Simulator Installation Details

Simulator Interface

Location	Liverpool Cathedral
Simulator Type	Multiple Bell
Sensor Channels Equipped	12
Interface Enclosure	MB4
PCB Versions	Simulator Interface PCB – Rev B LED/Reset Board – Rev A
Firmware	Simulator Interface v2.2
Active Channels	12
De-bounce Timer	4ms
Power/Data Cable Length	24m
Power Supply	9v
Serial Port	PC RS-232 (COM1)
Simulator Software Package	Abel v3.9.0b
Notes: Tracopower TSR 1-2450 voltage regulator fitted. Reset switch fitted.	

Sensor Heads

Bell	Sensor Head Type	Sensor Head Cable Length	Sensor Head Mounting	Delay Timer (~~ms~~ / cs)
1	Hedley Magneto-Resistive Rev A	6.5m	Timber Batten 0.50m	39
2	Infra-Red – E18-D80NK	8.8m	Timber Batten 0.51m	41
3	Infra-Red – E18-D80NK	10.0m	Timber Batten 0.52m	44
4	Infra-Red – E18-D80NK	11.2m	Timber Batten 0.54m	46
5	Infra-Red – E18-D80NK	10.5m	Timber Batten 0.59m	48
6	Infra-Red – E18-D80NK	9.3m	Timber Batten 0.60m	51
7	Infra-Red – E18-D80NK	7.9m	Timber Batten 0.69m	53
8	Infra-Red – E18-D80NK	6.4m	Timber Batten 0.81m	55
9	Infra-Red – 38kHz Rev A1	4.7m	Timber Batten 0.77m	58
10	Infra-Red – E18-D80NK	2.7m	Timber Batten 0.79m	60
11	Infra-Red – E18-D80NK	1.8m	Timber Batten 0.93m	62
12	Infra-Red – E18-D80NK	4.3m	Timber Batten 1.20m	65

Belfry Installation

Sensor Heads

The Sensor Heads are mounted on 38mm x 22mm softwood support battens, which in turn are screwed to the pulley box beams with No10 x 50mm stainless steel pan head screws. The Sensor Heads are positioned with the connector pointing downwards to limit water ingress, and the battens are treated with a proprietary wood preservative.

A length of reflective tape is stuck to the shroud of the wheel, positioned directly opposite the sensor when the bell is down. The tape is self-adhesive, and the wheel shroud was lightly sanded and cleaned with methylated spirits to improve adhesion of the tape.

There is no Sensor Head on the Sharp 2nd bell. When the bells are silenced it does not matter which 2nd is rung with the light eight, the correct mapping and tuning being handled in the Abel configuration.

The following pictures show the Sensor Head installations on the treble and 11th. The reflective tape is not visible on the 11th's wheel because the bell is up.

Treble Sensor Head

Eleventh Sensor Head

Sensor Head Cables

The Sensor Head cables are cable tied to the support battens, and run vertically down to the top surface of the circular frame plinth.

From there they run around the top of the plinth to the Simulator Interface, which is located in the pit of the 10th bell. To keep the cable runs as short as possible, cables for bells 5 – 10 run clockwise round the frame plinth to the Simulator Interface, and the remainder run anticlockwise.

Where the bundle of cables passes each frame element, it runs through a 200mm length of 16mm x 16mm plastic trunking, which is held in place on the concrete frame by a small concrete paving block.

Simulator Interface

The Simulator Interface is located in the pit of the 10th bell. To protect it from the worst of the weather the Interface has been placed in a secondary enclosure, with cable entry arranged so as to limit any water ingress.

The following picture shows the Simulator Interface in position.

Installed Simulator Interface

A small concrete paving block has been placed on top of the secondary enclosure to limit movement.

Custom Tuning

Abel Sound Configuration

The samples of Worcester Cathedral bells supplied with Abel 3.8.0a onwards are used, with some configuration modifications to enable the correct lower Liverpool Cathedral pitch to be sounded.

Bell Sound Files

The 12 bell sound files from the Worcester set are used unmodified in the Bells subdirectory[1] of the Abel installation on the Simulator PC.

Bell Description File

The original Bell Description File supplied with the Worcester samples has been modified to allow Abel to produce simulated ringing using these sound files in the key of A♭. Abel v3.9.0b only allows the simulated bells to be tuned down to the key of A, while Liverpool Cathedral bells are in the key of A♭. This limitation does not affect any other tower, Liverpool Cathedral having the only ring of bells tuned lower than B♭. A workaround is therefore required to support tuning down to A♭.

