



Range Rover Classic

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Schuler - Ferguson Formula - Service and Maintenance Instructions

Range Rover Conversion

Ferguson Formula

All-Wheel-Control system

Driving - Service and Maintenance Instructions



SCHULER PRESSES LIMITED
High Street

February 1981
Vehicle no: 10.0163

Sunninghill

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Ascot, Berkshire
SL5 9NR

INTRODUCTION

Your vehicle has been fitted with the universally acclaimed Schuler FF transmission. The benefits you can now expect from having chosen the best in four wheel drive are listed below.

We would like to wish you many miles of enjoyable motoring and assure you of our best attention at all times.

YOUR SCHULER TRANSMISSION OFFERS THE FOLLOWING BENEFITS:

Higher Overall Gearing: - Less noise, less wear, less fuel wastage.

Economy: - 5% better with automatic. 15% better with manual, due to reduced power losses in transfer box, advantageous overall gearing and reduced weight.

Handling: - 37% front / 63% rear torque bias from special centre differential improves both response and stability to give an unrivalled level of safety and control.

Traction: - Automatic limited slip centre differential prevents wheelspin with viscous action to cushion shock loads and protect driveline from damage.

Reduced Noise: - Silent transmission and reduced engine revs drastically reduce interior noise levels.

Backlash: - Special Morse-Chain drive system is free from snatch due to tolerance build up.

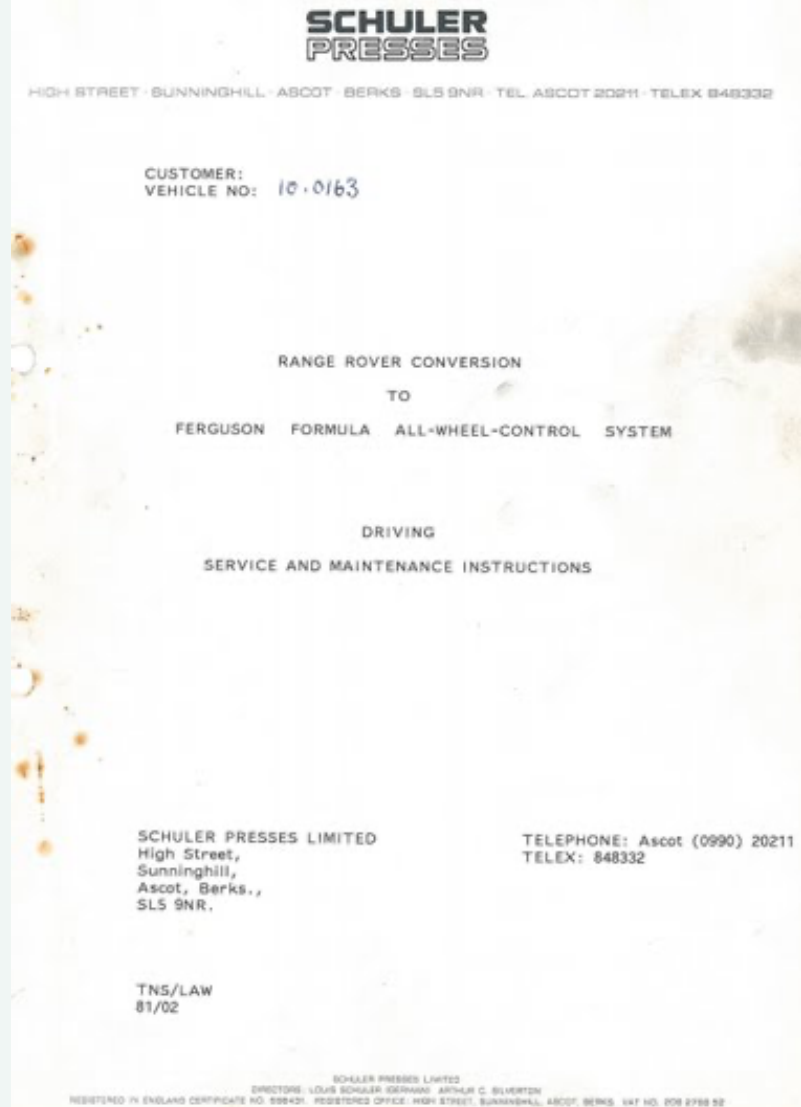
Braking: - Viscous centre differential prevents instability due to uneven wheel lock up. Optional Anti Skid system gives freedom from control loss due to locked wheels. Optimum deceleration is available and the driver is free to steer the vehicle to safety.

