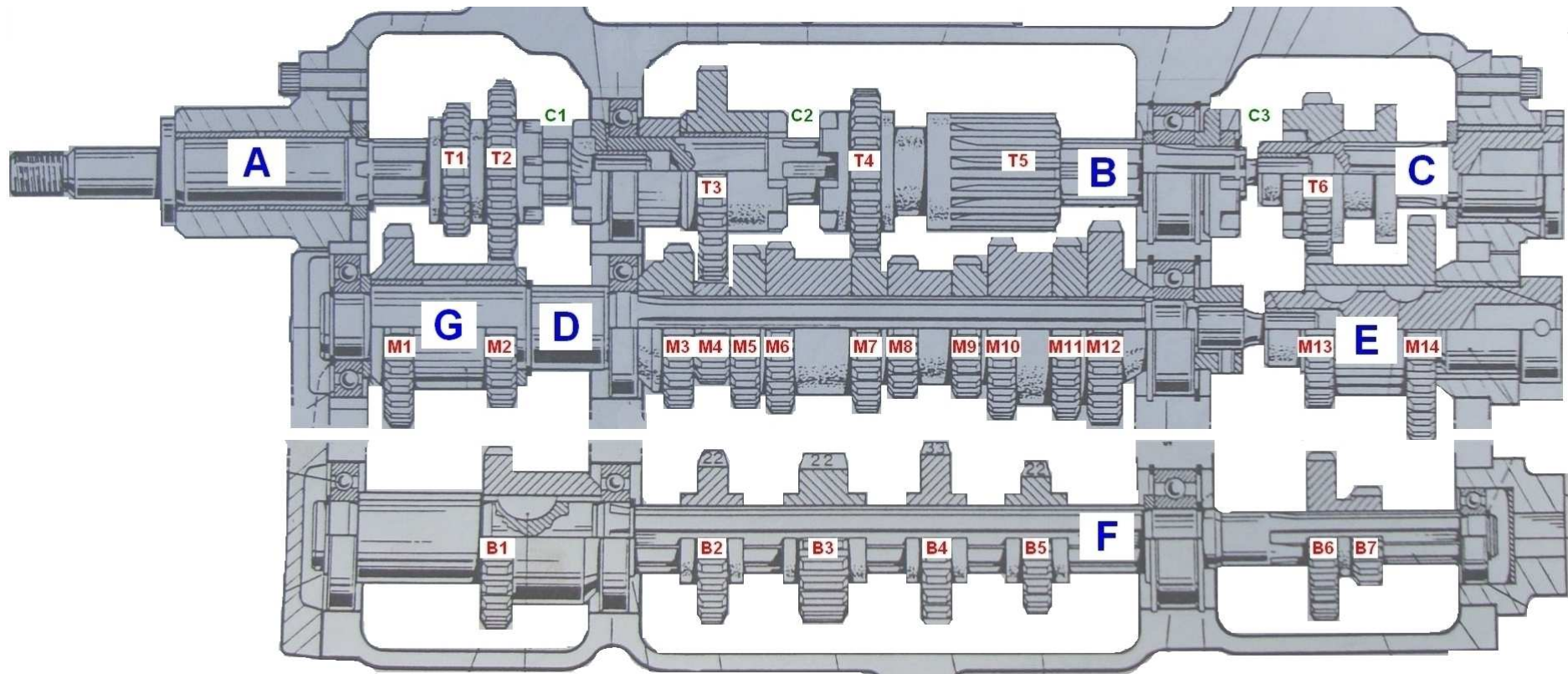


Colchester Student 1800 gearbox



Number of teeth on gears														
Gear number on level	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Top level – prefixed T	20	19	38	23	19	35								
Middle level – prefixed M	30	19	22	19	20	24	23	27	24	28	26	38	35	50
Bottom level – prefixed B	22	22	22	33	22	36	20							

The usual disclaimers apply to this document i.e. there may be errors and it is up to you to verify any provided data before making use of it.

