Pratico di BASCOM AVR - (25)

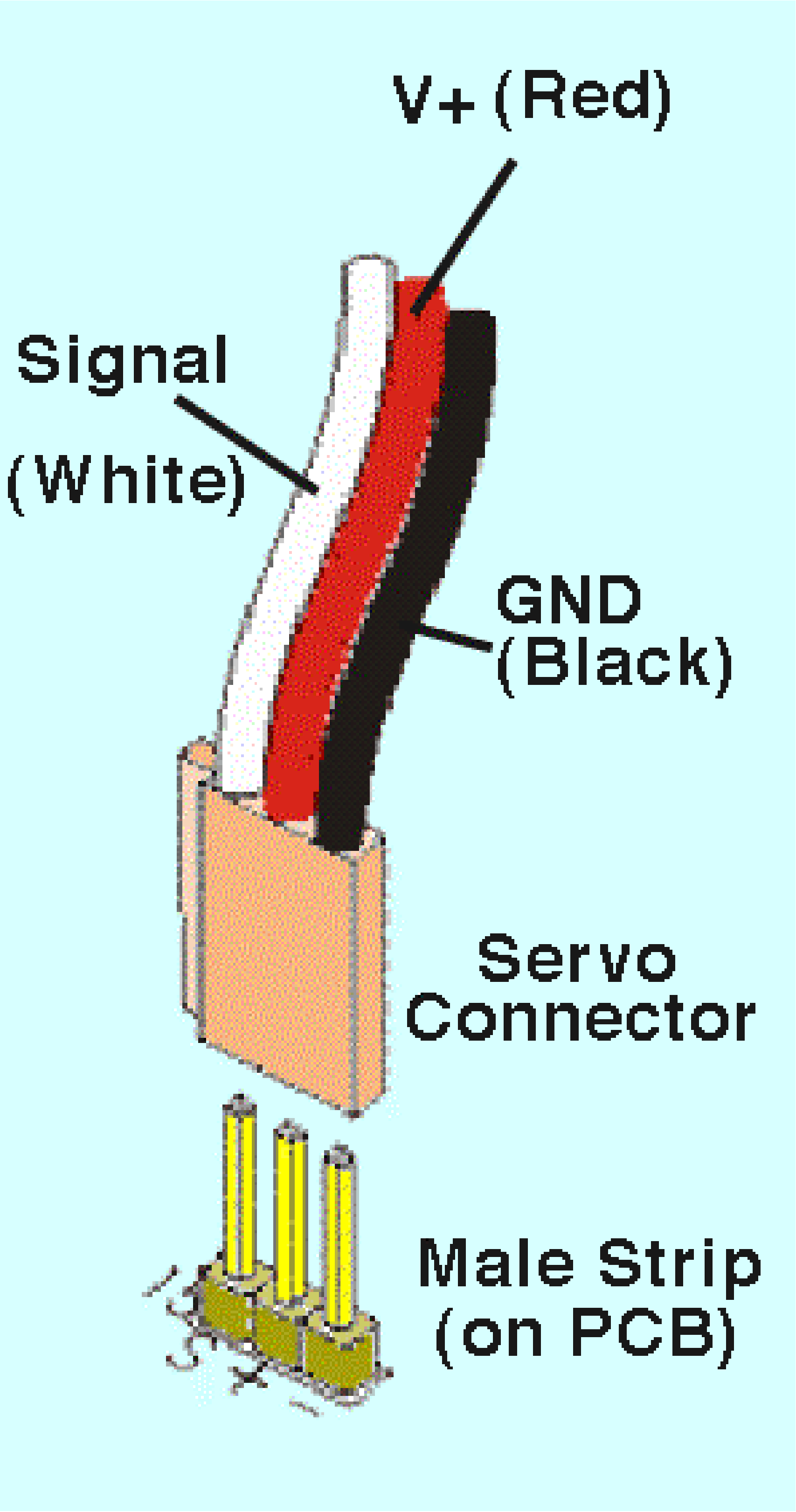
Theoretic/Practical course on BASCOM AVR Programming.
Author: DAMINO Salvatore.

SERVOMOTORS (1)

A **Servomotor** is power mechanical device, capable to produce a movement, that can be driven by a logic signal with low, or very low, power. In this chapter we don't consider the sophisticated industrial models but the widely diffused ones, commonly used in the model-making environment for airplanes, boats, cars, robots, etc. We'll talk about those models named **SERVOS**, that many passionate use, or would like to use, on their small models.

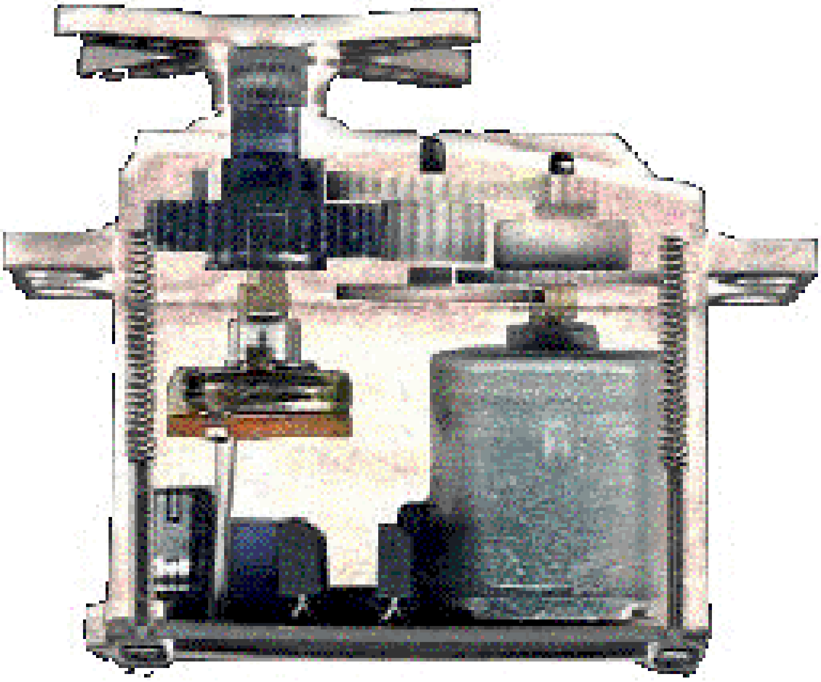
Some Types of Servomotors, Commonly Known as Servos.

