU is mostly pre-adjusted and tuned to your turbine. Nevertheless, you have to adjust the ECU to the remote control unit.

To do this, follow the ProJet instructions on page 18 vor, activate manual point 2.1 accordingly, Trimmung und Gas hinten – Enter, trim forward – Enter, Throttle forward – Enter. Sender is now adjusted.

Make sure that no sender functions like Dual Rate, Expo, distance limit, etc. are programmed!

- It is necessary to de-aerate the fuel tube before the first operation in a new model. That means the fuel tube must be filled with kerosene. Do this manually (throttle back, trim back). This must be done carefully to prevent the turbine from being flooded with kerosene. So let kerosene flow until it can be seen that it has reached the turbine. Never pump kerosene into the turbine. Press the button on the I/O platine circuit board.
- This measure must be taken before the virgin operation as well as after emptying the tank through engine operation.
- Should the turbine have been flooded, place the model with the nozzle facing downwards to allow excess kerosene to leave the turbine. Thus you avoid a hot start, which can damage the turbine.

3.2. First Test Run of Your Turbine

- Be sure to have a fire extinguisher (CO₂) within reach.
- The ECU does an automatic calibration routine to adjust to all turbine and weather parameters as well as tube lengths. The Hornet III, unlike the Hornet II, does this routine at every start.
- After the factory adjustment of the temperature probe and the pump's starting voltage, you can start the turbine. Throttle forward - trim forward – turbine standby. Set throttle to a minimum and within three seconds to full. Now the starting procedure happens. See Pro Jet instructions (pages 24 – 27). Attention: there the turbine adjusts to the factory set rotation speed of ca. 60.000 rpm. Hold or adjust your model for this procedure. The procedure can be interrupted any time with **emergency stop** by setting trim and throttle in the back position.
- After that, the turbine can be controlled with the throttle.
- All parameters necessary for operation are now controlled. Failure of the turbine or the system are now excluded.
- Conduct a test run of your turbine, preferably by testing the range of your model.
- Shut off the turbine at a medium rotation speed. This is done by setting the trim back all the way and then setting the throttle back from a middle setting. An engine shut-off at a medium rotation speed benefits a gentle cool down of the spindle ball bearings and the whole system.
- Put the model against the wind and wait until the after cooling process is over (around 2 minutes). **After** that you can turn off the receiver unit.
- Check the model's fuel supply connections and de-fuel, if necessary.

3.3. Control Functions

- In case of error, check the **ProJet** manual. From p. 15 on you will find concise error descriptions and explanations.
- Sender signal: Shut off happens if the sender signal fails. **Attention!** With PCM receivers, the fail safe function should be programmed to idle in order to avoid emergency stops at short receiving errors. This, however, is within the decision range of the pilot.

3.4. Tuning Options / Electronics

- We do not want to elaborate on the electronic control because it is explained in detail in the Pro Jet manual. You should study the latter carefully.
- **Avoid a system reset!!!**
As a result, the ECU may have to be updated at the BF Turbines factory.
- The ECU features a CODE controlled menu system. Every number features an individual menu point. From these menu points you have options of changing different pre-set parameters. This should, if at all, be done very carefully because the factory setting of the parameters is optimal already.
- The following parameters are to be controlled, i.e. changed, also after a system reset (see attached sheet).
 - 3.1 Battery voltage
 - 2.3 Adjustment of the temperature probe
 - 2.2 Glow voltage
 - 2.1 Pulse width of the sender signal
 - 1.4 Pump starting voltage

4. Disclaimer (Liability, Damage)

Fa. BF Turbines GmbH & Co. KG cannot supervise a compliance of the rules for turbine installation and operation. Therefore, Fa. BF Turbines GmbH & Co. KG will not assume any liability resulting from damage, loss and costs resulting from operation. Fa. BF Turbines GmbH & Co. KG is excluded from compensation of any kind unless regulated differently by law. This includes injury, death, material damage, loss of profit or business, interruption of business and other directly or indirectly resulting consequent loss.

Full liability is in every case limited to the sum paid for the turbine. Fa. BF Turbines GmbH & Co. KG has not granted any pledge, contract or accord in terms of functionality and operation of the model with the turbine.

Set up and operation of the model and the turbine take place under full liability and responsibility of the operator.

5. Maintenance Instructions

5.1. Correct Maintenance of Your Turbine

BF Turbines need only little maintenance under normal operation conditions. However, some points must be considered to guarantee a faultless function of the engine. This includes regular cleaning and inspection.

