CH-1092 Belmont, Suisse
Tel +41 21 728-6156, Fax 728-6157
Email info@didel.com, www.didel.com

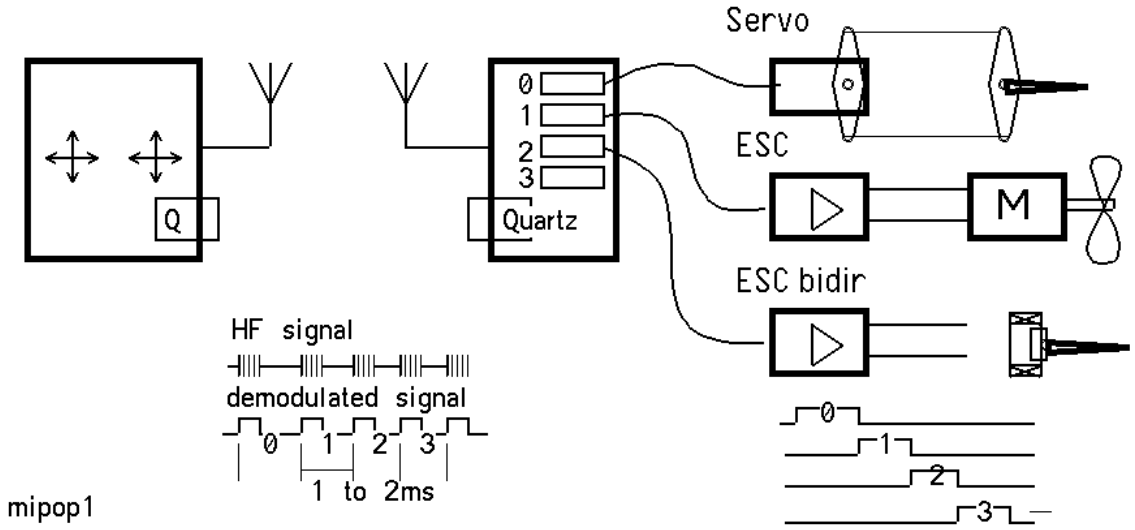
www.didel.com/slow/mirted/Solutions.doc

Solutions for controlling an ultralight plane

The objective is to fly a 3 or 4 channel plane or helicopter at the lowest possible weight. A transmitter with its usual joysticks sends a signal to a receiver that distributes the received information over 3 or 4 channels on which servos and propeller motors are connected.

Traditional radio solution

Radio receivers have different frequencies and are either narrow band, with a removable quartz, or wide band, responding to all frequencies of the band.
3-pin connectors (power and signal) are usually provided for the servos, but the pinout and connectors may vary from one manufacturer to another. These connectors contribute significantly to the receiver weight.



Lightest available receivers

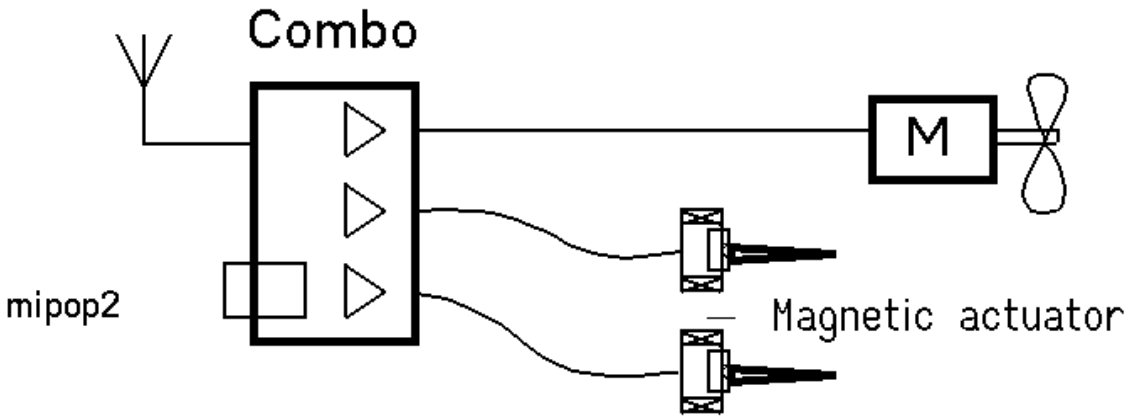
Nick Leichty receiver users.joplin.com/~bselman/nleichty.htm	0.35g	27 MHz wide		
JLCoural Receiver http://www.microplanesolution.com/	0.7g	41/72 MHz wide		
SkyHook RX72 http://www.microrc.com/hybrid.htm	2.8g	72 MHz quartz		
Potensky PICO SMART 5 FM http://www.potensky.cz/an.htm	3 g	35/40 Mhz quartz		