Four modifications are necessary to a copy of the Bell Description File to achieve this:

- The BDF row text has been amended to indicate that this is a modified configuration, and Abel should be set to the key of A in order to sound as A♭.
- The MIDI bottom note values (last field) for each bell sample have been adjusted downwards where required to allow all the samples to be used down to the key of A.
- The MIDI base note value for each bell has been raised by one semitone, so that the Abel will treat the samples as though they were in the key of B♭, and tunes each note sample down a further semitone to sound the note A♭ when the configuration is set to A.
- The MIDI top note values have been adjusted to allow the front 6, 8 or 10 bells to be rung as simulated diatonic rings of bells, with the appropriate tenor notes. Refer to the table below.

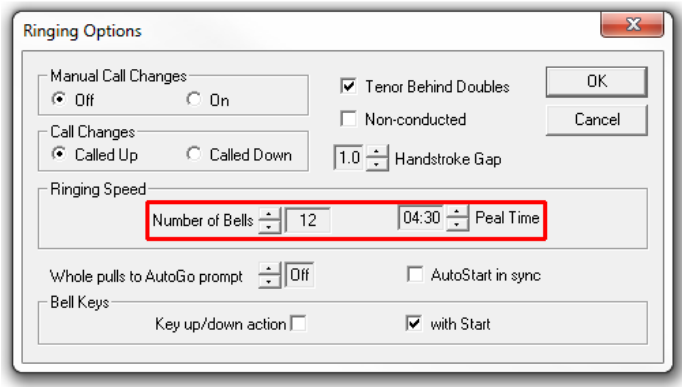
The modified BDF file looks like this:

```
BDF, Worcester Custom Tuning A for Ab
wr12.wav, 48, 45, 45
wr11.wav, 50, 47, 47
wr10.wav, 52, 49, 49
wr9.wav, 53, 51, 50
wr8.wav, 55, 53, 52
wr7.wav, 57, 54, 54
wr6.wav, 59, 56, 56
wr5.wav, 60, 58, 57
wr4.wav, 62, 60, 59
wr3.wav, 64, 61, 61
wr2.wav, 65, 63, 62
wr1.wav, 67, 65, 64
```

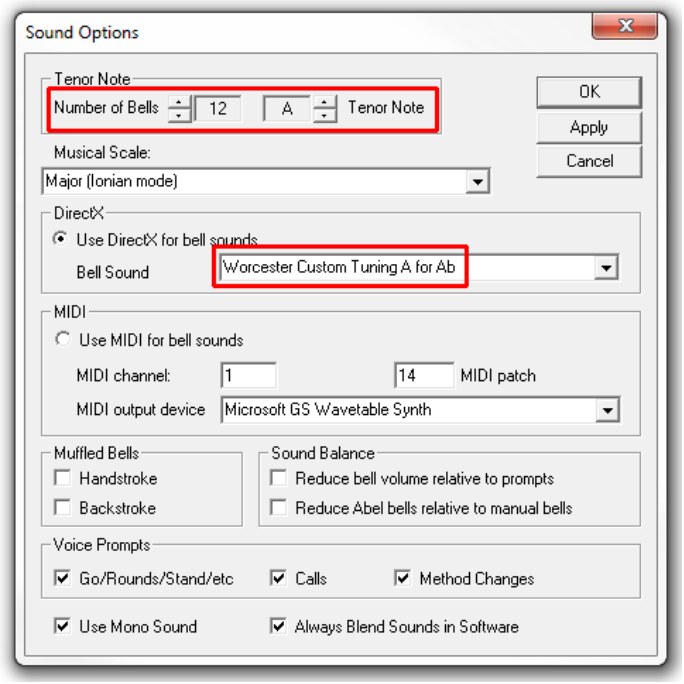
[1] C:\Program Files\Abel 3\Bells\

Abel Sound Options

1. In Abel, select *Ringing Options…* from the *Options* menu.
2. In the *Ringing Options* window, set the *Number of Bells* to “12”, and the *Peal Time* to “04:30” (4h 30m). Then click *OK*.



