

Welcome to Ratios.ods (Release 006.Mk1 - 2017/03/12) **The A-Series Gearbox comparison and analysis spreadsheet**

This spreadsheet is a comprehensive tool for analysing or assisting in the choice of gearbox and drive train ratios for A-Series cars and possibly others.

Also included is a feature to calculate and display the results of various speedometer drive permutations. Calibration/correction is available for geometrically calculated tyre sizes which would otherwise produce inaccurate results.

This is a LibreOffice (.ods) document which should also open in OpenOffice. Requests to convert this to a "different" format will be futile as the above software is both easy to obtain and is totally free of charge. The author uses LibreOffice v3.4 which is highly recommended for all systems that will run it.

For Windows7 and earlier, LibreOffice v3.4 can be downloaded from this link:
[Lib0_3.4.5rc2_Win_x86_install_multi.exe](#)

For most other OS's, the latest (untested) version can be downloaded from:
<http://www.libreoffice.org/download>

General Information:

The spreadsheet incorporates features to display and calculate the overall drive ratio and road speed, and includes various drop gear, final drive and tyre size parameter options. It allows two drive train setups to be displayed and compared at the same time on tab "Main" and can be set to provide either MPH or Km/h values. Column 'D' Speeds are the road speed per 1000 engine RPM.

Most known standard gearsets are pre-programmed and can be accessed directly. The details of the available gearsets are provided on the "Data" tab and these have been compiled from various sources. On tab "Main", the gearset name/identifier for each of the two setups can either be keyed manually or otherwise be selected from a pull-down list.

The "Primary Drive" ratio and the "Final Drive" ratio refer to the drop gears and differential respectively. These can either be entered directly or else can be calculated by the spreadsheet. For example, a 3.444 diff can either be entered as "3.444" or by typing a formula of the tooth count, ie "+62/18". Both of these items should be typed without the quotes and the latter formula method is the more accurate of the two.

Another aspect which affects the drive train ratio will be the effective circumference of the tyre. Traditionally, manufacturers quoted a value which was the "Wheel Revolutions Per Mile" and it is this figure which is needed by the spreadsheet for its calculations. If a linear value is quoted, this will usually be the circumference in millimeters and a calculator is provided to convert this to a WRPM value.

It should be noted that there are many tyre size calculators available which will geometrically work out the circumference using the tyre's profile values, for example 165x70x10. Invariably, these tools are not very accurate because they do not take into consideration the "flat" at the base of the tyre when it is fitted to the vehicle and the vehicle is on the ground. The difference between the actual "rolling" size and the geometrically calculated sizes can vary significantly but the author understands there to be an "industry standard" correction factor of 3.1%. The author's personal experience puts the figure closer to 4% for typical tyres of 10" and 12" diameter. The WRPM calculator on tab "Main" allows for correction factors in the range from 0% to 6%.

Official tyre size values can be found either from a manufacturer's website, or else by sending a polite email request. Tyre suppliers ought to be able to provide this information at the point of sale but this is not always the case.

The "Speedo Drive Setup" tool on tab "Main" is provided to assist in the calibration of the speedometer and odometer. It can be used to predict the cable drive ratio installed in the gearbox without having to physically check the gears.

All that is needed is to undo the speedo end of the cable and put a 360 degree protractor on the end of it. Set a pointer to zero degrees.

Then:

- (1) Ensure that the car is on level ground
- (2) Ensure that the gearbox is in neutral
- (3) Make a mark on the front driver's side tyre in the 6 o'clock position (Use a set square and line up with the centre of the drive shaft)
- (4) Release the hand-brake
- (5) Roll the car forwards exactly one complete turn of the tyre mark made in (3)
- (6) Re-apply the hand-brake
- (7) Observe the protractor reading in degrees
- (8) Use the Degrees column in the table to deduce the likely cable drive ratio

The "Speedo Drive Setup" tool can also be used to compare various pairs of drive gears that are available.

On tab "Data" there are also features to allow users to create their own calculations based on either providing a tooth count, or a set of known ratios. The "Ttest" (Tooth Test) gearset will allow a gearset to be calculated when the tooth counts are known and the "Rtest" (Ratio Test) gearset will suffice if they are not. Clicking the column headings for either of these items will display help on the respective useage.

Limitations:

Like most utilities, this one has its limitations, and being an editable spreadsheet is one of them. The spreadsheet is generally protected against typing in areas which should not be typed in. Areas where user input is allowed are shown with a pale yellow background. In most cases, invalid user input will be prevented but this is not guaranteed.

