

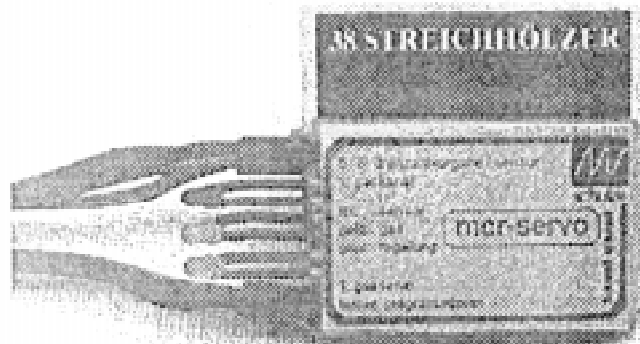


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**mcr-servo** (preliminary translation)

## **Rate of revolutions regulator (governor)**

**Date of issue: 11 NOV 1997**



The mcr-servo is a high-class regulator which combines high functionality with easy use.

### **A) General warnings:**

Before you switch on your receiver and/or start your engine, check that:

- Your transmitter is turned on and the throttle channel is positioned at STOP.
- Your transmitter is the only one using your frequency.

Also:

- Electronic devices should always be kept dry, and also devices which got wet and had been dried again can malfunction because of verdigris.
- Don't push or press the regulator.
- These regulators are designed for use only in models. Their use in mancarrying flight equipment is forbidden!

## **B) Special warning notes:**

- Before turning off your receiver, be sure to have turned off the engine so it can't start accelerating.
- Make sure your engine runs cleanly in all throttle positions and that there is no play within your linkage rods. Use a faster servo for the throttle channel than for elevator, aileron and pitch, so that corrections can be made without big differences in the rate of revolutions.

## **C) Range of use and attributes**

The mcr-servo is a real regulator and made especially for fuel-engine-helicopters. It uses an impulse connector for the throttle servo.

The IS-rpm of the rotor is checked on by a sensor and translated into control signals by the regulator, so that the rate of revolutions can be kept almost constant.

- This regulator is designed with a magnetfield-sensor which receives the rate of revolutions-information of the three magnets mounted on the mainrotor shaft.
- There is an additional channel plug for radio-controlled nominal-rpm-setting (also possible to set while flying) or to turn off the regulation (bypass-mode).
- The regulator is equipped with three LEDs for regulator setting and function control of the rate of revolutions-sensor.
- A push-button is used to program the regulator.
- The regulator is shrinked in clear plastic.

## **Explanation of words used**

rpm: This is often used in the text as an abbreviation for "rate of revolutions".

rpm-setting: This is an additional channel which is needed for this regulator to be able to run in regulation-mode with a certain rate of revolutions. If this channel is not plugged in, the regulator works in bypass-mode. With this channel the nominal-rpm (900-2000rpm) is defined for regulation-mode.

## **D) Way of work**

### **1) Bypass-mode only:**

As long as the rpm-setting is OFF (AUS) (or the rpm-setting channel isn't plugged in), the regulator conducts the signal unchanged directly to the throttle servo.

The helicopter's basic adjustments have to be made in bypass-mode.

Be careful when switching on the IDLE-UP-curve: in bypass-mode the servo signal follows exactly the throttle channel.

The green LED is off in bypass-mode.

### **2) Switching to regulator-mode:**

If the rpm-setting passes a value of 5%, the throttle-channel passes the pretaught minimum throttle value or if the speed of the mainrotor reaches at least 800 rpm, the regulator switches

from bypass-mode to regulator-mode. The automatic, soft up-regulation indicates the takeover-point. From this moment on, the throttle stick has no more direct control of the rpm. The green LED turns on as soon as the regulator has switched to regulator-mode.

### 3) Switching back to bypass-mode:

- Either you reduce the rpm-setting to below 5% or
- you pull back the throttle/pitch stick to below minimum throttle. The rpm sinks back to the value according to the stick position

**Attention:** because the IDLE-UP-curve should be a bit above the minimum throttle value, it is not possible to unwillingly switch the regulator back to bypass mode while flying.

- or a reduction of rpm to below a certain value (for example mechanical blockage)
- or the throttle channel, the rpm-setting channel or the magnet sensor doesn't send any more signals (wire break).

In any of these cases the green LED turns off.

