Lemon RX Microbrick: Basic Manual

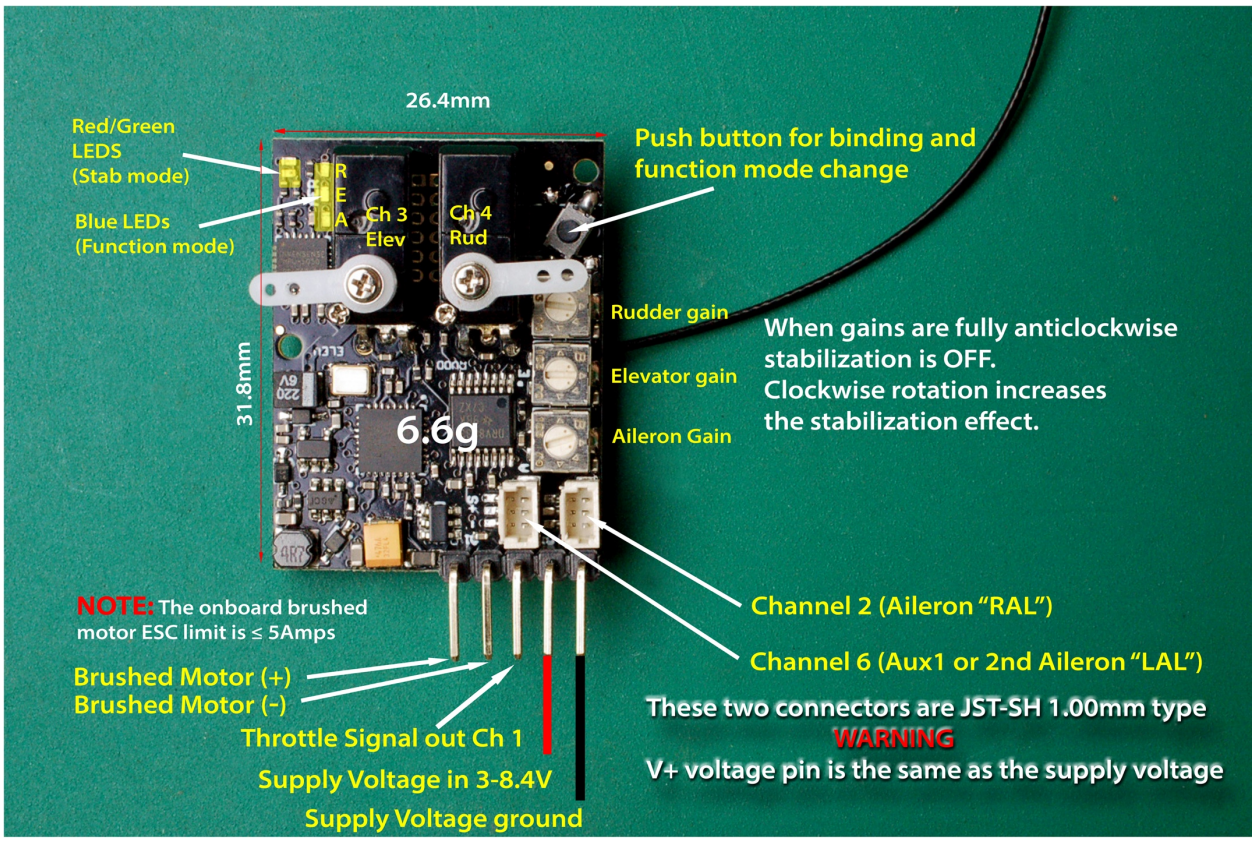
Introduction

The Lemon Microbrick combines a full-range DSMX™/DSM2™ compatible receiver with two onboard ultramicro servos and a 5A brushed speed controller in a package that weighs under 7g. It has connectors for two external servos and can also support a separate brushless ESC. Finally, it provides optional three-axis stabilization (similar to AS3X™). It is an ideal solution for models up to about 250g, including many light weight UMX type planes.