Please send any comments or corrections to bob@chainganger.co.uk

Input to the gearbox

The input shaft, A, of the gearbox is driven from an output shaft in the headstock (labelled G in the parts section of the Colchester manual) via gears mounted on the swing frame. Shaft G rotates at the same speed as the main spindle It can be reversed, for left hand threading, by the upper left control lever.

The standard gears supplied with the lathe for mounting on the swing frame can be configured either for screwcutting and feeds, in two ranges, or DP and Mod

The gear arrangements of the metric leadscrew machines differ from those of the imperial model so that the same gearbox can be used by both types of leadscrew.

Mode	Imperial leadscrew machine		Metric leadscrew machine	
	Swing frame gears	Shaft A:Spindle	Swing frame gears	Shaft A:Spindle
Screwcutting & feeding, low range (L)	(40x44)/(95x88)	0.2105:1	(55x35)/(96X90)	0.2228:1
Screwcutting & feeding, high range (H)	(40x88)/(95x44)	0.8421:1	(55X84)/(96X54)	0.8912:1
Mod & DP (K)	(40x88)/(95x56)	0.6617:1	(55X66)/96X54)	0.7002:1

There are 6 independent shafts in the gearbox labelled A to F as shown in the diagram.

C is coupled to the leadscrew using a shear pin

E drives the feed shaft

With the following exceptions all gears are splined or keywayed to their shafts.

Exception 1. Gear T3 and left element of clutch C2 is free to run on shaft B.

Exception 2 Cluster G, comprising gears M1 & M2, is free to run on shaft D.

Constant mesh gears.

T3(38t) and M4(19t) D = -2xB when C2 engaged

M2(19t) and B1(22t) F = -0.8636xG

Selector ABC

Slides cluster comprising gears T1 and T2 and left element of clutch C1 on shaft A.

Position A: T1(20t) meshes with M1(30t) G = -0.6667xA -F = 0.8636xG so F = 0.5758xA. (T1 is incorrectly shown as having 19 teeth in my copy of the manual)

Position B: T2(19t) meshes with M2(19t) G = -1.0xA so F = 0.8636xA. (T2 is incorrectly shown as having 20 teeth in my copy of the manual)

Position C: Clutch C1 engaged B = A

Selector RST

Slides cluster comprising right element of clutch C2 and gears T4 & T5 on shaft B .

Position R: C2 engaged, T3(38t) drives M4(19t) D = -2xB

Position S: T4(23t) meshes with M7(23t) D = -B

Position T; T5(19t) meshes with M12(38t) D = -0.5xB (M12 is incorrectly shown as having 28 teeth in my copy of the manual)

Selector VWXYZ

Slides clusters comprising right element of clutch C3 and gear T6 on shaft C and cluster B6/B7 on shaft F. Both have 3 positions.
Cluster C3/T6. Left: C3 engaged. Middle: neither C3 engaged nor T6 meshing with M13 (leadscrew undriven). Right: T6 meshes with M13
Cluster B6/B7. Left: B6 meshes with M13. Middle: No meshing. Right B7 meshes with M14

Position V. (Imperial threading)	C3/T6 left.	B6/B7 middle.	C = B	Feed shaft undriven
Position W: (Feeding)	C3/T6 mid.	B7/M14 meshed.	E = -0.4xF	Leadscrew undriven
Position X: (Feeding)	C3/T6 mid.	B6/M13 meshed.	E = -1.0xF	Leadscrew undriven
Position Y: (Metric threading)	C3/T6 right.	B6/M13 meshed.	C = 1.0286xF	Feed shaft is driven
Position Z: (Metric threading)	C3/T6 right.	B7/M14 meshed.	C = 0.4114xF	Feed shaft is driven

8 speed joystick (Gate selector)

The mechanism moves one of the splined gears B2, B3, B4 or B5 on shaft F. For odd numbered speed positions the relevant gear is slid to the right and for evens to the left.