The **Servo** is normally placed into a container and it includes an electric motor, a mechanic reducer, a feedback system for the output shaft position and all the necessary control electronic. Thanks to a proper command system it is possible to rotate the shaft of the servo on the required specific position.



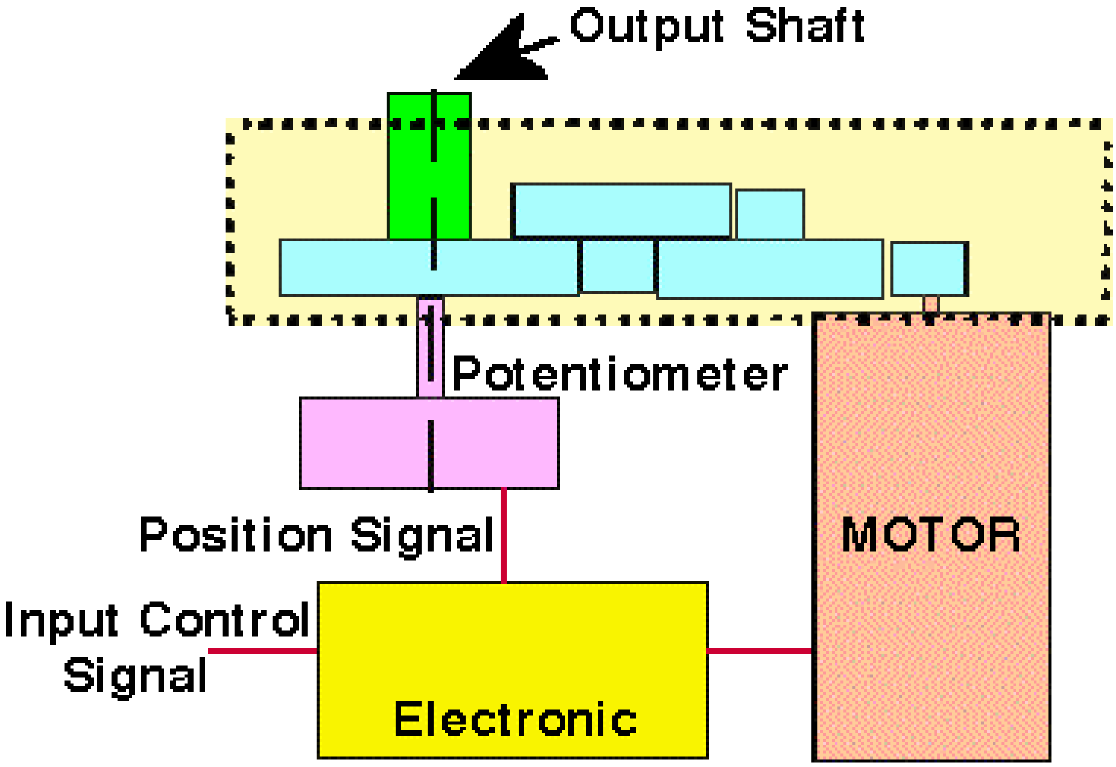
Electric Connection of a Servo.

There are **Servos** with different powers, dimensions, functionalities etc. but all them have a common feature: they are all driven in the same manner.



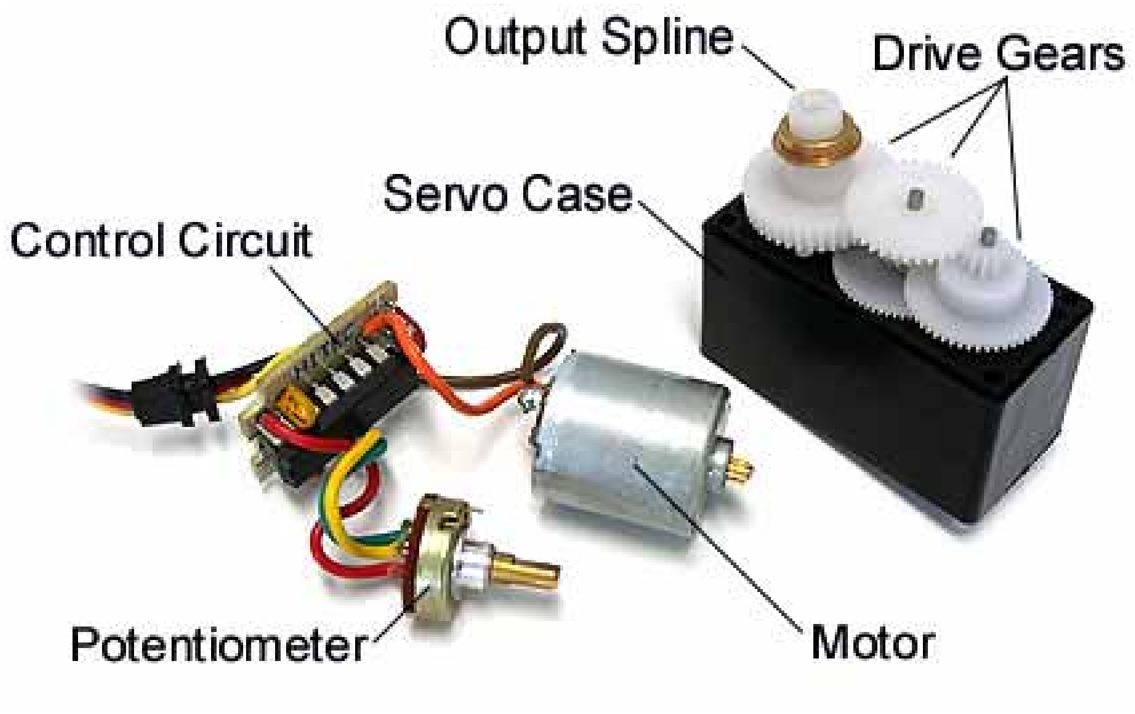
Internal View of a Typical Servo.