An ESC (Electronic Speed Control) is required between the receiver and the propeller motor. Frequently, the motor is powered at a higher voltage than the radio, and the ESC includes the voltage converter to connect with the receiver and avoid an additional

battery, hence the name BEC (Battery Eliminator Circuit). ESC and BEC convert the 1-2ms pulse into a PWM signal, 2 to 20 kHz frequency.
Magnetic actuators need bidirectionnal ESC circuits, with a current of 40-120 mA.

Combo receivers

Combos include weak or strong amplifiers for the propeller motor and magnetic actuators.

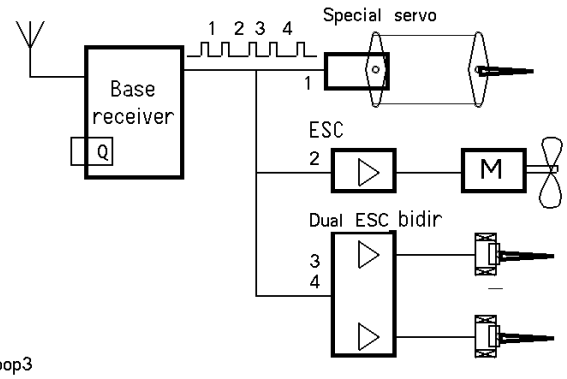


Lightest available combos

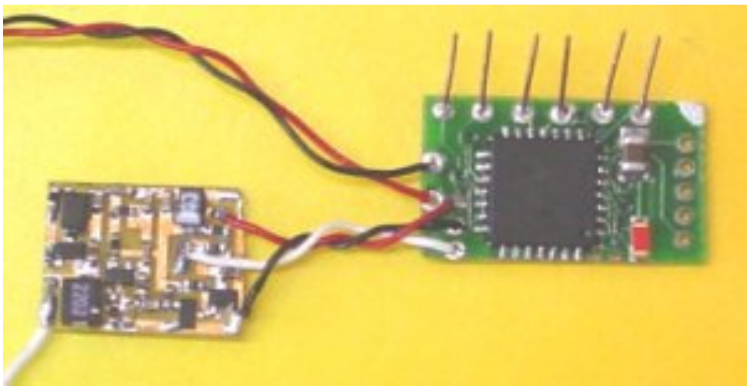
JMP RxCombo www.indoor.flyer.co.uk/jmp.htm users.joplin.com/~bselman/JMPCombo.htm	2.2g	40/72 MHz quartz	3-4 chan	
JLCoural Combo www.microplanesolution.com/	0.9g	41/72 MHz quartz	3 chan	
RFFS100 slowfly.com/products.html#Receivers	1.8g	35/72 MHz wide	3 chan	

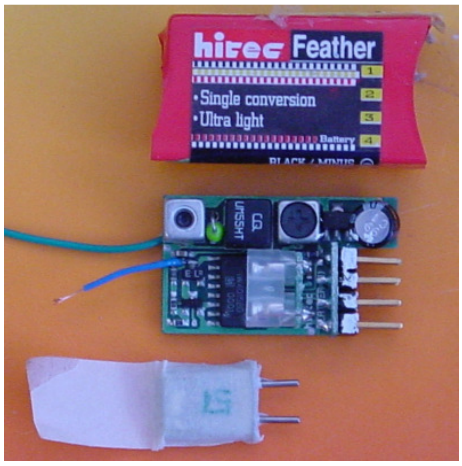
Base receivers

We feel the need for “base receivers”, that includes only the radio demodulation, and leaves the channel selection to the microcontrolers usually embedded in the actuator. One advantage is a better flexibility for playing with different control architectures, would it be a traditional plane, a V-tail, a bimotor. This saves the weight of the microcontroller and the plugs of traditional radios , and the simple change in the software of servos and ESC circuits to make them compatible with the PPM protocol does not increase the weight.



