

# GASTEC

## HIGH PERFORMANCE FUEL PROCESSOR MODEL

### 2 Models:

(2<sup>nd</sup> Edition- for Updated Fuel Processors)

**FP32**

**(Processor Only)**

**FP32-DS**

**(with Dual Fuel Start)**

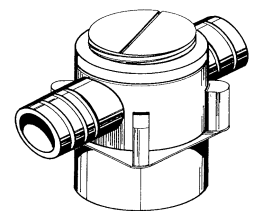
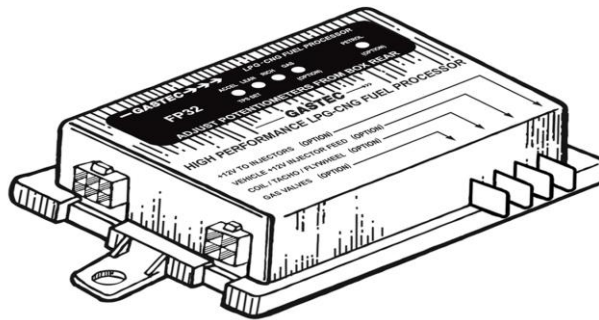
### Features:

- High Performance Microprocessor running at 20Mhz with 14 bit wide instructions;
- 260 microsecond worst case loop times (this gives the mathematical power to calculate the exact air/fuel ratio in real time);
- Two different air/fuel ratios – one for increased engine power during acceleration (and when under higher loads) and a second to provide excellent economy when cruising. This makes the FP32 an excellent choice for vehicles that tow heavy loads yet require maximum economy;
- Adjustable Dual Fuelling when changing from petrol to LPG/CNG (DS model only);
- Adjustable Open/Closed Loop at Idle;
- Rich/Lean Lambda Tuning Lights Built-in;
- Oxygen Sensor Emulation.

### Suitable for 1.3 to 6.2 litre vehicles

The mathematical calculations required to ensure fast air/fuel compliance are carried out by a high performance microprocessor. Acceleration override and air/fuel calculations are given priority. Usual minimum petrol injector pulses are in the vicinity of 2 milliseconds compared to the FP32's worst program loop times of 260 microseconds. The FP32 is therefore able to calculate the required air fuel ratio 7.6 times faster than the minimum petrol injector pulse.

This places the FP32 in a new performance class which is only exceeded by electronic fuel injection systems.



### *Before Proceeding*

*The FP32 Fuel Processor requires an oxygen sensor input (standard sensor output is 0.0 volts lean & 0.9 volts rich), a throttle position sensor input (standard TPS sensor is 0.2 to 1.6 volts at idle & 3.5 to 5.0 volts at full throttle).*

*This processor should not be installed if these two inputs are not available. If different sensor voltages are required please choose another processor from the Gastec range.*

The processor drives a high quality stepper valve (CV30) to control the gas mixtures accurately via a 90 degree rotational barrel. This valve operates continuously whilst driving on LPG or CNG. The slotted barrel rotates slowly to achieve the exact air fuel ratio required - unless it receives an increased load signal from the throttle position sensor (in which case it opens very much faster). **The CV30 is made with brass sintered bearings and contains no gears or worm drives to wear out. The design life of the valve is in excess of 500,000km.**

4 wire loom

**CV30 Stepper Valve**  
Read Tuning Instructions

# GASTEC High Performance Fuel Processor FP32 & FP32-DS

**Petrol/LPG-CNG  
Change-over  
Switch**

**+12 Volts from Ignition Switch or  
Fuse Box Must be able to supply 10  
amps & must hold +12V when Ignition  
is on & when cranking the engine**

Red Wire  
(Gas +12V)

Centre Terminal

**Install 10 Amp Fuse**

+12V

Gas Terminal

**90 Ohm LPG/CNG Gauge**

Sender Wire

90 Ohm Sender  
on Gas Tank

Earth (same as tank sender)

Earth

Green Wire (TPS Input)

**Throttle Position Sensor  
(TPS) [standard model  
0.2V-1.6V idle to  
3.5V-5.0V full throttle]**

+5V

Black Wire (Vehicle ECM Earth)

Connect to a point near  
the vehicle's ECM  
Must **NOT** be  
vehicle chassis

Vehicle  
ECM  
Earth

Grey Wire (O2 Emulation)

