



# Peterborough Cathedral Hill Organ background information and user instructions



WILLIAM HILL & SON	1868
WILLIAM HILL & SON	1894
HILL, NORMAN & BEARD	1930
HARRISON & HARRISON	1981







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# The Hastings Music Endowment Fund

Peterborough Cathedral has historically had a long and rich choral tradition supporting the worship and mission of the Cathedral through daily sung services. The Hastings Music Endowment Fund was established in order to secure the future of this great musical heritage, and it is still actively engaged in seeking donations to raise the funds required to secure the future of both the Choir and the splendid Hill Organ.

By purchasing this Hauptwerk sample set, you have already contributed to maintaining the musical tradition at Peterborough, as some of the proceeds of each sale are passed on for the purposes of supporting the music department. The Trust would like to thank you sincerely for your generous support! However, if like us, you have a strong desire to preserve the unique English choral tradition at Peterborough, you may wish to consider a further donation to this extremely important and worthwhile cause, either with a one-off sum, bequeathing a legacy or through regular monthly giving. In return for your generous support, there are various benefits available to benefactors. Should you wish to find out more, please contact [hastings@peterborough-cathedral.org.uk](mailto:hastings@peterborough-cathedral.org.uk) for further details.



The Hastings Music Endowment Fund (Hastings) is an endowment fund created to provide grants from the income received from funds invested to The Chapter of Peterborough Cathedral specifically to support the music of Peterborough Cathedral.

A majority of the fund was raised as part of a large Cathedral appeal conducted during the period 1995-2001 led by Dean Michael Bunker and the Hastings fund was created specifically for the funds raised for the purpose of supporting the music of Peterborough Cathedral.

This appeal established the concept of “Endow a Day” whereby funds are given to Hastings in return for a loved one being remembered on that day in perpetuity. The loved one is remembered in prayer for that day, acknowledgement made to the donor and relatives invited to join worship for the day which is most often a sung evensong. Endow a Day remains open for new funds and remains a very effective way of supporting the choir through donation or bequest.

The name Hastings came from the Chair of the main 1995 appeal Sir Stephen Hastings and his wife Elizabeth Anne Hastings – Lady Fitzwilliam – who sadly died before the appeal was closed. Hastings initially bore her name but when Sir Stephen subsequently died some years later the fund was renamed to its present title in their memory.

The Hastings Music Endowment Fund was formed by trust deed in 2001 and has its own constitution and board of trustees. The Dean is an ex-officio Trustee and Chapter appoints one other Trustee. The Trustee body must include two ex-choristers of the Cathedral and the current trustees have stated that the Chair for the time being is a lay person. The Trust deed requires that the Trustees invest in endowment funds and other investments for the long term and to grow the income. Grants to Chapter are agreed on an annual basis and made quarterly.

The Franklin bequest is managed within the Hastings fund and has different objectives to the main fund. The funds being given to support the education of the Choristers. The Trustees make Grants to Chapter and the Music department of Peterborough Cathedral to meet the terms of the bequest.





# The history of Peterborough Cathedral

Archeological evidence found under the site of the current Cathedral suggests that there may have originally been a Roman building where the Cathedral now stands. A monastery was first founded at this site in 655 A.D. by Peada, the son of King Penda of Mercia, in what was originally a wooden building. Some accounts suggest that this was destroyed by Vikings in 870, and later rebuilt. In 1116, a fire broke out in the town, which by now was known as Burgh st. Peter (Peterborough), again destroying the abbey, and in 1118 construction began on the present building.

The new monastic church was consecrated in 1238, and this building has survived with little change to the present day. The notable decorated wooden nave ceiling, completed between 1230 and 1250 is one of a handful of surviving examples from this period in Europe. The "new building" was added at the east end in 1509 with a fan vaulted ceiling probably designed by John Wastell, who was to go on to use the technique to great effect in Kings College chapel.

The Abbey became a Cathedral in 1541 under Henry VIII, and two of his Queens were buried there; Katharine of Aragon, and Mary Queen of Scots. Amongst other things, the foundation charter provided for a choir of "8 singing men" and "8 Choristers" and the Kings School was founded in the precincts at this time.