Position	Gear on shaft D	Gear on shaft F	Ratio F:D	Ratio relative to position 1
1	M9(24t)	B4(33t)	-0.7273	1
2	M8(27t)	B4(33t)	-0.8182	1.125
3	M5(20t)	B2(22t)	-0.9091	1.250
4	M3(22t)	B2(22t)	-1.0000	1.375
5	M7(23t)	B3(22t)	-1.0455	1.4375
6	M6(24t)	B3(22t)	-1.0909	1.5
7	M11(26t)	B5(22t)	-1.1818	1.625
8	M10(28t)	B5(22t)	-1.2727	1.75

Leadscrew. Pitch is 0.25" for the Imperial version or 6mm for the metric model.

Metric screwcutting and Mod

The path through the gearbox is the same for both: the only difference between them is the arrangement of the gears on the swing frame.

Selector ABC is always in the C position so shaft B rotates with shaft A.

Shaft D is driven from shaft B (and A) by gear pairs T3 & M4, T4 & M7 or T5 & M12 as selected by lever RST.

Shaft F is driven from shaft D by one pair of gears selected by the joystick.

Shaft E (and the feed shaft) is driven by shaft F via the B6 & M13 when the VWXYZ selector is in the Y position or B7 & M14 for the Z position

Shaft C and the leadscrew are driven from shaft E by the gear pair M13 & T6.

Cluster G is driven from shaft F but doesn't perform any drive function.

Imperial screwcutting and D.P.

The path through the gearbox is the same for both: the only difference between them is the arrangement of the gears on the swing frame.

Selector VWXYZ is always in the V position so shaft C is directly coupled to shaft B by clutch C3.

19TPI & D.P. of 19 are a special case. In this instance selector ABC is in the C position engaging clutch C1 so output shaft C is driven directly by the input shaft: all other elements are idlers.

For all other pitches :-

Cluster G is driven from shaft A by gear pair T1 & M1 when the ABC selector is in the A position or T2 & M2 when in the B position.

Shaft F is driven from cluster G by the constant mesh pair M2 & B1.

Shaft E (and the feed shaft) is undriven because cluster B6/B7 is in the mid position and T6 is not in mesh with

Shaft D is driven from shaft F by one pair of gears selected by the joystick.

Shaft B, shaft C and the leadscrew are driven from shaft D by gear pairs T3 & 4, T4 & 7 or T5 & 12 as selected by lever RST.

Screwcutting tables

The following two pages list the screwcutting pitches in mm and TPI for all combinations of the selector settings using the standard gears on the swing frame.

Table 1 applies with the low (L) or high (H) arrangement of gears on the swing frame and table 2 covers the gears arranged for the DP/MOD (K) setting.

The first character is 'H', 'L' or 'K' is for the gear arrangement on the swing frame.

The second is 'A', 'B' or 'C', the third is 'R', 'S' or 'T' and the fourth is 'V', 'W', 'X', 'Y' or 'Z' for the respectively marked controls.

The final character is for the position of the joystick. Where shown as 0, the joystick should be in the neutral position but no damage will occur if it is in any numbered position.

Some pitches have alternate control settings. These are listed in case you want to avoid using a particular gear.

PLEASE DO A DRY RUN BEFORE CUTTING METAL TO CHECK IF THE TABLE DATA IS CORRECT

Student 3100, Master 2500, Triumph 2000, Mascot 1600 and Mastiff 1400

It seems very probable that their gearboxes function in much the same manner as the Student 1800. The Student 3100 is probably identical and the Master is very similar as it has the same layout of controls. The three larger machines have a 4 position selector labelled WXYZ instead of the 5 position lever of the S1800. They also have an additional headstock control, labelled H/L, either concentric (Mascot & Mastiff) with the LH/RH thread selector or just below it for the Triumph. In the H position the gearbox input shaft is driven at 4 times the speed of that when in the L position and there is only one arrangement of gears on the swing frame for normal (non DP/MOD) screwcutting.