Brown Wire (O2 Sensor Input)

**O2 Sensor**

[standard model 0.0V lean  
to 0.9V rich]  
Connect to 1 Wire, 2 Wire,  
3 Wire or 4 Wire sensors

+12V

+5V

E

To Vehicle  
ECM

Cut O2 Output  
Signal Wire

Resistive Injector  
Emulation (option)

Normally  
Closed Relay  
Contacts

Terminal (DS option)

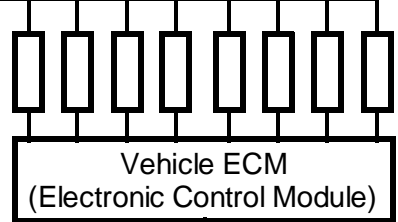
+12V to Injectors

Terminal (DS option)

Vehicle +12V Injector Feed

**Injector +12 Volt Loom Feed**

**Injectors**



Vehicle  
ECM  
Earth

## Install the FP32 away from excessive heat (ie exhaust manifold) and moisture

### WIRING CONNECTIONS

The FP32 is supplied with two looms. Each loom snaps into the connector on the side of the processor box. The first loom has the CV30 valve connected to it (**do not plug in the stepper valve until the tuning procedure is complete**) and the second loom is connected to the various vehicle sensors.

**Important Note: Fully unscrew and remove the adjusting cap from the CV30 stepper valve. Using your fingers, gently open the slotted barrel assembly until the valve is fully open (it rotates 90 degrees between the stops). Screw on the adjusting cap a full 2 turns and lightly lock into place with the locking ring.**

The CV30 should now be installed in the vapour line between the convertor and the gas mixer. A separate manual high speed adjuster (power valve) is not required to be installed in the vapour line.

For performance reasons, the vapour line should be kept as short as possible. The FP32 and associated CV30 valve are high performance components and are designed for 19mm vapour hose. **Do not install the stepper valve near the exhaust manifold or in other areas of extreme heat.**

The second (vehicle) loom containing five wires is connected as follows;

#### Red wire

Locate a suitable source to drive all the gas conversion electrics from either the vehicle's fuse box or ignition switch. The power supplying the gas/petrol switch should come from a "clean" power source **never** from the positive side of the vehicle's high tension coil. This chosen source must be able to safely supply 10 amps and must have a 10 amp fuse inserted to protect the vehicle's electrical system from any overloads. The fused wire should be connected to the central terminal on the petrol/gas changeover switch. **The FP32's red +12 volt wire should then be connected to the gas terminal of the gas/petrol changeover switch** (so that it only receives power when the driver wishes to run the vehicle on gas - see wiring diagram).

#### Black wire – Critical Vehicle ECM Earth Connection Only!

This should be connected to the **vehicle's OEM computer earth as closely as possible to the vehicle's ECM computer**. Many installations have been completed successfully by connecting the black earth wire to either the negative side of the battery or to the engine earth. This is however not guaranteed and if any instability in either the ACCEL or the RICH/LEAN lights is observed, relocate the black earth wire to a connection point close to the vehicle's ECM computer.

The **vehicle chassis must not be used as this is poorly referenced to the oxygen sensor**. Do not earth this wire close to electrical noise generators such as high tension wires or alternators.

#### Green wire

This should be connected to the **throttle position sensor (TPS)**. This sensor is normally found on the under-bonnet throttle butterfly. **On vehicles that operate "Drive by Wire" (where a stepper motor is used to move the throttle butterfly) the TPS sensor should instead always be connected to the accelerator pedal potentiometer**. Engine fault codes and instability in the ACCEL light may occur if connected to the butterfly potentiometer on Drive by Wire vehicles. Most TPS sensors read approximately 0.20 to 1.0 volt at idle. When the throttle is slowly depressed the TPS voltage normally slowly increases to around 3.5 to 5.0 volts at full throttle. The different air/fuel ratios are determined by the TPS setting. The standard programming sets the following Lambda points: TPS <1.0 volt sets the O2 Lambda point to 0.61 volts (to help stabilise the idle if closed loop at idle is chosen); TPS >1.0 volt <3.2 volts sets the O2 Lambda point to 0.39 volts (to improve economy under

light load conditions); TPS >3.2 volts sets the O2 Lambda point to 0.61 volts (for heavier load conditions). If a modified program is required please choose a different processor in the Gastec range.