- Dirt and grease deposit can cause slippage of the starter unit clutch. If this happens, clean the tappet rubber and the impeller nut with a grease-dissolving agent like acetone or liquid gas.
- The felt pendulum built into the tank should be cleaned or changed after 10 hours of operation.
- The upstream fine filter between pump and turbine should be cleaned every 5 hours of operation.

Do this very carefully and make sure no particles will enter the fuel supply tube. Destruction of the turbine could be the result!

Make sure the o-ring is in the correct position when screwing the filter together. Check for leak tightness!

- Cover the intake and nozzle areas when the turbine is not in use.
- Keep the turbine in a dry and dust-free place when it is not used for a longer time. We recommend a dehumidifier to prevent corrosion.
- Check battery condition regularly.
- **Your turbine's maintenance interval is at 40 – 50 hours (about 300 flights). After this time as well as after a special event (crash, etc.) the turbine should be returned to the factory.**

5.2. Repair Work

Repair and maintenance work which include the disassembly of the turbine must only be performed by professional personnel.

Address your BF Turbines dealer with all service questions.

Returning of warranty cases can only be carried out by your professional dealer. Only use original BF Turbines replacement parts.

When ordering replacement parts, engine type and serial number of the turbine must be specified. Maintenance and repair work performed by non authorized personnel will lead to expiration of the warranty.

6. Warranty

The warranty includes free repair and replacement of parts with manufacturing or material faults 24 months from the date of purchase. Further liability is excluded. Any costs caused by transport and packaging have to be paid by the customer. There is no liability of the BF Turbines company concerning transport damage. Before sending, please contact BF Turbines GmbH & Co. KG.

An explanation of the error or damage has to be included as well as a valid receipt of purchase with the date of purchase.

Any kind of warranty will expire in case of unauthorized opening, disassembly or removal of the housing locking device.

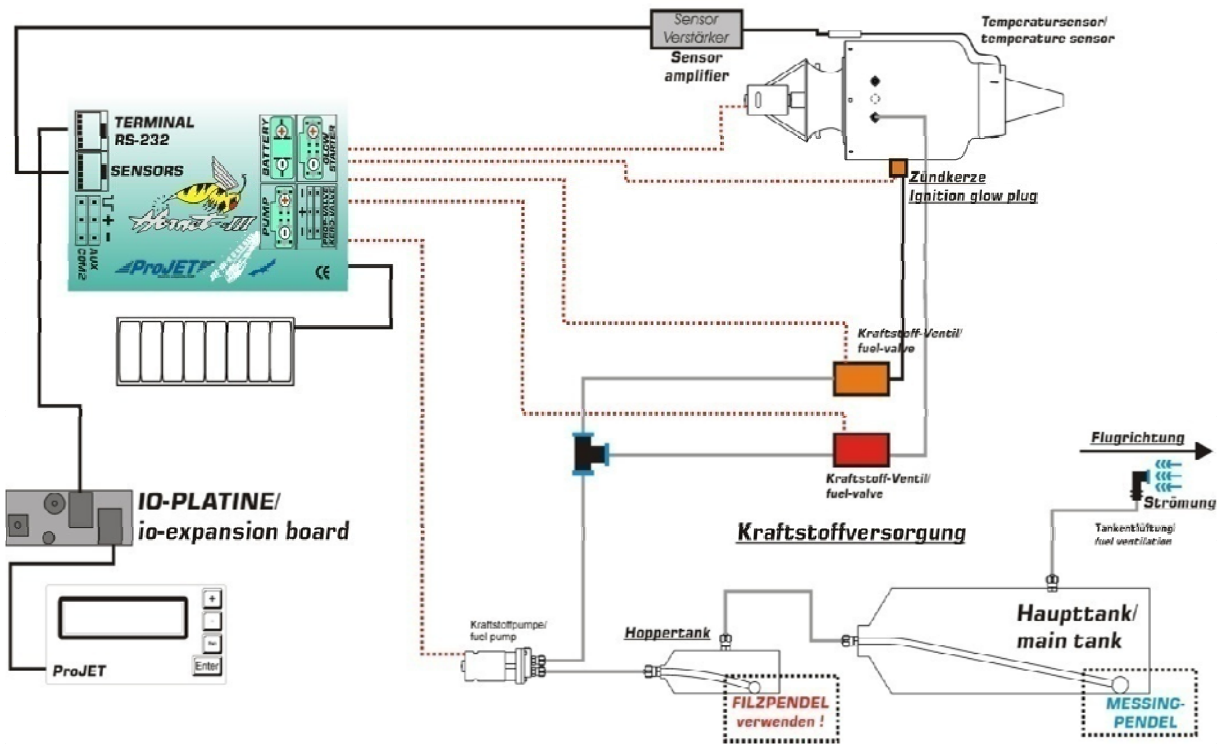
When returning the turbine to the factory, the ECU must be included so we can check the operation hours and other operation parameters. When a defective turbine which does not feature any faults in terms of the warranty, examination and repair will be invoiced (also see terms and conditions in your invoice)