This *Basic Manual*, prepared by two enthusiastic users of Lemon equipment, jj604 and Daedalus66, is intended to provide the essential information about the Microbrick. It expands upon the instruction sheet provided by Lemon RX (which readers should also consult). Our separate *Reference Guide* provides additional information likely to be of assistance to some users.

The Microbrick can be used with almost any DSMX™/DSM2™ compatible transmitter, but for fullest access to its features, a modern programmable transmitter is desirable. This manual assumes that a Spektrum Generation 2 transmitter, such as the DX6e, DX6, DX8G2, DX8e, DX9, NX6, NX8, iX12, etc. is used. Advice on use with other equipment, such as DX6i, DX8G1, RadioMaster TX16s or an OpenTX/ErSkyTX transmitter fitted with a DSMX™/DSM2™ compatible module are provided in the *Reference Guide*.

Lemon Microbrick Overall Layout (connector type may vary)



Main Features

Channels

The Microbrick has **five available flight control channels** in the usual Spektrum order, plus two internal stabilization control channels:

Channel 1: Throttle (onboard 5A brushed throttle or external signal for a brushless ESC)

Channel 2: Aileron (RAL in dual setups); OR Rudder in Rudder Steering mode

Channel 3: Elevator onboard servo

Channel 4: Rudder onboard servo (channel not used in Rudder Steering mode)

Channel 5: On/Off control of stabilizer (internal only)

Channel 6: Aux1 (LAL in dual servo aileron setups)

Channel 7: Not available

Channel 8: Master gain control of stabilizer sensitivity (internal only)

Connections

As shown in the photo on page 1, five solder pads are available on the circuit board. These provide ground (V-), positive power in (V+), throttle signal out for a brushless ESC, and two pads to power a brushed motor from the internal ESC. Wires can be soldered directly to the pads or header pins may be soldered in place to accept a regular servo connector.

The Microbrick is available in several configurations which differ only in the connection arrangements. Depending on the configuration ordered, there may be a power connector cable soldered to ground and V+. On some versions a small 3 pin connector is soldered to the two brushed motor pads (see photo on page 4). The leftmost pin (1) is connected to Motor+, the other two (2, 3) to Motor–. An E-Flite UMX motor connector can be plugged directly into 1 and 2.

Power

Power input to the Microbrick is most commonly provided in one of two ways:

1. For a brushed motor, a single LiPo cell (1s) is connected to Ground (V-) and V+. This powers the receiver and servos. The motor is powered through the built-in 5A brushed ESC.
2. For a brushless motor, an external ESC is connected to Ground (V-), V+ and Throttle Out. It is most commonly fed by a two cell (2s) battery and its BEC (battery eliminator circuit) provides 5.0v to the receiver and servos.

Warning: Since neither the Microbrick nor an external ESC has reverse voltage protection, it is vital to ensure correct supply polarity.

Other possible power configurations and voltages are discussed in the *Reference Guide*.

External Servo Connections

Channels 2 (Ail) and 6 (Aux1) servo outputs are available on the two JST-SH 1.00mm 3 pin connectors.[1] In a dual aileron servo setup, both channels are used, while in a single aileron servo (or dual servos with Y-cable) setup, channel 6 is available for another function, such as flaps or retracts.

[1] These are the same connectors as used on Spektrum linear servos and the HobbyKing HK5320S and HK5330S rotary 1S servos (the HK5320 and HK5330 servos have incompatible Molex Picoblade 1.25mm connectors).

With a 1s brushed motor setup, the voltage provided to the servos is a maximum of 4.2v. With a 2s brushless setup, the voltage to the receiver is determined by the ESC and is normally 5.0v.

Failsafe

If signal is lost, no control pulses are sent to the servos, which normally then stay in their last commanded position. The lack of pulses causes the motor to stop after a brief delay.

- With the onboard brushed speed controller, this behaviour is built in.
- With an external brushless electronic speed controller, the ESC should cut power to the motor. Not all small ESCs will do this, however, so you should test yours to be sure.