**Note: a TPS sensor provides a varying voltage as the throttle is depressed.** A minority of vehicles contain only a throttle position **switch** which suddenly switches the voltage. The FP32 should not be installed on vehicles that contain only a throttle position **switch**.

### **Brown wire**

The FP32 is normally programmed to suit O2 sensors that operate at 0.0 volts lean and 0.9 volts rich. There are other Fuel Processors in the Gastec range to suit different O2 sensors.

**The vehicle's O2 signal wire** should be isolated from all other wires leading from the O2 sensor, and then cut. The Brown wire should then be soldered to the cut signal wire that leads directly to the O2 sensor. This wire provides the FP32 with the rich/lean signals from the oxygen sensor. If the O2 signal wire is shielded make sure the shield is not broken. Also make sure the shield wire is not shorted (connected) to the O2 signal wire.

### **Grey wire**

This wire should be soldered to the cut oxygen sensor signal wire that leads directly back to the vehicle's ECM. This wire supplies an oxygen emulation signal to the vehicle's ECM to prevent the injector "block learn" from logging different values when operating on gas. Should the "block learn" parameters move significantly, rough idling, stuttering during acceleration and surging may occur when next operating the vehicle on petrol. The standard O2 emulation signal is a 0.7Hz square wave of 0.0 volts lean and 0.9 volts rich. This emulation suits many vehicles but not all. **Talk to your Gastec distributor if you experience engine management lights.** It may be that you require a different processor in the Gastec range or it may be that a separate oxygen emulator will need to be installed.

### **Vehicle +12V Injector Feed Terminal (FP32-DS model only)**

Locate the +12 volt source feeding the fuel injectors. This wire should be cut at a point close to the fuel injectors to ensure power is not interrupted to other parts of the vehicle. Connect this terminal to the wire that leads back to the vehicle's loom (ie this will be the wire that supplies the +12 volts).

### **+12V to Injectors Terminal (FP32-DS model only)**

Connect this terminal to the wire that leads directly to the Fuel Injectors. The internal relay is rated at 10 amps and this must not be exceeded. The standard processor does not contain any injector emulation. **If engine management lights are observed, it may be that you require an injector emulator.** Sometimes a separate injector emulator will need to be installed, or it may be that a different processor in the Gastec range can be fitted.

## **FP32 Indicator Lights**

### **Green light – ACCEL TPS SET**

The green ACCEL TPS SET light performs two functions;

- A. **TPS SET Function** - At Idle, the Green ACCEL light should flash quickly when in Open Loop mode (ie the CV 30 Stepper Valve is held open) or it will remain off when in Closed Loop mode (see Adjustments & Tuning below).
- B. **ACCEL Function** - The Green ACCEL light should come on when the accelerator is depressed quickly from idle. This indicates an increasing load condition to the processor. The processor will now open the CV30 stepper valve at a much faster rate to ensure adequate fuel is delivered to the engine during acceleration. The Green ACCEL light will stay on for varying times depending on how far and how fast the accelerator is depressed. It should go off within 3 seconds (after depressing and holding the accelerator steady).

### Lean & Rich Orange Lights

The left orange Lean light indicates when the engine is **running Lean** (ie not enough gas). The right orange Rich light indicates when the engine is **running Rich** (ie too much gas). As long as the gas mechanical delivery components (the convertor, vapour hose and mixer) can deliver sufficient gas to the engine, these lights should flicker constantly (when engine is above idle) between rich and lean. This indicates that the Lambda (or stoichiometric) region is being maintained. The exception to this is if the green ACCEL light is on or is flashing quickly (in which case the stepper valve is being held open and the rich light should remain on).

### Petrol Light (FP32-DS models only)

The red Petrol light comes on when the vehicle is operating on Petrol.

## ADJUSTMENTS & TUNING THE GASTEC FP32 FUEL PROCESSOR

1. Ensure that the CV30 Stepper Valve is fully open and its associated loom is **not** currently connected to the FP32. **The stepper valve must not be connected until the initial setup procedures below have been completed.**
2. Turn on the ignition but **do not start the engine**. Ensure that the gas/petrol **switch is in the gas position**.
3. The "**TPS/RPM SET**" potentiometer is adjusted by carefully inserting a small screwdriver through the hole (in the rear of the box) to engage the potentiometer on the circuit board.

