

An actuator is a type of motor for moving or controlling a mechanism or system. It is operated by a source of energy, typically electric current, hydraulic fluid pressure, or pneumatic pressure, and converts that energy into motion. An actuator is the mechanism by which a control system acts upon an environment.

Direct Drive Actuators are typically operated in a closed loop on system level. For Mechatronic Actuators, feedback loop is often locally or indirectly on system level. adjustments to the controller inputs to regulate the actuators. The closed loop feedback controller is what will be evaluated as the optimal design and is shown in **Figure 1** below.

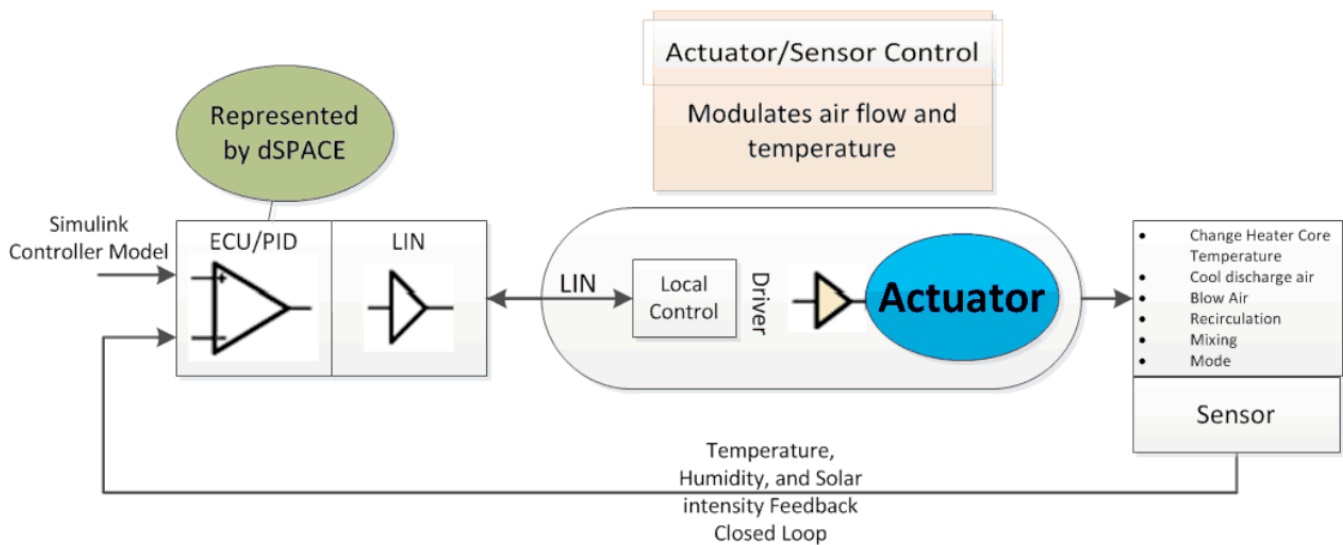


**Figure 1** Climate Control Logical Flow Diagram

The HVAC LIN Module subsystem can control actuators over a LIN communication channel by monitoring / detecting: actuator drive control & status, actuator faults, and communication faults.

The following are components to describe the actions within HVAC Door Actuator Drive Interface subsystem:

- LIN Actuator command and response frames- :
  - LIN Actuator Initialization Frames - The INI (initialization) command is used for starting the actuator.
  - LIN Actuator Set Frames - The Set command is used for positioning the actuator.
  - LIN Actuator Response Frame provides actual position, stall detection, and diagnostic status.
- Actuator Dynamic Range Learning- The Dynamic range tells the span of movement available to the actuator.
  - LIN ECC Wake Up- The LIN wake up defines the device hardware power up needs.
  - LIN ECC Shutdown- The LIN shut down defines the device hardware power down needs.

- LIN Actuator Command- The commanding of the actuator requires initializing and driving the actuator to a desired position.
- LIN Actuator Stall Detection- A detection of a blockage is determined when the torque goes beyond a certain limit.
- LIN Actuator Suspend Movement- The suspend movement of an actuator is activated when an event occurs that requires the actuator to stop moving to the commanded position.
- LIN Actuator Emergency Run- The emergency run condition allows and actuator to drive to an endstop based on its calibrated direction.
- DTCs- Diagnostic Trouble Codes are codes that can indicate where there is a problem in the system
  - DPID - Data Packet Identifier is a parameter that has a value that can be displayed by a test tool.
  - CPID - Control Packet Identifier, used to control DPID values or operation via a test tool.

Problems with actuators could cause inaccurate results. For example, when the customer is using the air conditioning system, the air inlet and delivery actuators control the air circulation internally and externally within the vehicle. If the air inlet and delivery actuators extract air particles when the customer switches from internal to external , it would be a problem delivering fresh air. Furthermore, problems with the temperature blend flaps, blower motor, evaporator and heat core would lead to errors in air circulation.