Useful information is provided when some cells are clicked but sometimes this will not display correctly. Clicking the same cell again should cure this. Sometimes the help may be intrusive, press the "ESC" key to clear it.

IMPORTANT WARNING:

"Copying and Pasting" should be avoided unless the user is able to select "Numbers Only" when pasting the clipboard contents into the spreadsheet. See under "Edit/Paste Special" or similar. Ignoring this advice will probably ruin the spreadsheet formatting and cause terminal damage.

Disclaimer:

The author will not be held responsible for any unfortunate events which may occur as a result of using this facility. The data and calculations in general should be correct, this cannot be guaranteed.

This spreadsheet has been created primarily as a technical challenge for the author, but also as a useful tool for his personal use. The author hopes that it will also be of benefit to other engine tuners, subject to the above.
E & OE – Use it "as is" and at your own risk!

Updates may become available. Suggestions are welcome for discussion!
Additional gearsets that are not listed can be added on request.

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If you would like to contribute some "beer money" towards this project, then PayPal donations are welcome using the same email address.

See also:

Needles.ods

The Carburetter Needle comparison and analysis spreadsheet

Acknowledgements:

Many thanks go to Mark Forster for hosting this work on his excellent website:
mk1-performance-conversions.co.uk

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Gearbox Setup 1	Gear	Ratio	Speed	MPH	RPM	RPM	MPH	70	Drop	Overall
4QFE1	1	2.877	6.6	20	3.044	7.000	46	N/A	▼	35%
Straight Cut 4Synchro Close Ratio Quaife	2	1.827	10.3	30	2.900	7.000	72	6.768	64%	55%
	3	1.329	14.2	40	2.811	7.000	100	4.920	73%	75%
	4	1.000	18.9	50	2.645	6.200	117	3.703	75%	100%
	5			60		5.200				
Primary Drive		1.000	2.950 ← Overall Ratio - Gear 4					Ratios.ods Release 006.Mk1 2017/03/12 © Ian Hamilton		
Final Drive		2.950								
Wheel Revs Per Mile WRPM		1076								
Maximum Engine RPM		7.400								