**Open Loop at Idle** - Adjust the TPS/RPM SET potentiometer **slowly** until the green ACCEL TPS SET light on the front of the FP32 **just begins** to blink rapidly. This will allow richer mixtures at **idle** (by holding the stepper valve open). Open loop is often chosen on vehicles that are known to backfire on hard acceleration from idle and/or vehicles that "stutter" when accelerating hard from idle. The TPS voltage at idle must be between 0.2 volts and 1.6 volts. If it is outside of this range you will not be able to adjust for open loop at idle. **Don't forget to plug the hole with the plastic stopper to prevent water entry.**

**Closed Loop at Idle** - Adjust the TPS/RPM SET potentiometer against its minimum stop so that the green ACCEL TPS SET light on the front of the FP32 remains off. This gives the maximum economy and minimum exhaust emissions by allowing the stepper valve to operate around the Lambda point all of the time. Be aware that the majority of the gas required at **idle** is supplied by the **needle idle jet**. The CV30 stepper valve **only** has a significant effect on the atmospheric diaphragm gas delivery valve. For this reason, stoichiometric control will/may only be achieved **just above** engine idle. **Don't forget to plug the hole with the plastic stopper to prevent water entry.**

4. Adjust the "**PETROL OVERLAP**" potentiometer (**FP32-DS model only**) to midway between the minimum and maximum stops. This potentiometer adjusts the time **both fuels** are allowed to enter the engine during the cranking (starting) phase.
5. Switch the gas/petrol dashboard changeover switch to the GAS position. Now start the engine (**still with the CV30 stepper valve disconnected**). If this is a new installation it may take several starting attempts to suck all of the air out of the gas lines. Turn off the ignition before each engine crank. This will ensure that the petrol injectors operate with every crank thereby aiding the starting process. If the vehicle does not idle smoothly, adjust the idle jet on the convertor.
6. **The CV30 stepper valve should still be disconnected.** AFTER DETERMINING THAT THE ENGINE IS IN GOOD CONDITION, rev the motor to approximately **2500 rpm** with no load being applied (ie in neutral). Wait for the O2 sensor to warm up (typically takes 10-20 seconds). Now **adjust the power valve** (the large screw adjustment on the CV30) until the mixture is **CONSTANTLY JUST**

**RICH.** Now allow the engine to fall back to idle before **unscrewing the power valve 1/4 of a turn.** Rev the vehicle several times from idle and observe the processor lights. The **lean light should not come on at all or should only come on for 1/4 of a second or less** (while accelerating). If the lean light comes on for more than 1/4 of a second then **unscrew the power valve another 1/4 of a turn and test again.** Continue this process until the lean light is lit for 1/4 of a second or less. Now **tighten the locking ring firmly** on the power valve making sure the adjustment cup is not moved. This then sets the maximum richness point. The CV30 stepper valve will then lean the mixtures from this point.

**7. The CV30 valve should still be disconnected. Re-adjust the idle mixture** on the convertor (vapouriser) to obtain a **JUST RICH** reading (the rich light on the processor should be on). **Ensure the engine idles smoothly with the air-conditioning on, head-lights on high beam, the front wheels turned to the full lock position (if power steering is fitted) and with the automatic transmission (if fitted) in DRIVE (obviously with your foot securely on the brake).** This places the maximum load onto the engine at idle. The vehicle should continue to idle smoothly. If it does not idle smoothly, re-adjust the idle mixture until it does.

#### **8. Fine Adjustments to the PETROL OVERLAP Potentiometer (FP32-DS model only)**

The FP32 contains an internal relay (with normally closed 10 amp contacts). This relay will turn the petrol injectors off when operating on gas. A short (adjustable) overlap is provided to ensure the engine starts easily.