Reliability: - From the outset, Schuler FF transmissions were stressed for engines of considerably more than 3.5 litres. Generous margins of safety are allied to the reliability reaped from our 4 year development programme to give a product that will many years of superior and uniquely enjoyable service.

A 12 month unlimited mileage warranty is provided on all conversions.

IMPORTANT

NOTES ON DRIVING WITH SCHULER FF ALL-WHEEL-CONTROL



Rare Schuler-Voith FF - Service and Maintenance Instructions



Townley Ltd - UK
 TWR Special Vehicles - UK
 Vantagefield of London - UK
 Wadham Stringer Ltd - UK
 Wood & Pickett Ltd - UK

Range Rover Classic Special Theme

Don Safety Trophy - 1971
 Range Rover Conversions
 Range Rover Advertisement
 Range Rover Camel Trophy
 Range Rover CKD Assembly
 Range Rover Darien Gap
 Darien Breakthrough
 Land-Rover Series S1 S2 S3
 Land Rover Defender
 Ferguson Formula

Schuler - Ferguson Formula - Service and Maintenance Instructions

LT95 Salisbury Powr-Lok lockable limited-slip center differential - LSD

Range Rover Classic by Year

Range Rover 1970
 Range Rover 1971
 Range Rover 1972
 Range Rover 1973
 Range Rover 1974
 Range Rover 1975
 Range Rover 1976
 Range Rover 1977
 Range Rover 1978
 Range Rover 1979
 Range Rover 1980
 Range Rover 1981
 Range Rover 1982
 Range Rover 1983

A. GENERAL HANDLING

It should be emphasised that the ultimate limitation of car control is the grip between the tyres and the road surface.

The Ferguson system of All-Wheel-Control helps the driver to use the full potential grip to the best advantage in all conditions, but it cannot increase it; therefore, the car should always be driven with due regard to the prevailing conditions.

An FF vehicle handles in the normal manner, but with a greatly increased margin of safety when accelerating, braking, or cornering. The best characteristics of front and rear wheel drive are combined.

B. BRAKING

On vehicles fitted with anti-skid brakes the driver will feel a kick back through the brake pedal when the anti-skid system comes into operation. This is normal and is a warning that you could be driving too fast for the road surface conditions and your speed should be adjusted accordingly.

It must be stressed that the ultimate limitation on braking is the grip between the tyres and the road. Therefore great care should be taken on very slippery surfaces. The anti-skid system will enable the available grip to be used fully. But it cannot be expected to compensate for errors of judgement on the part of the driver.

SELECTOR OPERATIONS - 3 SPEED AUTOMATIC

NORMAL

SPORTS (SPECIAL ORDER ONLY)

Fig 1 (See text)



Schuler FF advert - Automatic - Ferguson Formula - Anti-lock braking



The famous Schuler converted 'Automatic FF' - badge on many RRCs

- [Range Rover 1984](#)
- [Range Rover 1985](#)
- [Range Rover 1986](#)
- [Range Rover 1987](#)
- [Range Rover 1988](#)
- [Range Rover 1989](#)
- [Range Rover 1990](#)
- [Range Rover 1991](#)
- [Range Rover 1992](#)
- [Range Rover 1993](#)
- [Range Rover 1994](#)
- [Range Rover 1995](#)
- [Range Rover 1996](#)

**Range Rover Classic US
by Year**

- [Range Rover US 1987](#)
- [Range Rover US 1988](#)
- [Range Rover US 1989](#)
- [Range Rover US 1990](#)
- [Range Rover US 1994](#)

