G-Force SmokeDriver V1.1
Operator Manual

Dear valued customer,
thank you for purchasing our SmokeDriver. This small and light-weight component governs and supervises all functions of our electronic smoke device Smoke-EL.

- It regulates the heating element within the smoke device.
- It proportionally regulates the smoke pump.
- It supervises the lipo-voltage.

The unique feature that makes this SmokeDriver exceptional is its integrated MEMS sensor which measures acceleration. In particular, this sensor measures the force perpendicular to the airplane's wing. As soon as that force reaches a pre-defined threshold smoke will automatically be activated – and in turn deactivated as soon as the force falls below that threshold.
Using our device you can thus imitate the wake of man-carrying jets. Additionally, you can program the integrated timer to continue to produce smoke for up to 3 seconds after the perpendicular force has already decreased below your threshold.

To connect the receiver you will need only one slot. Please make sure you use a 3-step transmitter (-100% / 0% / +50%), since feeders and dials will compromise the faultless operation of the device.

If you wish to switch to Center-Smoke, please use a second switch (you can integrate this channel with the channel of the smoke-device).

Mounting the SmokeDriver:
The SmokeDriver has to be mounted in a way to ensure appropriate cooling, as continuous currents in excess of 40A might occur while the SmokeDriver is running.

⚠️ If the hull of your model is unsuited for the generated heat, it might be necessary to add additional air holes so that the airstream can cool down the SmokeDriver. A thermal overload protection system will shut down the smoke device automatically.

Please mount the SmokeDriver at an easily accessible area. The battery has to be deconnected after every flight, as this resets the SmokeDriver to its default setting. Furthermore, even though the standby current is low, the battery might discharge over time and in turn might be destroyed if it is not disconnected.

The SmokeDriver can be mounted in five ways. The MEMS sensor will detect the mounting orientation automatically (within the first 4 seconds of connecting it to the the battery). Mounting the SmokeDriver with its 6JR-connectors pointing up is not permissable.
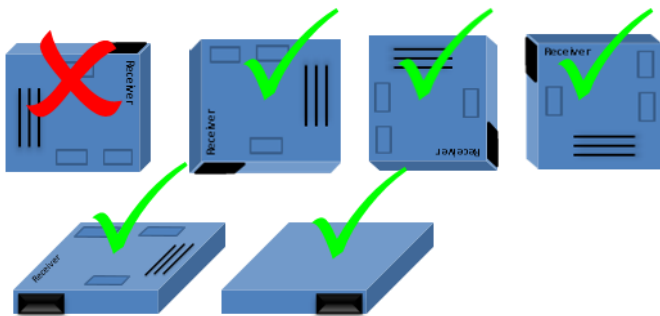
Connections:
The SmokeDriver has nine pins, 3xMPX on its top and 6xJR at the side. Each slot is clearly marked. The MPX/JR connections are equipped with reverse polarity protection. With the JR plugs you will find the negative pole situated on the bottom (closest to the circuit board).

MPX-connections:
The Smoke Pipe (Heating):
Please use the two MPX-plugs to connect the smoke pipes; use Port1 and Port2 for these connections. The cable diameter should be ca. 2-2.5 mm².

The Battery (6S – 10s Lipo):
The battery should be connected to the single MPX-plug. If you use self-manufactured battery cables please pay attention to the appropriate polarities. Plus and minus are clearly marked and additionally stamped into the plug itself.

JR-connections:
The Receiver:
The receiver should be connected to a free channel of the receiver with the enclosed patch cable. The negative pole (brown) of the patch cable should be closest to the circuit board.

AUX1 (optional):
The AUX1 slot is reserved for connections with a USB cable, BlueTooth adapter and telemetry. The SmokeDriver can be configured via BlueTooth and USB.

Fuel
The obligatory hopper tank with its oil sensor is connected here. The oil sensor will shut off the device if it detects air in the hopper.

LED
A status LED is already connected and signals the various operational states of the SmokeDriver. The LED will light up red, yellow or green.

The magnetic valve (optional)
The magnetic valve switches the pump from Wingtip-Smoke to Center-Smoke. In this operational state smoke can be produced behind the turbine or in the exhaust.

SmokePump (Pump):
This plug should be connected to the SmokePump. The SmokeDriver controls the output of the pump independently.