Given the exceptional range of the receiver, loss of signal is highly unlikely.

Low Voltage Warning

On a brushed 1s setup, the motor will begin cutting in and out when the voltage drops to 3.2v.

On a brushless setup, the ESC normally provides a low voltage cutoff (LVC) function.

Stabilization

The Microbrick is equipped with optional three-axis rate stabilization (similar to AS3X™), which smooths out flight in turbulent air.

Recognizing that many people will only use the Microbrick indoors or in calm conditions, and thus will not require stabilization, this manual first addresses use of the Microbrick as a simple unstabilized system in *Setup 1: Unstabilized*.

All details relating to stabilization are provided in the section *Setup 2: Stabilization Enabled*.

Mounting the Microbrick

If stabilization is not to be used, the Microbrick may be mounted in any orientation, including on edge or at an angle to the line of flight, that provides a good line from the onboard servos to the control surfaces.

If the Microbrick is to be used in stabilized mode, it must be mounted squarely and securely in level attitude, normally with the onboard servos at the back in relation to the direction of flight. It can be mounted upright or inverted. It should not be mounted crosswise, on edge or at angle.

Be aware that the underside of the circuit board is easily damaged. Any mounting method should avoid applying stress to the small PC board on the underside. It is therefore generally preferrable to use the two holes in the circuit board for mounting, rather than glue or mounting tape.

Binding

To bind the Microbrick, press and hold the button while powering up the unit.[2] The red LED on the bottom of the unit will begin to flash rapidly, indicating that the receiver is in bind mode. Release the button.

Now put the transmitter into bind mode and follow the appropriate bind procedure. Bind is achieved when the red LED on the underside stops flashing and changes to solidly ON. Check that the onboard servos are responsive.

If you have trouble binding, move the transmitter farther away. Binding is usually most reliable at 1-2m but may occasionally require more distance.

[2] Unlike UMX™ and many other small models, the Microbrick does not initiate Autobind when powered up.

Setup 1: Unstabilized

If Stabilization is disabled in the Microbrick, when setting up such features as V-tail, Elevons and Dual Ailerons you have a choice between: (a) configuring the receiver internally and (b) using normal transmitter mixing. The instructions below focus on internal settings of the receiver; for advice on mixing in the transmitter, please review the appropriate section in the *Reference Guide*.

Deactivating Stabilization

There are several ways to turn off Stabilization in the Microbrick.

a. Turn the three gain pots on the receiver fully anticlockwise.
b. On an 8+ channel transmitter, set channel 8 (Aux3) to –150%.
c. Set channel 5 to 100% for Stabilizer OFF mode (it must remain OFF at all times).

If you do not fully disable stabilization, you MUST follow the instructions in *Setup 2: Stabilization Enabled.*

Basic Configurations

Four Channel: Throttle, Aileron, Elevator, Rudder

For models using four channels to control basic flight controls, set up is very straightforward.

A single aileron servo, or a Y-cable with two servos, is plugged into the channel 2 external servo connector. See photo on page 1 to identify the connector.

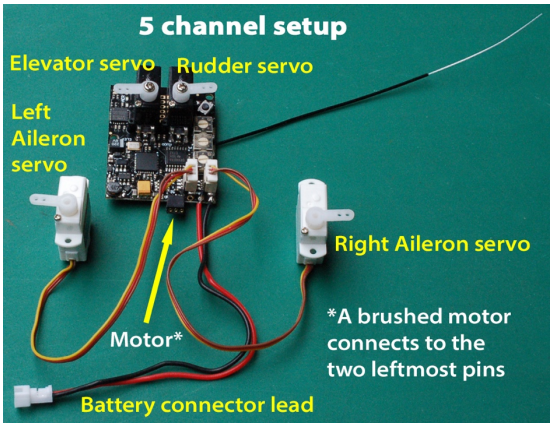
If a brushed motor is used, it is connected to the two brushed motor pads, or to the small connector shown in the photo below. It will then use the onboard brushed ESC.