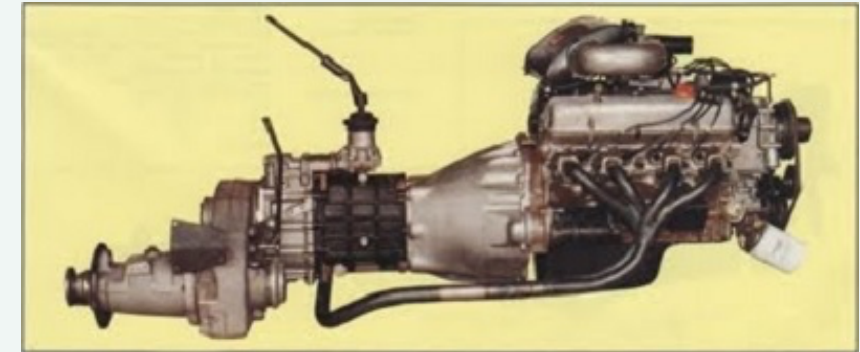
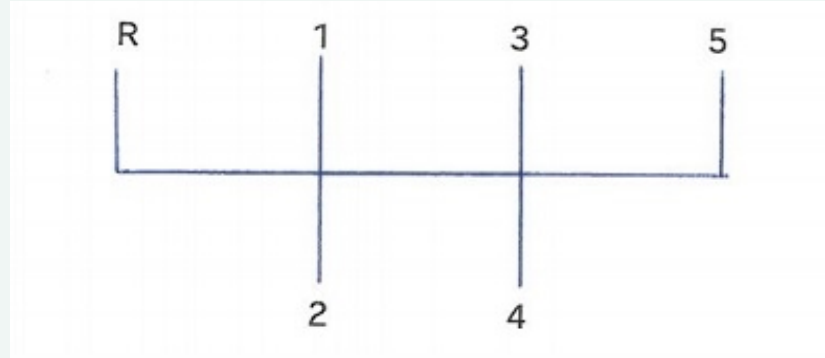
Land Rover - Special

- [Land Rover-Leyland Group](#)
- [Range Rover 1985 Salesman](#)



GEARCHANGE LAYOUT - 5 SPEED MANUAL

Fig 2



The more rare manual 5 speed JRT Schuler FF conversion

DRIVING THE AUTOMATIC FF RANGE ROVER

GENERAL - The automatic gearbox has been specially developed to give the best in smooth and effortless driving



and overtake driving.

Special attention to shift points gives an impressive blend of performance with economy.

Driver

fatigue due to stress is significantly reduced.

SELECTOR OPERATION - The centrally positioned selector lever allows free movement through those positions marked on Fig. 1 with arrows. All other movements require the button on the side of the T-bar selector to be depressed. Once the button is depressed, it is possible to engage any gear. It should not be depressed when the lever is being pushed forward and the car is in motion as this could involve the accidental selection of Reverse or Park.

SELECTOR POSITIONS

- P** The engine will only start with the lever in P or N. This is for reasons of safety. In the P position the gearbox output shaft is locked to provide a back-up parking brake. It is not recommended that it be used for securing the vehicle on slopes as it may prove difficult to disengage due to loadings on the locking mechanism. On no account should P be selected with the vehicle in motion as transmission damage will result.
- R** Reverse. Never engage this position when the vehicle is moving forwards.
- N** Neutral. The engine may be started in this position.
- D** Drive. To be used for all normal driving conditions. All three gears are used in sequence and the best gear for prevailing conditions is automatically selected. At town speeds a part throttle downshift operates under load to prevent the engine labouring in a high gear. Beyond the normal full throttle position, heavier pressure activates the kickdown facility causing the transmission to downshift into the most suitable gear for maximum performance when overtaking. In this position the engine's full rev range will be used. At town speeds, full throttle will engage 2nd gear for brisk acceleration while kickdown pressure will engage 1st for really rapid overtaking. Those used to other less responsive transmissions may be surprised by this eagerness of response and learn to adjust their throttle usage accordingly.
- 2** Manual Second. In this position the normal upward shift into 3rd does not occur. It can be used for extra engine braking (taking care not to overspeed the engine) or to prevent overfrequent automatic shifting where the driver is transferring repeatedly from power to overrun. No performance improvement is gained by delaying the 2-3 upshift manually. In this position
- 1** Manual First. Engages 1st gear to provide increased power at low speeds and extra engine braking. An inhibitor prevents engagement until road speed is reduced to safe levels but care must be taken not to overspeed the engine once the gear is engaged. In an emergency the speed inhibitor can be overridden to engage 1st at speed by briefly pushing the