The previous figure shows the mechanical parts of a servo. You can see that there are some gears that reduces the motor revolution speed to a low value compatible with the device to drive. Please remember that the servo output shaft, normally can rotate only for **180°**. When this limits is not acceptable you can use servo capable to cover all the **360°** or, alternatively, modify the servo.



Blocks Diagram of a Typical Servo.

Only three wires are required in order to drive the Servo. Two are used for power supply, that normally is **6Vdc** but, due to a force reduction, it is accepted also **5Vdc**. The third wire is the input **Control** signal that normally is at **TTL** level.



Building Elements of a Typical Servo.

It is important to underline that, even if it reaaly similar, the control signal of the servo absolutely **is not** a **PWM** signal, as many people not correctly informed, still believe and make know. The right indication for the signal is **PCM** that means **Pulse Code Modulation**. You can convince yourself it is sufficient to compare the two signals with a normal oscilloscope.

The **Servo** functionality is really simple. As you can observe in the block diagram, the **Control** signal is connected to **Electronic** circuit. This compare the received signal with those produced by **Potentiometer** and it decide if the motor must rotate and in which direction.

Control Signal Pulse					Connection Wires		
Manufacturer	**Min**	**Typ**	**Max**	**Hz**	**+Vservo**	**GND**	**Control**
Futaba	0.9	1.5	2.1	50	Red	Black	White
Hitech	0.9	1.5	2.1	50	Red	Black	Yellow
Graupner/Jr	0.8	1.5	2.2	50	Red	Brown	Orange
Multiplex	1.05	1.6	2.15	40	Red	Black	Yellow
Robbe	0.65	1.3	1.95	50	Red	Black	White

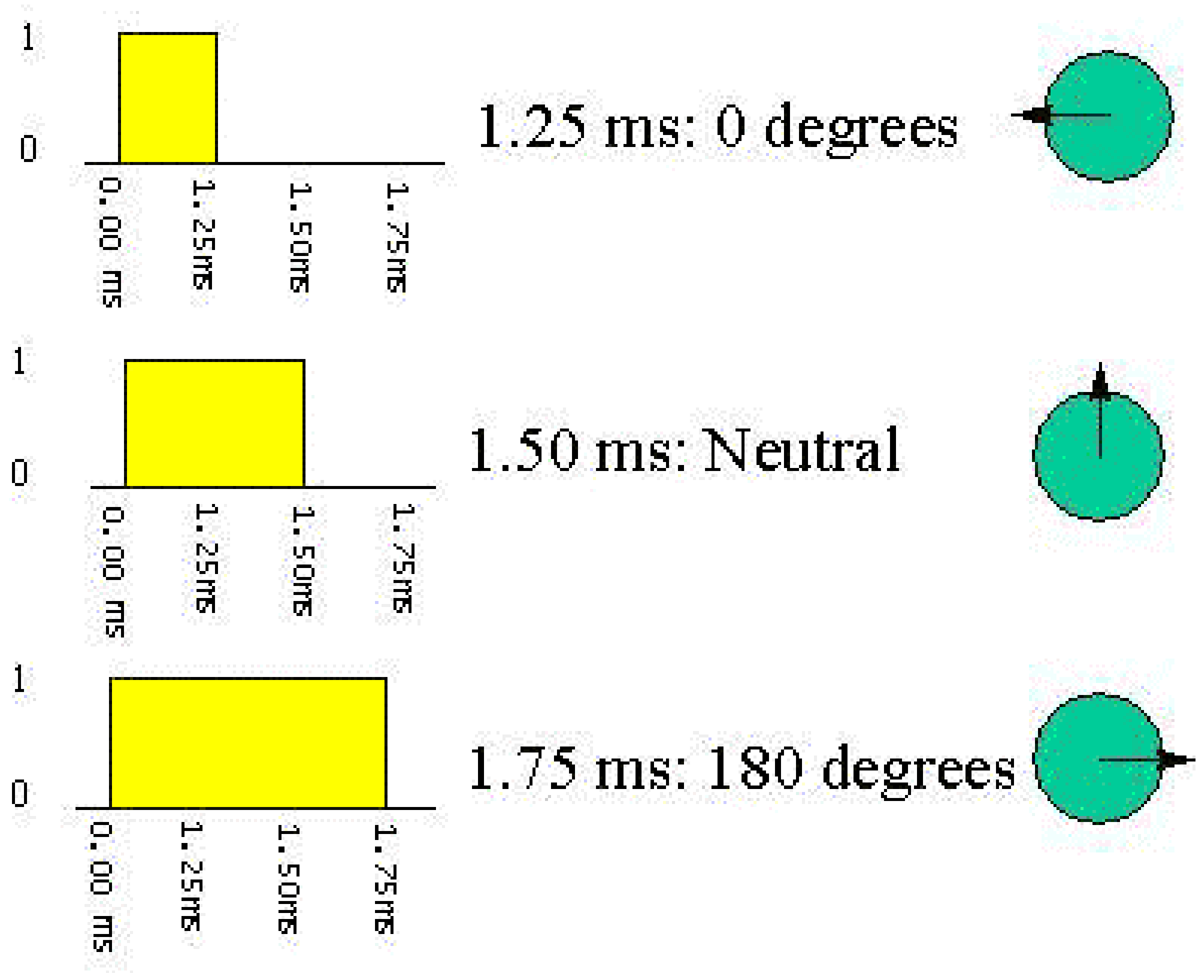
Features Summarizing Table of Some Servos.