mipop3

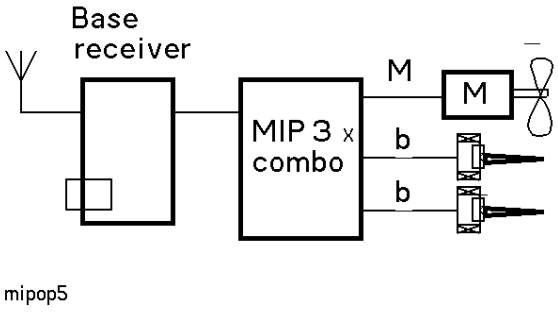




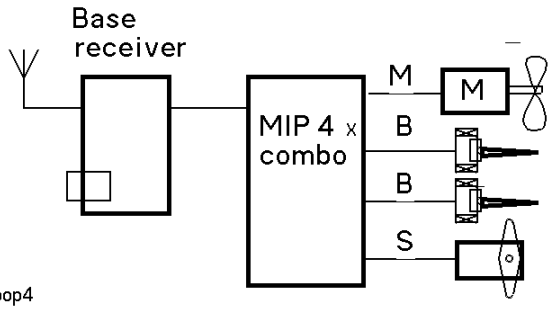
Nick Leichty base receiver and MIP3 (0.65g total).

Right: the blue wire is the PPM output.

DIDEL has been using a base receiver made by Nick Leichty (0.3g), together with the MIP4 and MIP3 circuits described later. The combination is equivalent to a Combo, with low power Bird amplifiers for MIP3 (0.3g), and transistorized outputs on the 4 channels for MIP4 (0.4g). The problem is there are several software versions for MIP4, according to the application.
Any receiver can be converted into a base receiver. It is necessary to find the output of the HF part, usually fed to a shift register, and connect an additional output wire.
The MIP3 and MIP4 are combos ready to be connected to a base receiver. The GD servo will be offered with a PPM interface and work with a new 0.2g MIP2 for controlling one or two propeller motors.



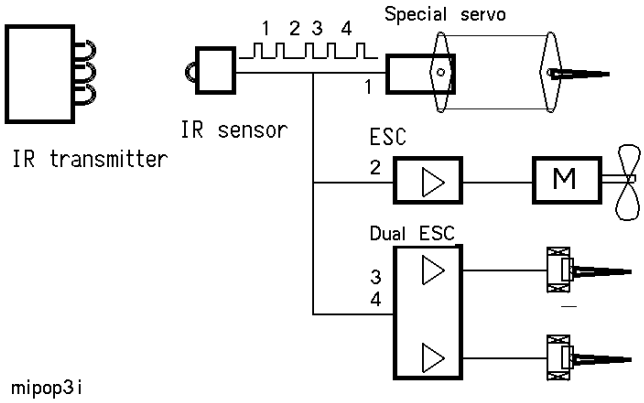
mipop5



mipop4

IR solutions

With IR control, the HF receiver is replaced by an IR sensor that weighs as low as 0.3g, uses only 3 mA and is very low cost. This made the success of IR. But IR is not normaly for a gym sized hall; it is a perfect solution for home flying, and standard radio can be used with a PPM to IR protocol converter like the TedRa.
IR protocols have been defined by Zigras, Tanaka, Didel and of course they are not compatible.