### 4) Rpm-setting:

With the rpm-setting channel a helicopter-typical nominal-rpm-setting should be defined. This can also be corrected while flying (hover- or speedflight-setting).

### 5) Program push-button

The regulator is equipped with a push-button to „teach“ the sticktravel and direction of the transmitter.

## **E) How to install:**

The installation of the regulator is not as complicated as one might think when reading this instruction manual:

- Installation of the magnet-sensor, the magnets (right side up!) and the regulator. See **F)**
- Saving the minimum- and maximum-values of throttle channel and rpm-setting. See **G)a)**
- Testflying the relation of throttle-pitch, just as you're used to in bypass-mode. Rpm-setting OFF (AUS)!
- Taking over the best rpm-rate to the rpm-setting. See **G)d)**
- finished

Now, for one step after the other, do the following:

## **F) Mounting**

### 1) Sensor/Magnets

**IMPORTANT:** The mounting and installation direction of the sensor is not as you may like!

Before mounting, the active side of each magnet has to be figured out by testing with the sensor. To do this, first connect the regulator with the sensor, then the regulator with the receiver. When you hold a magnet near the sensor head, the red LED lights up only, when the appropriate side of the magnet is held opposite the sensor. In case the LED doesn't light up, you either have to turn the sensor or the magnet. Mark the sides of the magnets that fit with the sensor.

The sensor is on both sides, one side for the northpole, the other for the southpole, equally sensitive. If you have a Graupner/Heim system, the three magnets have to be glued into the holes in the main gear on the mainrotor shaft (use f.e. silicone). With other systems you may have to drill holes into the main gear (5,1mm diameter, 1,5mm deep, exactly 120° appart from each other). Don't just stick them flatly to the main gear because of safety- and accuracy-reasons. The sensor (by Graupner/Heim systems) can be put into a U-formed placement in the sidepieces of the helicopter and then be shrinked to there with 7.5mm plastic rings. When using another system, you should mount the sensor on an aluminum anglepiece or on a piece of pine-wood and install it about 1-2mm above the magnets.

## **G) Adjustment:**

With the Rotary-Select way of adjustment it is possible to use the regulator in an already flown helicopter without having to change any linkage rods or servo-reverse data!

Take note that the hover position should not be achieved with full power, because then there's no more power left to hold the rpm constant when having more pitch.

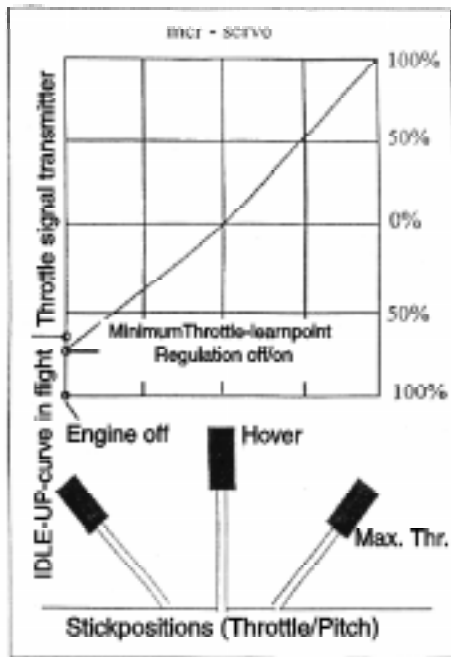
This has to be made sure of by chosing the right motor and gear.

The throttle servo and the throttle should be in center position (50%) and the motor should run optimal in all throttle positions and load changes. The neutral position and travel-adjustment of the servo should stay unchanged at 0% or 100%. If you have testflown different values before using the regulator, you may also use those. In any case, these adjustments have to be made before the following adjustments of MinimumThrottle- and MaximumThrottlePoint of the regulator.

The travel-setting in the transmitter is, like the setting of the regulator, only for the first use necessary.

A fine-adjustment can later be made with the normal IDLE-UP-curve (3- or 5-point curve). Even though this fine-adjustment isn't really necessary when in regulator-mode, it is recommended because

- the helicopter can then also be flown in bypass-mode and
- it provides an optimal use of the regulator's characteristics.



a) Adjustment (teaching, programming) of the Minimum- and MaximumPoint.

- 1) Turn transmitter on, adjust travel and neutral point of the throttle channel in the transmitter with the instructions from above, travel adjustment of the rpm-setting to + - 100%, neutral point to 0%.
- 2) Press the push-button for at least three seconds while switching on the receiver system.