If the engine is difficult to start, carefully observe the red **Petrol** light on the FP32. If the **Petrol** light goes out **before** the engine has properly started, turn the PETROL OVERLAP potentiometer a little more towards the arrow (for more petrol start). If the engine appears to start then stalls while the **Petrol** light remains on, turn the PETROL OVERLAP potentiometer slightly away from the arrow (for less petrol start). This procedure may need to be done several times to ensure easy starting is achieved. Remember that slightly more petrol start is required after the vehicle has been left overnight. **Don't forget to plug the hole with the plastic stopper to prevent water entry.**

#### **9. Fine Adjustments to the TPS/RPM SET Potentiometer**

If you require open loop operation at idle (to hold the stepper valve open), carefully adjust the TPS/RPM SET potentiometer until the green ACCEL TPS SET light **just** begins to flash quickly. Check that the green ACCEL TPS SET light stops flashing when you **slightly** depress (and hold) the accelerator. If you require closed loop operation at idle (so that the stepper valve operates normally), simply adjust the TPS/RPM SET potentiometer so that the green ACCEL TPS SET light does not flash at idle. **Don't forget to plug the hole with the plastic stopper to prevent water entry.**

#### **10. Turn off the engine. Connect the CV30 Stepper Valve for the very first time.**

11. Restart the engine again and operate on LPG/CNG. To check that the CV30 valve is operating correctly, **hold the revs steady at about 2500rpm. After approximately 3 to 8 seconds the two orange rich and lean lights should toggle back and forth** (the O2 sensor may take 20 seconds to warm up). This indicates that the stepper valve is controlling the gas mixtures around the Lambda (stoichiometric) point.

12. Check that the engine idles smoothly. If not, check the status of the orange Lean and Rich lights. If the **idle becomes "lumpy"** while either the rich or the lean lights are lit, a **small readjustment** to the idle mixture screw on the convertor may be necessary. This completes the tuning procedure.

## SUBSEQUENT RETUNING

All tuning procedures must be carried out with the CV30 stepper valve fully open. To force the CV30 stepper valve fully open, start the engine and wait for the O2 sensor to warm up. Now adjust the idle mixture on the convertor to lean (the rich light must not flicker). Wait for 15 seconds (the CV30 valve should now be fully open), then stop the engine by turning off the ignition. Now disconnect the CV30 loom and commence the tuning procedures from step 2 above. You can also force the CV30 valve fully open by adjusting the TPS/RPM SET potentiometer until the green Accel light flashes quickly. Wait for 3 seconds before turning off the ignition. Now disconnect the CV30 stepper motor loom.

## FP32 OPERATIONAL PROBLEMS AND HOW YOU MIGHT OVERCOME THEM

### FP32 ACCEL LIGHT IS ON ALL THE TIME (or flickers constantly)

Check that you have connected the processor's black earth wire to a point that is close to the vehicle's ECM earth. Make sure the processor's wiring loom does not run past the alternator or the high tension cables or coil. On a small number of vehicles, the ACCEL light flickers (or remains on) with a steady throttle. This is normally associated with unstable TPS voltages. A quick fix may be achieved by cutting the green TPS wire and inserting a silicon diode (ie 1N4004) with the stripe (cathode) facing towards the gas fuel processor.

### FP32 LEAN LIGHT IS ON ALL THE TIME

Ensure that the CV30 stepper valve is plugged into the FP32 and the stepper loom is undamaged.

Check that the FP32 is **earthed to the vehicle's ECM** and **not to the chassis**. Ensure that the FP32's oxygen sensor signal wire is not connected to the vehicle's oxygen sensor heater or earth wire. Oxygen sensors have a finite life, sometimes only 80,000km to 150,000km. When their life is expired they generally give out a constant lean signal.

Unscrew the power valve almost all of the way. Check if the lean light remains on. If so, check if the CV30 valve is fully open. To do this, allow the vehicle to run on gas at approximately 1500 rpm for 15 seconds. After 15 seconds have elapsed (but still holding the revs at approximately 1500 rpm) immediately stop the engine by **turning off the ignition**. Now unscrew the CV30 power valve completely. Check that the rotational barrel in the valve is fully open (so the gas can pass through the slot in the middle).

IF THE PISTON IS IN THE FULLY OPEN POSITION the problem lies with the mechanical gas system, not the FP32. Areas to examine would be: A/ the correct mixer is fitted to the vehicle, B/ no air leaks exist in the vehicle's intake system, especially around the mixer, C/ the inner wall of the vapour hose has not collapsed nor is the hose kinked, D/ the convertor is delivering gas without fault, E/ the tank contains a useable amount of gas, F/ the excess flow valve (in the tank) has not triggered, G/ the filters in the gas solenoids are not blocked.