In order to drive a **Servo** it must be supplied a **TTL** signal with periodic pulses, through the control wire. The single pulse duration defines the output shaft position. The time between the pulses can change with large limits with no problems in **Servo** control.

Up to now it has been supplied a general description and below there are some practical indications complete of specific numeric values.

The pulse duration can range between a minimum of **1mS** and a maximum of **2mS**.

The control pulse duration produces an output shaft rotation of the **Servo** and thank to potentiometer feedback the required output shaft position is reached and then mantained in perfect balance.



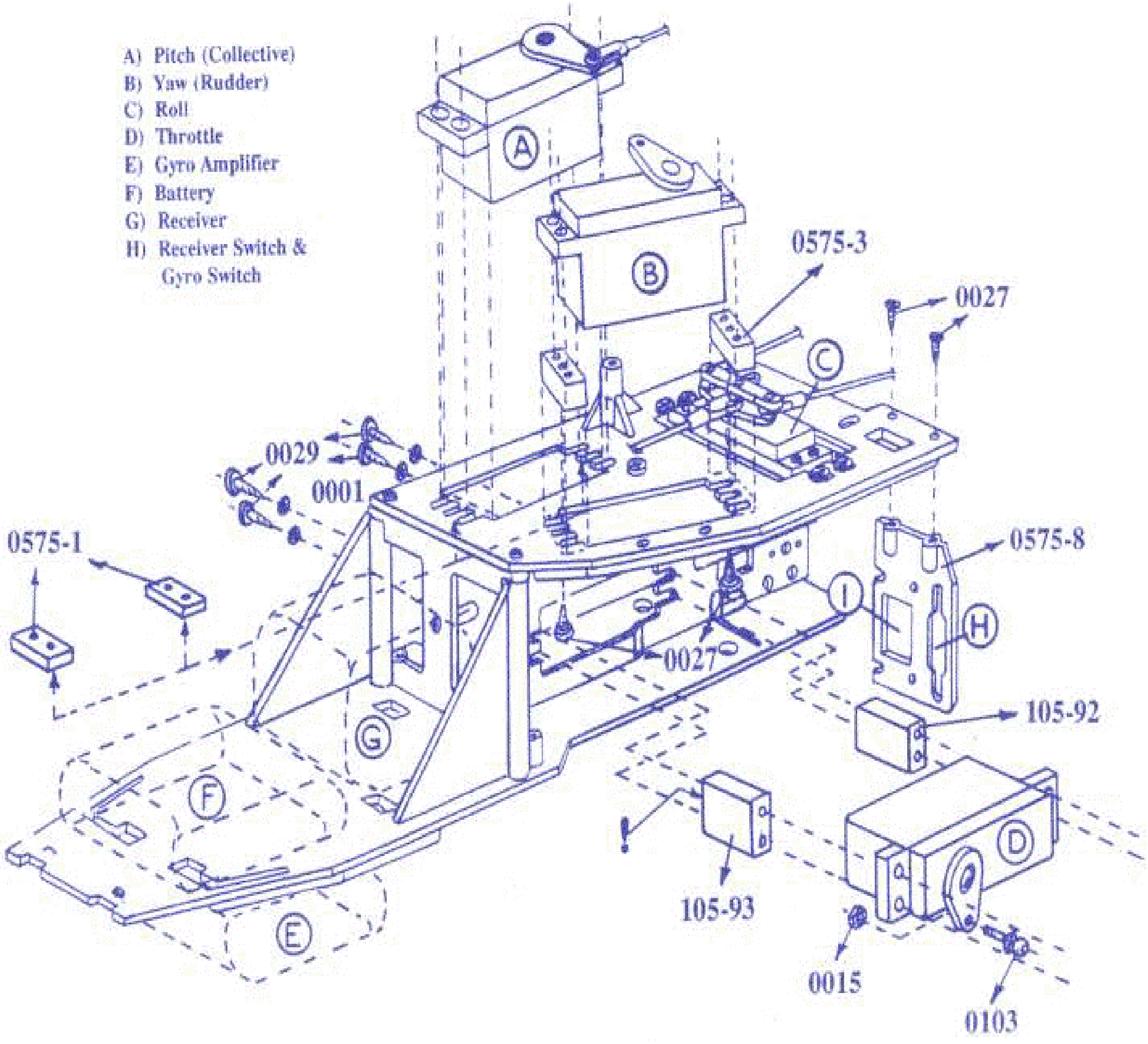
Relationship Between Pulses Duration and Rotation Positions.