3. Select *Sound Options…* from the *Options* menu.
4. In the *Sound Options* window, set the *Number of Bells* to “12”, the *Tenor Note* to “A” (the lowest possible setting, and not “a”, which is an octave higher), and in the *Bell Sound* field select the modified *Worcester Custom Tuning* file. Then Click *OK*.



5. Save the new options by selecting *Save Options* from the *Options* menu. If the options have changed, Abel will prompt you to do this when the program is closed.
6. Abel is now configured to produce simulated ringing in the key of A♭.

Simulated Diatonic Rings

The following table shows the Abel sound tuning and MIDI note values used in the Liverpool Cathedral Simulator to allow simulated diatonic rings of bells using the back 8, 10 or 12 bells, or the front 6, 8 or 10 bells.

In all cases the simulated bells sound a semitone lower than the values below configured in Abel.

All true diatonic rings of six are also shaded.

Accidentals which are not part of the real Cathedral diatonic ring of 12 are shown in bold.

Bell	The 12		Front 10		Front 8		Front 6		Back 10		Back 8		*Abel BDF MIDI Values*	
	Note	MIDI	Note	MIDI	Note	MIDI	Note	MIDI	Note	MIDI	Note	MIDI	*Top*	*Bottom*
1	E	64	**E♯**	**65**	E	64	**E♯**	**65**					*65*	*64*
2	D	62	**D♯**	**63**	**D♯**	**63**	**D♯**	**63**					*63*	*62*
3	C♯	61	C♯	61	C♯	61	C♯	61	C♯	61			*61*	*61*
4	B	59	**B♯**	**60**	B	59	**B♯**	**60**	B	59			*60*	*59*
5	A	57	**A♯**	**58**	A	57	**A♯**	**58**	A	57	A	57	*58*	*57*
6	G♯	56	G♯	56	G♯	56	G♯	56	G♯	56	G♯	56	*56*	*56*
7	F♯	54	F♯	54	F♯	54			F♯	54	F♯	54	*54*	*54*
8	E	52	**E♯**	**53**	E	52			E	52	E	52	*53*	*52*
9	D	50	**D♯**	**51**					D	50	D	50	*51*	*50*
10	C♯	49	C♯	49					C♯	49	C♯	49	*49*	*49*
11	B	47							B	47	B	47	*47*	*47*
12	A	45							A	45	A	45	*45*	*45*

Quick Reference

The following quick reference shows how to set up Abel in the tower for simulated diatonic rings of bells, using the pre-defined configurations and desktop icons.

No Simulated Ringers

All the bells are rung by real ringers (for example, for demonstration or silent practice); Abel only provides simulated bell sounds.

To Ring…	Start Abel by…	Then…
All 12	Double-click the ***Abel LivCath12*** icon.	Ring bells 1 – 12 (using 2♮, not 2♯)
Back 8	Double-click the ***Abel LivCath12*** icon.	Ring bells 5 – 12
Back 10	Double-click the ***Abel LivCath12*** icon.	Ring bells 3 – 12
Front 6	Double-click the ***Abel LivCath12*** icon. Then ***File… Open… 6bell.mcf***	Ring bells 1 – 6 (using 2♮, not 2♯)
Front 8	Double-click the ***Abel LivCath12*** icon. The ***File… Open… 8bell.mcf***	Ring bells 1 – 8 (using 2♮, not 2♯)
Front 10	Double-click the ***Abel LivCath12*** icon. Then ***File… Open… 10bell.mcf***	Ring bells 1 – 10 (using 2♮, not 2♯)

With Simulated Ringers

One or more bells are rung by real ringers (for example, for tenor covering practice); Abel provides simulated bell sounds, and method ringing for the remaining bells.

To Ring…	Start Abel by…	Then…
All 12	Double-click the ***Abel LivCath12*** icon. Then ***File… Open… 12bell.mcf*** or ***File… Open… 11bell.mcf*** for Maximus or Cinques respectively.	Select method and enable Auto-Start (***F10***)
Back 8	Double-click the ***Abel LivCathBack8*** icon. Then ***File… Open… 8bell.mcf*** or ***File… Open… 7bell.mcf*** for Major or Triples respectively.	Select method and enable Auto-Start (***F10***)
Back 10	Double-click the ***Abel LivCathBack10*** icon. Then ***File… Open… 10bell.mcf*** or ***File… Open… 9bell.mcf*** for Royal or Caters respectively.	Select method and enable Auto-Start (***F10***)