For a brushless motor, an external ESC is connected to the appropriate three pads or header pins on the circuit board to supply power to the Microbrick and to control the motor through throttle output (channel 1). See photo on page 1 for connections.

Five Channel: Throttle, Dual Aileron, Elevator, Rudder

For models using five channels to control the four basic flight control functions, set up is the same as above, except that aileron servos are plugged into both the external servo connectors: channel 2 (RAL) and channel 6 (LAL).

The Microbrick should be programmed for Dual Aileron as described below (or the transmitter can be set to Dual Aileron Aircraft/Wing type).



V-Tail

In this configuration, the onboard servos use a mix of inputs from channel 3 (Elevator) and channel 4 (Rudder) to drive the two tail control surfaces. Rudder input causes the servos to rotate in the same direction for yaw, while elevator input moves the two servos in opposite directions for pitch.[3] See Mixer Settings for details.

An external servo, or two servos on a Y-cable, can be used for aileron, plugged into the channel 2 connector. Alternatively, both connectors can be used, with a Dual Aileron setup programmed in the transmitter.

[3] Remember that rudder action with a V-tail is the opposite of aileron action. For left yaw, the left control surface goes down and the right control surface goes up.

Elevon (Delta Wing)

In this configuration, each of the two control surfaces (elevons) is operated by one of the onboard servos, using a mix of channel 2 (Aileron) and channel 3 (Elevator). Aileron stick input causes the servos to rotate in the same direction for roll, while elevator input moves the two servos in opposite directions for pitch. See Mixer Settings for details.

An external servo plugged into the outer JST connector can be used for rudder on channel 4.

Three-Channel (Rudder Steering)

When the model uses the onboard rudder servo as the primary turn control in a TRE (Throttle, Rudder, Elevator) setup, the aileron stick can be used for steering. To this end, the Microbrick can be configured so the onboard rudder servo is controlled by the aileron stick on channel 2. See Mixer Settings for details.

Alternatively, an external servo can be plugged into channel 2 and used to drive the rudder.

Lights (top left corner in the photos)

The green LED when ON indicates normal receiver operation.

The red LED when ON indicates that stabilization is inactive.

The three blue LEDS indicate the mixer status of the receiver.

Mixer Settings

The configurations of the blue lights indicating the current mixer setting are summarized in the table below.

With transmitter and receiver ON, any blue lights showing at this point are indicating stabilization direction and can be ignored if stabilization is OFF.

Normal setting has aileron (channel 2) driving an external servo (or two servos on a Y-cable), with elevator (channel 3) and rudder (channel 4) driving the onboard servos.

V-tail has the onboard servos driven by a mix of channels 3 and 4 to provide elevator and rudder action.

Elevon has the onboard servos driven by a mix of channels 2 and 3 to provide aileron and elevator action.

Rudder Steering shifts rudder control to the aileron stick for use in a three-channel (TRE) setup.

Dual Aileron feeds aileron input from channels 2 and 6 to the connectors shown in the photo on page 1. If this mode is used with a Spektrum transmitter, the Aircraft/Wing Type should be Dual Aileron.

Changing the Mixer Setting

To change the Mixer setting, hold the receiver push button for a little over 10 seconds[4] until all three blue LEDS start to flash. Quickly release the button. The blue “A” LED (LED1) should be lit, indicating **Normal** mix.

To change to **V-tail** mix, within 5 seconds press the button again and release. The blue “E” LED should be lit.

To select **Elevon** mix, within 5 seconds press and release again. The blue “R” LED should be lit.

For **Rudder Steering** (Rudder on the Aileron stick), proceed as above, pressing the button repeatedly until the blue “E” and “R” LEDs are lit.

For **Dual Aileron**, hold the button for a little over 18 seconds until the blue “A” and “R” LEDs are flashing. Release and the blue “E” LED should be flashing, while the “A” and “R” LEDs should be ON. Press briefly within 5 seconds to change between single and dual ailerons.