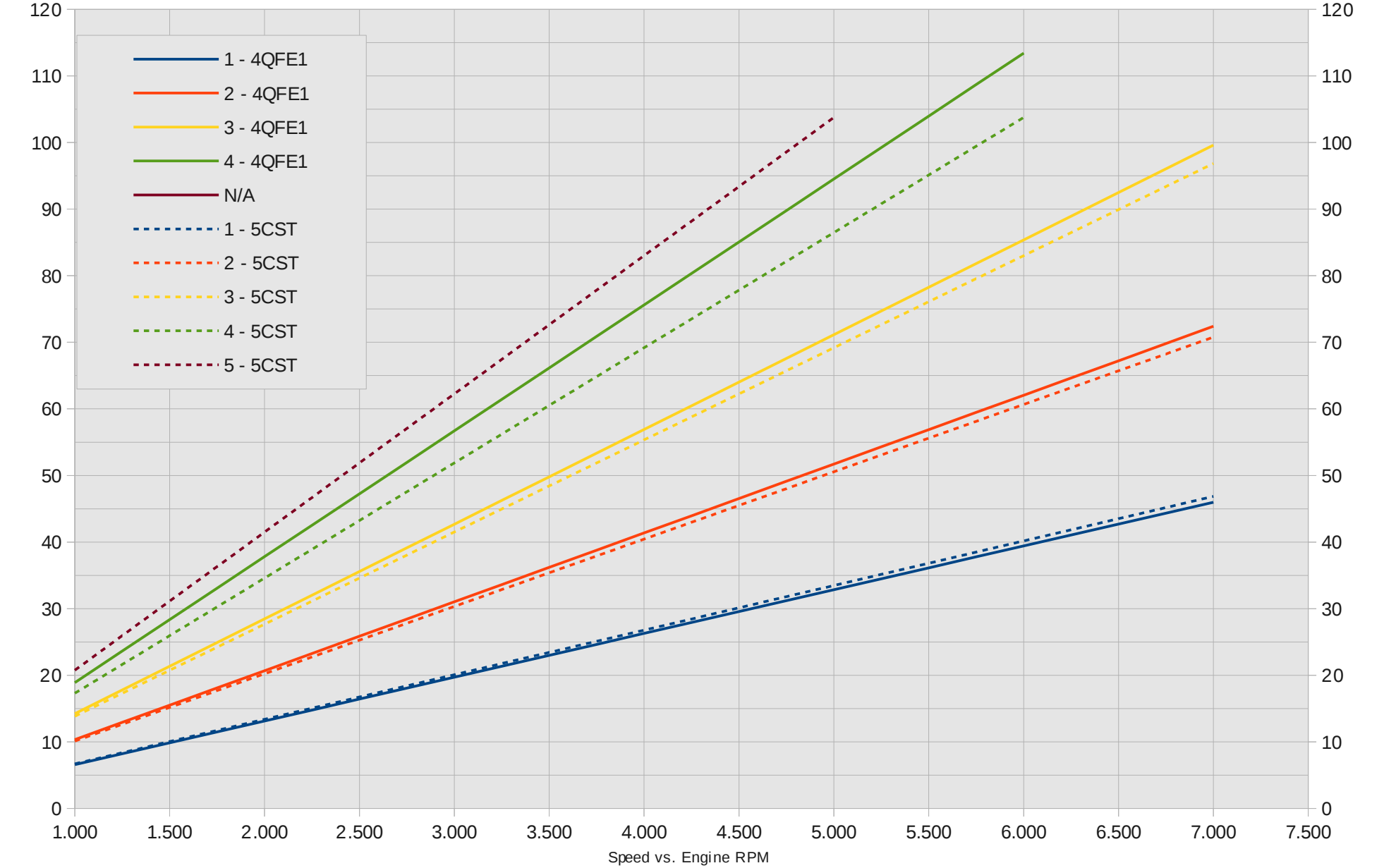
Gearbox Setup 2	Gear	Ratio	Speed	MPH	RPM	RPM	MPH	70	Drop	Overall
5CST	1	2.583	6.7	20	2.987	7.000	47	N/A	▼	32%
Hybrid of 5CLUB and 5ST (Built by the author and proposed for production by MiniSpares)	2	1.711	10.1	30	2.967	7.000	71	6.923	66%	49%
	3	1.250	13.8	40	2.891	7.000	97	5.059	73%	67%
	4	1.000	17.3	50	2.891	6.200	107	4.047	80%	83%
	5	0.833	20.8	60	2.891	5.200	108	3.373	83%	100%
Primary Drive		0.958	3.301 ← Overall Ratio - Gear 4					Notes: 60's Dunlop 145/80R10 = 1084 WRPM, Yoko A008 165/70R10 = 1076 WRPM, Michelin XM2 145/70R12 = 1036 WRPM, Yoko A539 165/60R12 = 1051 WRPM		
Final Drive		3.444								
Wheel Revs Per Mile WRPM		1051								
Maximum Engine RPM		7.400								

Speedo Drive Setup	with	Pinion	and	Shaft	Cable Revs	Cable Degrees	Cable TPM	Compare	Original Spec	
								6/17	Diff	Tyres
Final Drive	x	5	/	18	0.957	344°	1036	79%	3.211	12"
	x	6	/	17	1.216	438°	1317	100%	All	10"
3.444	x	6	/	16	1.292	465°	1399	106%	3.444	12"
Wheel Revs Per Mile WRPM	x	7	/	16	1.507	543°	1632	124%	3.105	12"
	x	7	/	15	1.607	579°	1741	132%	2.762	12"
1083	x	6	/	18	1.148	413°	1243	94%	Non-standard pair	

Tyre Circumference (mm)	1486	Speedometer Units		MPH		Check for Updates
Size is Rolling/Loaded						
Calculated WRPM →	1083					

For Full Screen Mode: Press Ctrl+Shift+J

Speedometer Units: MPH	Gearset	Hide All	Gear 1	Gear 2	Gear 3	Gear 4	Gear 5
Gearbox Setup 1	4QFE1	No	Show	Show	Show	Show	Show
Gearbox Setup 2	5CST	No	Show	Show	Show	Show	Show