The green LED flashes slowly, the regulator is now waiting for program input.

Be sure that the concerning adjustment regulators are in correct position for the following adjustment of the MinimumPoint. It is recommended to reduce the throttle curve before teaching the settings (f.e. about

5% with trim) or to raise it after the teaching, so that it is not possible to switch back to bypass-mode unwillingly while flying.

- 3) Throttle channel to MinimumThrottle, rpm-setting to bypass-mode (minimum position).
- 4) Press program push-button shortly and both the throttle channel and rpm-setting are taken over by the regulator.

The yellow LED is on, the red LED flashes slowly.

5) Throttle/pitch stick to MaximumThrottle, rpm-setting to 2000 rpm (position both stick and rpm-setting channel to maximum!)

6) Press program push-button shortly, both throttle channel and rpm-setting are taken over by the regulator.

The yellow and red LEDs are both off.

After letting go of the push-button wait for another 1-2 seconds and watch the yellow LED. If it switches on again after this time, you have made a mistake in programming, for example there is only one of the channels changed or the travel-difference between Minimum- and MaximumPoint of one channel was too little (below 0.2ms impulsedifference).

7) The programming is finished.

For safety reasons move throttle/pitch stick to STOP and the rpm-setting to OFF (AUS), the yellow LED is on.

**Note:**

Because of the setting of the sticktravel, the turn direction of the servo is automatically given. A switch of direction is not necessary. It is in your hands to choose the minimal throttle position of your engine in regulator-mode!

b) Nominal-rpm range

All adjustments of a) have to be made already, so that the setting range and setting direction of the rpm-setting are already known to the regulator.

For the helicopter, rpm from 900-2000rpm is interesting. The nominal-rpm can and must be set in this range with the rpm-setting.

If the channel is not plugged in, the regulator works only in bypass-mode!

### c) Bypass-mode

As long as the rpm-setting channel is not plugged into the receiver, the rpm-setting is positioned at minimum or there were mistakes in programming, the regulator works in bypass-mode. The regulation is turned off. That means:

The impulses of the throttle servo going into the regulator are sent on unchanged to the throttle servo output.

(technical note: The length of the positive pulse stays the same, pause- and repeattime can differ.)

### d) Adjustment of the nominal-rpm for regulator-mode (rpm-setting)

First of all, the helicopter has to be testflown (rpm-setting OFF (AUS)). The best relation of throttle-pitch (= almost stable rotor-rpm) should also be figured out.

At first, rpm-setting to OFF (AUS).

Throttle/pitch stick in idle position.

Set rpm-setting to almost minimum (not OFF (AUS), that means > 5%).

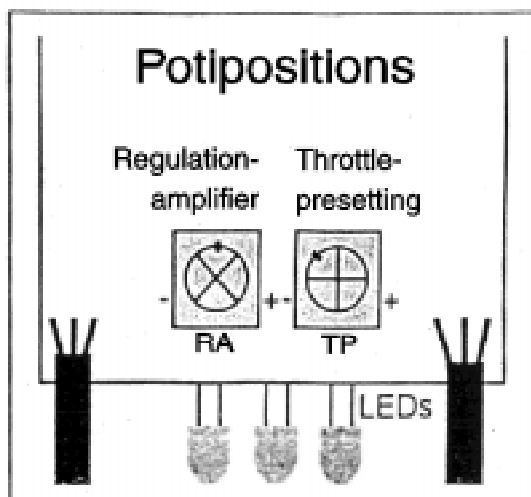
Activate IDLE-UP-curve on transmitter.

Move throttle-pitch stick slowly to hover position. Because the rpm-setting is at almost minimum, the helicopter should not yet lift off.

Slowly raise rpm-setting until the helicopter hovers.

This way the regulator is set to the optimal, through the previous testflights figured-out, rpm of the rotor!

Of course the found adjustments can be corrected at any time, but then the pitch-setting also has to be adjusted again.



### e) Fine-adjustment (not for first setting)

The workhabits of the regulator can be changed in two different ways.

Because of different system-weights (wood or fiberglass-blades), a fine-adjustment of the regulator may be necessary.

1) The regulation-amplifier can be changed with the trimpot on the left of the circuitboard (please use a screwdriver with a width of exactly 2mm). The factory adjustment is shown on the sticker on the regulator.

