



# S5000

## User Guide

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# 1 DOCUMENT REVISION TABLE

Document #	Date	Notes
V03	14/11/2021	<ol style="list-style-type: none"> <li>1. S5000 Team Centre details added (Page 5)</li> <li>2. Definition of Ride Height measuring points simplified (Page 7)</li> <li>3. Engine oil system schematic and oil change procedure added (Page 12)</li> <li>4. Revised differential preload definition (Page 16)</li> <li>5. Castor Measurement Procedure added (Page 20)</li> <li>6. Shock packer 5mm option added (Page 2222 and page 26)</li> <li>7. Mandatory gearbox pick-up points (Page 24)</li> <li>8. Shock set-up and adjustment information detailed (Page 28)</li> <li>9. Brake system service kit part numbers added (Page 31)</li> <li>10. Camera description added (Page 40)</li> <li>11. Dim Button added (Page 42)</li> <li>12. Dash Pages changed and added (Page 43)</li> <li>13. Alarms Updated (Page 46)</li> <li>14. Logged Channels Updated (Page 47)</li> <li>15. Fluid part numbers added (Page 51)</li> <li>16. Maintenance mileage table updated (Page 52)</li> <li>17. Tightening torques table added (Page 5353)</li> </ol>
V2.2	4/3/2020	Major updates
V2.1	19/2/2020	Full rewrite
V1.0	8/9/2019	Initial Release

## 2 CUSTOMER SERVICE CONTACT

### 2.1 TECHNICAL SUPPORT

Name	Email	Phone
Stefan Millard	s5000@grmotorsport.com.au	+61 400 282 934

### 2.2 GRM WORKSHOP

Website	grmotorsport.com.au	
E-Mail	mail@grmotorsport.com.au	
Phone	+61 3 9793 6933	
Address	Factory 2 13 Kitchen Road Dandenong South VIC 3175	

### 2.3 TEAM CENTRE

For the latest S5000 documents, bulletins and regulation updates please visit:

<https://grmotorsport.com.au/s5000-team-centre/>

## 3 OVERVIEW

### 3.1 GENERAL DIMENSIONS

Specific Dimensions (Refer to Homologation Document)	
Wheelbase	3090mm
Front Track	2020mm MAX
Rear Track	2020mm MAX
Power	560hp Maximum
Total Weight (Kerb no fuel)	850kg
Fuel Tank Capacity	62L

THE S5000 IS AN EXTREMELY HIGH-PERFORMANCE VEHICLE FIT FOR USE ONLY AT CONFEDERATION OF AUSTRALIAN MOTORSPORT LICENSED FACILITIES.

IT IS THE RESPONSIBILITY OF THE OPERATOR (THIS MAY OR MAY NOT BE THE DRIVER) TO ENSURE THE VEHICLE IS FIT FOR PURPOSE AND SAFE TO OPERATE.

ROGERS ENGINEERING AND DEVELOPMENT SHALL NOT BE LIABLE FOR DIRECT, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGE OR INJURY TO PERSONS OR PROPERTY THAT MIGHT BE CLAIMED AS A RESULT FROM THE OPERATION OF THE VEHICLE, INSTALLATION, IMPROPER INSTALLATION AND FAILURE OF PARTS INCLUDING CLAIMS FOR DELAY, LOSS OF PROFITS OR LABOUR. THERE ARE NO WARRANTIES EXPRESSED OR IMPLIED.

## 3.2 BASELINE SET-UP

This is a general Baseline Set-Up recommended by GRM (complete car, no fuel, no driver). It is intended to be tuned track to track.

Geometry		Front	Rear
Ride Height*	[mm]	26	45
Camber	[deg]	-3	-1.6
Castor (TCA)	[deg]	5.1	-
Toe	[mm]	1.5 OUT	1.5 IN
Anti-Dive <sup>+</sup>	[%]	20	-
Anti-Lift <sup>+</sup>	[%]	-	112
Anti-Squat <sup>+</sup>	[%]	-	-1
Roll Centre <sup>+</sup>	[mm]	71	80
Suspension			
Springs	[lbs/in]	700	1200
Preload**	[Turns]	5	4
Bump Rubber <sup>+</sup>	[Multimatic]	1x Blue	2x Red
Mandatory Packer <sup>+</sup>	[mm]	15	7
Additional Packer	[mm]	10	0
Damper	[LSR clicks]	-5	-5
	[HSR sweeps]	+5	+5
ARB Setting	[hole;mm]	4	5
Aero			
Main Element	[deg]	-	4
Secondary	[set;deg]	E5	29.5

\*Measured from the bottom surface of the Skid Block (5mm thick) to the ground. Front at the front edge and rear at rear edge of the Skid Block.

\*\*0 Turns of preload is right at the point where the spring is no longer loose on a fully extended damper.

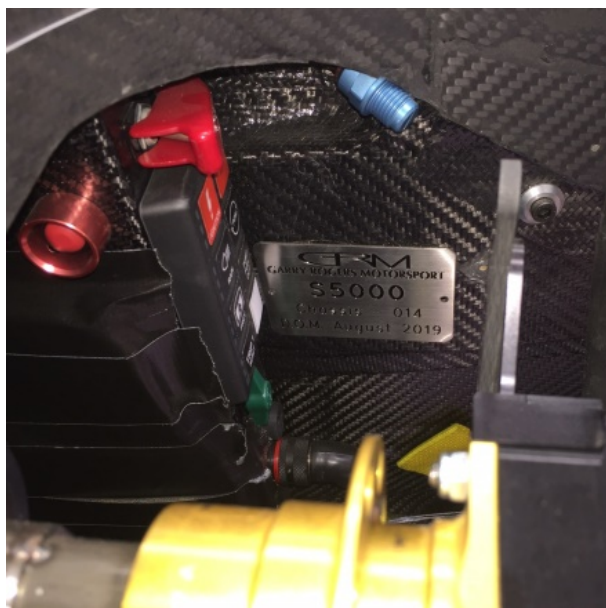
<sup>+</sup>For information only, not adjustable

### 3.3 CHASSIS IDENTIFICATION

Each Tub has a Manufacturer identification plate bonded to the inside of the cockpit on the LHS of the steering wheel.



And a Constructor identification plate is also bonded to the inside of the cockpit on the RHS of the steering wheel.





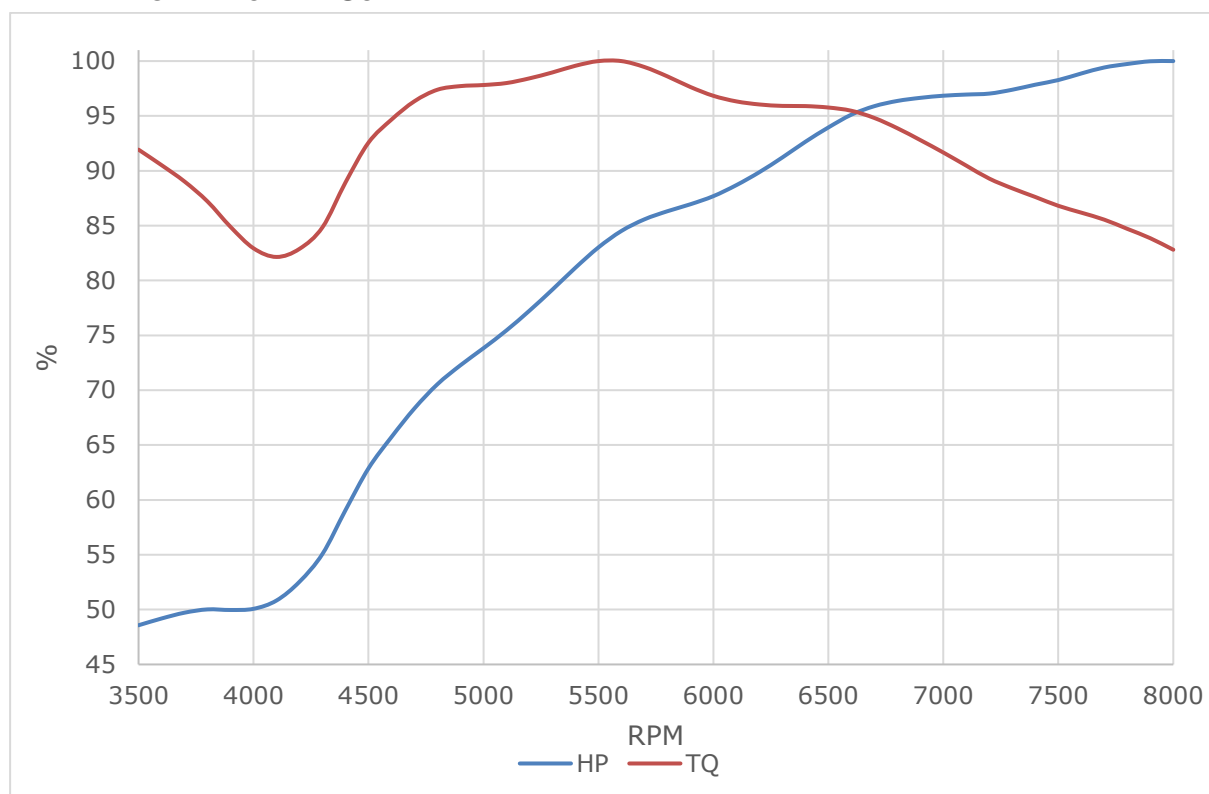
## 4 CAR CHARACTERISTICS

### 4.1 A - ENGINE

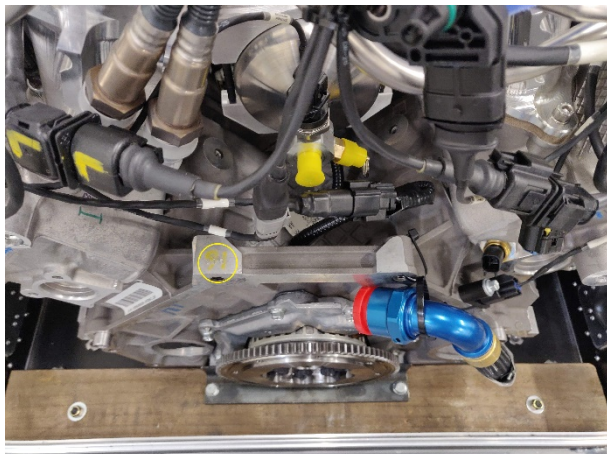
#### 4.1.1 GENERAL INFORMATION

Engine Information	
Type	V8 Naturally Aspirated
Capacity	5200 cm3
Bore & Stroke	94 x 93 mm
Maximum Speed	8000rpm
Cooling System	Water without thermostat
Fuel	Unleaded 98 RON
Lubrication	Dry Sump
Engine Management	Motec M150

#### 4.1.2 ENGINE POWER CURVE



### 4.1.3 ENGINE IDENTIFICATION



## 4.2 B - ENGINE SYSTEMS

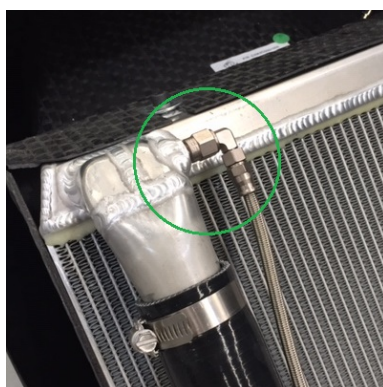
### 4.2.1 COOLING SYSTEM

The car is equipped with two water radiators, one water/oil heat exchanger for the engine oil and a separate transmission cooling system with a single radiator. A mechanically driven water pump generates the circulation for the engine coolant.

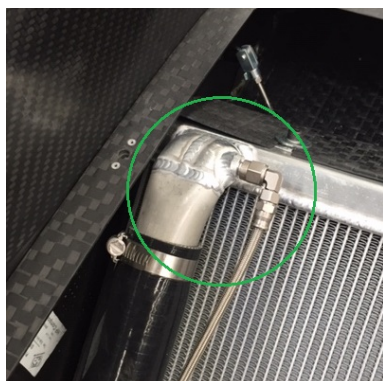
The coolant capacity is approximately 14L including a maximum of 1.0L of Coolant concentrate, with the level set by bleeding the system.

While adding coolant mixture to the Header tank, bleed air firstly from the disconnected fitting at the top of the LH radiator.

Once air has finished escaping from the top of the LH radiator reconnect the fitting and then bleed air from the disconnected fitting at the top of the RH radiator.