Initial Operation:
The GF-SmokeDriver will be activated by simply being connected to the LiPo battery.
The switch-on has three phases:

1. Connecting the LiPo battery (6S-10s)
The GF-SmokeDriver was developed for LiPo batteries with 6-12 cells. As soon as you connect the battery the GF-SmokeDriver will check the battery setup and signal the detected number of cells through the external LED (red). The LED will use the following light pattern:

- **6**S-Lipo   →   LED flashes red **1** time
- **8**S-Lipo   →   LED flashes red **2** times
- **10**S-Lipo   →   LED flashes red **3** times

Please make certain that the GF-SmokeDriver detects the correct battery setup since this will determine the discharge threshold. If a wrong number of cells is detected please check the battery voltage and recharge the battery.

2. Mounting Orientation
The GF-SmokeDriver has to identify its mounting orientation so that the force will be determined on the correct axis. Please let the model stand as quietly as possible while the MEMS sensor detects its mounting orientation. This will take approximately 3 seconds and will be signaled with a yellow LED.

3. Programming mode
After the battery setup and the detection of the mounting orientation, the GF-SmokeDriver will proceed to the programming mode. In this mode you can set up the following parameters:

- Force threshold for the smoke device to switch on in g (1g = 9,81m/s G-Force)
- The time you want the smoke device to continue to produce smoke after the set threshold has been underrun
- Pump revolution for the Center-Smoke (25%-100%)
- The utilized telemetry system

The SmokeDriver has already been programmed and can be used immediately. The pre-programmed values are 4g, 1sec., 50% and 0 (no telemetry).

You can also program the device via the transmitter; please use a proportional channel of your transmitter with the programming of -100% , 0% and +100%.
We also offer a USB cable to connect to a Windows-PC and a BlueTooth adapter to connect to a smart phone or tablet (Android/iOS) as optional accessory. Using this you can program the SmokeDriver through the SmokeSystems terninal.

⚠️ Programming with a PC or phone is only possible if there is no active received signal (receiver off).

If you program through your transmitter, the SmokeDriver has to be connected to the receiver and the receiver has to be switched on. In this case the LED will light up for 3 seconds. During this time you should bring the transmitter channel to the middle position to get to the programming mode. If the transmitter signal stays in the off position (-100%) the starting sequence will end and the pre-flight control for airing out the device will begin.

You can find a detailed programming guide in the "programming with the transmitter" manual.

Operating test:
For the first tests we recommend you disconnect the heating from the SmokeDriver. By doing so you will avoid burning the heating elements.

⚠️ **Heating up the smoke device without Smoke-oil can lead to the destruction of the heating elements. To protect the smoke device, the heating will be shut off automatically after 30 seconds if there is no change in the switch setting.**

The SmokeDriver needs the exact center position of the channel you have dedicated to the operation of the smoke device. Since this position depends on how the manufacturer of a transmitter defines this setting, we have allotted a wide range for the "center position."
The SmokeDriver is programmed to be ready for use. Please delete any programs which could interfere with the SmokeDriver from your transmitter. Adjust the setting to -100% and +60%. The center position should be at 0%. (It might be necessary to reverse the servoway if you are using Futabe, i.e. you have to adjust to +100% and -60%).

Please connect the complete SmokeDriver except for the heating. The pump can be tested directly out of the box. After the starting sequence is finished (LED –red, yellow, and green), please perform the following seven tests

	Schalterstellung	Impuls	Funktion
1	Bottom (-120)	<1300µs	reset the SmokeDriver
2	Top (+60%)	>1600µs	Pump on (valve switches, optional)
3	Center (0%)	1500µs ±<100µs	Pump off
4	Top (+60%)	>1600µs	Pump on (valve switches, optional)
5	Bottom (-120%)	<1300µs	Pump off, restart SmokeDriver (min. 0.5sec.)
6	Top (+60%)	>1600µs	The pump turns on after 30sec. delay
7	Bottom (-120%)	<1300µs	Pump off

If the pump works as described, your transmitter is programmed correctly, and the SmokeDriver is ready for use. The protective setting of the SmokeDriver ensures that the pump will not be turned on automatically when the receiver is switched on. Only when the channel is on -100% will the SmokeDriver be activated

The SmokeDriver recognizes four operating states: *Off, Standby, Smoke-ON* and *Center-Smoke*

Off, switch setting -100%:
The SmokeDriver is in standby. The heating and the pump are completely turned off, current consumption is minimal.