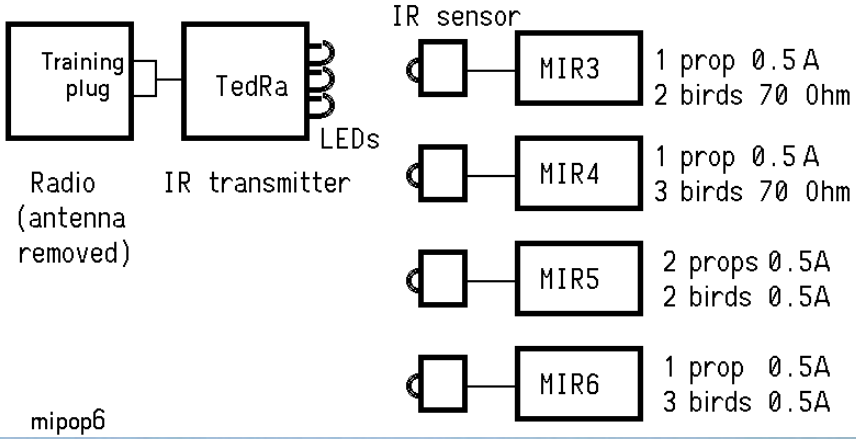


mipop3i

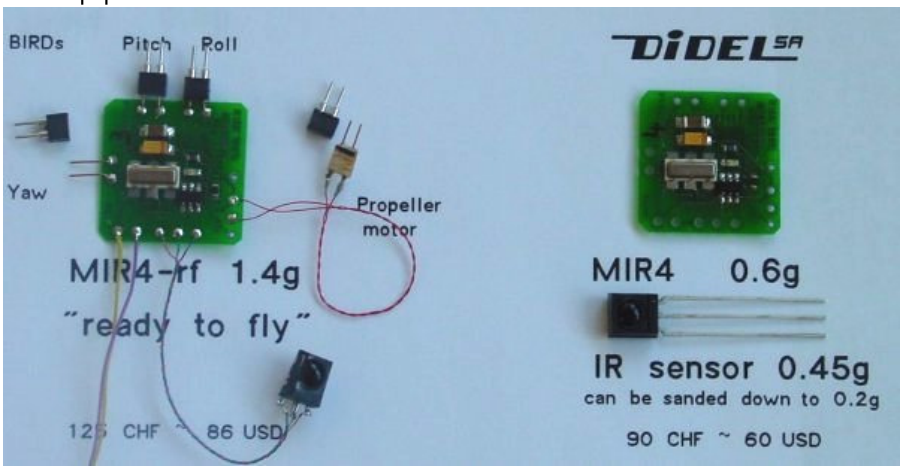
Didel protocol has been optimized with a redundant pulse for more reliable operations. It could be made compatible with the PPM timing; that would avoid having different ESC circuits depending if it is radio or IR.

DIDEL Infrared 2002-2003 products

Since 2002, DIDEL has offered the MIR family devices (see www.didel.com/slow/mirted/MIR.doc and www.didel.com/slow/mirted/TedRa.doc).



mipop6

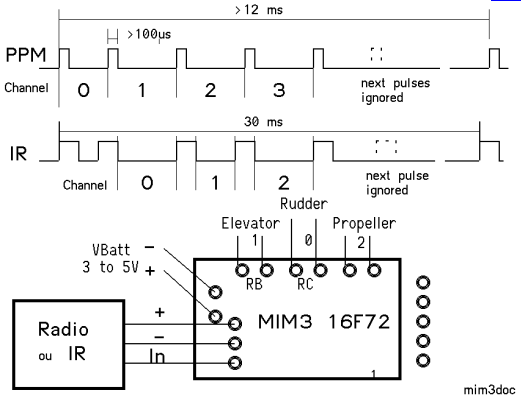


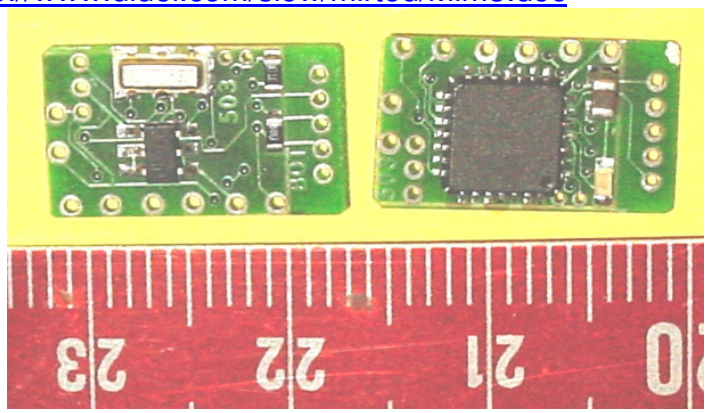
New 2004 DIDEL Combos and ESC circuits

New lighter microcontrollers have triggered the design of the new 3 and 4 channels ESC circuits, with software versions for IR, base radio or 1-2 ms servo pulses.
The family will be expanded with new combos and servos for base receivers.