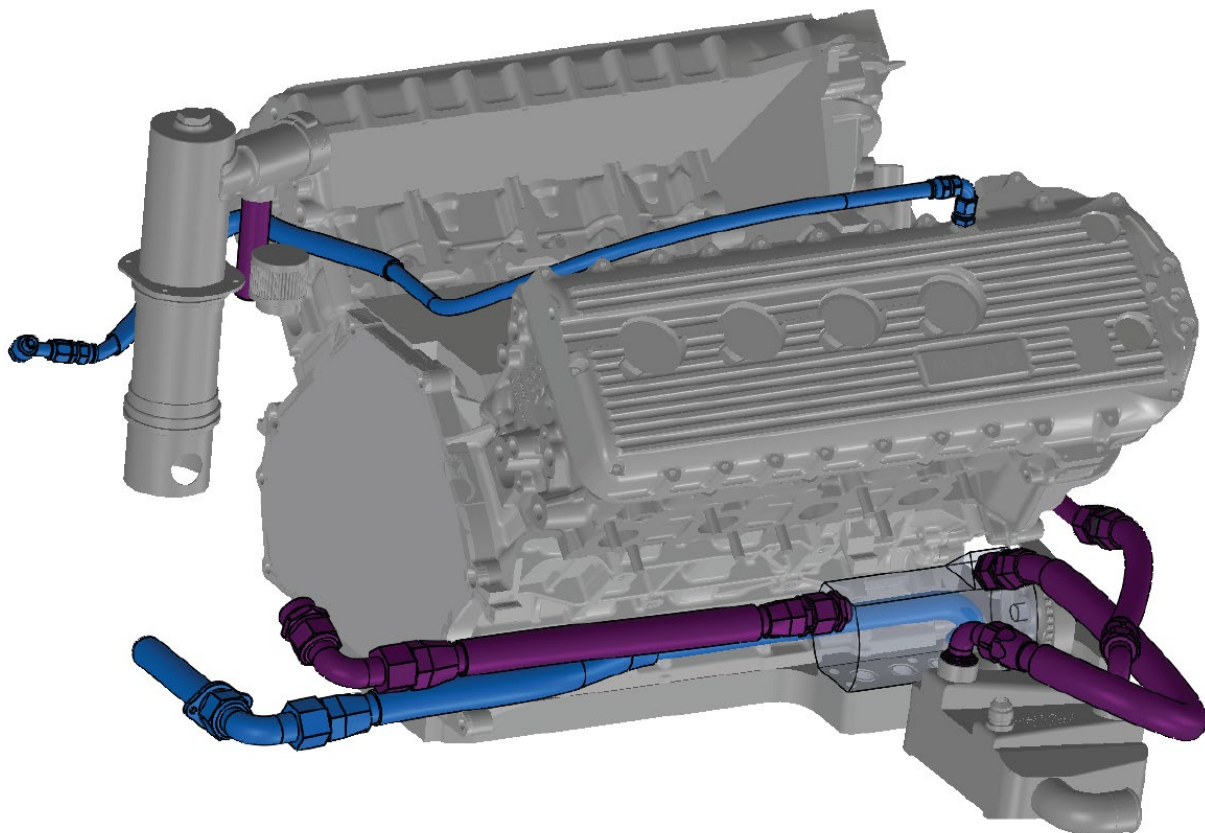
Once air has finished escaping from the top of the RH radiator, reconnect the fitting and continue filling the system until the header tank/swirl pot is approximately  $\frac{3}{4}$  full when engine is cold.



The maximum coolant temperature must not exceed 100°C.

### 4.2.2 OIL SYSTEM

Purple lines indicate positive pumping pressure for oil coming from the pump, while blue lines indicate negative pumping pressure for oil going to the pump.

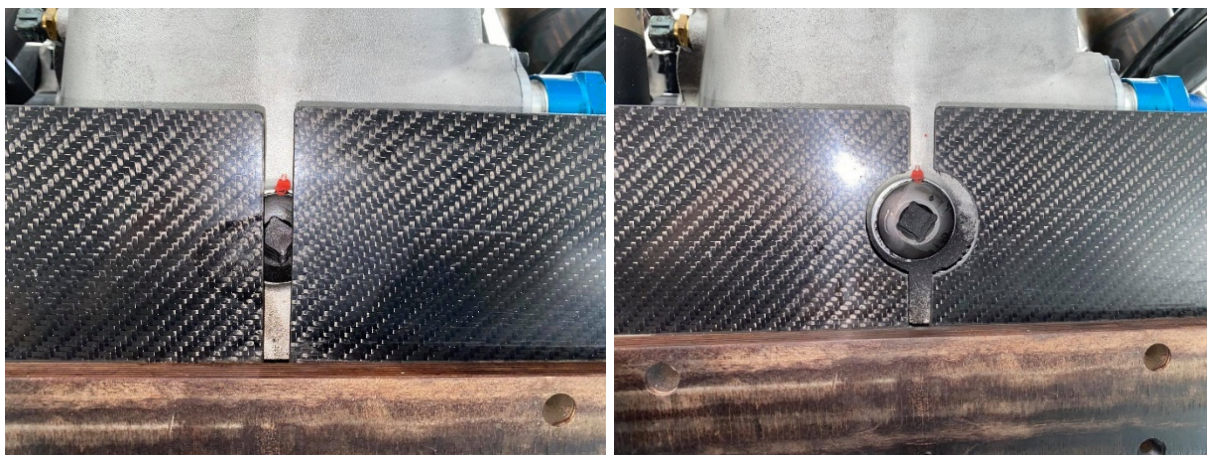


Below 50°C engine oil temperature the engine management system limits the maximum engine speed to 2500rpm. The maximum oil temperature must not exceed 120°C.

#### 4.2.2.1 OIL CHANGE

Drain the engine oil at the sump plug located at the bottom of the engine oil tank. If the rear carbon fibre floor undertray blocks the drainage point, a hole no larger than 50mm diameter will be allowed to cut out of the undertray to allow access to the sump plug.

After the engine oil is drained, tighten up the sump plug and change the oil filter (P/N: K&N HP-2010). Refer to the next chapter 'Oil Level' to ensure the right amount of new engine oil has been added to the system.



#### 4.2.2.2 OIL LEVEL

The engine has a dry sump oil system with the oil tank located in the bell housing between the engine and the transmission. The oil level must be checked using Dipstick Part# GRM-AW0470-00 and the oil level maintained between the minimum and maximum indicators on the dipstick. The oil capacity at the maximum indicator mark is approximately 8.0L. Oil level must be kept above the minimum mark.



#### 4.2.3 INTAKE SYSTEM

The custom inlet manifold with individual butterfly throttles on each cylinder intake trumpet is enclosed within an air box fed through a K&N air filter. Care must be taken when the air filter is removed to not let anything 'fall into' the air box.

Air Filter P/N: K&N 33-2116

#### 4.2.4 EXHAUST SYSTEM

The custom exhaust system consists of a pair of 4 into 1 exiting through a pair of rear mounted mufflers. It is important to ensure all mounts and heat shields are maintained and no contact occurs between the exhaust and any bodywork.

#### 4.2.5 FUEL SYSTEM

The car is equipped with a 62L foam filled ballistic fuel bladder to FIA FT-3 specification housed within the carbon tub. A single electric high-pressure fuel pump located at the bottom of the fuel bladder feeds the engine through an internal pressure regulator.

The pressure regulator is set at 56psi. If the recorded fuel pressure is less than 45psi at any time during normal vehicle operation notify GRM Technical Support.

Filling of the fuel bladder must be done slowly through the dry break on the fill tube via an external off vehicle pump.

To drain the fuel, disconnect the dry break on the fuel line from the fuel tank top cover. While ensuring the safe containment of any exiting fuel, operate the high-pressure fuel pump using the fuel pump switch on the switch panel in the cockpit.



## 4.3 C - TRANSMISSION

### 4.3.1 CLUTCH

The car is fitted with a Tilton Carbon/Carbon Clutch.

Information	
Type	Carbon/Carbon
Make	Tilton
Clutch bearing	Hydraulic
Master Cylinder	Tilton 0.75"
Fluid	Valvoline VR1

Between the clutch master cylinder and the clutch is a valve mounted on the tub inside the cockpit. LEAVE AT THE FACTORY SETTING – FULLY OPEN.

The clutch activation point is to be set between 6 and 7mm off the clutch pedal stop on the pedal box. The setting procedure is as follows:

- Fully depress the clutch pedal until the clutch stop is engaged.
- Release the clutch pedal until the rear wheels can just not be turned.
- Measure from the clutch stop to the bolt on the clutch pedal.
- Repeat this process.
- Ensure both measurements are between 6 & 7mm.
- If this measurement cannot be achieved the clutch must be inspected and re-shimmed as necessary.
- During engine run up there is a Dash page to check clutch activation.

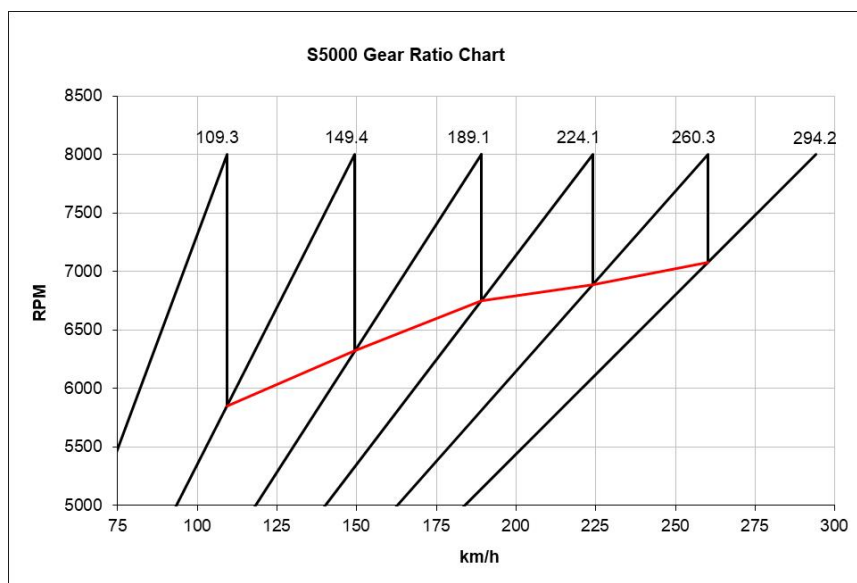
### 4.3.2 TRANSMISSION

The car is fitted with a Holinger MFT-S5000 gearbox incorporating rear suspension pickups, integral bell housing with engine oil tank, limited slip differential and pneumatic paddle gear selection.

A set of drop gears sit between the engine and the gearbox. This pair of gears are in their own oil chamber, separate from the gearbox, and require INDEPENDENT filling and draining.

The gearbox and the differential are sealed.

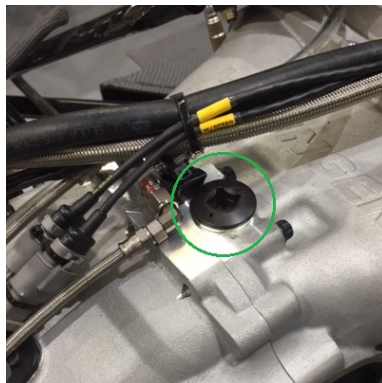
The gear diagram is below.



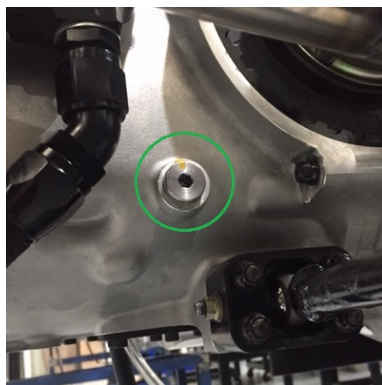
### 4.3.3 LUBRICATION

The gearbox has an integral oil pump and filter and an external radiator for cooling the oil. The filter cartridge O-Ring is 65x2.5 NBR and the filter is a Ryco 2605P.

The gearbox is filled via the access cap on top of the unit.



The oil level is set to the bottom of the RH level plug.



When filled from dry, and after the first transmission run up, the oil level will need to be topped up to the correct fill level. The capacity is approximately 3.5L.

The drop gear oil level is INDEPENDENT OF THE GEARBOX and is filled through the temperature sensor hole.



The oil level is to the bottom of this fill hole and the oil capacity is approximately 0.5L.

The transmission should be above 60°C before it is operated in racing conditions. The maximum oil temperature must not exceed 130°C at the drop gears and 120°C at the gearbox. If these maximum temperatures are reached or exceeded, at a minimum the oil must be changed.

#### 4.3.4 PNEUMATIC GEAR SELECTION SYSTEM

The car is equipped with a pneumatic gear selection system operated by two paddles on the steering wheel. To select a higher gear, the RH paddle is operated, to select a lower gear, the LH paddle is operated.

There is a pneumatic compressor located in the RH side pod, with an air accumulator/tank located between the cylinder heads on the engine. The gear selection barrel in the gearbox is operated by externally mounted Pneumatic Solenoid Valves.

The Ignition switch must be 'On' to allow gear selection.

The Pneumatic Solenoid Valves remain maintenance free. Please avoid removing the Solenoid Values, opening the air line between the Solenoid Block and air tank/compressor as any dust or foreign objects in the system will reduce performance.

If any pneumatic gear selection issues occur refer to GRM Technical Support. If any maintenance work is to be carried out, the system must be depressurised before commencing. This is achieved by operating the Pressure Relief Valve at the air tank.

At the end of each day, please depressurise the system using the Pressure Relief Valve at the air tank. This will reduce the stress on the components when not in use.

#### 4.3.5 DIFFERENTIAL

The Holinger MFT-S5000 transmission is fitted with a conventional ramp activated multi-plate clutch limited slip differential.

The differential clutch pack is lightly preloaded. The preload should be noticeable by hand when turning the wheels on stands.

The differential is non-adjustable and is sealed in the transmission.

#### 4.3.6 DRIVESHAFT

The driveshaft M10 mounting bolts are to be tightened to 50ftlbs WITHOUT Loctite.

Please ensure that the driveshafts are mounted in a consistent direction over their lifetime. This will reduce the stress in the shaft and prolong mileage.



## 4.4 D - WARM UP PROCEDURE

For the first engine run after an Engine, ECU, Throttle Pedal Sensor replacement, or any adjustments made to the pedal box please contact GRM technical support as the following cannot be done by the customer:

- Change ECU parameters
- Calibrating the throttle pedal sensor
- Calibrating the throttle servo

CAUTION - When the engine is not running, the starter motor will function when the vehicle is in Gear.

This warmup procedure must be done while the car is safely isolated and secured with its rear wheels off the ground.

### Engine crank procedure to prime the oil pressure

- Connect Auxiliary Battery
- Master Switch On, Ignition Off
- Ensure Neutral is selected
- Press and maintain the Start button until some engine oil pressure is present
- Once oil pressure is established the engine is ready to run

This procedure needs to be carried out after an oil change, or after the engine has not run for more than four hours.

