



Notation	Meaning
0	Bell 10.
E	Bell 11 ('E' for Eleven).
T	Bell 12 ('T' for Twelve).
A	Bell 13.
B	Bell 14.
C	Bell 15.
D	Bell 16.

Table 2 – How to interpret place notation.

## External Places

The two external places are '1' and '*n*' where *n* is the number of bells the methods is to be rung on, i.e. leading and lying. The MicroSiril libraries omit these numbers from the place notation as they can be inferred given knowledge of how many bells the method is intended for, which is provided in the filename. For example, a method in the S6 file might contain the notation "3.4". So we now know that the full place notation should be "36.14". No other interpretation makes sense. The shorthand is used to save space in the file, and typing. The disadvantage is for computer programs that can no longer infer from the place notation how many bells are being rung, which is possible if external places are included. The rules for adding external places are simple; if the first place in the row is even, prefix a '1'. For even bell methods, if the last place in the row is odd, add an *n*<sup>th</sup> place to the end. For odd bell methods, if the last place is even, add an *n*<sup>th</sup> place to the end.

## Column Format

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Abbessroding h &-34-4.2-2.23-4-3
Abbotsleigh 2z &-3-45-5-3-4-1
Ackworth 4z &-3-4-2-3.4-2.3
Acle a &3-5.4-5-3-2-5
Acs a &-34-4.5-2.3.2-34.5
Actonbynantwich a &-5-45-2-3-4-1
Adminius f &3-34.4.2-2.3.34-34.1
Adventsunday f &-3-45-5-23-4-1
Afishmongerandjudithshat g &-5-4-5-3-4-3

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Figure 2 – Extract from the Surprise Minor (S6) file.

Each file contains a single method per line, with each line having three columns. The first column contains the method name, often with spaces removed, e.g. 'Littlebob'. The second column provides a cryptic letter (a-m, p-s), a letter followed by a number (e.g. 'k1'), or numbers plus a 'z' (e.g. '4z'). This describes the lead head order and indicates what the lead head place notation should be, as described in the next section. The third column provides the place notation as described above.

## Lead Head Orders

The letter in the second column should be used to verify that you have written the method out correctly. You should either be able to compare the first lead end with your knowledge of what you were expecting given the letter, or be able to check the place bell order against the same. The interpretation of these letters depends on the number of hunt bells in the method, odd or even. The lead head orders are of considerable use to composers looking for methods for compositions of spliced.

Tables of the lead head orders are provided as follows.

- Appendix 1. Lead head orders for even bell methods with a single bell.
- Appendix 2. Lead head orders for odd bell methods with a single hunt bell.

- Appendix 3. Lead head orders for odd bell methods with two hunt bells.
- Appendix 4. Lead head orders for even bell methods with two hunt bells.

Lead heads 'a' to 'f' are 2<sup>nds</sup> place methods, lead heads 'g' to 'm' are  $n^{\text{th}}$  place methods. In old versions of the library files, or in conversation, you might come across the term 'mx method'. This simply means that the method has 'm' type lead head order and the 'x' means 'extending', in the sense 'extending lead'. In these methods the use of 4<sup>th</sup> place bobs is generally preferred instead of  $(n-2)^{\text{th}}$  place bobs in this  $n^{\text{th}}$  place method. You may also find 'jx' methods, my favourite being 'Michelle Pfeiffer Delight Major'. The effect of the bob's in these methods can be quite interesting, taking you back a lead or two in the plain course.

Terms with a 'z', e.g. '4z', mean that the method has an 'irregular lead head' or 'irregular place bell order'. In short this means the lead head is not one of those in Plain Bob, or Grandsire. The numbers supplied before the 'z' give the plain lead place notation (without external places). Odd bells methods without '+3' or '+n' post lead head place notation are all of type 'z'.

The provided tables can be extended to any number of hunt bells. The lettering used to describe the lead head order is dependent on whether the number of hunt bells is even or odd.

## ***Impossible Lead Heads***

From the tables in the appendices, some interesting observations can be made, apart from the shortcomings in the chosen lettering system having to be augmented with numbers. Royal with one hunt bell and lead head order 'c' effectively has only three leads. This means that such a method could not be a plain or surprise method, in fact it must be a differential method, since only this method class allows short courses. For the same reason, non-differential Sixteen (16 bells) with one hunt bell cannot have lead head orders 'c' and 'c2'. More generally, non-differential odd bell methods with one hunt bell cannot have a lead head order equivalent to a multiple of two leads of Plain Bob. Hence when the system of lettering the lead head orders was derived; those leads heads of Plain Bob were not lettered at all (p, q, r, & s).