At each stage the pattern of blue LEDs briefly reflects the mix selected (see table below).

[4] Counting “One thousand, two thousand, ….” is accurate enough for this purpose.

LED			Mixer Function
A	E	R	
◉			**Normal** wing and tail. Aileron on channel 2
	◉		**V-Tail**. Surfaces connect to onboard servos operated by channels 3 and 4
		◉	**Elevon**/Delta Wing. Surfaces connect to onboard servos operated by channels 2 and 3
	◉	◉	**Rudder Steering**. Channels 2 and 4 swapped. Aileron stick operates onboard rudder servo
◉		◉	**Dual Aileron**: Activates Channel 6 (LAL). Requires Dual Aileron setup in transmitter.

Note: Mixes can also be performed in the transmitter, but V-Tail or Elevon in transmitter must only be used if stabilization is disabled. See *Reference Guide* for additional information.

Servo Swap

The photo on page 1 shows the normal assignment of the two onboard servos. Servo Swap allows their functions to be interchanged. In the photo can be seen the three blue LEDs involved in changing the setting.

Start by testing the Microbrick to determine whether servo swap is actually required for your installation. If change is required, proceed as follows:

1. With the transmitter OFF, press and hold the bind button while applying power to the Microbrick. This will cause the red bind indicator light to flash (ignore).

2. Continue to hold the button until the blue "A" LED flashes (about 10-12 seconds).

3. Immediately release the button. The blue LEDs "A" and "R" should be flashing for Servo Swap mode.

4. Within 3 seconds, briefly press the bind button once to enter Servo Swap.

5. If the "A" LED is now ON, the two functions are swapped (left in the picture on page 1 is now rudder, right is elevator). If the LED is OFF, they are in normal configuration as labelled in the picture.

6. Power down the receiver.

7. Power up transmitter and receiver and verify that the two servos work correctly.

Setup 2: Stabilization Enabled

The Lemon Microbrick is equipped with optional rate (AS3X-type)[5] stabilization to counteract wind turbulence and smooth out flight. This is the same type of stabilization as provided by the Lemon Stabilized Receiver and by the Lemon StabilizerPLUS when in Gyro mode. The Microbrick does not provide self-leveling.

Activating Stabilization

To enable stabilization in the Microbrick, first ensure that the three gain pots are set to about mid-range (12 o'clock), as shown in the photos.

On the transmitter, set up a switch on channel 5 (Gear) for Stability Mode on/off. For example, on a generation 2 Spektrum, you may want to use Switch A. The switch can be 2-position or 3-position; if the latter, positions 0 and 1 will be OFF and position 2 two will be ON. This can be reversed if desired.

The red Stability Mode light illuminates to indicate Stability OFF. Thus, when the red and green lights are both lit, Stability is OFF. Stability is ON when only the green light is lit.

For transmitters with eight or more channels, channel 8 controls Master Gain. It should be adjusted by a knob or slider, such as RKnb on a Generation 2 Spektrum transmitter. Initially, set the control to midpoint (0%), which corresponds to a gain multiplier of 1x (i.e., no effect). Full anticlockwise (-100%) gives practically zero

[5] "Rate stabilization" has nothing to do with dual rates. They just happen to share terminology.

gain,[6] while full clockwise (100%) gives approximately 2x gain. For transmitters with seven or fewer channels, Master Gain is fixed at 1x.

When stabilization is active, with gain turned up, the servos may jitter and should move when the Microbrick is disturbed. When the brick is sharply tilted or rotated about any axis, the corresponding servos should displace briefly, then return to neutral.

Stabilization Status

Stabilization, when activated, normally applies only to the three primary flight control channels: Aileron (channel 2); Elevator (channel 3) and Rudder (channel 4). When the Dual Aileron mix is selected, both Right Aileron, (channel 2) and Left Aileron (channel 6) are stabilized.

When the Rudder Steering mix is activated with Stabilization ON, Elevator (3) and Rudder (4) are stabilized.