### Running the engine

- Auxiliary Battery connected
- Master Switch On, Ignition Off
- Ensure Neutral is selected
- Ignition On
- Ensure fuel pressure is present on ignition activation
- Press the Start Button
- Check the coolant level in the header tank/swirl pot (approximately  $\frac{3}{4}$  full when engine is cold)
- Ensure there are no fluid or air leaks
- During the first engine run of the day the gearbox must be run through all gears
- With the engine running, to exit neutral, the clutch must be depressed
- With the engine running, to select reverse, while in neutral the down paddle must be active for 2 seconds
- Warm the engine until the water temperature reaches 90°C

### Checks

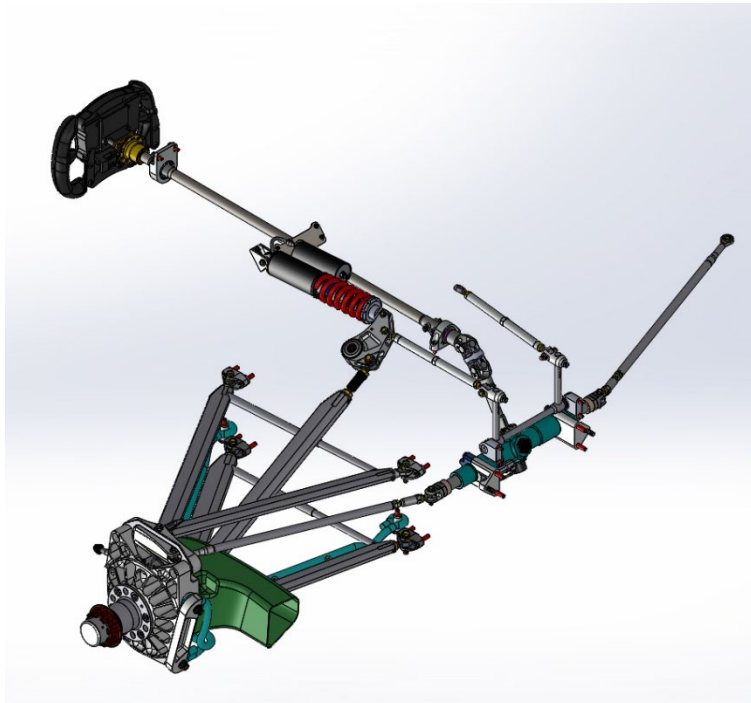
After the engine warm up:

- Check the engine oil level on the dipstick before oil drains back into the sump
- Check the gearbox and drop gear oil levels
- Ensure there are no fluid leaks
- Download and check the data from the warmup
- Disconnect the Auxiliary Battery before driving the vehicle

## 4.5 F - FRONT AND REAR SUSPENSION

### 4.5.1 OVERVIEW

The S5000 has unequal length double wishbone front suspension with coil over dampers and adjustable anti-roll bar actuated by a pushrod and rocker mechanism. Steering is achieved through a non-power assisted rack and steering arms controlling the toe angle.



The rear suspension of the S5000 is unequal length double wishbone with an upper toe link to control toe angle. As with the front suspension, the rear coil over dampers and adjustable anti-roll bar are actuated by a pushrod and rocker mechanism.



There is only a single spring and damper per wheel, there is no third element or interconnection between front and rear suspensions. In addition to the coil over spring, each damper has a bump rubber and packer system.

## 4.5.2 SET-UP ADJUSTMENTS

Effects of the adjustments on the car's set-up.

			Front	Rear
<b>Ride Height</b>	Pushrod adjuster	mm/turn	5.55	5.75
		mm/flat	0.92	0.95
<b>Spring Preload</b>	Spring platform	Thread step [mm]	1.41	1.41
		Ride Height change* [mm/turn]	1.57	1.95
<b>Camber</b>	Shim	deg/mm	0.269	0.197
<b>Toe</b>	Steering arm/toe link adjuster	mm/flat	1.71	0.90
		deg/flat	0.26	0.14
<b>Castor</b>	Lower wishbone rod end	deg/turn		
<b>Motion Ratio</b>		Wheel/Spring	1.115	1.38
		Wheel/ARB	1.533	1.015

\*No Ride Height change when car is already in full droop

### 4.5.3 CASTOR MEASUREMENT PROCEDURE

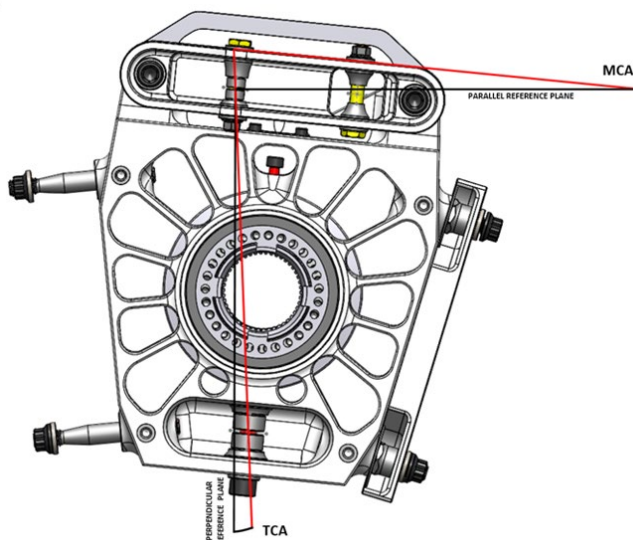
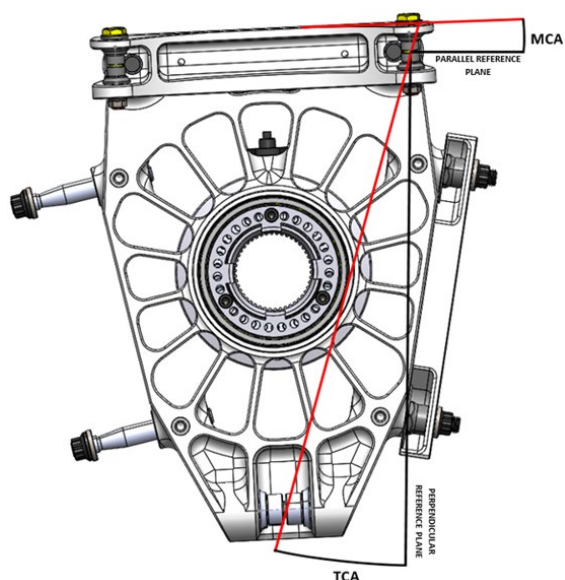
The castor angle is the angle, in side-view, between the steering and the vertical axis. It is considered positive when the steering axis is inclined rearwards. You can check the castor angle in the same way at the front and the rear suspension.

The castor angle can be checked as followed:

Measure the angle of the steering arm plane for the front (or the wishbone mount plane for the rear) to the reference plane of the car – this is your Measured Castor Angle (MCA). Positive when inclined down to the front (nose down).

Calculate the True Castor Angle (TCA) as followed:

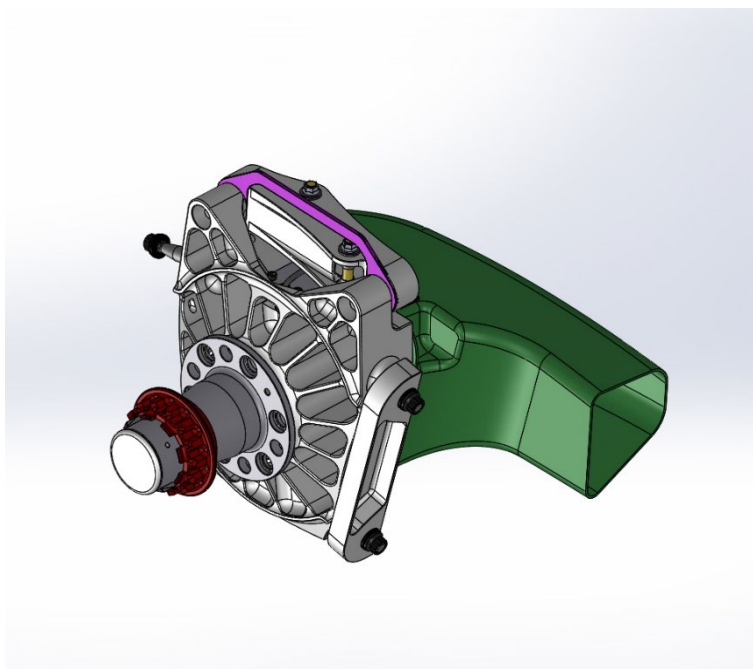
	Rear Castor Angle	Front Castor Angle
<b>True Castor Angle (TCA)</b>	$= 17.58^{\circ} + \text{MCA}$	$= 7.69^{\circ} - \text{MCA}$
<b>Base Settings</b>		$5.1^{\circ}$



The Castor Angle influences the Castor Offset/Mechanical Trail and therefore the force to turn the wheel. Castor Offset is along the ground plane while the Mechanical Trail is perpendicular to the steering axis.

#### 4.5.4 FRONT SUSPENSION GEOMETRY ADJUSTMENT

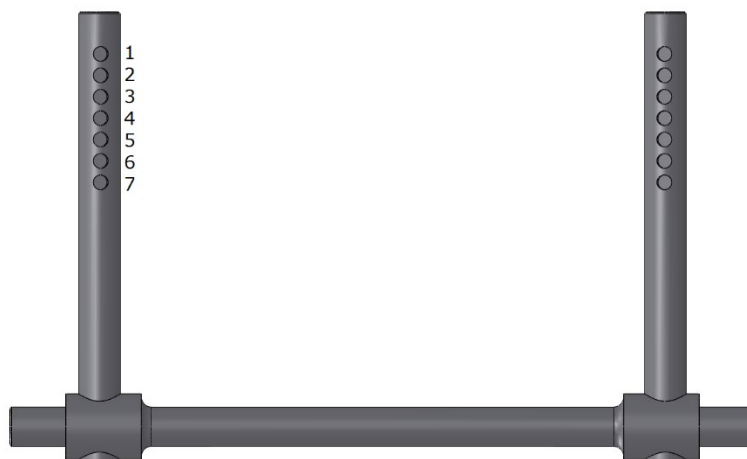
Camber adjustment for the front suspension is achieved by adjusting the thickness of the shims (in purple) on the upright as illustrated in the picture below and overall dimensions of the bottom wishbone.



#### 4.5.5 FRONT ANTI-ROLL BAR

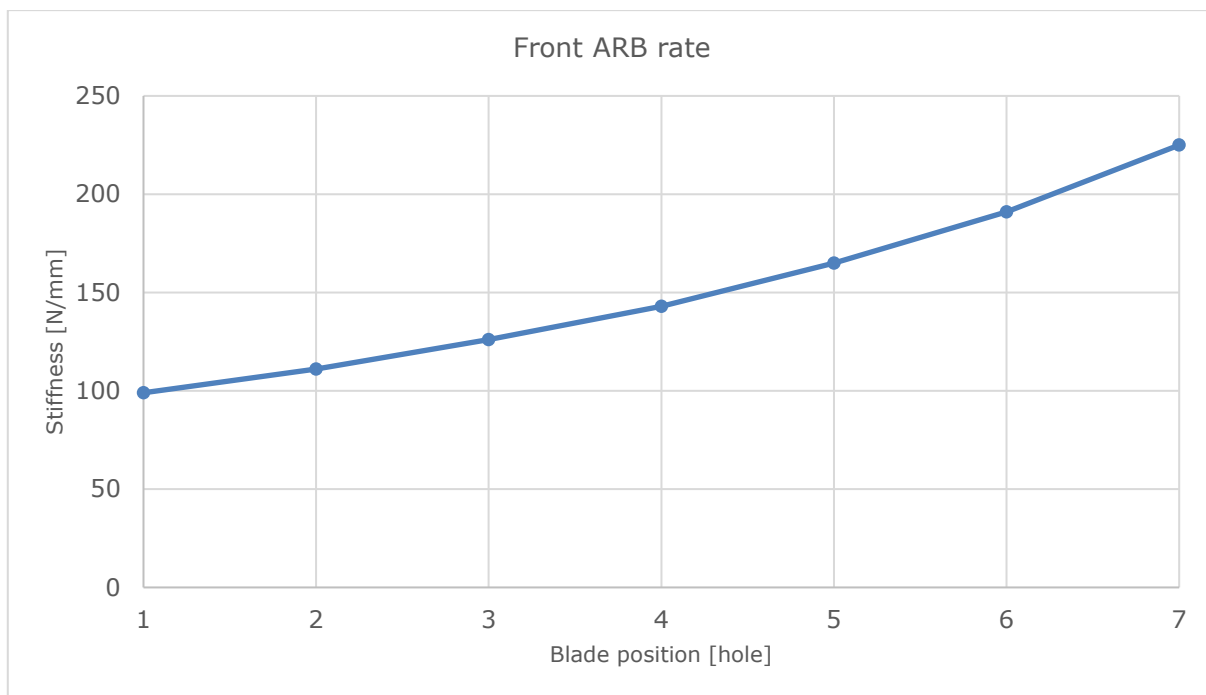
The front anti-roll bar is actuated by movement of each front upright via a pair of pushrods, rockers and drop links.

A single front anti-roll bar is specified. The stiffness can be adjusted by changing the connection position of the two drop links.



Front ARB rate							
Position*	1	2	3	4	5	6	7
N/mm	99	111	126	143	165	191	225

\*FARB hole settings start at the top hole being position 1 and increasing in number/rate as the adjuster is moved down.



#### 4.5.6 FRONT SPRING

Three sets of front springs used in a coil-over configuration are available.

