



# AUTO PILOT

## Definition

The autopilot or automatic pilot is a system of **automatic controls that holds the aircraft** on any selected magnetic heading & returns the aircraft to that heading when it is displaced from it.

The automatic pilot also keeps the aircraft stabilized around its horizontal and lateral axes.



## Purpose:

- It primarily reduce the work strain work & fatigue of controlling the aircraft during long flights.
- It allows the pilot to maneuver the aircraft with a minimum of manual operations.
- It provides for one, two or three axes control of the aircraft.



## Principle:

- Rate of disturbance = Rate of correction

The autopilot systems flies the aircraft by using electrical signals developed in **gyro sensing units**. These units are connected to **flight instruments that indicate direction, rate of turn, bank or pitch**. If the flight attitude or magnetic heading is changed, the electrical signals are developed in the gyros. These signals are used to control the operation of the servo units, **which convert the electrical energy into mechanical motion**.

The **servo** is connected to the **control surface** & converts the electrical signals into mechanical force, which moves the control surface in response to corrective signals or pilot commands.



## Basic components:

- All the autopilot system contain the same basic components:
  - The **sensing elements (gyro)**:to sense what airplane is doing
  - The command elements: to automatically generate signals to keep the movements in control
  - The computing elements (**amplifier**):to increase the **strength of gyro signals** to operate servos
  - The output elements (**servo**):to move control surfaces
- **Three channels:**
  1. Rudder channel.
  2. Aileron channel.
  3. Elevator channel.



## **Sensing Elements: Gyro**

- The directional gyro, turn & bank and attitude control gyro are the sensing elements.
- These units sense the movements of the aircraft & automatically generate signals to keep the movements in control



## Command Elements:

- The command unit (flight controller) is manually operated to generate signals that cause the aircraft to climb, drive or perform coordinated turns.
- **Additional command signals** can be sent to the autopilot system by the **aircraft's navigational equipments**.
- The autopilot system is engaged or disengaged electrically or mechanically depending on design.



## Computing Elements: Computer or Amplifier

- The computing elements consists of an **amplifier or computer**.
- The **amplifier receives signals**, determines what action to the signals is calling for and amplifies the signals received from the **sensing elements**.
- It passes these signals to the ailerons, rudder & elevators **servo to drive the control surfaces** to the position called for.