Converted Range Rover by Wood & Pickett with Schuler FF automatic



One of the 25 Schuler converted 'Super Ranger' approved by LR

the speed limiter can be overridden to engage 1st at speed by briefly pushing the accelerator pedal to its kickdown position then releasing.

It should be stressed that this must only be used in a dire emergency (total brake failure at below 50 m.p.h. for example) as it will cause severe stress and possible damage to the gearbox and driveline.

NOTE The above general comments also apply in low range although speeds in the gears are severely limited and shifts will be firmer. Delicate use of the accelerator is recommended. Manual selection for engine braking off road should be made well in advance of requirements.

For low range instructions see below.

DRIVING THE 5-SPEED FF RANGE ROVER

GENERAL - The five speed Range Rover offers all the advantages of vehicle control of the normal manual control with the addition of a slick, sporting gearchange and a high fifth gear for *RR* cruising. It should be noted that new maximum speeds in the intermediate gears apply, these being:

1st	31 m.p.h.
2nd	50 m.p.h.
3rd	75 m.p.h.
4th	104 m.p.h.

GEARCHANGE LAYOUT - See Fig. 2

To assist gear-changing there is a spring bias into the 3rd/4th plane. To engage reverse slap lever sharply across to the left and then forwards.

HIGH-LOW RANGE SELECTION - IMPORTANT

To change from high to low, or low to high:

- 1 Stop vehicle.
- 2 Apply handbrake.
- 3 a) Automatic - select P on auto selector.
b) Manual - select neutral on main gearlever.
- 4 Move transfer gear lever smartly and firmly to desired range. If a delay is made in neutral the shift may not be accomplished. In this case the engine must be switched off before attempting to complete the shift.

Low range would normally only be required in severe 'off-road' conditions, i.e. deep mud



Typical Range Rover from Wood & Pickett with Schuler FF transmission. Most probably between 1-2000 Schuler transmissions were installed in



THE JENSEN FF.

Jensen FF and other carmakers used a similar, but slightly different Ferguson Formula system produced of GKN - in Range Rover the Schuler Presses Ferguson Formula transmission was produced of Schuler-Voith.

Low range would normally only be required in severe on-road conditions, i.e. deep mud or sand or very steep hills. Low/low should always be used when descending off-road steep hills. When in doubt use low range off-road.

SERVICING REQUIREMENTS

- A - Automatic
- B - 5-Speed JRT Manual (Jaguar Rover Triumph)

1 A WEEKLY

Check automatic transmission fluid level. The dipstick/filler tube is located at the rear of the engine compartment close to the bulkhead on the vehicles right hand side. The oil level should be up to the high mark on the dipstick with the engine idling and the gear selector in neutral.

Topping-up requires Mopar, Dexron, Dexron II or equivalent.
Any persistent loss of fluid must be investigated.

2 A/B AFTER FIRST 500 MILES

Check transfer gearbox oil level. The combined filler/ level plug and also the drain plug are situated in the rear-facing wall of the main casing and both should be carefully cleaned before refitting.

Filling must be carried out slowly to achieve the correct level. Automatic transmission fluid must be used. (If ATF is not available, any S.A.E. 10 engine oil may be used in an emergency, but the unit should be drained and refilled with the correct oil at the earliest opportunity.