Front Springs	
Reference	Stiffness
GRM-CE0037	600 lbs/in
GRM-CE0038	700 lbs/in
GRM-CE0039	800 lbs/in

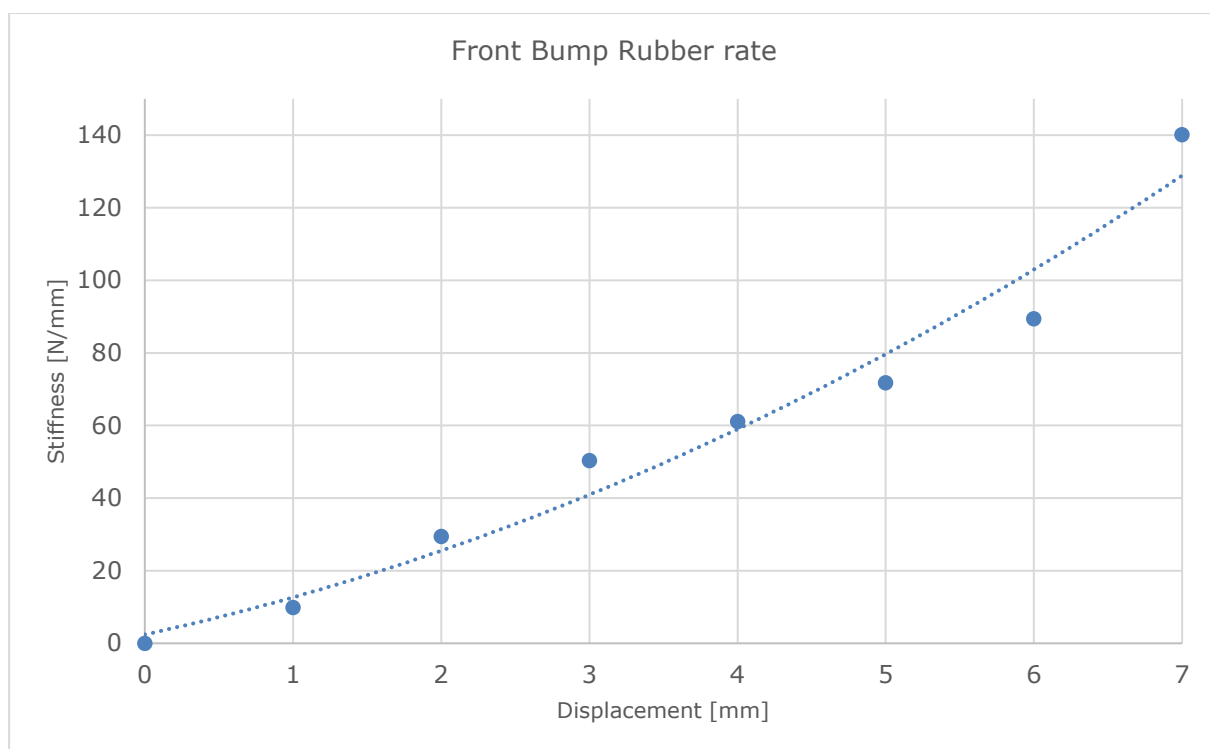
The following packers can be used to tune the overall solid packer set.

Optional Solid Packer	
Reference	Thickness
GRM-AF0487	1mm
GRM-AF0488	2mm
GRM-AF0563	5mm

The front bump rubber and packer system is shown in the following picture.

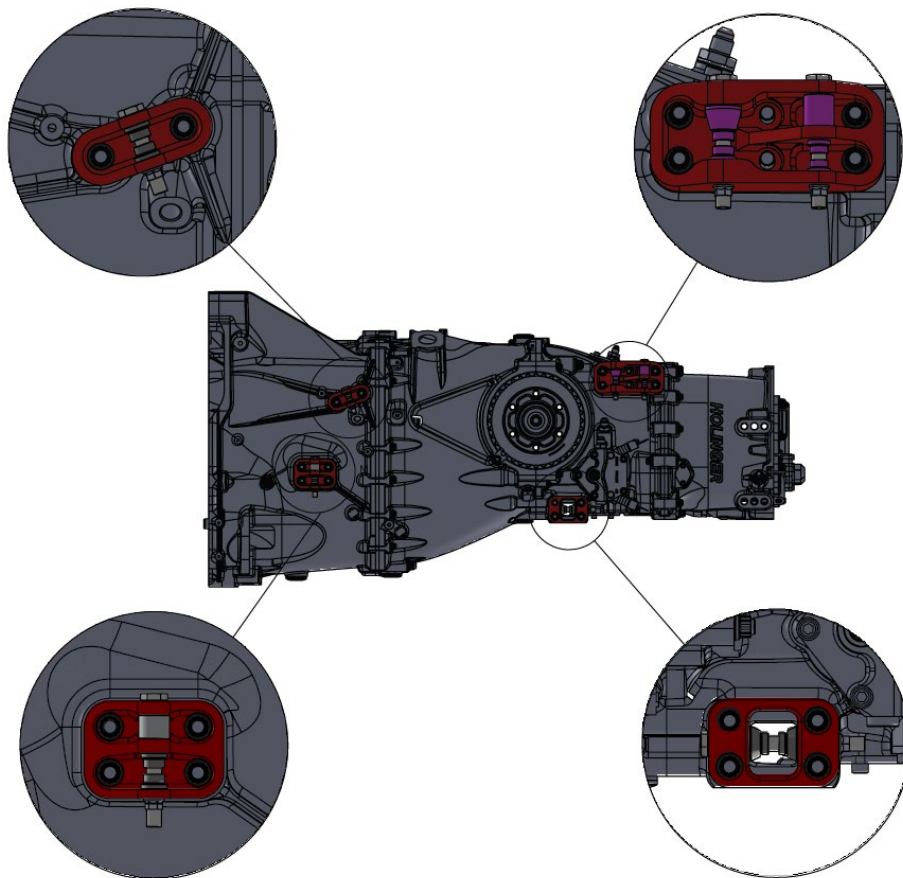


	Front Bump Rubber rate							
Disp. [mm]	0	1	2	3	4	5	6	7
1xBLUE [N/mm]	0.0	9.8	29.4	50.4	61.1	71.8	89.4	140.1

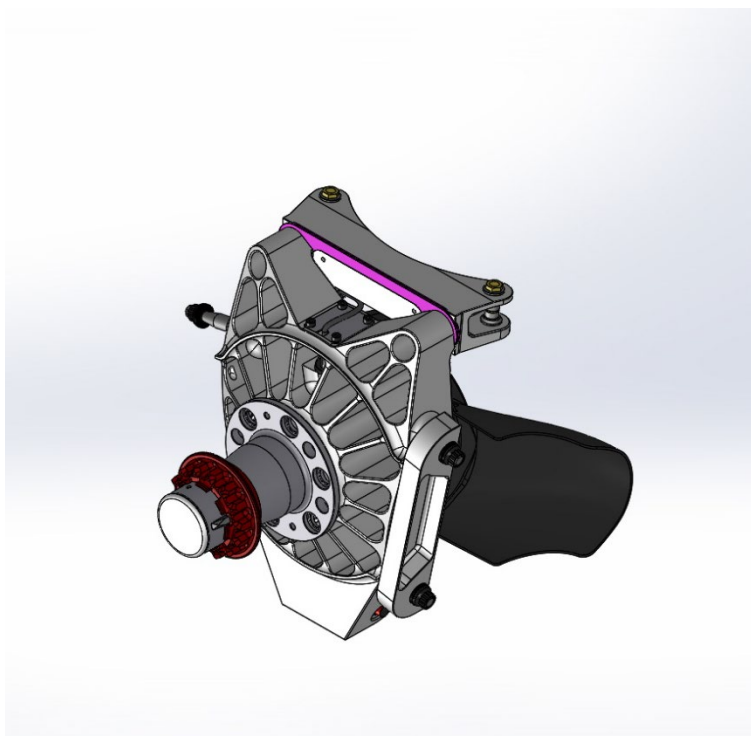


### 4.5.7 REAR SUSPENSION GEOMETRY ADJUSTMENT

Mandatory gearbox pick-up points with wishbone clevis.



Camber adjustment for the rear suspension is achieved by adjusting the thickness of the shims on the upright (in purple) as illustrated in the picture below and overall dimensions of the top and bottom wishbones.

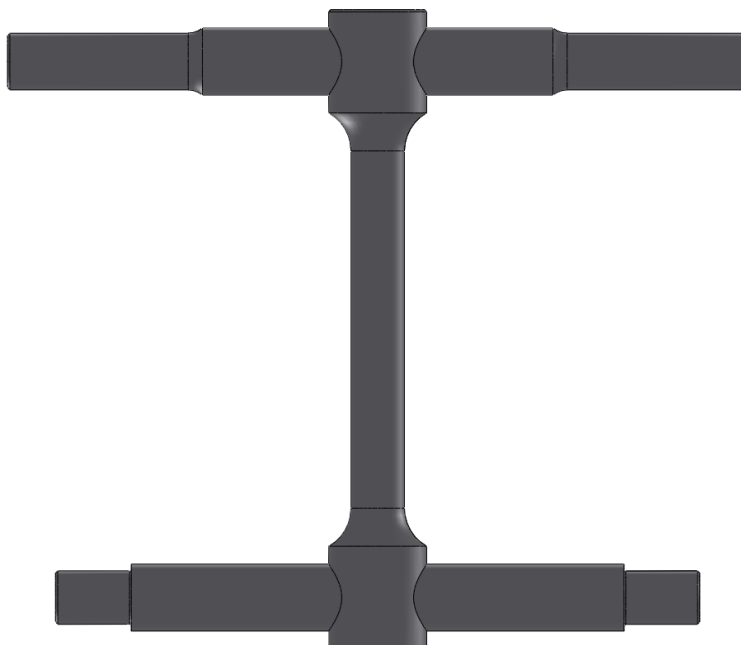




### 4.5.8 REAR ANTI-ROLL BAR

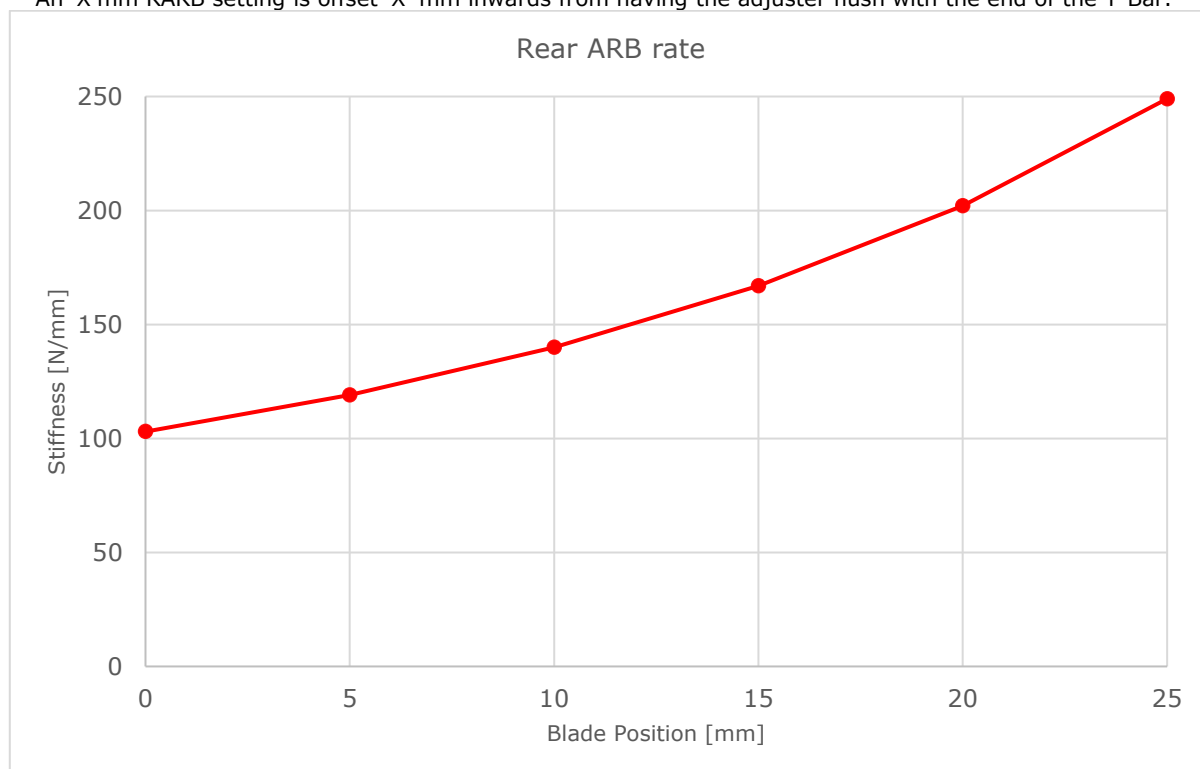
The rear anti-roll bar is actuated by movement of each rear upright via a pair of pushrods, rockers and drop links.

A single rear anti-roll bar is specified. The stiffness can be adjusted by changing the connection position of the two drop links.



	Rear ARB rate					
mm*	0	5	10	15	20	25
N/mm	103	119	140	167	202	249

\*An 'X' mm RARB setting is offset 'X' mm inwards from having the adjuster flush with the end of the T-Bar.



### 4.5.9 REAR SPRING

Three sets of rear springs used in a coil-over configuration are available.