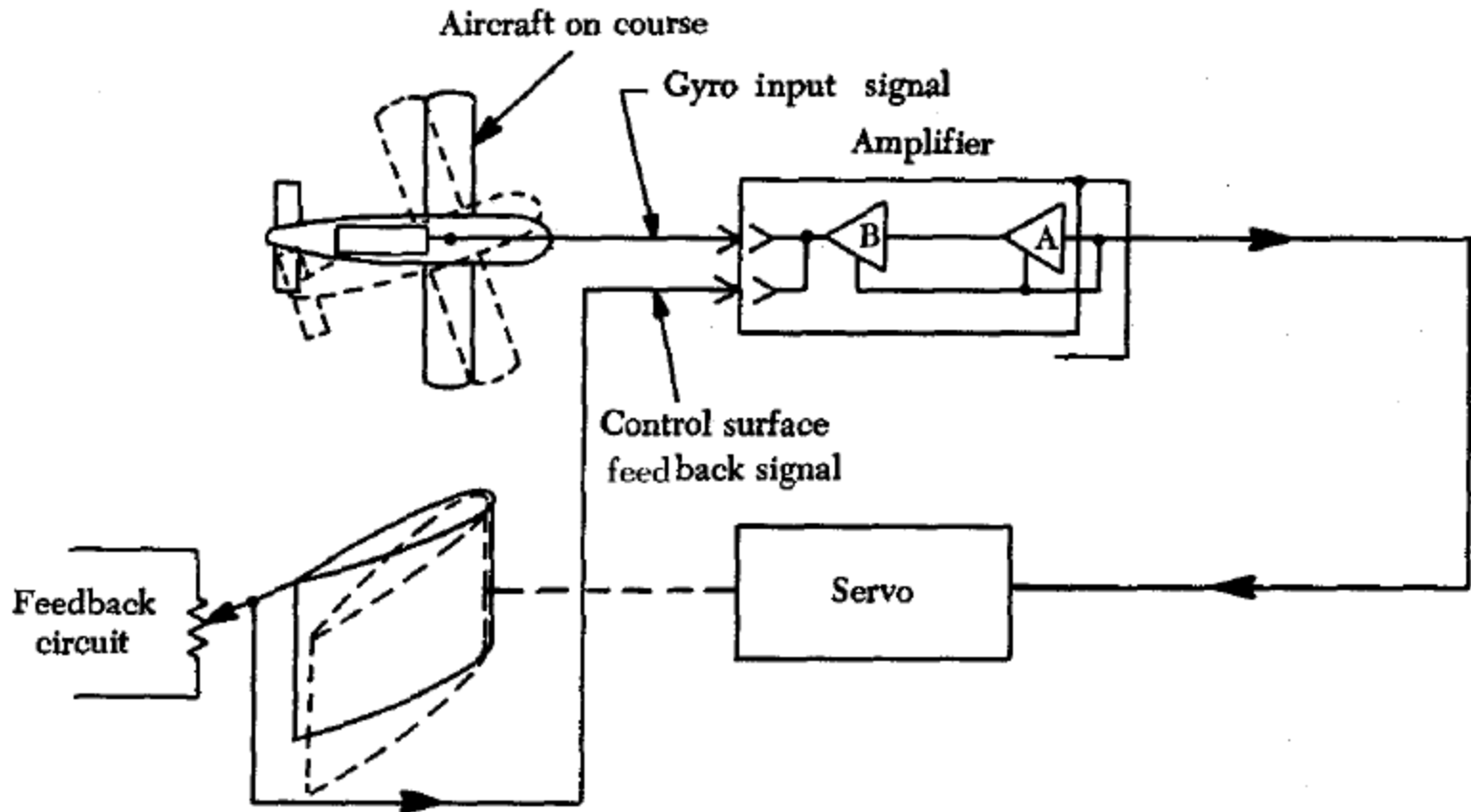
## **Output Elements: Servo motors**

- These are the servo motors which actuate the control surfaces.
- The majority of the servos in use are either electric motors or electro-pneumatic motors





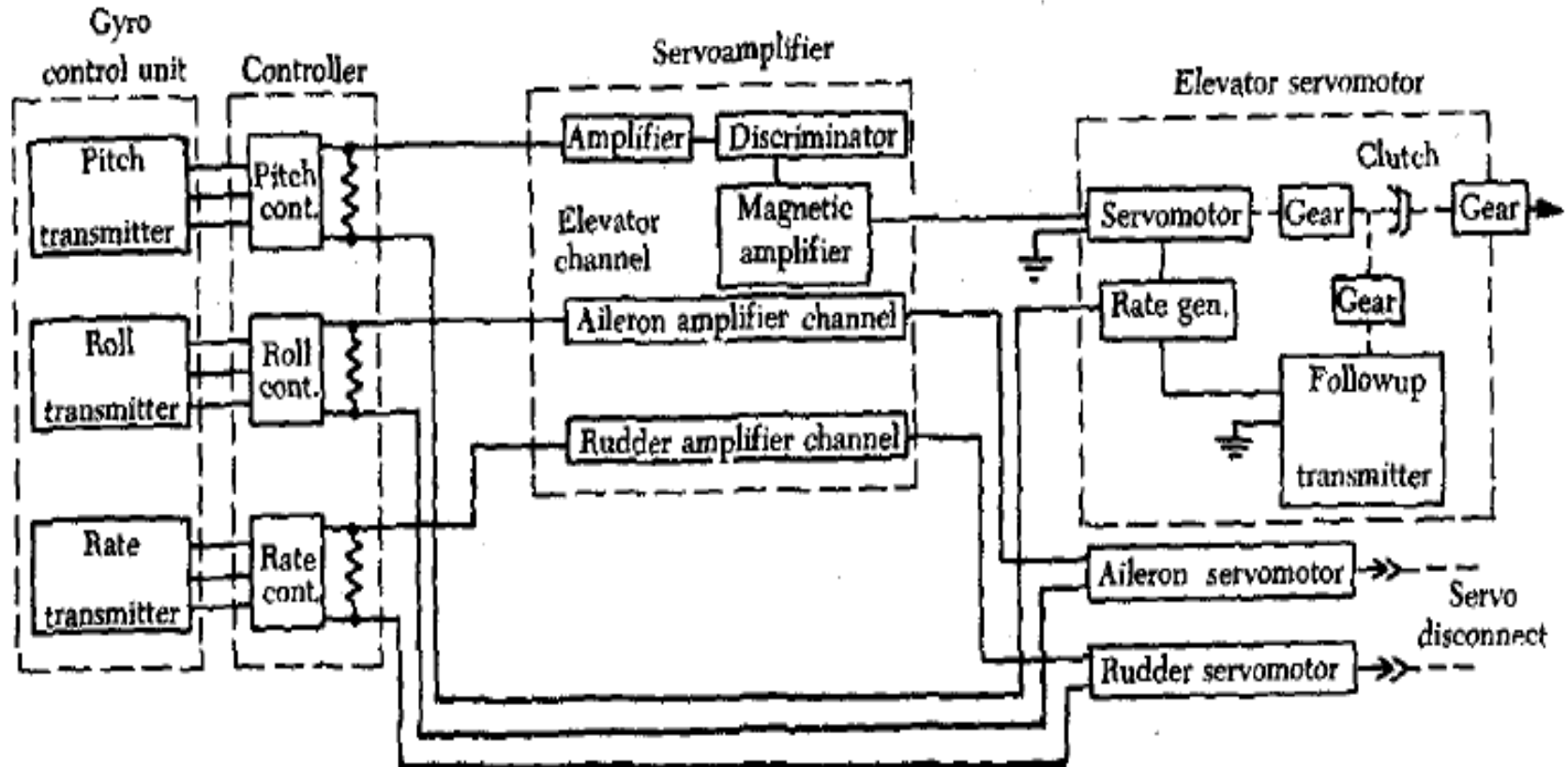
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Basic autopilot system.



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Autopilot block diagram.



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