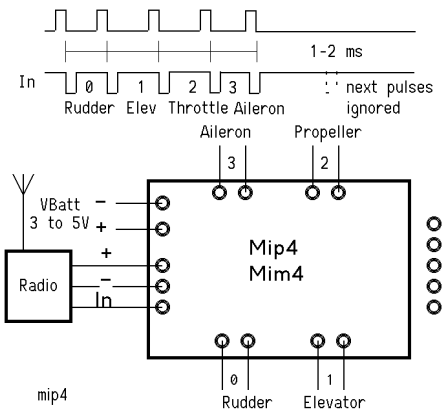
Mim3/Mip3 – 0.27g

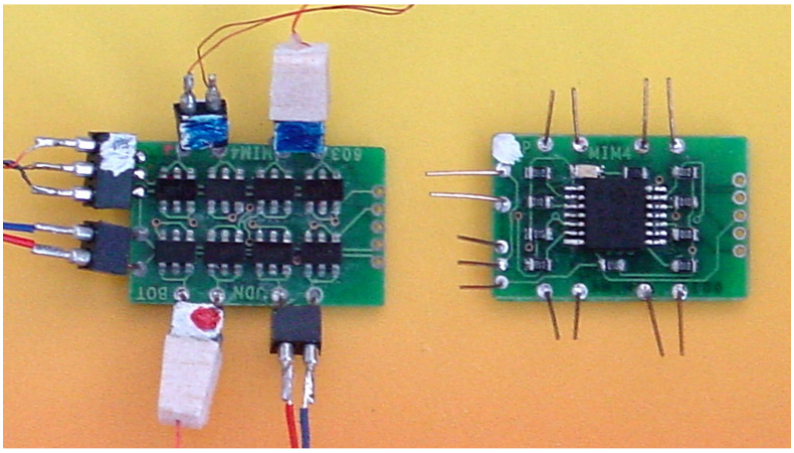
3 channels for Bird actuators. See http://www.didel.com/slow/mirted/Mim3.doc





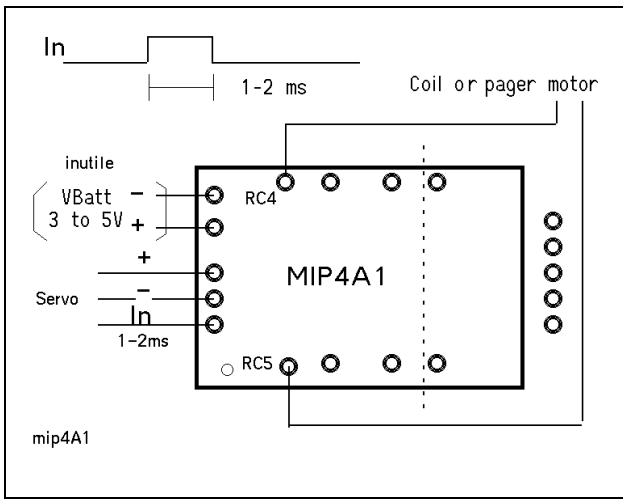
Mim4/Mip4 – 0.44g
4 channels with 0.5A outputs. See http://www.didel.com/slow/mirted/Mim4.doc