Rear Springs	
Reference	Stiffness
GRM-CE0040	1000 lbs/in
GRM-CE0041	1100 lbs/in
GRM-CE0042	1200 lbs/in

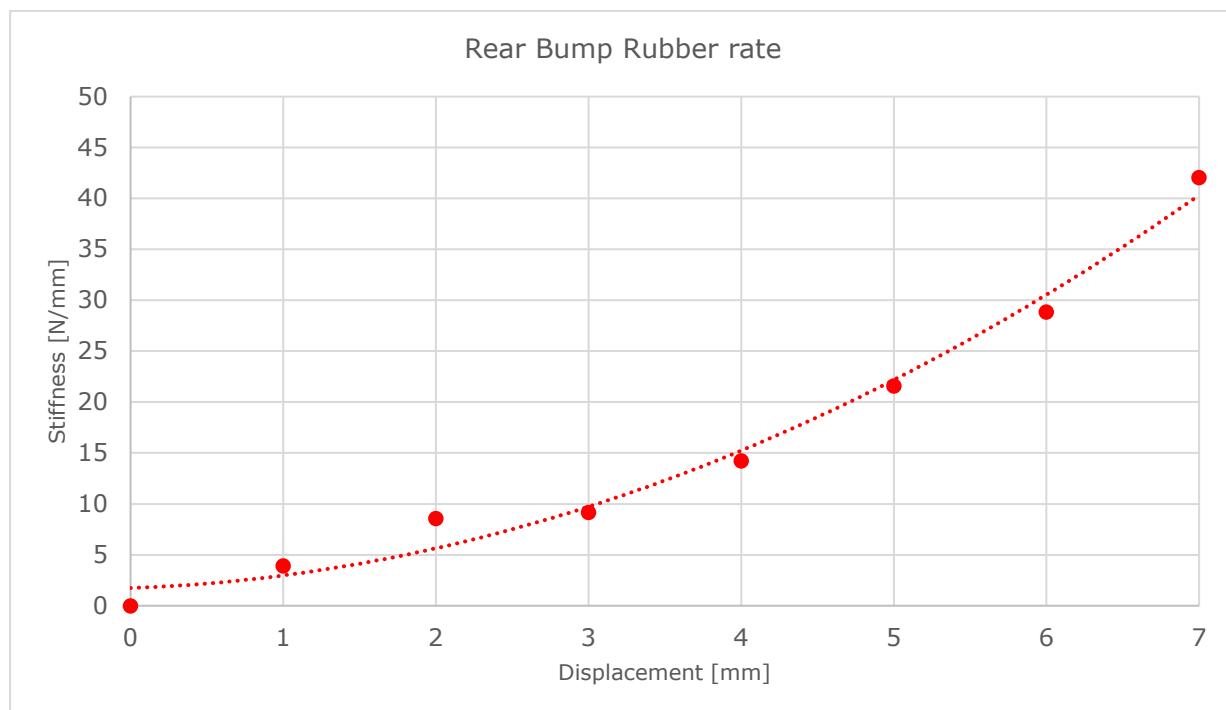
The following packers can be used to tune the overall solid packer set.

Optional Solid Packer	
Reference	Thickness
GRM-AF0487	1mm
GRM-AF0488	2mm
GRM-AF0563	5mm

The rear bump rubber and packer system is shown in the following picture.

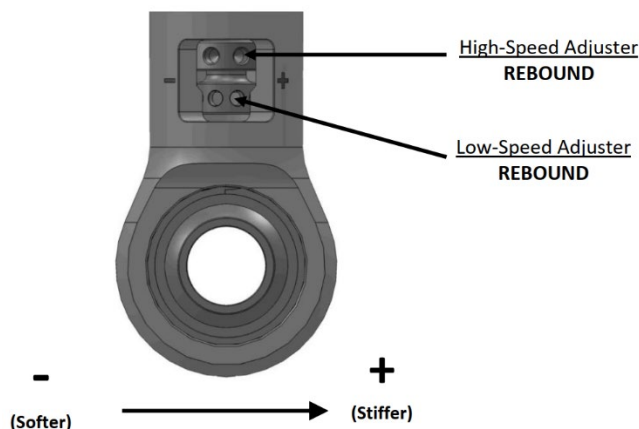


	Rear Bump Rubber rate							
Disp. [mm]	0	1	2	3	4	5	6	7
2xRED (series) [N/mm]	0.0	3.9	8.6	9.2	14.2	21.6	28.9	42.0



### 4.5.10 FRONT AND REAR DAMPERS

The S5000 is fitted with a pair of JRi dampers at each axle. Front and rear are identical. Only rebound, high- and low-speed, is adjustable. When adjusting rebound, please use the JRi pin tool (GRM-CI0002-00) to not overtighten and jam the adjuster. These are designed to snap if forced too hard. The tool can be ground flat & re-used if the dowel pin remains with sufficient length. New pin tools are available to purchase.

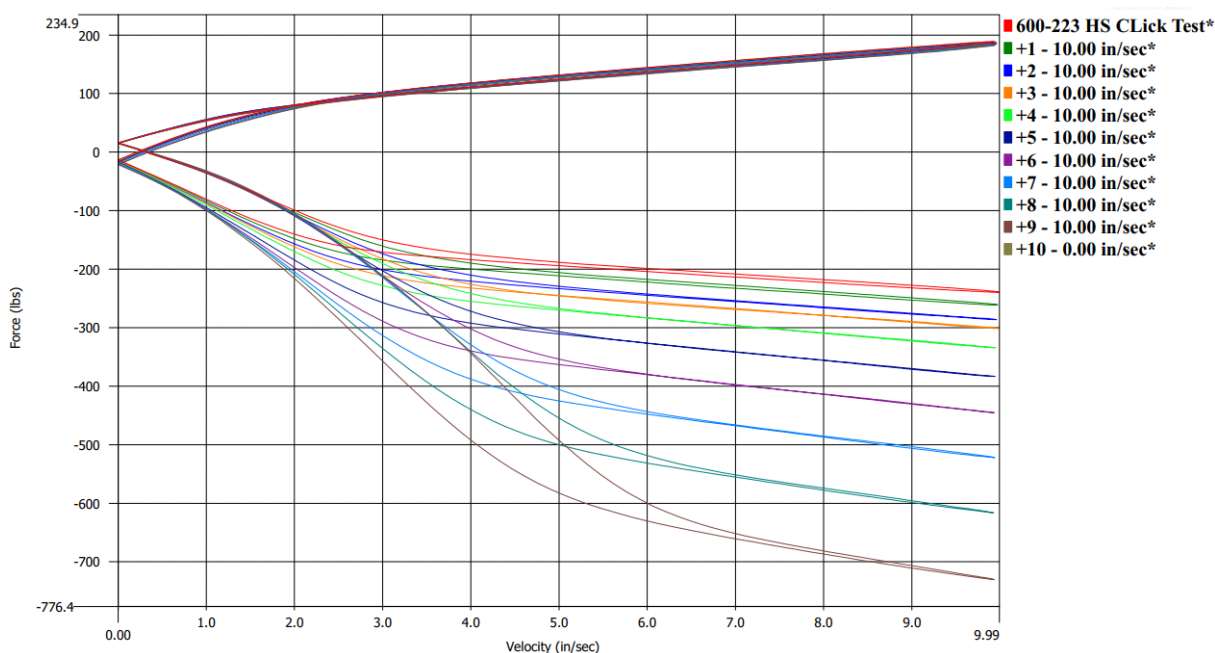


#### High-Speed Adjuster

The high-speed adjuster is a “sweep” style adjuster, meaning that its adjustment is measured by the location of the adjuster in the eyelet window. It uses left-hand thread in its operation which means; as you increase high-speed, the adjuster will move down in the window (The low-speed adjustment does not change when adjusting the high-speed).

The high-speed adjuster’s reference position is full soft and referred to as 0 (adjuster all the way to the negative sign on the threaded eyelet).

High-speed +10 = full hard (+10 sweeps from zero). **Do not start from full hard as zero as you will not get matching damping forces left to right. Do not try to force the adjuster any further than 10 sweeps or it will jam.**

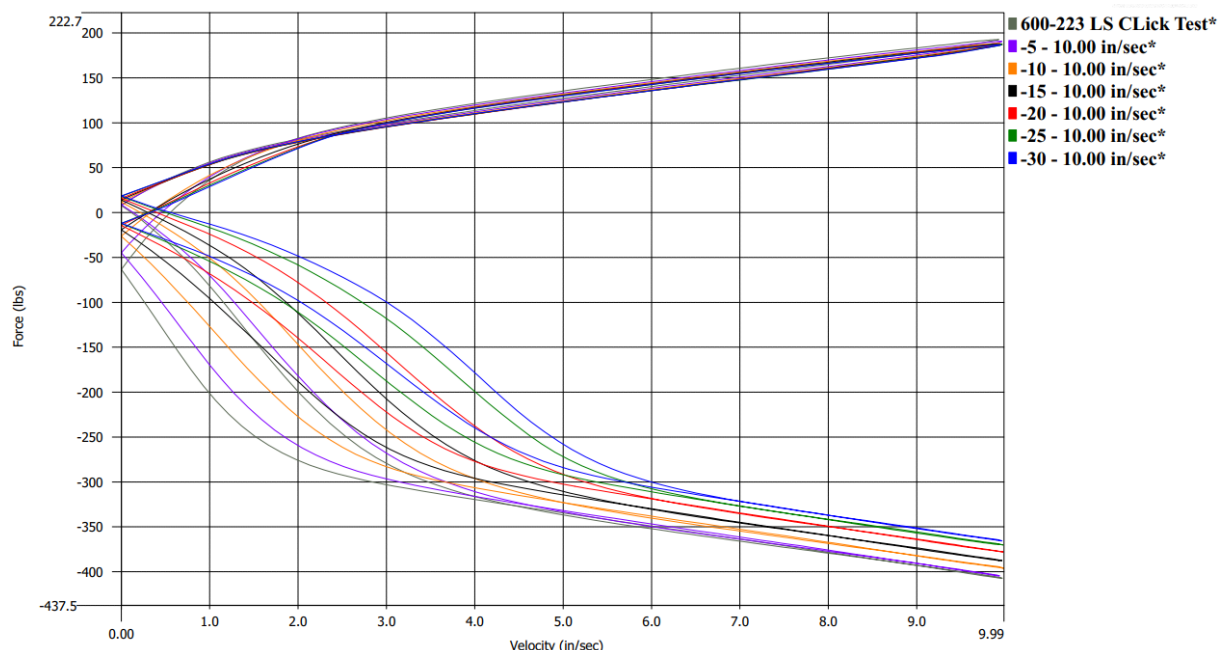


### Low-Speed Adjuster

The low-speed adjuster is a “clicker” style adjuster, meaning that its adjustment is measured by detent grooves located inside the high-speed shaft. It uses a right-hand thread in its operation which means; as you increase low speed, the adjuster will move up in the window.

The low-speed adjuster’s reference position is full stiff and referred to as 0 (adjuster all the way to the positive sign on the threaded eyelet. If at this point the adjuster is not in a detent position, then rotate the adjuster back until it falls into the closest detent. This is your zero setting). **THE HSR ADJUSTER MUST NOT TURN WHEN YOU ADJUST THE LSR ADJUSTER. IF IT STARTS THEN YOU HAVE REACHED THE LSR ZERO POINT.**

Low-speed -30 = full soft (-30 clicks from zero). **Do not start from full soft as zero as you will not get matching damping forces left to right.**



Occasionally due to manufacturing tolerances, not all shocks supplied will have equal shock settings for the same forces. Please confirm with GRM if your set has unequal settings.

For example – one shock may be set at LSR-15/HSR+5. The matching shock from the same set may be set at LSR-15/HSR+7 for the same damping. Most shock manufacturers will have a tolerance of +/-2 sweeps from the baseline setting to match various sets. The offset is typically seen more on the high speed rebound adjuster with the JRi brand.

If your shocks do have an offset setting, then the shocks must always have the same offset from zero. In the example above, the shock with the lower rebound “number” must always be the base shock for settings & will be equal to zero at full soft. The shock with the higher base setting must be no more than 10 for full hard. This limits the adjustment range to only 8 sweeps on this set of shocks on the high-speed adjuster. The table below is an example of setting changes for the two shocks.

	LSR	HSR	Position
LR	-15	5	JRi Base
RR	-15	7	JRi Base
LR	-15	0	Full Soft
RR	-15	2	Full soft
LR	-15	8	Full hard
RR	-15	10	Full hard

Any offsets will be reviewed in the future when the shocks are due for servicing to be improved. Until then please utilize the baseline settings & move the adjusters equally from there.

### **Setting the gas pressure**

The shocks are delivered with 150psi of nitrogen gas pressure in the remote canister when cold.

This value rarely changes unless a problem with the shock exists. With regular checking with a gauge only, a small amount of pressure may be lost over time.

Before checking the gas pressure ensure the shock is cold & is at its full extended length. Failure to do this will cause damage to the internal parts of the shock as the gas pressure sets the displacement height of the oil/gas separating piston. The gas pressure should never be checked hot. Leave it to cool for a few hours before proceeding. The damper settings will not affect the gas pressure in the shock.

Occasional you will see some oil sweating around the shock shaft. This is normal & does not affect the operation of the shock.

## 4.6 G - STEERING

The S5000 is fitted with a non-power assisted rack actuated by a steering column with a quick release coupling for the steering wheel.

An integral sensor measures the steering angle. The ratio of turns of the column to displacement of the rack is 36.8mm/turn.

There are 1.52 turns lock to lock of the steering wheel.

The steering angle sensor is calibrated and zeroed during the pre-delivery checks. This cannot be changed by the customer, therefore if the rack has been replaced or reinstalled please contact GRM technical support to get it recalibrated.

## 4.7 H - BRAKING

### 4.7.1 BRAKE SYSTEMS

The S5000 is fitted with AP Racing Rotors and Calipers, these are the same front and rear.

	Front	Rear
Caliper – LH	CP9440-3S4L	CP9440-3S4L
Caliper – RH	CP9440-2S4L	CP9440-2S4L
Rotor – LH	CP3580-2573 G4	CP3580-2573 G4
Rotor – RH	CP3580-2572 G4	CP3580-2572 G4
Pads	PFC11	PFC11
Caliper Piston Seal Kit	CP8518-HK	CP8518-HK

The wear of all brake components must be closely monitored and replaced when necessary.