The minimum and maximum duration of the pulses correspond to two rotation extremes of the **Servo**. The pulse with **1,5 ms** duration corresponds to central, or neutral, position of the **Servo**.

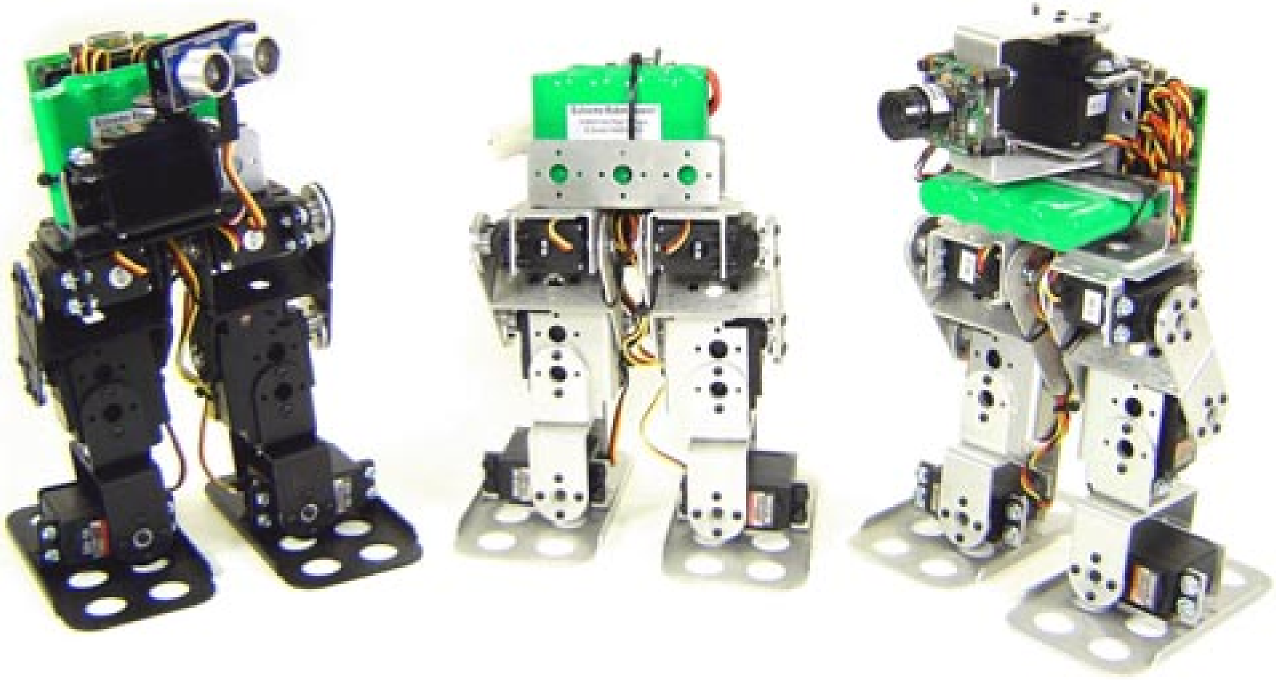
It is important remind that these pulses must be continuously repeated, otherwise the **Servo**, no more driven, will return to rest position. In this situation the position is no more mantained and ensured and the shaft will be moved by the forces currently applied by the connected load.

The **Pause** duration between one pulse and the following one, must be included between a minimum of **10 ms** and a maximum of **40 ms**.