Standby / heating up, switch position 0% (center position)
In this position the evaporators will be heated up with reduced power. The pump is still off. The heating process will take 30 seconds, and is controlled by the SmokeDriver. The MEMS sensor is activ and is determining the g-force that is perpendicular to the wing constantly. As son as the force reaches a preprogrammed threshold the smoke device will automatically activate. Once this threshold is underrun the smoke device will continue to run for a preset amount of time and then switch off and return to standby.

Smoke-ON, switch setting +10 to +90%
As soon as the signal from the transmitter climbs past 10% and the heating up phase has ended (30 seconds), the heating will be increased to 100% and the pump will be added proportionally. The pump output will increase linearly to the transmitter signal from 10% to 90%. You can adjust the output with the transmitter via limiting your chosen channel. Usually, a pump output between 40% to 60% will be sufficient. Smoke production will stop automatically after 30 seconds. You can always reactivate the smoke by using the center position (switch setting on standby and then on Smoke-On).

Center-Smoke-ON, switch setting >90%
If you are using our optional magnetic valve system and you have also mounted the smoke device so that smoke can be produced through the turbine or the exhaust, this will be activated now. The Smoke-EL smoke pipes will be heated with low power, the MEMS sensor is inactive. The SmokePump is now working according to the value you determined in the programming mode (pre-programmed at 50%). The magnetic valves will divert the smoke oil to the turbines or exhaust instead of the original smoke pipes. You can accomplish this switch setting best by using a second toggle switch and a mixer on the smoke channel. Please return to standby after turning the center smoke off.

Pre-flight check / Airing the model
To ensure that the whole device is completely aired before every flight, the SmokeDriver is outfitted with a pre-flight program that has to be run before each flight. When switching the SmokeDriver on for the first time, the heating will always be deactivated.

Switch on the pump first (switch setting "Smoke-ON") and wait until the pump has started to deliver SmokeOil to the evaporators. You can now adjust the amount of oil you need with the appropriate valves. The amount is correctly adjusted once a small rivulet of oil comes out of the evaporator, while single drops of oil are not sufficient for the device to work properly. You can disrupt the pump by turning the switch to the center position.You can now increase or decrease the pump output through the switch setting of the transmitter. After you have correctly adjusted the oil output, please turn off the smoke device (switch setting "Off"). The Smoke-EL is now ready for use.

Lipo-Supervision:
Our smoke device Smoke-EL is powered with the GF-SmokeDriver on a 6s-10s Lipo battery. The recommended capacity for the battery (for approximately 90 seconds Smoke-ON) depends on the smoke device you are using.

Smoke-EL	Lipo Capacity
S	1100 mAh from 6s LiPo
S Duo	1600 mAh from 8s LiPo
S Twin	1600 mAh from 8s LiPo
S Jet	2400mAh from 8s LiPo

The GF-SmokeDriver is usually connected directly to the main battery. The battery capacities above refer to a setup where a seperate Smoke battery is used.

The Lipo-Supervisor will turn off the whole device if the battery voltage falls below **3.3 volt per cell** (19.8V with 6s, 26.4V with 8s, and 33V with 10s batteries). The SmokeDriver will be reset when the battery is disconnected. Both the power for the heating elements and the pump originate from the smoke battery, so that the receiver battery will not be burdened. Be aware however, that the standby voltage of the SmokeDriver is 0.04A and can discharge the battery. To avoid damage or even destruction of the battery, please disconnect the battery after each use. Also, please consider the extra load of approximately 700Watt per evaporator that the the main battery has to handle on top of its usage as power source.

For further tips on how to adjust the smoke device, please watch this video:
http://youtu.be/wSig1LeaJJc

Fuel-Sensor
Since running the device without Smoke-oil can lead to the destruction of the heating elements, controlling the oil is necessary during automatic usage of the MEMS sensor. The fuel sensor is integrated into the hopper tank. The hopper should be free from air. If the sensor should detect an air bubble in the hopper (for longer than 3 seconds), it will shut off the smoke device completely. A flashing red LED will signal a shut-off due to air in the tank.

Programming with the transmitter
Please use a proportional channel on your transmitter to program the SmokeDriver. Whether you want to use a sliding controller or a control dial is at your discretion. If you do not have a suitable controller on your transmitter, you can also use a joy-stick.

