

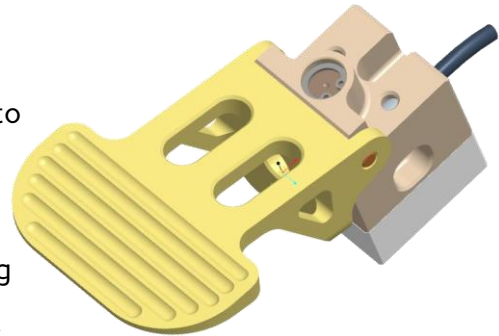


# ZYTEK EGS System Overview

## Background

The Zytek EGS (= Electrically-assisted Gearshift System) is unique as the only high-level advanced gearshift system which is purely electro-mechanical. Most commercially available automatic and semi-automatic gearshift systems used in motor racing applications are based on either hydraulic or pneumatic power sources.

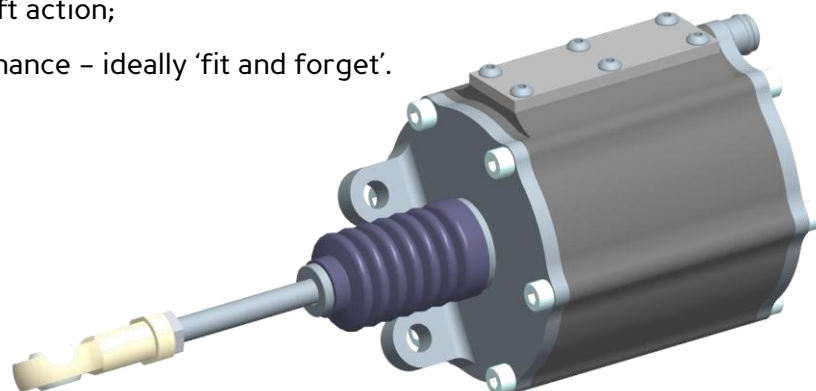
The Zytek EGS has been specifically developed to avoid the installation complexity, maintenance requirements, and weight associated with pneumatics or hydraulics, whilst delivering equivalent shift energies and quick shift speeds.



## Concept

The technical concept of the EGS is based on the following:

- All-electric operation – requires no hydraulics or pneumatics;
- Simple installation – two actuators, an electronic control unit and two ‘paddle’ switches mounted on the steering wheel.
- All components connected by a simple wiring harness;
- Intended for race cars fitted with sequential gearboxes with a simple ‘push-pull’ gearshift action;
- Low maintenance – ideally ‘fit and forget’.



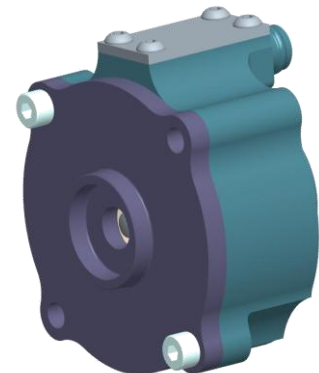


## Implementation

The EGS operates using high-performance solenoids. To minimise electrical losses the solenoids are controlled using a high voltage drive signal. A shift solenoid effects the gearshift (twin single actuators may also be used, depending on installation constraints), whilst a throttle solenoid provides a throttle ‘blip’ function during downshifts. Electrical energy for the gearshift and throttle blip is stored ready for use within the GCU (= Gearshift Control Unit) and recharged by the 12V vehicle charging system between shifts. The GCU also provides the control and monitoring capabilities of the system.