### 4.7.2 BRAKE ACTUATION

The S5000 is fitted with a Tilton Pedal Box. The position of this can be adjusted backwards and forwards depending on the driver preference. The pedal box includes the throttle pedal and sensor, hydraulic clutch circuit actuation and front and rear brake circuit actuation with a driver adjustable brake balance bar.

The hydraulic circuit actuation details are given below.

Function	Dimension	Reference	Rebuild Kit
Front Brake	0.8125"	Tilton	76-812RK
Rear Brake	0.8750"	Tilton	76-875RK
Clutch	0.7500"	Tilton	76-750RK
Fluids		Valvoline VR1	

The reservoirs for the master cylinders are mounted to the front bulkhead of the carbon tub. Appropriate fluid levels must be maintained in all circuits. Ensure all hydraulic circuits are properly bled of all air prior to vehicle operation.





## 4.8 I - WHEELS AND TYRES

### 4.8.1 WHEELS

The S5000 has 15x10" front wheels and 15x15" rear wheels. It is important to ensure the integrity and safety of all wheels fitted to the car.

We recommend regular replacement of the rubber Schrader valves in the wheels.

### 4.8.2 WHEEL NUTS

A single wheel nut is used to attach the wheels to each axle. This must be tightened to 540 ftlbs using the 1" drive wheel socket supplied with the car. A lubricant must be applied to the taper on both the nut and the wheel. Use of Kluber MOLYBKOMBIN UMF T4 Spray is recommended, this is a dry lubricant. Anti-Seize should also be applied to the thread, usually this is applied to the spindle thread prior to each session.

### 4.8.3 TYRES

The tyres used on the S5000 are from Hoosier. The integrity and safety of all tyres fitted to the car must be checked before vehicle operation.

	Front	Rear
Wheel	15x10"	15x15"
Slick – Size	23.0x9.5R15 5000	27.0x14.0R15 5000
Slick – Code	43574	43594
Rain – Size	23.0x9.5R15 W3	27.0x14.0R15 W3
Rain – Code	44195	44517

Hoosier's recommendations are:

	Front	Rear
Pressure	20-22 hot	24-26 hot
Temp Target	82-104°C (up to 115°C can be tolerated)	
Temp Spread	Range of 8-14°C (with inside being hotter)	
Camber	3-4 neg	1-2 neg

The tyre spring rates are:

<b>Slick Front (43574)</b>			
Pressure	23psi	25psi	27psi
1050lbs (476kg)	1650 lbs/in	1655 lbs/in	1810 lbs/in
850lbs (386kg)	1590 lbs/in	1605 lbs/in	1760 lbs/in
650lbs (295kg)	1550 lbs/in	1565 lbs/in	1720 lbs/in
<b>Slick Rear (43594)</b>			
Pressure	23psi	25psi	27psi
1050lbs (476kg)	1795 lbs/in	1855 lbs/in	1995 lbs/in
850lbs (386kg)	1745 lbs/in	1795 lbs/in	1935 lbs/in
650lbs (295kg)	1675 lbs/in	1715 lbs/in	1850 lbs/in

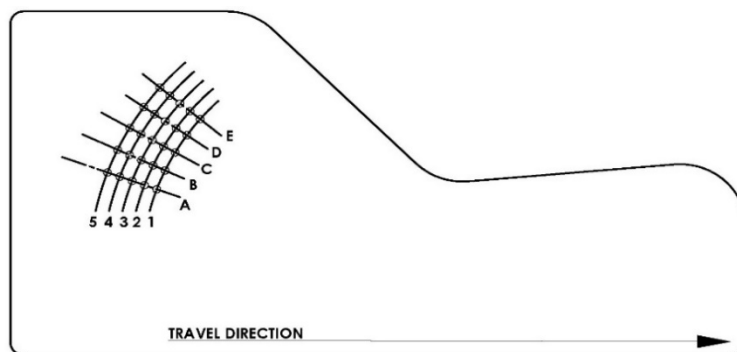
<b>Wet Front (44195)</b>			
Pressure	23psi	25psi	27psi
1050lbs (476kg)	1440 lbs/in	1525 lbs/in	1645 lbs/in
850lbs (386kg)	1405 lbs/in	1490 lbs/in	1605 lbs/in
650lbs (295kg)	1345 lbs/in	1435 lbs/in	1545 lbs/in

<b>Wet Rear (44517)</b>			
Pressure	23psi	25psi	27psi
1050lbs (476kg)	1755 lbs/in	1845 lbs/in	1935 lbs/in
850lbs (386kg)	1700 lbs/in	1785 lbs/in	1870 lbs/in
650lbs (295kg)	1620 lbs/in	1705 lbs/in	1790 lbs/in

## 4.9 J - AERODYNAMIC

### 4.9.1 FRONT WING

Front Wing holes are labelled LETTERS for ROWS, and NUMBERS for COLUMNS (e.g. 'E1' is the forwardmost hole in the top row).

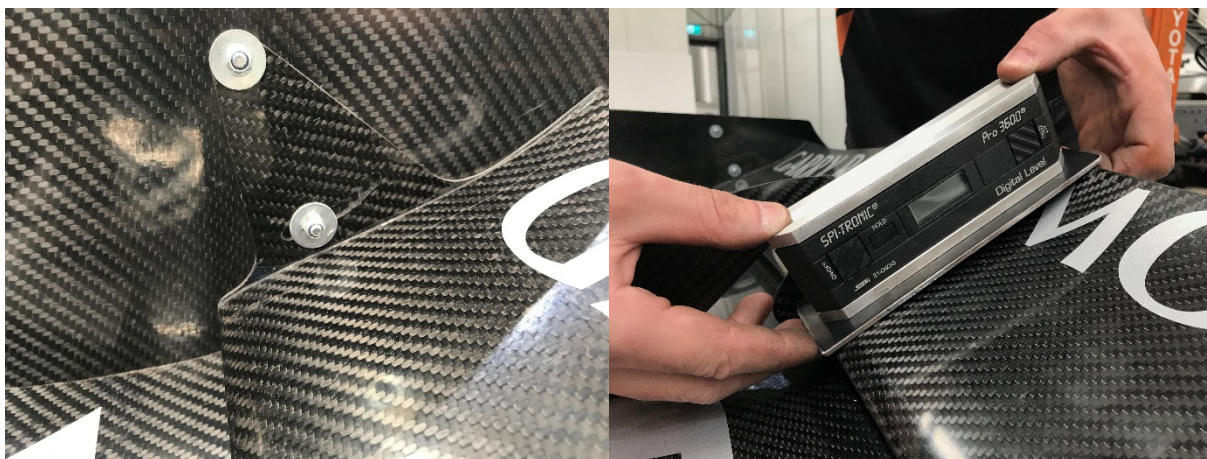


### 4.9.2 REAR WING

Rear Wing angles are zeroed to the flat surfaces either side of the Main Roll Hoop (near the rearward mounts of the halo).



### Upper Rear wing adjustment and measurement



### Lower Rear wing adjustment and measurement



## 5 ELECTRICAL SYSTEM

### 5.1 OVERVIEW

The electrical system is comprised of a 12V power circuit which includes an alternator, battery and master relay. The Motec control systems are as follows:

	MODEL	LOCATION
ECU	M150	Under driver's seat
PDM	PDM15	Under driver's seat
DASH	D153	Steering Wheel
SHIFT LIGHTS	SLM	Steering Wheel
GPS	GPS-L10	Roll Hoop
CAMERA	V2	Roll Hoop
LOGGER	L120	LH Sidepod
LAMBDA	LTCD	Rear of Airbox

All systems are locked and must not be modified. Users can download the L120 datalogger and set a reference lap time. The software required for these functions is Motec C125 Dash Manager V6.10H9.

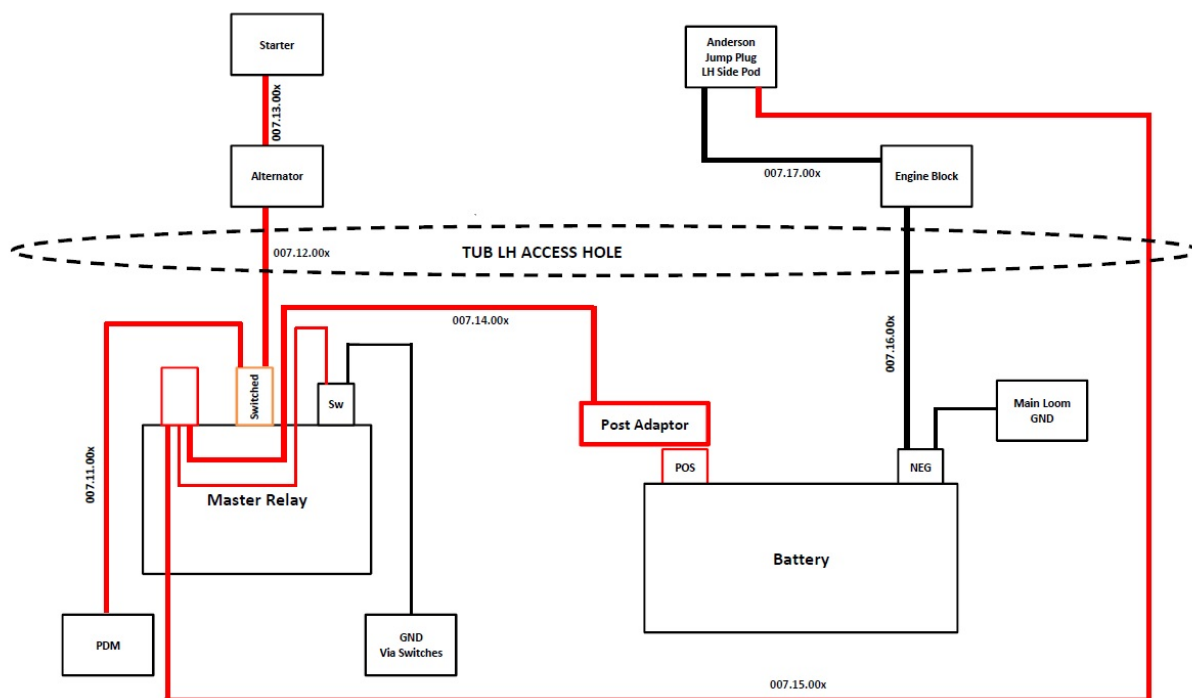
It is assumed that the customer is familiar with the use of Motec Dash Manager and Motec i2 Pro. Please contact GRM Technical Support if help is required.

### 5.2 POWER CIRCUIT

The Ford Performance alternator is located on the left-hand side of the engine and is connected to a Varley Red Top 15 battery located under and behind the driver's seat. The master relay, also located under the driver's seat, is activated by the Master Switch on the Dash Panel, or in Emergencies only, a Kill switch on the roll hoop.

**CAUTION – The emergency Kill Switch on the roll hoop deactivates the electrical system AND ACTIVATES THE FIRE EXTINGUISHER AT THE SAME TIME.**

A schematic of the power circuit is shown below.



An Anderson Jump plug is located in the left-hand side pod for connection of an auxiliary battery. It is recommended an auxiliary battery is connected at all times the car is turned on without the engine running.

*CAUTION – Always disconnect the auxiliary battery before driving the car. And be aware the auxiliary battery connection is ALWAYS LIVE - it is directly connected to the battery.*

## 5.3 FIRE EXTINGUISHER

The car is equipped with a Lifeline Fire Extinguisher system. The pressurised tank containing the retardant is located under and behind the driver's seat, with the Power Pack mounted on the right-hand side of the cockpit beside the driver. It is important all manufacturer's instructions are followed at all times and electrical function is regularly checked.

*NOTE – Always activate the system before the car is driven by placing the switch on the Power Pack in the ARMED position.*

If the switch on the power pack is pulled against the spring towards the AMBER LED and the AMBER LED does NOT illuminate or immediately goes out the battery needs replacing. Only use a battery recommended by Lifeline. If the switch on the power pack is placed in the centre position, activation of either the fire button or the emergency kill switch should illuminate the GREEN LED. If the GREEN LED is illuminated BEFORE activating either fire button the system is LIVE and the switch should NOT be put in the armed position. If the GREEN LED does not illuminate or is permanently illuminated in this central switch position, there is a fault which must be rectified before the car is driven.

## 5.4 RADIO CONNECTIONS

The main electrical harness in the s5000 is equipped with radio connections to avoid having to piggy back additional radio looms. The customer needs to provide an adapter loom from the autosport connector to their handheld radio that matches the pinout given below.

### 5.4.1 RADIO TO CAR CONNECTION

- AS6 07-35 PN - Located on a panel on the right-hand side of the cockpit next to the Driver
  1. MIC NEG (GND)
  2. PTT +ve
  3. PTT -ve
  4. MIC POS (EMC)
  5. SPEAKER POS (SP+)
  6. SPEAKER NEG (SP-)

### 5.4.2 HELMET TO CAR CONNECTION

- Nexus 4 pole Male - Located next to the right-hand shoulder belt fixing
  1. MIC NEG (GND)
  2. SPEAKER NEG (SP-)
  3. MIC POS (EMC)
  4. SPEAKER POS (SP+)

## 5.5 CAMERA

The car has a Motec V2 camera placed on top of the roll hoop. It records Full HD to a removable micro SD card up to 32GB and starts/stops automatically. It sources 12 V power directly from the vehicle.

It automatically CAN synchronizes with data in i2 and live gauges are recorded on the video. This includes G-force, Gear, RPM, Lap number, Laptime, Speed, Brake pressure and Throttle position.

The configuration of the camera can be changed with the V2 Manager software.