Screwcutting table 1A & 1B with normal (L or H) gears fitted to swing frame

TPI	Selectors	mm	TPI	Selectors	mm	TPI	Selectors	Mm	TPI	Selectors	Mm	TPI	Selectors	Mm
127.0	LCTZ1	0.200	50.80	LCTY1	0.500	33.87	LCTY6	0.750	21.17	LCRZ6	1.200	13.50	LATV2	1.881
112.9	LCTZ2	0.225	48.00	LBRV6	0.529	33.00	LASV4	0.770	21.00	LATV8	1.210	13.00	LBTV7	1.954
101.6	LCTZ3	0.250	48.00	LARV1	0.529	32.00	LBRV1	0.794	20.32	LCSY3	1.250	12.70	LCRY1	2.000
92.36	LCTZ4	0.275	46.18	LCSZ4	0.550	31.75	LCRZ1	0.800	20.00	LBSV3	1.270	12.00	LATV1	2.117
88.35	LCTZ5	0.287	46.00	LBRV5	0.552	31.26	LCTY7	0.813	19.54	LCRZ7	1.300	12.00	LBTV6	2.117
84.66	LCTZ6	0.300	45.15	LCTY2	0.563	30.00	LASV3	0.847	19.50	LATV7	1.303	11.50	LBTV5	2.209
84.00	LARV8	0.302	44.17	LCSZ5	0.575	29.03	LCTY8	0.875	19.00	LCSV2	1.337	11.29	LCRY2	2.250
78.15	LCTZ7	0.325	44.00	LBRV4	0.577	28.22	LCRZ2	0.900	18.47	LCSY4	1.375	11.00	LBTV4	2.309
78.00	LARV7	0.326	42.33	LCSZ6	0.600	28.00	LBSV8	0.907	18.14	LCRZ8	1.400	10.16	LCRY3	2.500
72.57	LCTZ8	0.350	42.00	LASV8	0.605	27.00	LASV2	0.941	18.00	LBSV2	1.411	10.00	LBTV3	2.540
72.00	LARV6	0.353	40.64	LCTY3	0.625	26.00	LBSV7	0.977	18.00	LATV6	1.411	9.236	LCRY4	2.750
69.00	LARV5	0.368	40.00	LBRV3	0.635	25.40	LCSY1	1.000	17.67	LCSY5	1.437	9.000	LBTV2	2.822
66.00	LARV4	0.385	39.08	LCSZ7	0.650	25.40	LCRZ3	1.000	17.25	LATV5	1.472	8.835	LCRY5	2.875
63.50	LCSZ1	0.400	39.00	LASV7	0.651	24.00	LASV1	1.058	16.93	LCSY6	1.500	8.466	LCRY6	3.000
60.00	LARV3	0.423	36.94	LCTY4	0.688	24.00	LBSV6	1.058	16.50	LATV4	1.539	8.000	LBTV1	3.175
56.44	LCSZ2	0.450	36.28	LCSZ8	0.700	23.09	LCRZ4	1.100	16.00	LBSV1	1.587	7.815	LCRY7	3.250
56.00	LBRV8	0.454	36.00	LASV6	0.706	23.00	LBSV5	1.104	15.63	LCSY7	1.625	7.257	LCRY8	3.500
54.00	LARV2	0.470	36.00	LBRV2	0.706	22.58	LCSY2	1.125	15.00	LATV3	1.693			
52.00	LBRV7	0.488	35.34	LCTY5	0.719	22.09	LCRZ5	1.150	14.51	LCSY8	1.750			
50.80	LCSZ3	0.500	34.50	LASV5	0.736	22.00	LBSV4	1.155	14.00	LBTV8	1.814			