When programming with the transmitter you have to **always adjust all 4 parameters**. Even if you wish to change only one paramter you will need to readjust all four.

When you connect the battery the SmokeDriver runs various tests and will offer the programming mode for 3 seconds (LED = green). Set your switch to the center position during this time (3 seconds green LED) and leave it there. You have now reached the programming mode and can put in the first parameter.

Threshold G-Force:
The LED shows the programmed value (preconfigured at 4g).
After signalling the programmed value the LED will light up green for 2 seconds.
You can change the value by pushing the sliding control further from the center towards the top. The actual value will be shown immediately with the red LED.
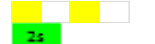The threshold G-Force value can be determined between 2g and 7g. To permanently set a value push the sliding control to its lowest position (-100%) while you see the green LED flash for 2 seconds.

The LED now flashes (red/green) and signals the switch to the next parameter. Bring the channel back to the center position to start programming the next parameter.

Timer for additional smoke production after falling below the threshold
When you fly a tight curve or a looping the g-force will decrease shortly before the flight manouever has been completed. With the GF-SmokeDriver you can program additional smoke production time to ensure that smoke will be produced until the completion of the manouever. To set the value please return the channel to its center setting.
The actual value will be shown with a yellow flashing LED.
After signalling the programmed value the LED will light up green for 2 seconds.
You can change the value by pushing the sliding control further from the center towards the top. The actual value will be shown immediately with the red LED.
The timer can be set for 0 seconds to 3seconds. To permanently set a value push the sliding control to its lowest position (-100%) while you see the green LED flash for 2 seconds.

The LED now flashes (red/green) and signals the switch to the next parameter. Bring the channel back to the center position to start programming the next parameter.

Pump revolution for the Center-Smoke
When you switch to center-smoke (using our optional magnetic valve), the pump output is independent from the switch setting of the transmitter You have to connect the pump to the SmokeDriver to adjust the pump revolution (preset value is 50%).
You can change the output by pushing the sliding control further from the center towards the top. The pump will now run with the determined value and the LED is off.
After signalling the programmed value the LED will light up green for 2 seconds.
The pump output can be adjusted from 25%-100%. To permanently set a value push the sliding control to its lowest position (-100%) while you see the green LED flash for 2 seconds.

The LED now flashes (red/green) and signals the switch to the next parameter. Bring the channel back to the center position to start programming the next parameter.

Telemetry System (with optional TeleConverter)
The final parameter chooses the protocol for broadcasting the telemetry. Since every manufacturer uses their own design there is no uniform format for data transmission.
The preset value for this paramter is no telemetry (LED off). You can choose either of the following: 0= off (default), 1=Jeti, 2=Veatronik, 3=Spektrum, 4=Multiplex, 5=Hott und 6=JR. Please refer to the manual of your TeleConverter to find out which systems are supported.
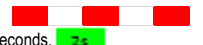
The actual value will be shown with a yellow flashing LED.
After signalling the programmed value, the LED will light up green for 2 seconds.
You can change the value by pushing the sliding control further from the center towards the top. The actual value will be shown immediately with the red LED.
To permanently set a value push the sliding control to its lowest position (-100%) while you see the green LED flash for 2 seconds.

Programming is now completed and the chosen values are saved in the SmokeDriver. The threshold value for the G-Force will finally be shown via the green flashing LED. The SmokeDriver will now switch to pre-flight control (airing of the model).

Programming range
1. G-Force
2. Timer
3. Pump revolution
4. Telemetry System

Switch to the next parameter
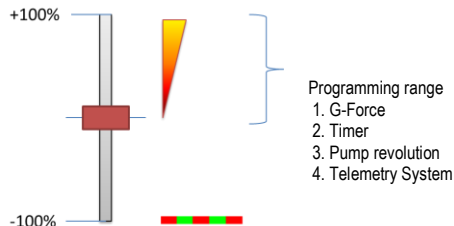
You can use a Windows-PC, a tablet or a smart phone for quick programming (especially for single parameters). The required USB cable and the BlueCom adapter can be purchased with us as optional accessories. The software is available as a download.