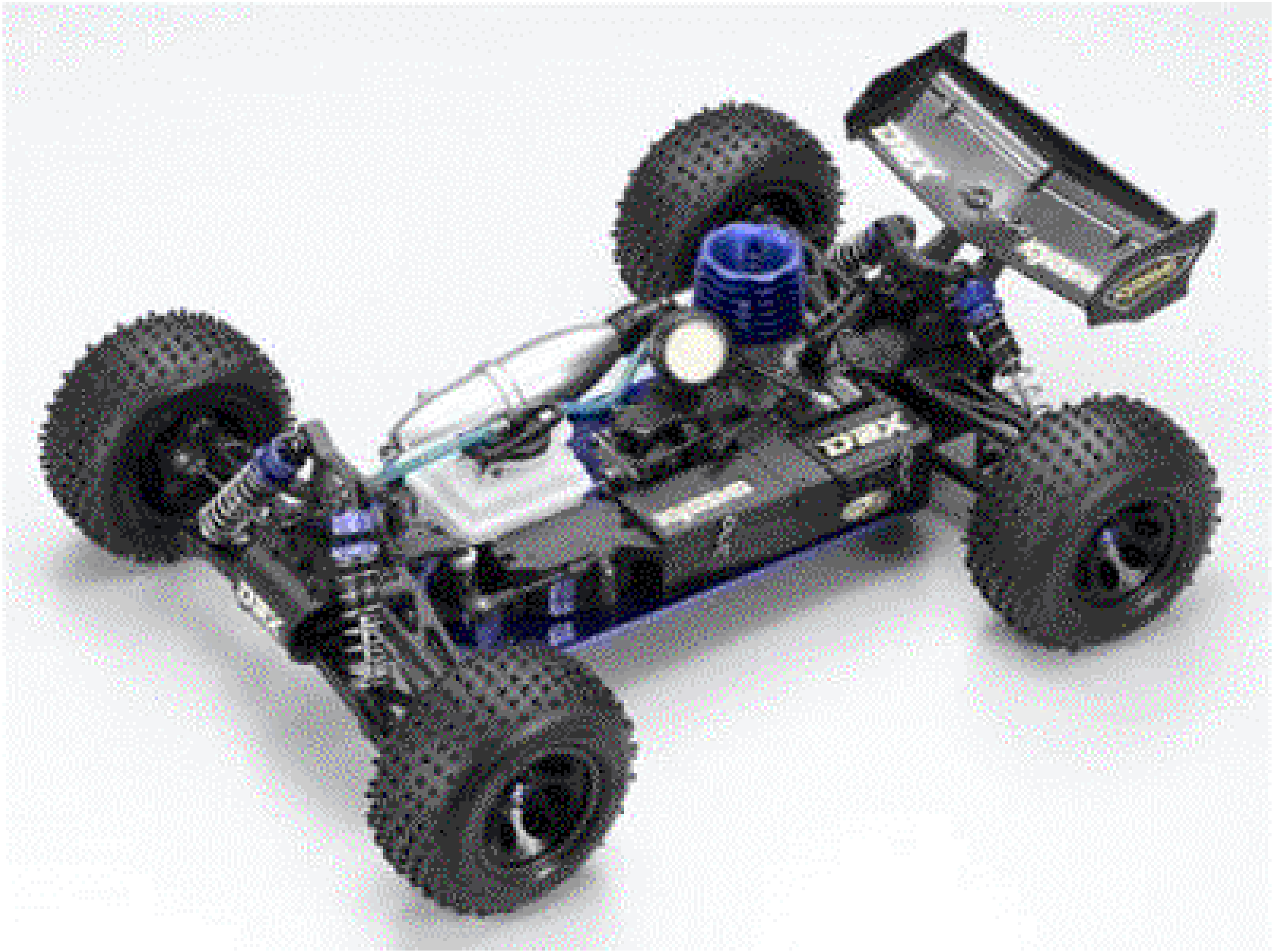
The typical duration of the **Pause** between the pulses is **20 ms** equal to **50 Hz**.



Typical Application Example of Servos.



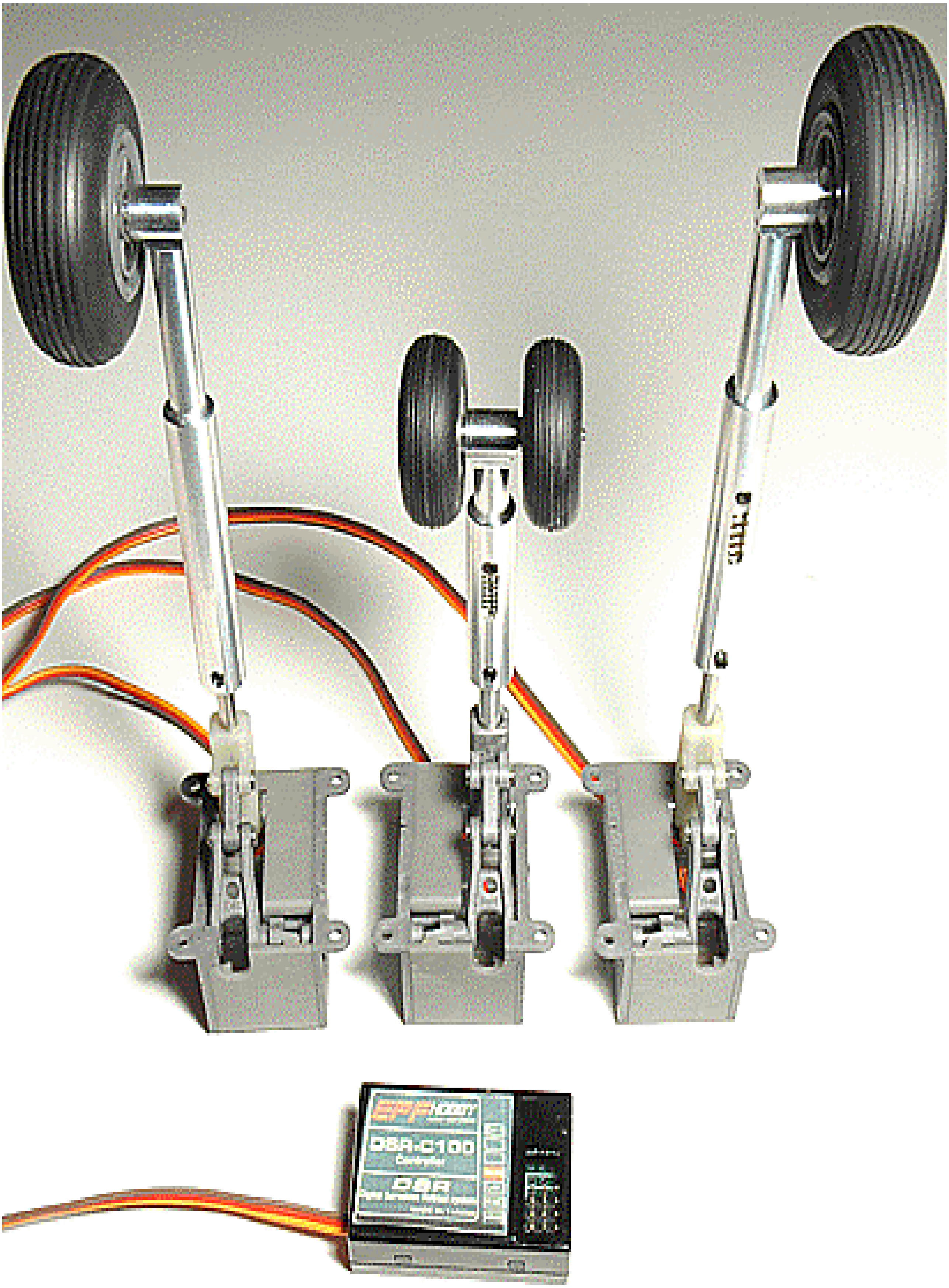
Applications of Servos in Robots.