7. Technical Data

Diameter	99,0 mm
Length	296,0 mm
Weight	ca.1180 g
Max. thrust @ 125.000 rpm	100 N
Min . thrust @ 39.000 rpm	5 N
Fuel consumption	365 ml/min @ 100% thrust
Exhaust temperature	560 - 760 °C
Glow plug	Burner
Fuel	Jet A1, Diesel (with 5% Oil)
Acceleration 39-125.000U/min	ca.3 seconds
Acceleration 60-125.000U/min	ca.1 seconds
Maintenance interval	every 50 hours, earlier in case of bearing noise or other reasons

8. System Installation Plan

System Installation Plan for Fuel Start



9. Pictures



When the turbine is not used or returned to the factory, the kerosene and propane joints must always be sealed. Please use included plugs. Miniscule particles can clog kerosene tubes and fault free operation of the turbine cannot be guaranteed.

Repair costs of up to 360 Euros can be the result.



Tank size must be determined by the user. See technical data, fuel consumption. Usually 2 – 3 liter tanks are used with *B100F* turbines. Drill a 6 mm hole in the fuel tank cap of your choice.



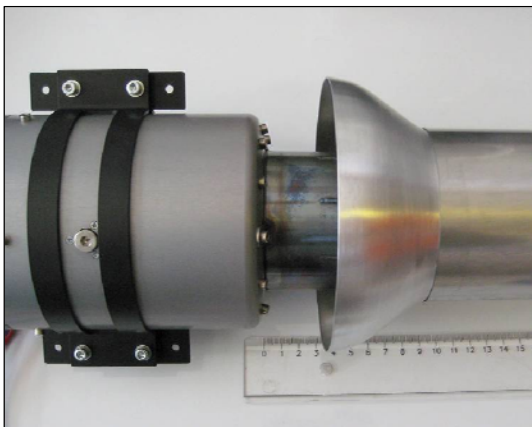
Use the included tank pendulum device and screw it together with the tank cap. Check for tightness. Cut a piece of Tygon tube with a length of ca. 120 – 150 mm. This is the ideal length for the typically used 1.5 liter and 2.0 liter Coca Cola bottles. The length of the tank pendulum, however, depends on the type of tank used. We recommend to choose the length the way that the felt pendulum lies at around 75% of the tank length.



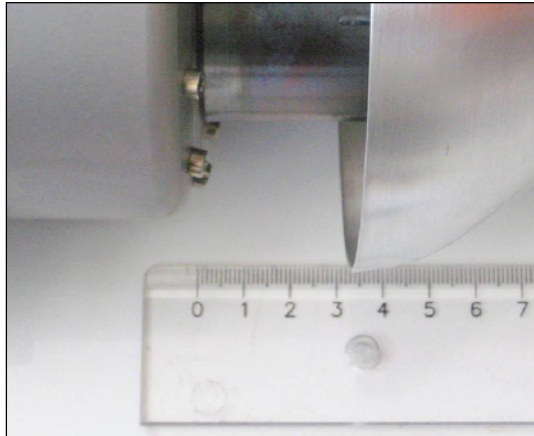
Now place a 6mm flat washer on the felt pendulum and connect it with the Tygon tube. This will prevent slippage of the felt body. Then secure the Tygon tube connections with wire. Again, check for leak tightness.



Braze the battery cable to your chosen battery. Red = plus, black = minus. We recommend Ni-Mh batteries with 8 cells. Batteries with a capacity of at least 3000mAh and 12 V maximum have proven to be ideal for turbines of type *B100F*. Energy consumption is roughly at 450 – 550 mAh, dependent on your style of flying, for 8 minutes plus after flight cool down period. The use of 3S Lipos has proven of great benefit. These should feature max. 5 – 10C de-charging current max. 12 V. Lipos with a higher de-charging rate (20 – 30C) can destroy the ECU due to the higher current situation.



When using a nozzle extension with your model, the diameter of the extension pipe and the distance from nozzle to nozzle extension must be correct. With *B100F* turbines the entry diameter of the extension pipe should be around 100mm while the end diameter should measure around 95mm. The shorter the nozzle extension the smaller the loss of power.



When using BF Turbines nozzle extension pipes for *B100F* type turbines, the distance from the end of the aluminum turbine housing to the aluminum hopper should be 3 – 4 cm. The extension pipe must be securely attached to the model.

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