IF THE BARREL IS NOT IN THE FULLY OPEN POSITION the problem is likely to be a wiring fault, or the processor, or the stepper valve itself. Check the following: A/ the fuel processor is **earthed to the vehicle's ECM** and not the vehicle's chassis, B/ the loom connector to the CV30 is fully plugged in. If the above have been checked carefully, replace the CV30 stepper valve and retest. If the problem remains, replace the FP32 (the original CV30 stepper valve may well be fully operational).

### FP32 RICH LIGHT IS ON ALL THE TIME

Check that the green ACCEL TPS SET light is not on. If it is flashing quickly, then the processor is in Open Loop mode (which holds the CV30 valve open and so rich mixtures would be expected). The

TPS/RPM SET potentiometer should be adjusted so that the ACCEL TPS SET light does NOT flash once the accelerator is depressed **slightly**. If the green ACCEL TPS SET light is **constantly on just above idle** (while you are holding the throttle steady), check the TPS input wire. The voltage must slowly change as you depress the accelerator (from 0.2 to 1.6 volts at idle to 3.5 to 5.0 volts at full throttle for the standard FP32 model). TPS sensors do wear out. If the change in voltage is erratic, the sensor may need replacing.

Ensure that the CV30 stepper valve is plugged into the FP32 and the stepper loom is undamaged.

Check that the FP32 is **earthed to the vehicle's ECM** and **not the chassis**. Ensure that the FP32's oxygen sensor wire is not connected to the oxygen sensor heater wire. This will give a constant rich reading while the oxygen sensor is being electrically heated. On some vehicles the heater wire will contain +12 volts for several minutes. If the heater is turned off when the sensor is hot, the FP32 will then read a constant lean signal from this time on.

At revs ensure you can lean the mixture by screwing in the power valve. If the orange Rich light remains on, check that the CV30 is actually fully closed. Run the vehicle on gas at 1500 rpm for 15 seconds. Without taking your foot off the accelerator, immediately stop the engine by **turning off the ignition**. Unscrew the manual power valve on the CV30 stepper valve. If the rotational barrel is fully closed then the problem does not lie with the FP32 Fuel Processor or the CV30 stepper valve.

If the rotational barrel is fully open (and you were able to adjust the mixture lean by screwing in the CV30 power valve), replace the CV30 stepper valve. Now restart the engine and hold the revs at 1500rpm (allow the oxygen sensor to warm up again). Turn off the engine without removing your foot from the accelerator. Once again unscrew the manual power valve. If the rotational barrel remains fully open replace the FP32 (the original CV30 stepper valve may well be fully operational).

### **Warranty - First 3 Years (36 months)**

Gastec is proud of the high quality components used to manufacture the FP32. This processor is therefore sold with a three year warranty that is transferable between owners, provided it has not been abused in any way [ie it must not be melted from excessive heat, must not have been damaged by fluids such as water, must not be burnt out due to electrical overload (always install the 10 amp fuse) and it must not be crushed etc]. Within this warranty period the FP32 should be returned to your local Gastec distributor for repair and/or replacement at no cost to the owner. Each FP32 is date coded so no invoice is required by the factory.

### **Warranty - Years 4 to Year 10**

The processor should be returned directly to the factory (or to the importer in your country of purchase) with a payment of US\$30 (AUD\$40) to cover its direct return. Each FP32 is date coded so no invoice is required by the factory. The same warranty conditions apply as listed for the first 36 months.

### **NOTE – Fuel Economy**

LPG contains only 26 Megajoules per litre compared with 32 Megajoules for Unleaded Petrol (ie 19% less). To ensure maximum power when accelerating the FP32 will allow the engine to run richer on LPG/CNG. This is governed by the TPS sensor and the internal programmed air/fuel ratios.

*Gastec certify that the FP32 is CE Compliant. Installers should contact their closest distributor for wiring and placement instructions for **specific** vehicles to comply with local standards and emission regulations. Updated instructions and information on the FP32 and other Gastec products may be found at [www.gastec.ws](http://www.gastec.ws)*

The Gastec Group appreciates feedback from our customers. If our instructions or products need improvement, please let us know by contacting us through our website. We thank all our customers for supporting our products.

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***Save time by installing the FP50 Fuel Processor with built-in Rev Change-over and Safety Switch!***