3. EVERY 6,000 MILES

- a) A Check automatic gearbox fluid level as in point 1 above.
- b) B Check 5-speed gearbox fluid level. The oil level should be up to the bottom of the filler plug.
Topping up fluid should be as per Jaguar/Rover/Triumph recommendations for this unit.
- c) A/B Check transfer gearbox fluid level as in paragraph 2 above.
Not only should a lack of fluid be investigated but also an excess of fluid which may indicate an internal fluid migration which requires rectification.
- d) A/B Check centre diff operation. Apply handbrake and leave gear lever in neutral. Chock the wheel diagonally opposite to that being jacked up. Jack one front wheel clear of the ground. If this wheel is stiff to turn the viscous coupling unit is functioning correctly.

If the wheel will not rotate either the front axle or the 4 wheel drive unit is at fault. If the wheel rotates freely the viscous coupling unit is at fault.



Schuler-Voith Ferguson Formula transfer case - clearly seen badge



the wheel rotates freely the viscous coupling unit is at fault.

If the wheel turns freely, and the front drive-line is all intact, it means that the V.C. unit is not functioning correctly, in this case contact Schuler Presses Limited.

- e) A Check automatic gearbox shift performance. Test shift speeds against those shown below.
The transfer box sprocket ratio is shown next to the serial number on the rearward face of the transfer gearbox.

If the gearbox shift points are not as shown below follow the rectification procedure outlined.

Cable adjustment can be carried out (after removing the engine air filter) using the threaded portion of the outer cable. To raise line pressures and shift speeds, tighten cable. A slack cable will cause clutch and band slip giving premature failure of the unit.

If the kickdown cable fails the vehicle must not be driven.

- f) A/B The whole transmission should be visually examined for oil leaks. Advice for rectification can be obtained from Schuler Presses Limited.
No attempt to carry out warranty work should be made without prior authorisation from Schuler Presses Limited.



Larger picture of the number #488 Schuler FF transmission

PARAMETERS FOR ADJUSTMENT OF THROTTLE VALVE CABLE ON A727 / RANGE ROVER

AUTOMATIC INSTALLATION, VEHICLES EQUIPPED WITH COLT GOVERNOR

1. With the accelerator in the kickdown position and the transmission selector lever in 'D', full throttle downshifts should be available up to speeds shown below.

Change of gear		Sprocket ratio	
	1.16:1	1.08:1	1:1



3 - 2	56-66 mph (90-106 kmh)	60-71 mph (96-114 kmh)	65-77 mph (104-123 kmh)
2 - 1	24-29 mph (38-46 kmh)	26-32 mph (42-51 kmh)	28-34 mph (45-54 kmh)

Adjust throttle valve cable to minimum tension at which these downshifts are obtained and then tighten 1 turn.

2. Allow car to gather speed downhill with throttle closed and transmission selector lever in 'D'. Upshifts should occur at speeds shown below.

Change of gear	Sprocket ratio		
	1.16:1	1.08:1	1:1
1 - 2	8-13 mph (13-21 kmh)	9-14 mph (14-22 kmh)	10-15 mph (16-24 kmh)
2 - 3	12-17 mph (19-27 kmh)	13-18 mph (21-29 kmh)	14-20 mph (22-32 kmh)