The camera case is waterproof and the windscreen can be replaced if stone chipped or cracked.

Pay special attention to the cable of the camera not rubbing on the engine cover!

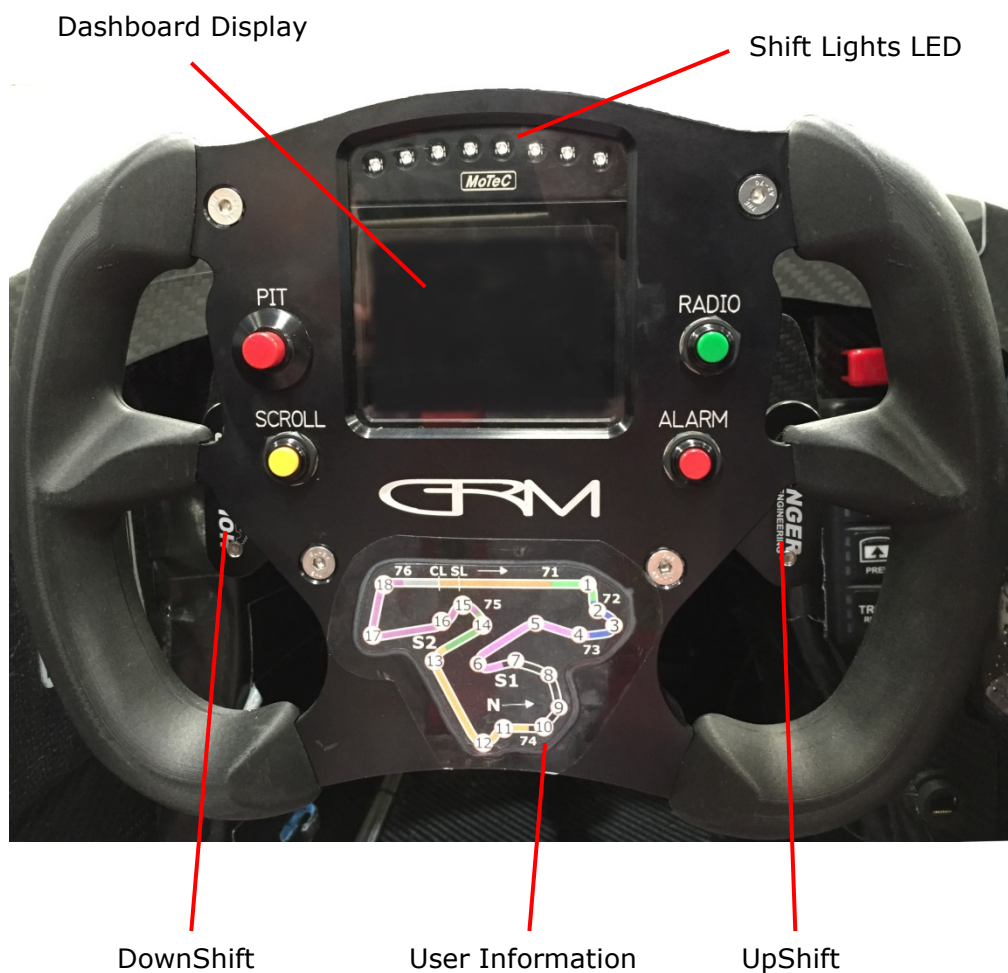


## 6 ELECTRONICS

### 6.1 USER INTERFACE

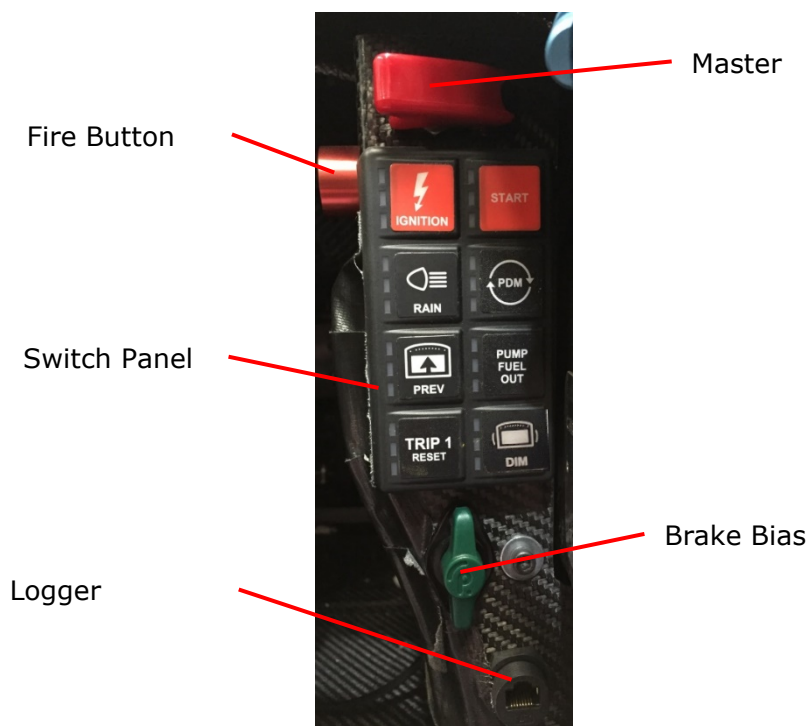
#### 6.1.1 STEERING WHEEL

*CAUTION - When removing the steering wheel, care must be taken to ensure the long-term reliability of the electrical connection between the chassis and the steering wheel. THIS CONNECTION IS CRITICAL TO THE VIABLE OPERATION OF THE VEHICLE.*



<b>DASHBOARD DISPLAY:</b>	Motec D153 Electronic Display
<b>PIT:</b>	Push to activate the Pit Limiter, push again to deactivate the Pit Limiter
<b>SCROLL:</b>	Push to scroll through the Display pages
<b>DOWNSHIFT:</b>	Pull to request next lower Gear
<b>SHIFT LIGHTS LED:</b>	Light sequence to indicate Up Shift point
<b>USER INFORMATION:</b>	<i>Optional</i> – Static User information using adhesive labels
<b>RADIO:</b>	Push to talk, release when finished talking
<b>ALARM:</b>	Clears Alarm messages on Display (Hold down for 3s to reset Fuel Used)
<b>UPSHIFT:</b>	Pull to request next higher Gear

## 6.1.2 CONTROL PANEL



**MASTER SWITCH:** Toggle Switch, turns the Car on (switch to the right) and off

**Note:** *This Master Switch must always be used for electrical deactivation; unless the car is on fire or this switch is inaccessible. In this situation the emergency switch on the roll hoop must be used.*

**FIRE BUTTON:** Push to discharge the fire extinguisher system

**SWITCH PANEL:**

- Ignition:** Push to activate electrical systems to enable the Engine to run  
Push again to turn Ignition off
- Start:** With Ignition on and Engine not running, push to start the Engine
- Rain:** Push to turn on the Rain Light, push again to turn off
- PDM:** PDM Master Retry (push to retry all tripped outputs)
- PREV:** Push to return directly to the "Driver" dash page
- Pump Fuel Out:** Push to activate Fuel Pump – Pump will continue to pump out until the fuel pump current drops has dropped below 2.5A for 5secs, at which point, the tank will be empty  
  
By pressing and holding the button, the pump can be activated manually
- TRIP 1 Reset:** Push to reset the Trip Distance and Total Fuel Used values
- Dim:** Press repeatedly to change the brightness of both the display and the shift lights

**BRAKE BIAS:** Clockwise rotation provides more FRONT braking

**LOGGER DOWNLOAD:** Connection to the Motec L120 Datalogger

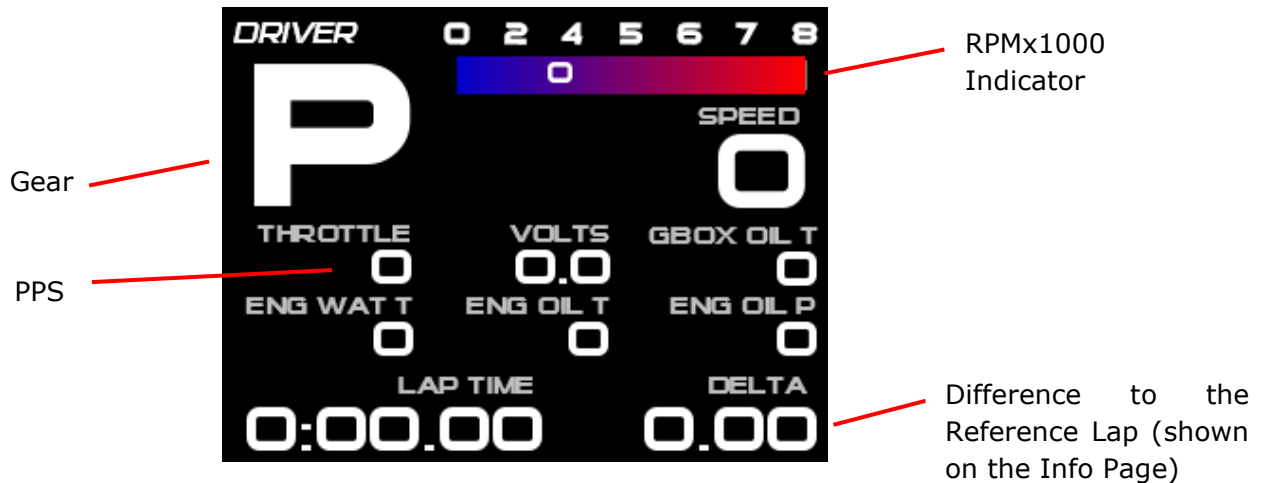
### 6.1.3 DASHBOARD

#### Dashboard Pages:

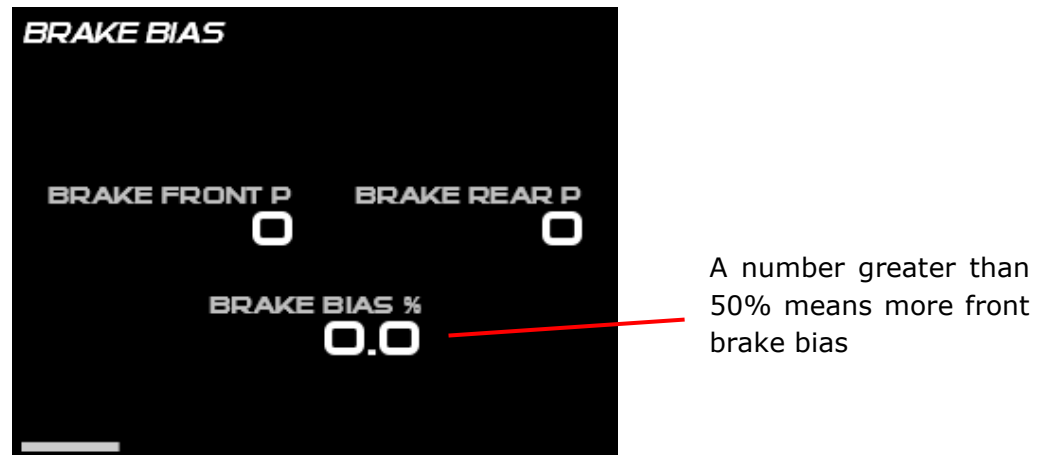
There are 7 pages available on the Display. The Default display on power up is the 'Driver' page; the remaining 6 pages are displayed on successive pushes of the Scroll button on the steering wheel.

All pressures are shown in PSI.

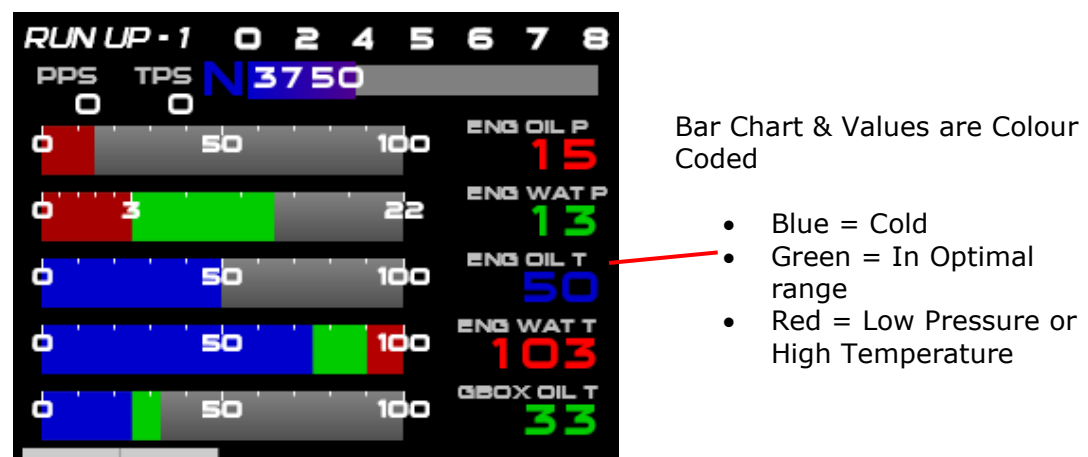
#### DRIVER PAGE:



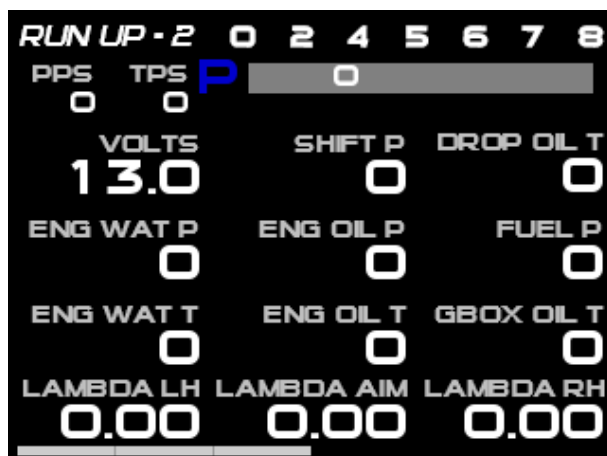
#### BRAKE BIAS PAGE:



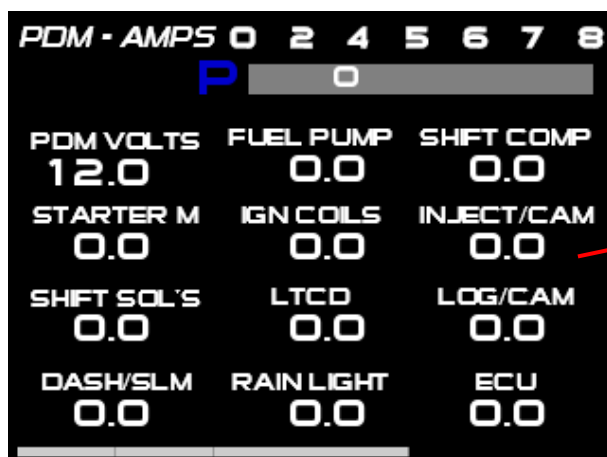
#### ENGINE RUN UP PAGE 1:



**ENGINE RUN UP PAGE 2:**



**PDM - AMPS PAGE:**



Displays the current being output by the PDM.