34 Gearsets →		RTEST	TTEST	3STD	3E12G	3COOP	3ST	3HCR	3SCC	5CFRC	5CFRD	4STD	4SGT	5SGT	4APL	5APL
		Contains a	Contains a	Helical 3	Helical 3	Helical 3	Straight	Helical 3	Straight	Dog Box	Dog Box	Helical 4	Helical 4	Helical 5	Helical 4	Helical 5
Gearbox Ratios	1	2.761	2.583	3.628	3.829	3.200	2.573	2.569	3.077	2.764	2.960	3.525	3.330	3.330	3.647	3.282
	2	1.702	1.711	2.172	2.420	1.916	1.722	1.780	1.875	1.714	1.730	2.218	2.094	2.094	2.185	1.966
	3	1.349	1.250	1.412	1.426	1.357	1.255	1.242	1.307	1.351	1.350	1.433	1.353	1.353	1.425	1.283
	4	1.145	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.146	1.150	1.000	1.000	1.000	1.000	1.000
	5	1.000	-	-	-	-	-	-	-	1.000	1.000	-	-	0.868	-	0.882
First Motion Shaft →			20	19	18	20	22	23	20	15		17	18	18	17	17
Laygear (Bold = Driven)	1	TTEST Details ↓	15	13	13	13	13	13	13	11		15	15	15	15	15
	2		19	19	18	19	17	17	18	17		20	20	20	21	21
	3		23	24	24	23	20	21	22	15		25	25	25	26	26
	4	Driven →	25	28	28	26	23	24	25	21		29	29	29	30	27
	5		27	-	-	-	-	-	-	19		-	-	39	-	27
Third Motion Shaft (Driven Gears)	1		31	32	32	32	32	32	32	24		31	31	31	31	31
	2		26	28	28	28	28	29	27	23		26	26	26	26	26
	3		23	23	22	24	24	25	23	16		21	21	21	21	21
	4	← Direct	19	Direct	Direct	Direct	Direct	Direct	Direct	19		Direct	Direct	Direct	Direct	Direct
	5	None	18	-	-	-	-	-	-	Direct		-	-	21	-	15

Search By →	Laygear	3ST	3ST
C-22G306			
Straight Cut 3Synchro Close Ratio Leyland ST (C-22G306/22G1047 Laygear)			

Notes:	
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Drop Gears		
Common Available Ratios		
Primary	Input	Ratio
30	28	0.933
24	23	0.958
29	28	0.966
30	29	0.967
24	24	1.000
24	25	1.042
23	24	1.043
22	23	1.045
23	25	1.087
22	24	1.091
22	25	1.136

Differential		
Standard Helical Ratios		
C/W	Pinion	Ratio
58	21	2.762
59	20	2.950
59	19	3.105
61	19	3.211
62	18	3.444
62	17	3.647
64	17	3.765
63	16	3.938
62	15	4.133
64	15	4.267
65	15	4.333

4HLE	4HDCR	4ST	5ST	4CLUB	5CLUB	5HDCR	5CST	4CHAL	4JKN1	4KAD1	5KAD1	5KAD2	4MED1	4QFE1	4SEL1	4SWF1	4SWF2	4SWF3
Helical 4	Helical	Straight	Straight	Straight	Straight	Straight	Hybrid o	Straight	Straight	Tooth co	Dog Box	Dog Box	(2.239 -	Straight	(2.174 -	Dog Box	Dog Box	Dog Box
4.004	2.583	2.544	2.544	2.583	2.583	2.583	2.583	2.315	2.214	2.173	2.616	2.399	2.240	2.877	2.175	2.143	2.362	1.692
2.307	1.645	1.731	1.731	1.711	1.711	1.645	1.711	1.568	1.500	1.493	1.989	1.825	1.568	1.827	1.458	1.486	1.564	1.441
1.435	1.250	1.259	1.259	1.250	1.250	1.250	1.250	1.188	1.136	1.197	1.671	1.533	1.245	1.329	1.208	1.195	1.195	1.197
1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.294	1.187	1.000	1.000	1.000	1.000	1.000	1.000
-	-	-	0.877	-	0.865	0.865	0.833	-	-	-	1.000	1.000	-	-	-	-	-	-
16	20	19	19	20	20	20	20	22	23	19	20	21	22	18	20	21	21	24
15	15	15	15	15	15	15	15	14	14	17	16	16	14	14	14	16	15	15
21	19	19	19	19	19	19	19	18	18	22	19	19	18	19	18	20	19	17
27	23	23	23	23	23	23	23	22	22	24	21	21	21	23	20	22	22	19
31	25	25	25	25	25	25	25	23	23	26	24	24	23	25	21	24	24	21
-	-	-	27	-	26	26	27	-	-	-	27	26	-	-	-	-	-	-
31	31	29	29	31	31	31	31	31	31	27	31	31	30	29	29	30	31	29
25	25	25	25	26	26	25	26	27	27	24	28	28	27	25	25	26	26	28
20	23	22	22	23	23	23	23	25	25	21	26	26	25	22	23	23	23	26
Direct	Direct	Direct	Direct	Direct	Direct	Direct	Direct	Direct	Direct	Direct	23	23	Direct	Direct	Direct	Direct	Direct	Direct
-	-	-	18	-	18	18	18	-	-	-	Direct	Direct	-	-	-	-	-	-