A turn to the right causes a stronger regulation with very fine changes in rpm when differently

loaded, but the consequence of this is an unstable engine rpm, because the regulator reacts to very fine changes in rpm.

When turning it left, the regulation gets softer with a bit greater differences in system rpm.

**A changed potiposition is only valid after having turned the receiver off and on again!**

2) On the right side of the poti is another one which is used to adjust the so-called throttle-presteering. The throttle-presteering causes the rpm to hold an almost constant speed while raising (or lowering) the pitch-angle in opening (or closing) the throttle before the rpm can

change. The regulator gets this pre-information from the throttle signal. This is why it is important that the mixture of throttle-pitch is correct.

The potirange is divided into four parts:

- a) all the way left, the throttle-presteering is OFF,
- b) in the 11 o'clock position, a load change will be compensated only half and only in positive pitch-direction (pitch-increase),
- c) in the 1 o'clock position, positive as well as negative load changes will be half compensated,
- d) all the way right, both positive and negative pitch-directions will be fully compensated.

For the factory adjustments, see sticker on regulator. The positions b) and c) are the least critical, the presteering doesn't interfere too much in the regulation. By rise of pitch, position d) can lead to an increase (or decrease) of rpm by bad adjustment of the system!

### **A changed potiposition is only valid after having turned the receiver off and on again!**

3) Often, the nominal-rpm is not defined over a proportional linear regulator or turnmodule, but over a switch with for example three positions. In this case, note a little trick with the adjustment (teaching) of the Stop- and MaximumThrottlePoint:

Reservate a model memory in your transmitter which you name for example "HeliAdjustment". In this memory you adjust:

- a) the travel adjustment/neutral position of the throttle channel to standard and
- b) the travel adjustment/neutral position of the rpm-setting to 100%, 0%, 100%.  
While doing "a) Adjustment of the minimum- and maximum throttle point", you choose the model "HeliAdjustment". After teaching the sticktravel to the regulator you can switch to a different heli-program and then adjust the rpm-setting channel with change of travel and neutral position, just as you want it to be.
- c) Position the switch on your transmitter to switch-mode: To reach the bypass-mode of the regulator in any case, it is recommended to raise the travel of the OFF-position to 150%.
- d) Position the switch to medium: a medium rpm can then be achieved by moving the neutral position.
- e) Position the switch to maximum: A higher rpm can be achieved by lowering the travel adjustment of the maximum-point.

Note 1: An adjustment of the neutral point often also causes a movement of the maximum-point.

Note 2: If the "bent" values of the rpm-setting are taught to the regulator, it will take these as new 100% values and the result will not be the same. For this you need a special adjustment program.

## **H) Control:**

You can control the regulator's way of work with three LEDs.

The brightness of the Throttle-LED follows the information of the throttle-/pitch-channel and turns off when throttle is at maximum.

The regulation-LED is turned on when the regulator doesn't work as a switch, but as a regulator (even when the nominal rate of revolutions is not yet achieved).

The sensor-LED turns on when a magnet gets near the rate of revolutions-sensor.

After mounting the regulator, the LEDs can once be bent to the viewer, over a radius greater than 5mm, for better recognition.

## **I) Problemsolving (wenn the regulator "goes crazy")**

### **1) If the regulator does not let itself adjust at or after Ga) Adjustment :**

**a) after letting go of the the push-button after having turned on the receiver system, the regulation- and throttle-LEDs stay off:**

The receiver or the transmitter is not turned on, the regulator does not get any valid signals from the transmitter, the regulator switches automatically to normal mode - with the old, not wanted values!

**b) after programming, the throttle-LED turns off for about one second and then stays on even when moving the throttle-stick:**

While teaching, you have changed only one channel or the autorotation switch was still active and has prevented a change of the throttle channel. For travel-length- and direction-recognition, you have to change throttle- and rpm-channel. The correct functioning of the two channels can be controlled by connecting a servo to the appropriate receiver channels instead of the regulator and then moving the transmitter input device. Also when having a too small travel-difference (smaller than 0.2ms impulse-difference, normal is about 0.6 - 1ms) the regulator will show it. Then the regulator only works in bypass-mode, in case you don't correct the program settings.