There is a formula for which non-differential lead head orders are allowed. It is simple to state, but mathematically intensive:

*The number of working bells must be 'co-prime'<sup>1</sup> with the number of leads of Plain Bob for that lead head letter.*

Or

*The number of working bells must not have any prime factors in common with the number of leads of Plain Bob for that lead head letter.*

E.g. Surprise Royal has 9 working bells, therefore lead head letter 'c' is impossible because 9 and 3 are not *co-prime*, in fact 9 is a multiple of 3. If you were to construct a single hunt Royal blue line with lead head order 'c', it would be considered by the Central Council to belong to the Differential method class, as there would only be 3 leads per course, so not all 9 working bells can follow the same line. Another example is lead head order 'c3' in Sixteen with a single hunt bell, where 6 and 15 are not co-prime as they share a common factor of 3.

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<sup>1</sup> E.g. 15 has prime factors 3 x 5, 10 has prime factors 2 x 5, therefore 10 and 15 share a factor of 5 so are not 'co-prime'.

## Lead Head Order vs. Stage

In general, you may expect a method to have the same lead head order at every stage. Perhaps the most well known exception to this 'rule of thumb' is Bristol.

Stage	Plain Bob	Cambridge S.	Bristol S.
Major	A	B	$M = -1 = -8 \pmod{7}$
Royal	A	B	$G = 1 = -8 \pmod{9}$
Maximus	A	B	$J = 3 = -8 \pmod{11}$
Fouteen	A	B	$J2 = 5 = -8 \pmod{13}$
Sixteen	A	B	$J4 = 7 = -8 \pmod{15}$

Table 3 – Comparison of lead head orders as the number of bells increases.

The 'mod' term in Table 3 means 'using arithmetic modular  $m$ ', where ' $m$ ' is the modulus. Effectively, this means the remainder after division by  $m$ . E.g.  $15 \pmod{7} = 8 \pmod{7} = 1 \pmod{7} = -6 \pmod{7}$  and so on. This raises an interesting question over Bristol's true lead order descriptor, since the present system is unable to cope with this peculiarity!

## Acknowledgements

Mark Davies worked out the Bristol lead head order conundrum.

Philip Abbey  
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## Appendix 1. Lead head orders for even bell methods with a single bell.

e.g. Plain Bob, Treble Bob & Place, Surprise, Delight and Alliance.

Lead Head Place Notation		# Leads of Plain Bob <sup>2</sup>	First Lead Head / Place Bell Order						
+12	+1 <i>n</i>		Minimus (n = 4)	Minor (n = 6)	Major (n = 8)	Royal (n = 10)	Maximus (n = 12)	Fourteen (n = 14)	Sixteen (n = 16)
A	G	1	1342 / 243	135264 / 24653	13527486 / 2468753	1352749608 / 246809753	13527496E8T0 / 24680TE9753	13527496E8A0BT / 24680TBAE9753	13527496E8A0CTDB / 24680TBDCAE9753
B	H	2		156342 / 26345	15738264 / 2673485	1573920486 / 260734895	157392E4T608 / 260E7348T95	157392E4A6B8T0 / 260BE7348TA95	157392E4A6C8D0BT / 260BCE7348TDA95
C	J	3			17856342 / 2836547	(1795038264)	1795E3T20486 / 28936TE5407	1795E3A2B4T608 / 28B936TE540A7	(1795E3A2C4D6B8T0)
C1	J1	4				1907856342 / 203856749	19E7T5038264 / 2074T56E389	19E7A5B3T20486 / 20E38A56B74T9	19E7A5C3D2B4T608 / 20C74TA56BE38D9
C2	J2	5					1ET907856342 / 2T30587694E	1EA9B7T5038264 / 2T76A3094B58E	(1EA9C7D5B3T20486)
C3	J3	6						1ABET907856342 / 2B3T507896E4A	(1ACED9B7T5038264)
C4	J4	7							1CDABET907856342 / 2D3B5T7098E6A4C
D4	K4	-7							1DBCTA0E89674523 / 2C4A6E8907T5B3D
D3	K3	-6						1BTA0E89674523 / 2A4E698705T3B	(1BTD0C8A6E492735)
D2	K2	-5					1T0E89674523 / 2E49678503T	1T0B8A6E492735 / 2E85B4903A67T	(1T0B8D6C4A2E3957)
D1	K1	-4				1089674523 / 294765830	108T6E492735 / 2983E65T470	108T6B4A2E3957 / 29T47B65A83E0	108T6B4D2C3A5E79 / 29D83EB65AT47C0