Car Model.

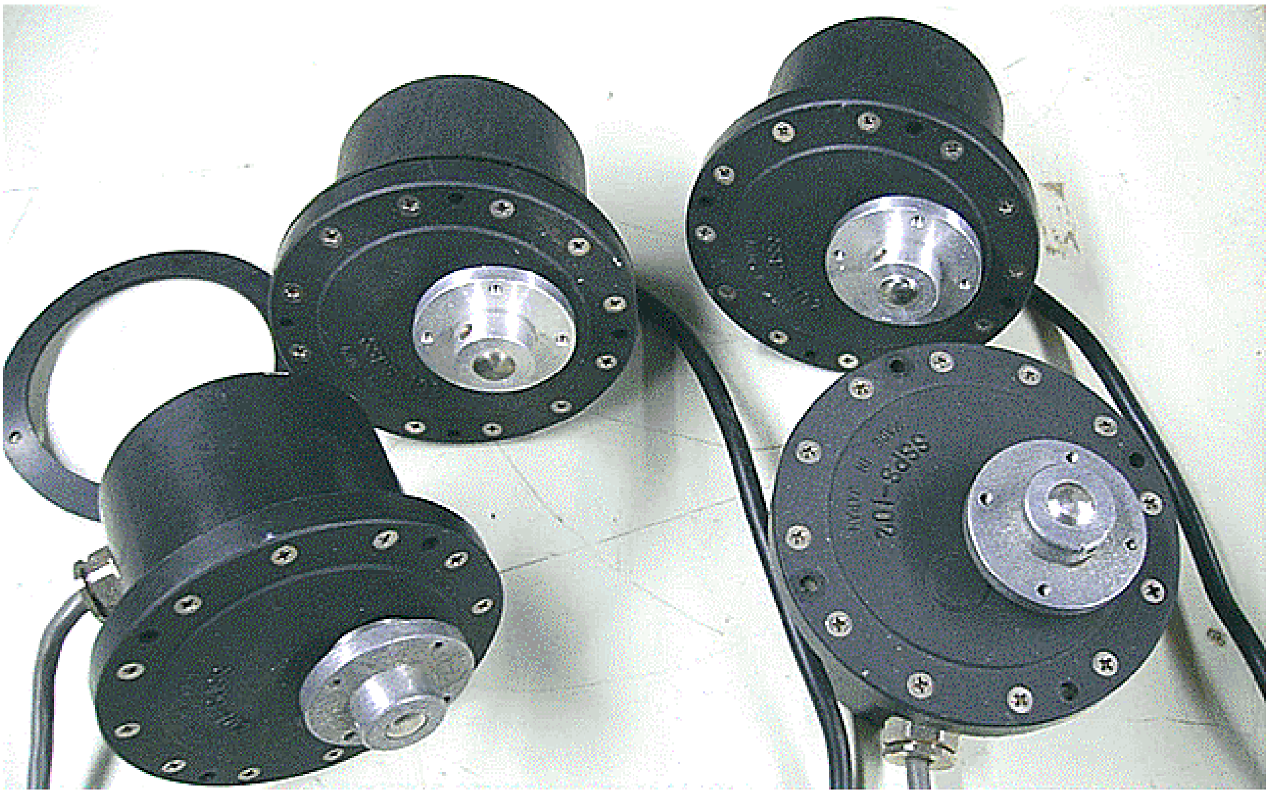
Typical Radio Commands.

Airplane Model With Radio Command and Electric Motor.



Application Example for Trolley Control.

Radio Commanded   Boat   Model.



Industrial   Servomotors.