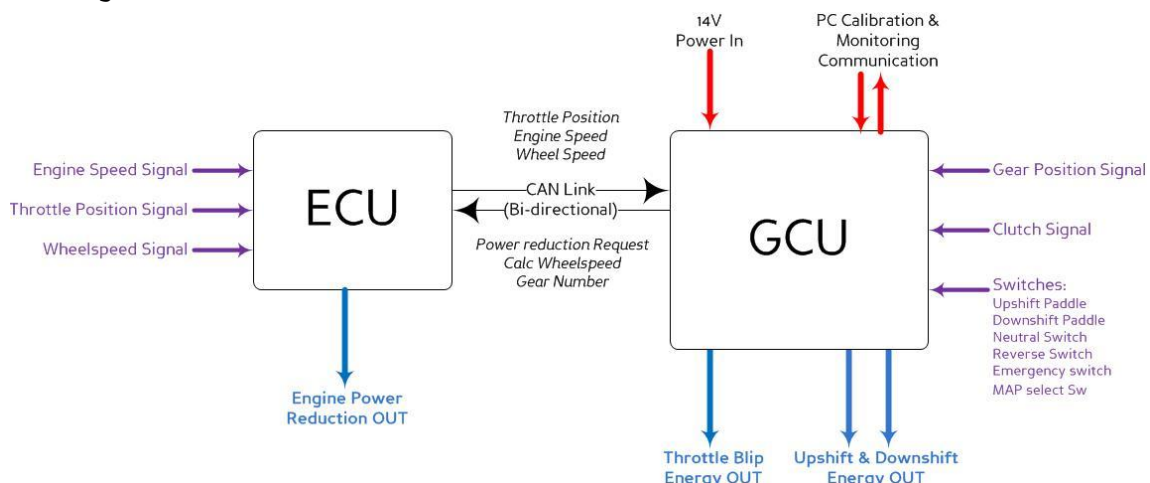
The driver initiates a gear shift using steering-wheel mounted ‘paddle’ switches, with separate push-button switches to select reverse and neutral. Both upshifts and downshifts are achieved without the need to operate the clutch, except for launch, stopping, selecting neutral and selecting first / reverse gears from neutral.

The GCU can be programmed to interface to both Zytek and third-party engine controllers, using a CAN interface. The unit also interfaces with steering wheel instrumentation. Rapid system calibration is facilitated with the support of built-in data logging and Zytek’s calibration and data analysis tools, which are run on a notebook PC connected to the control unit.



## Basic System Layout

The following system block diagram illustrates a typical EGS installation, showing the connections to sensors and actuators together with a bi-directional CAN link to an engine control unit:





## Performance

The EGS is capable of individual gearshifts in 25 milliseconds, and up to 5 downshifts in less than a second. Additionally, the precise control of the electric actuators results in very little wear on the gear selector mechanism and dog rings, which extends gearbox life, improves reliability and shift accuracy.

Gear ratios are set and stored in Non Volatile memory for downshift over-rev protection of the engine. Access to these settings are via Zytek supplied PC or PDA software packages.

## Technical Specification

<b>Operating Voltage:</b>	14V, +/- 2V		
<b>Operating Temperature:</b>	50°C Ambient, 60°C (Internal as reported by Caltool)		
<b>Current Draw</b>	Continuous:	~1A	
	Peak (immediately after shifting):	~50A (very short-duration)	
<b>EMS ECU interface:</b>	CAN		
<b>System Calibration:</b>	Notebook PC Optional use of PDA for simple setup changes		
<b>Shift Actuator Types:</b>	Single-acting:	Used in pairs on the gear selector rack	
	Double-acting:	Designed to be used on the gear selector lever	
<b>Throttle Actuator Types:</b>	Solenoid only:	The mechanical integration of this on to the engine is the responsibility of the customer and subject to technical approval by Zytek.	
	Cable operating:	The cable type throttle actuator is designed to work on most cable-operated throttles. It is designed to be fitted inline with the throttle cable.	
<b>System Masses:</b>	<b>Component</b>		
	GCU:		2200g
	Single-acting actuator:		760g
	Double-acting actuator:		1700g
	Standard Throttle actuator		580g
	Inline Throttle actuator		1100g
	Paddle switch:		65g



## Product Summary

The Zytek EGS is an 'alternative' approach to semi-automatic gearshift on race cars, avoiding the need for either pneumatics or hydraulics. It has the capability for better shift control than comparable pneumatic systems and is simpler to install and maintain than hydraulic shift systems. It has been extremely successful on the racetrack to date and its operation, performance and reliability have been well-received by both drivers and teams.

The Zytek EGS is currently used on all cars in, the Formula Nippon and Japan GT racing series and the Zytek, HPD, Mugen-Courage, Dome, Embassy Racing and WR sports prototypes. It was also used on the A1GP racing series Lola-Zytek Cars and continues to be used in the AutoGP Championship.



## Contacts:

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