<sup>2</sup> Note the numbers in this column can be re-written modulus the number of working bells i.e. (n-1). E.g. -1 in surprise major = -1 mod 7 = +6.

Lead Head Place Notation		# Leads of Plain Bob <sup>2</sup>	First Lead Head / Place Bell Order						
+12	+1 <i>n</i>		Minimus (n = 4)	Minor (n = 6)	Major (n = 8)	Royal (n = 10)	Maximus (n = 12)	Fourteen (n = 14)	Sixteen (n = 16)
D	K	-3			18674523 / 2745638	(1860492735)	18604T2E3957 / 27T639045E8	18604T2B3A5E79 / 27A045ET639B8	(18604T2B3D5C7A9E)
E	L	-2		164523 / 25436	16482735 / 2584376	1648203957 / 259843706	1648203T5E79 / 259T8437E06	1648203T5B7A9E / 259AT8437EB06	1648203T5B7D9CEA / 259ADT8437ECB06
F	M	-1	1423 / 234	142635 / 23564	14263857 / 2357864	1426385079 / 235790864	142638507T9E / 23579ET0864	142638507T9BEA / 23579EABT0864	142638507T9BEDAC / 23579EACDBT0864

## Appendix 2. Lead head orders for odd bell methods with a single hunt bell.

e.g. Plain Bob.

Lead Head Place Notation		# Leads of Plain Bob	First Lead Head / Place Bell Order					
+12n	+1		Doubles (n = 5)	Triples (n = 7)	Caters (n = 9)	Cinques (n = 11)	Sextuples (n = 13)	Septuples (n = 15)
P	R	1	13524 / 2453	1352746 / 246753	135274968 / 24689753	13527496E80 / 24680E9753	13527496E8A0T / 24680TAE9753	13527496E8A0CTB / 24680TBCAE9753
		2	(15432)	(1573624)	(157392846)	(157392E4068)	(157392E4A6T80)	(157392E4A6C8B0T)
P1	R1	3		(1765432)	179583624 / 28549367	1795E302846 / 28936E5407	1795E3A2T4068 / 28A728A728A7	1795E3A2C4B6T80 / 28BE540C936TA7
		4			(198765432)	(19E70583624)	(19E7A5T302846)	(19E7A5C3B2T4068)
P2	R2	5				(1E098765432)	1EA9T70583624 / 2T5894A3076E	1EA9C7B5T302846 / 2T94B76C58A30E
		6					(1ATE098765432)	(1ACEB9T70583624)
		7=-7					(1CBATE098765432)	
		-6					(1ATE098765432)	(1BTC0A8E6947253)
Q2	S2	-5				(1E098765432)	1T0A8E6947253 / 2E6703A4985T	1T0B8C6A4E29375 / 2E03A85C67B49T
		-4			(198765432)	(108E6947253)	(108T6A4E29375)	(108T6B4C2A3E597)
Q1	S1	-3		(1765432)	186947253 / 27639458	18604E29375 / 27045E6398	18604T2A3E597 / 27A827A827A8	18604T2B3C5A7E9 / 27AT639C045EB8
		-2	(15432)	(1647253)	(164829375)	(1648203E597)	(1648203T5A7E9)	(1648203T5B7C9AE)
Q	S	-1	14253 / 2354	1426375 / 235764	142638597 / 23579864	142638507E9 / 23579E0864	142638507T9AE / 23579EAT0864	142638507T9BECA / 23579EACBT0864

### Appendix 3. Lead head orders for odd bell methods with two hunt bells.

e.g. Grandsire.