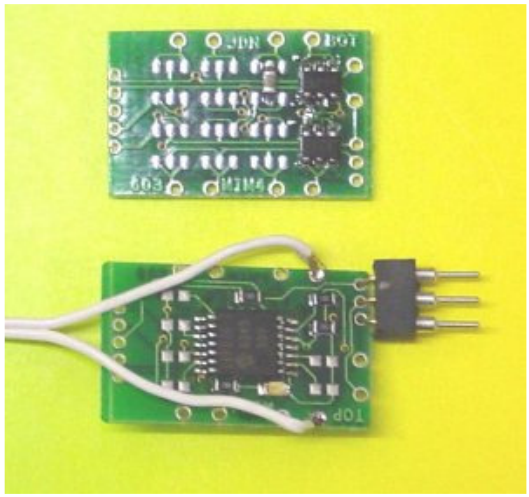


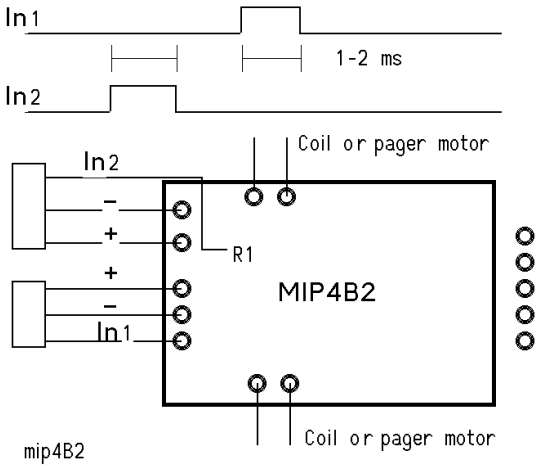


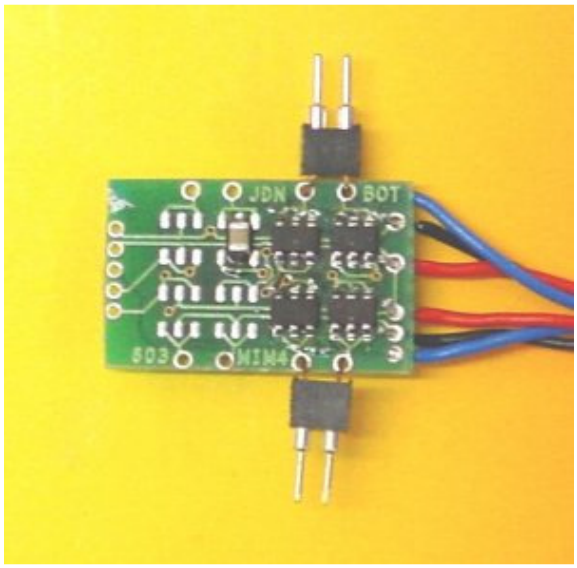
MIP4A1 MIP4B2 - 0.34 g

These are partly populated MIM4 circuits, with a software that makes them standard one and two channels ESC circuits, at a much lower weight.
See http://www.didel.com/slow/mirted/Mim4A1.doc.



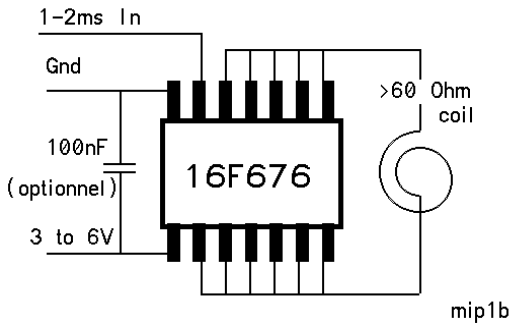


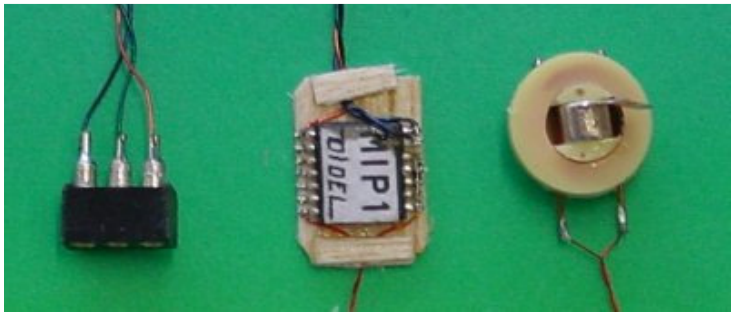




MIP1 – 0.13g with wires

MIP1 is an 1-2ms ESC for controlling a 70 Ohm Bird. The new 16F676 is not only lighter, but also provides more power than the 12C508 found in competing products. See http://www.didel.com/slow/mirted/Mip1.doc for details.





Together with the Nick Leichty 0.35g receiver, one can imagine connecting two MIP1 for driving the Birds, and add a transistor controlled by one of these MIP1 for the throttle. Total weight including wires would be less than 0.7 grams (a special easy software has to be developed for this).

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