### **2) The regulator doesn't switch to regulator mode (green LED doesn't light up):**

a) The rpm-setting is still in bypass mode (<5% travel).

b) You haven't achieved 800rpm yet.

c) On the throttle channel the impulses are still below the taught MinimumThrottle length because the IDLE-UP-curve or the trim isn't correct or the autorotation switch is still positioned at autorotation.

d) You have a wire break in the channel of the rpm-setting or the sensor input cable.

### **3) You can't turn off the engine:**

The IDLE-UP-curve is still turned on, the throttle stick is not in OFF-position or the trim is not all the way back.

Maybe the autorotation switch doesn't define the correct OFF-value.

### **4) By fast downwards flying the model shows a higher system-rpm:**

In regulator-mode the throttle is never closed more than your defined MinimumThrottle setting, as not to let the motor die. Because of the negative pitch-setting and the freespins the rotor accelerates on its own, if the engine accelerates with it, maybe the carburettor mix is wrong!

### **5) The regulation doesn't occur smoothly:**

- a) Check the free movement of the throttle linking rod and the optimal, jerkless working of the throttle servo. In any case the throttle servo has to work faster than the nick, pitch and roll servos, else the regulation cannot function without greater losses in rpm! Maybe you have to exchange it with a servotype with greater accuracy and speed.
- b) Check the gyro-effect.
- c) Reduce the regulation amplifier setting on the RA-trimpoti in turning it left. This would also be the best thing to do when the regulator "sees" a too little rotor energy and is "pumping". This can also occur during a fast descent, when the freespinn is disengaging because of higher rotor rpm.

### **6) The regulator regulates the engine in certain intervals up or down during flying:**

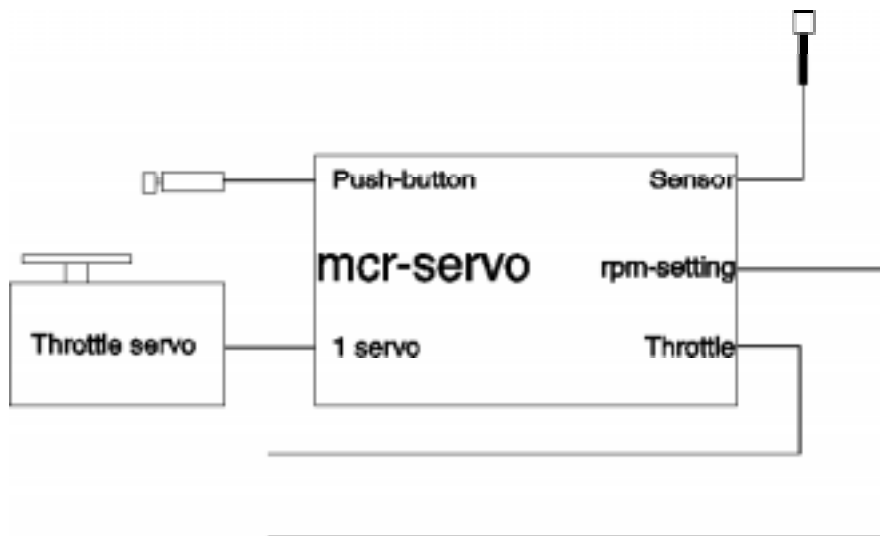
Most likely this is a frequency disturbance problem. The regulator switches to bypass-mode until the disturbance is over and there was a valid signal received before. In doing this it signals a disturbance. Most often this happens with helicopters which use toothbelts because of static charge! The disturbance occurs also without an rpm-regulator!

### **7) If none of the above helps: new programming of the throttle channel- and rpm-setting data:**

The regulator uses an EEPROM for definite saving of data. Even though the data is saved more than once it can be made unreadable by static charge. If the data in the EEPROM is destroyed, it can be reprogrammed unless there is a physical defect.

## **J) Technical Data**

|                                    | <b>mcr-servo</b> |
|------------------------------------|------------------|
| Order name:                        | mcr-servo        |
| Voltage:                           | 4,8-6V           |
| Weight with cable and push-button: | 38g              |
| Dimensions in mm                   | 50 x 32 x 10     |
| Nominal-value rpm-setting:         | 900-2000 rpm     |
| Regulation overtaking-point:       | 800 rpm          |



Both cables to the receiver: throttle channel (coupled with pitch-stick of the transmitter) and aux. channel (coupled with sliding pot for rpm-setting in the transmitter)