TPI	Selectors	mm	TPI	Selectors	mm	TPI	Selectors	Mm	TPI	Selectors	Mm	TPI	Selectors	Mm
31.75	HCTZ1	0.800	12.70	HCTY1	2.000	8.466	HCTY6	3.000	5.292	HCRZ6	4.800	3.375	HATV2	7.526
28.22	HCTZ2	0.900	12.00	HBRV6	2.117	8.250	HASV4	3.079	5.250	HATV8	4.838	3.250	HBTV7	7.815
25.40	HCTZ3	1.000	12.00	HARV1	2.117	8.000	HBRV1	3.175	5.080	HCSY3	5.000	3.175	HCRY1	8.000
23.09	HCTZ4	1.100	11.55	HCSZ4	2.199	7.937	HCRZ1	3.200	5.000	HBSV3	5.080	3.000	HATV1	8.467
22.09	HCTZ5	1.150	11.50	HBRV5	2.209	7.815	HCTY7	3.250	4.884	HCRZ7	5.201	3.000	HBTV6	8.467
21.17	HCTZ6	1.200	11.29	HCTY2	2.250	7.500	HASV3	3.387	4.875	HATV7	5.210	2.875	HBTV5	8.835
21.00	HARV8	1.210	11.04	HCSZ5	2.301	7.257	HCTY8	3.500	4.750	HCRV8	5.347	2.822	HCRY2	9.001
19.54	HCTZ7	1.300	11.00	HBRV4	2.309	7.055	HCRZ2	3.600	4.618	HCSY4	5.500	2.750	HBTV4	9.236
19.50	HARV7	1.303	10.58	HCSZ6	2.401	7.000	HBSV8	3.629	4.536	HCRZ8	5.600	2.540	HCRY3	10.00
18.14	HCTZ8	1.400	10.50	HASV8	2.419	6.750	HASV2	3.763	4.500	HBSV2	5.644	2.500	HBTV3	10.16
18.00	HARV6	1.411	10.16	HCTY3	2.500	6.500	HBSV7	3.908	4.500	HATV6	5.644	2.309	HCRY4	11.00
17.25	HARV5	1.472	10.00	HBRV3	2.540	6.350	HCSY1	4.000	4.417	HCSY5	5.751	2.250	HBTV2	11.29
16.50	HARV4	1.539	9.769	HCSZ7	2.600	6.350	HCRZ3	4.000	4.312	HATV5	5.891	2.209	HCRY5	11.50
15.87	HCSZ1	1.601	9.750	HASV7	2.605	6.000	HASV1	4.233	4.233	HCSY6	6.000	2.117	HCRY6	12.00
15.00	HARV3	1.693	9.236	HCTY4	2.750	6.000	HBSV6	4.233	4.125	HATV4	6.158	2.000	HBTV1	12.70
14.11	HCSZ2	1.800	9.071	HCSZ8	2.800	5.773	HCRZ4	4.400	4.000	HBSV1	6.350	1.954	HCRY7	13.00
14.00	HBRV8	1.814	9.000	HASV6	2.822	5.750	HBSV5	4.417	3.908	HCSY7	6.499	1.814	HCRY8	14.00
13.50	HARV2	1.881	9.000	HBRV2	2.822	5.644	HCSY2	4.500	3.750	HATV3	6.773			
13.00	HBRV7	1.954	8.835	HCTY5	2.875	5.522	HCRZ5	4.600	3.628	HCSY8	7.001			
12.70	HCSZ3	2.000	8.625	HASV5	2.945	5.500	HBSV4	4.618	3.500	HBTV8	7.257			

Standard TPI pitches (i.e. those on the faceplate) are red and standard metric pitches are magenta

Screwcutting table No 2 with DP/MOD (K) gears fitted to swing frame.
 Note that these are actual screwcutting pitches – NOT MOD/DP values