The following table shows how, when turned ON, stabilization applies to the various mixes.

LEDs			**Stabilization Enabled with a Specific Mix**
A	**E**	**R**	
◉			No Mixing: Normal wing and tail. Channels 2, 3 and 4 stabilized
	◉		V-Tail Mix. Channels 2, 3 and 4 stabilized
		◉	Elevon/Delta Wing Mix: Channels 2, 3 and 4 stabilized
	◉	◉	Rudder Steering Mix: Aileron stick operates rudder servo. Channels 2, 3 and 4 stabilized
◉		◉	Dual Aileron Mix: Channels 2, 3, 4, and 6 stabilized. Use Dual Ail in transmitter

Stabilization Directions

Once the Microbrick is mounted in the model, **set control directions** using transmitter reversing as necessary.

Next, it is essential to ensure that **stabilization** works in the correct direction on each channel.[7]

Turn up all the gain pots to maximum (fully clockwise) to make stabilization motions more detectable. For a transmitter with eight or more channels, make sure the Master Gain is set to at least the midpoint (0%).

Check stabilization directions, using sharp rotational movements of the model, as follows:

Rudder: Hold the plane by the nose and swing the tail sharply to your left and right. The rudder should move briefly in the direction of the swing. If you swing the plane to your left, the rudder should move to your left briefly. Once the swing reaches its maximum and reverses, the rudder should neutralize, then move to your right as the plane swings to the right.

Looked at from the point of view of the plane, swinging it to your left is causing the plane to yaw to the left. The stabilizer tries to oppose the disturbance with a brief shot of right rudder (your left).

Elevator: Similarly, lift and lower the tail very quickly while holding the plane by the nose. When you lift the tail suddenly, the plane adopts diving attitude; the stabilizer should thus give a quick shot of UP elevator as correction.

Aileron: To test roll stabilization, hold the plane by the nose and twist back and forth to bank the wings. When the plane rolls to its right, the right aileron should go DOWN and the left aileron should go UP to oppose the disturbance.

When finished, set gain pots back to their centred positions.

[6] For truly zero gain, set channel 8 to –150%.

[7] Unlike SAFE models, Lemon stabilized products allow reversal of channels in the transmitter because the receiver allows reversal of stabilization.

Changing Stabilization Direction

If the any of the control surfaces goes the wrong way, change the direction as follows and test again.

Aileron Stabilization Reversing

Hold the button for just over 1 second. Blue LED "A" will flash. Release the button and the other two LEDs will flash. To change stabilization direction on the channel, press the button briefly within 5 seconds. LED1 will become solid, while the other two LEDs will flash. The stabilizer will resume normal operation when flashing ceases. To undo the change, repeat the operation.

Elevator Stabilization Reversing

Hold the button for just over 3 seconds. Blue LED "E" will flash. Proceed as above.

Rudder Stabilization Reversing

Hold the button for just over 5 seconds. Blue LED "R" will flash. Proceed as above.

Cancel All Reversals

Hold the button for just over 7 seconds. All blue LEDs will turn OFF. Release the button.

Adjusting Gain

Set the gain pots on the Microbrick to midpoint (12 o'clock). Set Master Gain, if available, to midpoint (0%).

Use the channel 5 switch (Stabilization on/off) to turn OFF stabilization. This is signalled by both the red and green LEDs being ON (when stabilization is ON, red LED is OFF).

Fly the model to ensure that the controls are working properly and that it is correctly trimmed.

Switch ON stabilization and observe the behaviour of the model. The model should fly more smoothly and be less affected by turbulence than with the switch OFF.

If the model reacts unusually, switch off stabilization, land and correct the problem.

If the model displays oscillation on one or more axes, turn down Master Gain by 1-2 "hours". If Master Gain is not available, land and reduce gain on the relevant pot (anticlockwise). Most commonly, the Aileron gain pot will need to be turned down.

See the *Reference Guide* for another view on checking stabilizer directions and for further details on optimizing gain settings.