Post Lead Head Place Notation		# Leads of Plain Bob	First Lead Head / Place Bell Order					
+3	+n		Doubles (n = 5)	Triples (n = 7)	Caters (n = 9)	Cinques (n = 11)	Sextuples (n = 13)	Septuples (n = 15)
A	G	1	12534 / 345	1253746 / 34675	125374968 / 3468975	12537496E80 / 34680E975	12537496E8A0T / 34680TAE975	12537496E8A0CTB / 34680TBCAE975
B	H	2		1275634 / 36547	127593846 / 3695487	127593E4068 / 3609548E7	127593E4A6T80 / 360A9548TE7	127593E4A6C8B0T / 360BA9548TCE7
C	J	3			129785634 / 3856749	(1297E503846)	1297E5A3T4068 / 38A740E56T9	1297E5A3C4B6T80 / 38BE56TA740C9
C1	J1	4				12E90785634 / 30587694E	12E9A7T503846 / 3094T76A58E	12E9A7C5B3T4068 / 30A58C76B94TE
C2	J2	5					12AET90785634 / 3T507896E4A	12AEC9B7T503846 / 3T96C50E4B78A
C3	J3	6						12CABET90785634 / 3B5T7098E6A4C
D3	K3	-6						12BCTA0E8967453 / 3C4A6E8907T5B
D2	K2	-5					12TA0E8967453 / 3A4E698705T	12TB0C8A6E49375 / 3A87B4E05C69T
D1	K1	-4				120E8967453 / 3E4967850	120T8A6E49375 / 3E85A67T490	120T8B6C4A3E597 / 3ET49B67C85A0
D	K	-3			128967453 / 3947658	(12806E49375)	12806T4A3E597 / 39T65E047A8	12806T4B3C5A7E9 / 39C047AT65EB8
E	L	-2		1267453 / 37456	126849375 / 3784596	1268403E597 / 37E845906	1268403T5A7E9 / 37ET8459A06	1268403T5B7C9AE / 37ECT8459AB06
F	M	-1	12453 / 354	1246375 / 35764	124638597 / 3579864	124638507E9 / 3579E0864	124638507T9AE / 3579EAT0864	124638507T9BECA / 3579EACBT0864

## Appendix 4. Lead head orders for even bell methods with two hunt bells.

e.g. Syongipsy Hybrid Royal and Grandsire.

Post Lead Head Place Notation		# Leads of Plain Bob	First Lead Head / Place Bell Order					
+3n	+n		Minor (n = 6)	Major (n = 8)	Royal (n = 10)	Maximus (n = 12)	Fourteen (n = 14)	Sixteen (n = 16)
P	R	1	125364 / 3465	75816243 / 346875	1253749608 / 34680975	12537496E8T0 / 34680TE975	12537496E8A0BT / 34680TBAE975	12537496E8A0CTDB / 34680TBDCAE975
		2	(126543)	(46372518)	(1275930486)	(127593E4T608)	(127593E4A6B8T0)	(127593E4A6C8D0BT)
P1	R1	3		(12845673)	1297058364 / 38740569	1297E5T30486 / 38E56T7409	(1297E5A3B4T608)	1297E5A3C4D6B8T0 / 38BA740DE56TC9
		4			(1209876543)	(12E9T7058364)	(12E9A7B5T30486)	(12E9A7C5D3B4T608)
P2	R2	5				(12TE09876543)	12AEB9T7058364 / 3T78E4B5096A	12AEC9D7B5T30486 / 3TE4B96D78C50A
		6					(12BATE09876543)	(12CADEB9T7058364)
P3	R3	7						(12DCBATE09876543)
Q3	S3	-7						(12DCBATE09876543)
		-6					(12BATE09876543)	(12BDTC0A8E694735)
Q2	S2	-5				(12TE09876543)	12TB0A8E694735 / 3A6905B4E87T	12TB0D8C6A4E3957 / 3A05C87D69B4ET
		-4			(1209876543)	(120T8E694735)	(120T8B6A4E3957)	(120T8B6D4C3A5E79)
Q1	S1	-3		(12845673)	1280694735 / 39650478	12806T4E3957 / 39047T65E8	(12806T4B3A5E79)	12806T4B3D5C7A9E / 39CT65ED047AB8
		-2	(126543)	(75316248)	(1268403957)	(1268403T5E79)	(1268403T5B7A9E)	(1268403T5B7D9CEA)
Q	S	-1	124635 / 3564	46872513 / 357864	1246385079 / 35790864	124638507T9E / 3579ET0864	124638507T9BEA / 3579EABT0864	124638507T9BEDAC / 3579EACDBT0864