TPI	Selectors	mm	TPI	Selectors	mm	TPI	Selectors	mm	TPI	Selectors	Mm	TPI	Selectors	Mm
40.41	KCTZ1	0.629	16.16	KCTY1	1.572	10.78	KCTY6	2.356	6.735	KCRZ6	3.771	4.295	KATV2	5.914
35.92	KCTZ2	0.707	15.27	KBRV6	1.663	10.50	KASV4	2.419	6.682	KATV8	3.801	4.136	KBTV7	6.141
32.33	KCTZ3	0.786	15.27	KARV1	1.663	10.18	KBRV1	2.495	6.465	KCSY3	3.929	4.041	KCRY1	6.286
29.39	KCTZ4	0.864	14.69	KCSZ4	1.729	10.10	KCRZ1	2.515	6.364	KBSV3	3.991	3.818	KATV1	6.653
28.11	KCTZ5	0.904	14.64	KBRV5	1.735	9.947	KCTY7	2.554	6.217	KCRZ7	4.086	3.818	KBTV6	6.653
26.94	KCTZ6	0.943	14.37	KCTY2	1.768	9.545	KASV3	2.661	6.205	KATV7	4.093	3.659	KBTV5	6.942
26.73	KARV8	0.950	14.05	KCSZ5	1.808	9.236	KCTY8	2.750	6.045	KCRV8	4.202	3.592	KCRY2	7.071
24.87	KCTZ7	1.021	14.00	KBRV4	1.814	8.980	KCRZ2	2.829	5.878	KCSY4	4.321	3.500	KBTV4	7.257
24.82	KARV7	1.023	13.47	KCSZ6	1.886	8.909	KBSV8	2.851	5.773	KCRZ8	4.400	3.233	KCRY3	7.856
23.09	KCTZ8	1.100	13.36	KASV8	1.901	8.591	KASV2	2.957	5.727	KBSV2	4.435	3.182	KBTV3	7.982
22.91	KARV6	1.109	12.93	KCTY3	1.964	8.273	KBSV7	3.070	5.727	KATV6	4.435	2.939	KCRY4	8.642
21.95	KARV5	1.157	12.73	KBRV3	1.995	8.082	KCSY1	3.143	5.622	KCSY5	4.518	2.864	KBTV2	8.869
21.00	KARV4	1.210	12.43	KCSZ7	2.043	8.082	KCRZ3	3.143	5.489	KATV5	4.627	2.811	KCRY5	9.036
20.20	KCSZ1	1.257	12.41	KASV7	2.047	7.636	KASV1	3.326	5.388	KCSY6	4.714	2.694	KCRY6	9.428
19.09	KARV3	1.331	11.76	KCTY4	2.160	7.636	KBSV6	3.326	5.250	KATV4	4.838	2.545	KBTV1	9.980
17.96	KCSZ2	1.414	11.55	KCSZ8	2.199	7.347	KCRZ4	3.457	5.091	KBSV1	4.989	2.487	KCRY7	10.21
17.82	KBRV8	1.425	11.45	KASV6	2.218	7.318	KBSV5	3.471	4.973	KCSY7	5.108	2.309	KCRY8	11.00
17.18	KARV2	1.478	11.45	KBRV2	2.218	7.184	KCSY2	3.536	4.773	KATV3	5.322			
16.55	KBRV7	1.535	11.24	KCTY5	2.260	7.027	KCRZ5	3.615	4.618	KCSY8	5.500			
16.16	KCSZ3	1.572	10.98	KASV5	2.313	7.000	KBSV4	3.629	4.455	KBTV8	5.701			

Screwcutting table No 3. Best available matches for 0 to 12BA pitches

BA number	Pitch mm	Nearest	Setting	Error %
0	1.0000	1.000	LCRZ3	0
1	0.9000	0.900	LCRZ2	0
2	0.8100	0.813	LCTY7	0.37
3	0.7300	0.736	LASV5	0.82
4	0.6600	0.651	LASV7	1.53
5	0.5900	0.600	LCSZ6	1.69
6	0.5300	0.529	LARV1	0.19
7	0.4800	0.488	LBRV7	1.67
8	0.4300	0.423	LARV3	1.63
9	0.3900	0.385	LARV4	1.28
10	0.3500	0.350	LCTZ8	0
11	0.3100	0.302	LARV8	2.58
12	0.2800	0.275	LCTZ4	1.79