Safeguarding equipment

The GF-SmokeDriver has extensive safeguarding equipment. Since the possible operating voltage might reach 50V, severe sparks can be emitted when the battery is connected. To protect the battery, the GF-SmokeDriver is equipped with an automatic safety fuse which will result in a one second time lag when turning the device on.
After deconnecting the battery, please wait a few seconds before you reconnect the battery as the safety fuse needs this time to reset itself.

Additionally, the GF-SmokeDriver will continually monitor possible malfunctions during operation and will react before it might be damaged. If a forced switch-off occurs, the SmokeDriver will stay deactivated even if the malfunction is no longer apparent. The flashing signal will continue until the battery is physically disconnected to ensure that you will be able to read the error code after landing.

LiPo-Supervision
The LiPo-supervision has already been discussed above. Depending on the detected battery setup, a forced shut-off will occur at an end-of-discharge voltage of 26.4V, 33V or 39.6V. The GF-SmokeDriver will indicate a forced shut-off through a flashing signal on the internal and external LED.

| ■ | | | | | | | 2sec. Pause | ■ | | | | | | |

LED flashes once: The LiPo voltage fell below 3.3Volt per cell.

Temperature supervision
The GF-SmokeDriver is able to process an electrical capacity of 2000Watt. Despite choosing our material with care, loss of power is inevitable, especially in the form of heat within the components. To avoid overheating, and in turn the possible destruction of the SmokeDriver, we equipped the device with a temperature monitoring system that will shut off the smoke device before a critical temperature is reached. However, please make sure that the SmokeDriver is cooled appropriately to avoid a forced shut-off in the first place.

| ■ | | ■ | | | | | 2sec. Pause | ■ | | ■ | | | | |

LED flashes twice: The temperature monitoring system shut off the device.

Power limitation to the pump
Usually, the pump needs less than 3A power. If the pump needs more power, the choke valves are either turned too far, or the evaporators are strongly sooted and have to be cleaned. The GF-SmokeDriver monitors the power needs of the SmokePump and will shut it off if it is too high.

| ■ | | ■ | | ■ | | | 2sec. Pause | ■ | | ■ | | ■ | | |

LED flashes three times: The power for the pump has exceeded its defined maximum.

Internal Voltage Supervision
The voltage of the the LiPo battery is regulated within the SmokeDriver to an internal operating voltage which produces a constant voltage for the SmokeDriver. If the internal voltage falls below its defined limit, the GF-SmokeDriver will shut off the smoke device.

| ■ | | ■ | | ■ | | ■ | 2sec. Pause | ■ | | ■ | | ■ | | ■ |

LED flashes four times: The internal voltage fell below its defined limit.

FailSave / no signal from the receiver
To make sure that the smoke device will be shut down in case of loss of the transmitter signal, you should add a FailSave channel. Program this channel to turn the smoke device into its OFF setting. Doing so will decrease the risk of fire in case of a missing signal. If the SmokeDriver does not recognize a valid RC signal for more than 3 seconds it will shut down and signal this with a LED that flashes five times.

| ■ | ■ | ■ | ■ | ■ | 2sec. Pause | ■ | ■ | ■ | ■ | ■ |

LED flashes 5 times: no signal from the receiver for more than 3 seconds.

Fuel sensor / no oil left
The oil sensor detects air in the hopper and shuts the device down. If the sensor detects air in the hopper, it will permanently shut down the smoke device. This forced shut down will be signaled with a LED that flashes 6 times.

| ■ | ■ | ■ | ■ | ■ | ■ | 2sec. Pause | ■ | ■ | ■ | ■ | ■ | ■ |

LED flashes 6 times: air was detected in the hopper for more than 3 seconds.

Safety Fuse
Additionally to our internal safeguards, we recommend using a sefety fuse for the battery feeder cable. For each SmokePipe you should calculate 15-20A. You can purchase a holder for the fuse in the accessories section in our webshop.

Technichal Data:

Operating Voltage	6S-10s-Lipo (22-43Volt)
Current Load (Heating)	40A continually (70A short-term)
Current Load (Pump)	3A (max)
Standby	0,04A (<u>Warning: Disconnect the battery!</u>)
Temperature range	0°C (32°F) to 45°C (113°F)
Weight	ca.50g
Connectors	JR and MPX
Accessories	Magnetic valve
	Hoppertank with oil sensor
	USB-cable
	BlueCom-Adapter

We hope you will have great flights and "many happy landings."
Sieverstedt, 2016

Smoke Systems

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