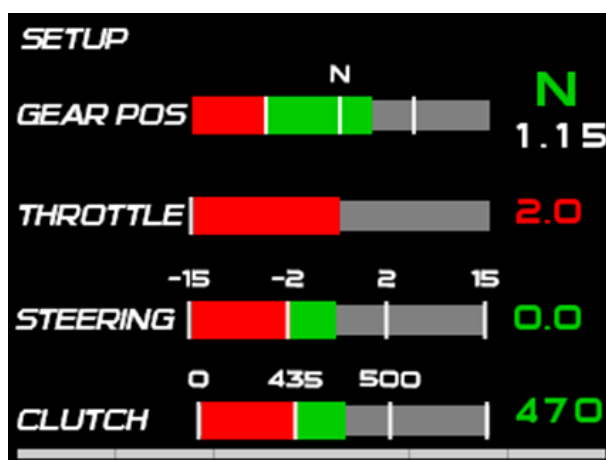
Individual items will turn red in error state.

**INFORMATION PAGE:**



Name	Description
Loaded Ref Lap	The currently loaded reference lap in seconds
Fuel Used	Fuel Used counter 1 (reset by holding Alarm button for 3s)
Total Fuel Used	Fuel Used counter 2 (reset by holding Trip 1 Reset button)
Trip Dist	Trip Distance (reset by holding Trip 1 Reset button)
Odometer	Total mileage of vehicle

**SETUP PAGE:**



Gear Sensor Voltage

Name	Description
Gear Pos	If the gear position sensor has been moved, then adjust while the trans is in neutral until the marker is between the white lines closest to 'N'.  Then cycle the transmission through all gears and ensure that the correct gear is displayed.
Throttle	Should display 0.0 when throttle is released. Avoid adjusting throttle position sensor without GRM technical support.
Steering	Displays steering angle. Contact GRM Technical support for recalibration.
Clutch	When clutch is depressed ensure marker goes beyond white line. If not, check clutch height as described earlier.

## 6.1.4 DASH ALARMS

Message	Condition
OIL PRESSURE	Oil Pressure <65psi with RPM>5500 OR Oil Pressure <25psi with 900<RPM>5500
ENG HOT WARN	Water Temperature>105 and Engine Running State OR Oil Temperature>120 and Engine Running State
HOT RPM LIMIT	Water Temperature>110 and Engine Running State (This alarm is used to show the driver that the Engine Speed will be limited to 7200RPM)
TRANS HOT	Transmission Temp>120 Engine Running State OR Drop Gear Temp>140 Engine Running State
FUEL PRESSURE	Fuel Pressure<35psi and Engine Running State
BATT VOLTS	Volts<11 with engine not in cranking state
ENG COLD – 2500RPM LIMIT	Oil Temperature<50 and Engine Running State (This alarm is used to show the driver/crew that the Engine Speed will be limited to 2500RPM While Oil Temp is Low)
FUEL PUMP – ON	Displayed during pump-out for either automatic or manual methods
FUEL RESET	Displays to confirm fuel used has been reset
TRIP RESET	Displays to confirm total fuel used and trip distance has been reset

## 7 DATA LOGGER

### 7.1 CHANNEL LIST

Channel Name	Comment	Unit	Sample Rate [Hz]
Ambient Pressure	Ambient pressure	kPa	10
Bat Volts PDM	Battery voltage	V	20
Beacon	Beacon signal		1
Brake Bias Setting	Brake balance setting	%	100
Brake Pressure Front	Brake pressure front	psi	100
Brake Pressure Rear	Brake pressure rear	psi	100
Clutch Pressure	Clutch pressure	psi	20
Coolant Pressure	Water system pressure	psi	10
Coolant Pressure Warning	Coolant Pressure warning from ECU		20
Coolant Temperature	Water system temperature	°C	10
Coolant Temperature Warning	Coolant temperature warning from ECU		20
Display Page	Steering wheel display page number		10
Drop Gear Temp	Drop Gear temperature	°C	1
Engine Oil Pressure	Engine oil pressure	psi	10
Engine Oil Pressure Warning	Engine oil pressure warning from ECU		20
Engine Oil Temperature	Engine oil temperature	°C	10
Engine Oil Temperature Warning	Engine oil temperature warning from ECU		20
Engine Speed	Engine speed	rpm	100
Engine Speed Limit State	From ECU, displays the cause of RPM Limit		20
Engine State	Engine State		20
Exhaust Lambda Bank 1	Exhaust Lambda left-hand	LA	50
Exhaust Lambda Bank 2	Exhaust Lambda right-hand	LA	50
Fuel Mixture Aim	Lambda Aim	LA	100
Fuel Pressure Sensor	Fuel pressure	psi	10
Fuel Pressure Warning	Fuel Pressure Warning from ECU		20
Fuel Pump State	Fuel Pump State		10
Fuel Temperature	Fuel temperature	°C	10
Fuel Used	Used fuel	l	1
G Force Lat	Lateral g-force	G	50
G Force Long	Longitudinal g-force	G	50
G Force Vert	Vertical g-force	G	50

Channel Name	Comment	Unit	Sample Rate [Hz]
Gear	Selected gear		10
Gear Sensor Voltage	Gear potentiometer voltage	V	100
Gear Shift Actu Pressure	Shift compressor pressure	psi	1
GPS Altitude	Altitude	m	20
GPS Date	Date		1
Ground Speed	Car travel speed	km/h	20
Inlet Air Temperature	Inlet air temperature	°C	10
Inlet Manifold Pressure	Inlet manifold pressure	kPa	10
Lap Distance	Lap distance	m	1
Lap Time	Lap time	s	1
Odometer	Odometer	km	1
PDM Fault Flag	Global channel error		10
PDM Input 1 Voltage	Master switch	V	10
PDM Input 2 Voltage	Fuel pump control ECU	V	10
PDM Input 5 Voltage	Shift compressor control ECU	V	10
PDM Output 1 Current	Fuel pump	A	10
PDM Output 1 Status	Fuel pump		10
PDM Output 2 Current	Shift compressor 1	A	10
PDM Output 2 Status	Shift compressor 1		10
PDM Output 3 Current	Shift compressor 2	A	10
PDM Output 3 Status	Shift compressor 2		10
PDM Output 4 Current	Starter motor	A	10
PDM Output 4 Status	Starter motor		10
PDM Output 5 Current	Ignition coils	A	10
PDM Output 5 Status	Ignition coils		10
PDM Output 6 Current	Injectors/Cams	A	10
PDM Output 6 Status	Injectors/Cams		10
PDM Output 10 Current	Shift solenoids	A	10
PDM Output 10 Status	Shift solenoids		10
PDM Output 11 Current	LTCD (Lambda CAN Modul)	A	10
PDM Output 11 Status	LTCD (Lambda CAN Modul)		10
PDM Output 12 Current	Logger/Camera	A	10
PDM Output 12 Status	Logger/Camera		10



Channel Name	Comment	Unit	Sample Rate [Hz]
PDM Output 13 Current	Dash/SLM/Keypad	A	10
PDM Output 13 Status	Dash/SLM/Keypad		10
PDM Output 14 Current	Rain light	A	10
PDM Output 14 Status	Rain light		10
PDM Output 15 Current	ECU	A	10
PDM Output 15 Status	ECU		10
Steering Angle	Steering Angle	°	20
Throttle Pedal	Throttle pedal position	%	20
Throttle Position	Butterfly position	%	20
Total Fuel Used	Total fuel used	l	1
Transmission Temperature	Gearbox temperature	°C	10
Trip Distance	Trip distance	km	1
Wheel Speed FL	Wheel speed front left	km/h	100
Wheel Speed FR	Wheel speed front right	km/h	100
Wheel Speed RL	Wheel speed rear left	km/h	100
Wheel Speed RR	Wheel speed rear right	km/h	100
Alarm Bat Volts Lo	Alarm battery voltage low		10
Alarm Eng Oil Pres Lo	Alarm engine oil pressure low		10
Alarm Eng Oil Temp Lo	Alarm engine temperature low		10
Alarm Eng Temp Hi	Alarm engine temperature high		10
Alarm Gbox Oil Temp Hi	Alarm gearbox oil temperature high		10
Alarm Water Press Lo	Alarm water pressure low		10
BAlarmAcknowledgeButtonFromD1	Steering wheel acknowledge button		10
BPageButtonFromD1	Steering wheel page scroll button		10
Driver Switch 1	Steering wheel pit limit button		10
Driver Switch 2	Down shift paddle actuated		10
Driver Switch 3	Up shift paddle actuated		10
Driver Switch 4	Ignition switch		10
Gear Paddle Down Switch	Down shift paddle actuated		10
Gear Paddle Up Switch	Up shift paddle actuated		10
PDM Input 1 State	Master switch		10
PDM Input 2 State	Fuel pump control ECU		10
PDM Input 5 State	Shift compressor control ECU		10

Channel Name	Comment	Unit	Sample Rate [Hz]
Up Shift Light 1	Up shift light 1		100
Up Shift Light 2	Up shift light 2		100
Up Shift Light 3	Up shift light 3		100
Up Shift Light 4	Up shift light 4		100
Warning Source	Used as part of the Battery Volt Warning		20
Warning Light	Steering wheel display alarm		1

## 8 FLUIDS

Description	Part Number	Quality	Quantity
Engine Oil	GRM-ER0001	Valvoline ProV 20W-50	≈8L (dipstick)
Engine Coolant	GRM-ER0003	Valvoline G-05 Zerex concentrate	≈14L (Coolant/water=1/13)
Fuel		98RON	62L tank capacity
Brake/Clutch Fluid	GRM-ER0004	Valvoline VR1	
Gearbox Oil	GRM-ER0002	Valvoline SynGear 75W-140	≈3.5L (fill level plug)
Drop Gear Oil	GRM-ER0002	Valvoline SynGear 75W-140	≈0.5L (fill level plug)
Driveshaft Grease		NEO HPCC-1 CV	TBC
Pneumatic Valve Grease	P/N 51360	Loctite LB8801 Silicone lubricant	TBC

## 9 CAR MAINTENANCE

Description	Check	Service/Change	Information
<b>Engine</b>			
Engine		5000kms	
Accessory Belt	Each event	Depending visual state	
Radiator	Each event	Depending visual state	Flush coolant water
Engine Oil and Filter		500 km	Oil Filter P/N: K&N HP-2010
Fuel Filter		tbc	
Fuel Pump		tbc	
Flywheel			Visual inspection at each disassembly of clutch
Air Filter	Each event	Depending visual state	Clean with specific K&N products Air Filter P/N: K&N 33-2116
<b>Transmission</b>			
Gearbox		3000kms	
Clutch	1500 km		Record wear, shim if necessary
Gearbox Oil and Filter		1000 km or Temp > 120 °C	When new after first 200 km. Oil Filter P/N: Ryco 2605P
Drop Gear Oil		Each event or Temp > 130 °C	
Driveshaft		3000kms	
<b>Front and Rear Axle</b>			
Wheel Bearing	Each event	3000kms	Check for play
Wheel nut	Each event		Clean and dry lubricate
Dampers		3000kms	
<b>Brakes</b>			
Master Cylinder		12 months	Service and replace seals
Caliper	Each event	12 months or Temp intermittently > 220 °C	Service and replace seals
Disc	Each event	Depending visual state/wear	Check for excessive heat crazing and cracking
Pad	Each session	Depending wear	

## 10 TIGHTENINGS

Description	Size	Tightening torque		Loctite	Notes
		N.m	lbf.ft		
Wheel nut	TR58x3	732	540		Taper: Kluber MOLYBKOMBIN UMF T4 Spray  Thread: Anti-Seize*
Drive shaft	M10x1.5	68	50		dry
Brake caliper fastener	M10x1.5	54	40		Anti-Seize*
Front rocker	M10x1.5	54	40		
Outer bottom wishbone	M10x1.5	54	40		
Rear rocker	M8x1.25	30	22		
Clutch	5/16UNF	30	22		Anti-Seize*
Brake pad retaining		19	14		Anti-Seize*
Brake bleed nipple		17	13		
Rim flange	1/4UNF	15	11	243	
Front wing mainplane	M6x1	14	10.5	243	
Disc mounting	1/4UNF	14	10.5		Anti-Seize*
Suspension (NAS bolts)	3/8	34	25		Anti-Seize*
	5/16	27	20		
	1/4	13.5	10		

\*silver-grade dry lube