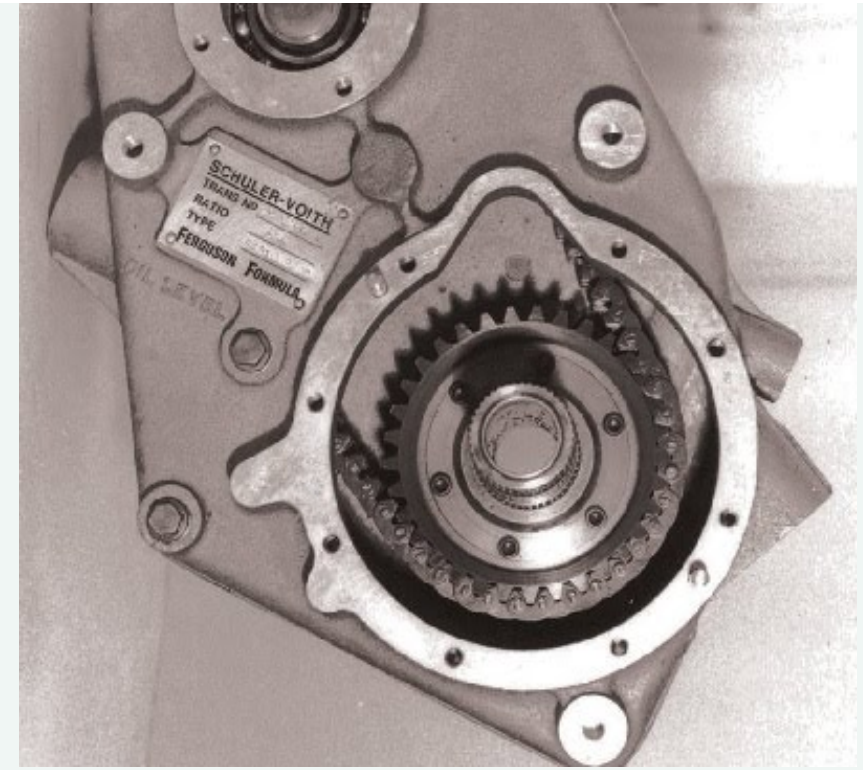
Part throttle shifts should be comparable in terms of smoothness with conventional automatics.

If the vehicle does not pass the above test, check:

- That basic engine tune is satisfactory.
- Carburettor butterflies are fully open at kickdown position.

- Throttle valve lever is getting full travel of $54 \pm 3^\circ$.
- Throttle valve return spring is fitted and functioning correctly.
- Transmission oil level is correct.

On completion of road test the adjustment of the gear selector must be rechecked. If it does not correspond in every position exactly with the detents on the automatic box early transmission failure will result.



Inside view of the transfer case - visible with the morse-chain drive



TOWING

1. Engine Failure

In an emergency a car equipped with automatic transmission may be towed safely with the high/low selector lever in neutral and the automatic selector in 'P' without the need to disconnect the front or rear propshaft.

Similarly manual gearbox cars may be towed with the high/low selector lever in neutral and the main manual gearbox in 4th gear.

2. Front Axle Failure

Tow with rear propeller shaft removed and front end pick-up.

3. Rear Axle Failure

Tow with front propeller shaft removed and rear end pick-up.

4. Failure of Transmission or 4-W-D Unit, or doors locked and transmission in gear

Tow with either:-

a) Rear propeller shaft removed and front end pick-up

or

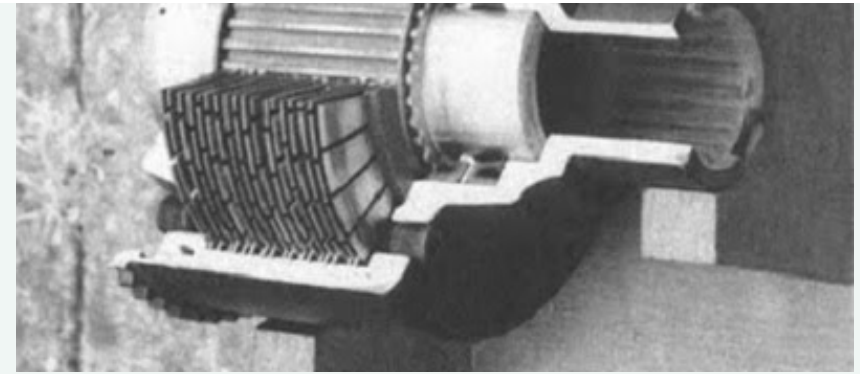
b) Front propeller shaft removed and rear end pick-up,

or

c) Both propeller shafts removed with/without pick-up.

5. Roller Rig Operation

Due to the integral limited-slip centre differential a special purpose 4 wheel drive roller rig must be used.



The viscous lamellae shown in this demonstration cut-out 37/63-ratio



The Schuler-Voith FF seen from the upper side with hand-brake drum

TNS/LAW

81/02