2017/03/12

Release 006.Mk1

Added gearset "3E12G", 3 Synchro Early 1275 12G Engine (22G714 Laygear)
 Added gearset "4HDCR", MiniSpare Centre Heavy Duty Close Ratio Helical.
 Added gearset "4KAD1", Dog Box KAD. Source: KAD website as at March 2017.
 Added gearset "4MED1", Dog Box MED. Source: MED website as at March 2017.
 Added gearset "4QFE1", 4 Synchro SCCR Quaife. 1st=2.877. Probably NLA.
 Added gearset "4SEL1", Dog Box Selby Race Parts. Source: Website as at March 2017
 Added gearset "4JKN1", 4 Synchro Jack Knight
 Many thanks to mk1-forum.net member "underkut" for providing details for this se
 Annotated all the Swiftone boxes as (Quaife) as they are manufactured by them.
 Added "Sequential" mode to tab "Data". This now allows any 5 speed gearset
 with or without a "first motion shaft and laygear" setup to be handled.
 Added "Tyre circumference to WRPM calibration" to allow geometrically calculated
 sizes to be more accurately converted.
 Added "Speedo Drive Setup" tool to assist in speedo calibration/gearing issues.
 Added standard/helical overdrive drop gears to the list on the "Data" tab.
 Many thanks to mk1-forum.net member "Alex" for the steer on this one.
 Added pull-down menus on "Main" for drop gears and diff ratios.
 Added several 10"-13" tyres to the external WRPM list and changed the layout to
 spreadsheet-friendly ".csv" format.
 Copyright dates updated to 2017.

2014/10/31

Release 005.Mk1

On "Data", added laygear part numbers to many of the comments and added a
 "Search By" feature to help identify the various gearsets.
 Moved the comments and gearbox ratios to the top of the grid.
 Added pulldown menus for the numbers of teeth in "TTEST".
 Improved "TTEST" to allow for 5th being direct and 4th being geared.
 Added two more Leyland gearsets: "3HCR", Helical Close Ratio (22G210 Laygear)
 and "3SCC", Straight Cut Standard Cooper 'S' (22G335 Laygear).
 Added two Ford Type 9 helical boxes, "T9F20" 1.6-2.0L and "T9F28" 2.8-2.9L.
 Added two Colotti-Francis dog boxes, "5CFRD" Road Set and "5CFRC" Race Set.
 Many thanks to mk1-forum.net member JohnA for providing 1960's document scans
 detailing "5CFRC" and "5CFRD".
 Thanks also to mk1-forum.net member mlch1 (Mike) for providing the actual
 tooth count for "5CFRC".
 Search mk1-forum.net or Google "Colotti-Francis Gearbox" (With the quotes).
[or Click Here!](#)

2014/09/19

Release 004.Mk1

Chart added. "Check for Updates" added. Notes field on tab "Main" enlarged
 and pre-filled with some sample WRPM values that can be modified/deleted.
 Minispare Centre "5SGT" gearset added (NLA). Various minor layout changes.

2014/08/07

Release 003.Mk1

Print ranges added to allow sample .PDF's to be created. Tabs coloured.
 Font on ReadMeFirst and Updates changed to DejaVu Sans Mono.
 Better handling of excessively high input for speed or RPM.
 Minor layout changes.
 For a full .pdf sample, export pages "1-2,3,4,5,6-", and set
 "Initial View" Tab, Magnification - Zoom factor 75%.

2012/12/07

Release 002.Mk1

Minor changes to formulas on "Main" and inclusion of overall 4th/5th ratio.
 Comment display added to data tab.
 Differential and Drop Gear tables added for information only, no dropdowns on
 tab Main as this would prevent the user from keying formulas eg "+59/19".
 Better help added to headings instead of input fields.

More gearsets added from KAD, Swiftune and MiniSpares.

2012/11/28

Release 001.Mk1

First version for release