USE EXAMPLE

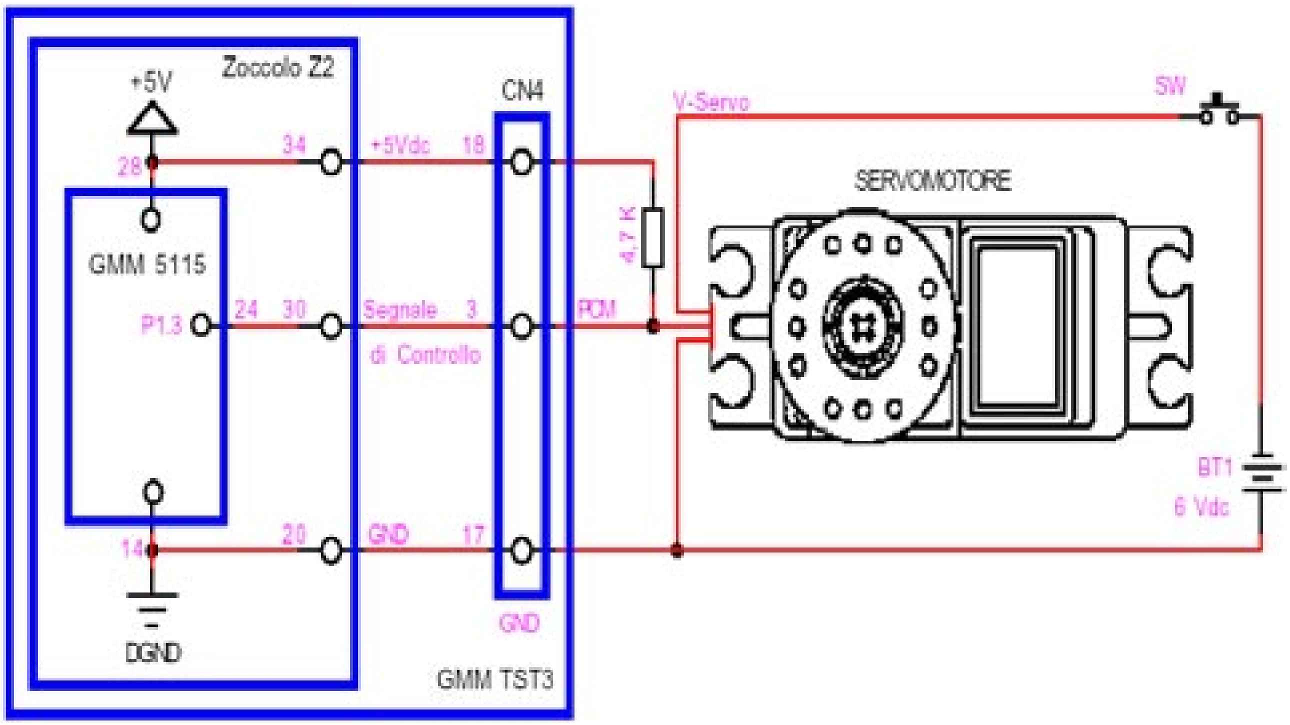
The **Example.041** shows how to use the **BASCOM AVR** instructions in order to manage the **Servos**.

The **Servomotor** management is performed with the high level instructions of **BASCOM** compiler. These generates a signal that doesn't exactly match the timing specifications of the Servo control signal **PCM**, but they allows anyway a right movement.

The **BASCOM instructions** use a periodic **Interrupt** generated by **TIMER0**, that can't be used for other functions!!!

The timing **resolution** (**=duration**) is defined by **Reload** value used in **Config Servo...** instruction and by selected position with **Servo...** instruction, as illustrated in **BASCOM** on line help.

This demo define a minimum reload time, equal to **10 µs**, in order to obtain a maximum resolution on positions and to avoid motor vibrations.



Application Diagram for Servo Connection.

The **Example.042** is an evolution of previous one. In fact it allows to drive the **Servo** in any position from **0°** to **200°** with continuity. This result is obtained with modality similar to previous example. The position are decided by the user that inserts the **Reload** number directly by console.

Example.041. Servomotor. From Console it can be Positioned on 0°, 90° or 180° Positions.

Added Definitions:

None

Added Declarations:

None

Added Instructions:

CONFIG SERVOS ; SERVO(..).

Added Operators:

None

Example program **41** of **BASCOM AVR** course.

The program allows to define some **Servo Motor** rotations in the start position (**0°**), middle or neutral position (**90°**) and stop position (**180°**), through a proper choice from console menu. The signal selected to drive the **Servo** is the **P1.3** of **Mini Module**, reported on **CN4.3** connector of **GMM TST3**.

The program has been tested with the model **Servo** standard **900-00005** produced by **Parallax** but it can be naturally used also with other **Servo** models as, for example, those manufactured by **Futaba** or other companies.

The program describe its functionalities and uses a serial console provided of monitor and keyboard with a fixed physical protocol at **19.200 Baud**, **8 Bit x chr**, **1 Stop bit**, **No parity**.

This console can be another system capable to support a serial **RS 232** communication. In order to simplify the use it can be used a **PC** provided of one **COMx** line, that execute a terminal emulation program as **HYPERTERMINAL** or the homonym modality provided by **BASCOM AVR** (see **IDE** Configuration).

The program works only when the **GMM AM08** is mounted on **Z2** socket of **GMM TST3**!!

Example.042. Servomotor. From Menu it can be Positioned on any Position Included in 0° and 180° Range.

Added Definitions:
None

Added Declarations:
None

Added Instructions:
None

Added Operators:
None

Example program **42** of **BASCOM AVR** course.

The program allows to define **Servo Motor** rotations in all the allowed positions (**0°÷200°**), through a proper value inserted by **console**. The signal selected to drive the **Servo** is the **P1.3** of **Mini Module**, reported on **CN4.3** connector of **GMM TST3**.

The program has been tested with the model **Servo** standard **900-00005** produced by **Parallax** but it can be naturally used also with other **Servo** models as, for example, those manufactured by **Futaba** or other companies.

The program describe its functionalities and uses a serial console provided of monitor and keyboard with a fixed physical protocol at **19.200 Baud**, **8 Bit x chr**, **1 Stop bit**, **No parity**.

This console can be another system capable to support a serial **RS 232** communication. In order to simplify the use it can be used a **PC** provided of one **COMx** line, that execute a terminal emulation program as **HYPERTERMINAL** or the homonym modality provided by **BASCOM AVR** (see **IDE** Configuration).

The program works only when the **GMM AM08** is mounted on **Z2** socket of **GMM TST3**!!