The Cathedral was defaced by Cromwell in 1643 during the English civil war, destroying the altar, most of the stained glass windows, the Lady chapel and the cloisters. The central tower was rebuilt in 1883 following the discovery of cracks in the supporting pillars, and the opportunity was taken at this time to provide new carved wooden choir stalls and remove the old screen.

In 2001 a substantial fire broke out in the north aisle behind the choir stalls and immediately below the organ case. Miraculously the fire was discovered and promptly extinguished, but there was considerable damage to the organ (from both the fire and the water used to extinguish it), and it took several years to rebuild it.

The Cathedral still provides daily sung services from its thriving choirs and music department, as well as serving as a vibrant and developing community with outreach and education programmes, and performances and civic events.

If you would like to help support the ongoing musical tradition at Peterborough, please contact **Hastings@peterborough-cathedral.org.uk**







# The history of Peterborough Cathedral Hill Organ

## Previous Instruments

Thomas Thamar was commissioned to build an organ for Peterborough Cathedral in 1661, which was completed in 1663. This instrument was considered to be too small by the then Chapter, and it was enlarged in 1681 (possibly by Schmidt or Harris), however very little information survives about this instrument and its fate. In 1735, a new instrument and case was built by a local Peterborough builder, John Ulrich Killeburgh, which was then rebuilt by William Allen in 1809. Further alterations were made, including a new case on the screen in 1830, and in 1868 it was rebuilt and enlarged by William Hill.

## The Current Instrument

The organ screen was removed in 1883, and in 1894 Hill & Son built the present instrument, incorporating some of the 1735 and 1868 pipework. The Great, Swell, Solo and Pedal divisions are located in 3 bays of the north triforium, with a case designed by Dr Arthur Hill filling the central bay. The Choir Organ is in the north quire aisle, along with with the Pedal Bourdon and Bass Flute. The console was originally placed in a gallery north of the choir stalls. In 1930 the organ was rebuilt and enlarged by Hill Norman & Beard, updating the instrument to electro-pneumatic action, with a new console being installed in a gallery above the south choir stalls. HN&B retained most of the 1894 pipework, but made a number of tonal alterations and additions.



Part of the Great Organ behind the main case



The Console

The organ was restored by Harrison & Harrison in 1981, with some tonal changes, but broadly guided by the original Hill concept. Following a fire in the Cathedral in 2001, the organ was dismantled, overhauled, and reinstated by 2005. During this work, the Choir division was moved one bay to the west, bringing it directly beneath the main organ case, the console was re-oriented, and new electrical systems were installed.



## Re-pitching

The Hill Instrument was originally constructed at old Philharmonic pitch (approximately A = 452). There had been discussion over the years about the possibility of changing the organ to concert pitch which date at least as far back as the days of Stanley Vann in the 1970's. In 2015, approval to alter the pitch was granted by the Cathedrals Fabric Commission for England. Harrison & Harrison very sensitively undertook the work, ensuring that the instrument's integrity was preserved, and allowing for the possibility that the work could be reversed at a later date if this were ever desired. The pipework was retuned where possible, with pipes being extended where necessary, and all the working being meticulously documented. In addition to the pitch change, tonal changes were made, including the addition of a new Tuba Mirabilis which was produced in the style of Hill, along with the addition of a Pedal 16' Open Wood (originally listed as the Open Diapason Wood, which is now provided by an extension of the 32')



The Great reeds (before repitch)



# The history of the Peterborough Cathedral Hill Organ

...continued from previous page

Open Diapason), and the addition of a Nazard and a two rank Sesquialtera (based on the Nazard) on the Choir. The re-pitch is widely regarded as being a great success, with the instrument considered by many to speak even better in the building at the lower pitch.

The current instrument comprises 89 stops, and around 5,400 pipes over 4 Manuals and Pedals, with enclosed Swell, Solo and Choir divisions, with a compass of 61 notes on the manuals and 31 notes on the Pedals.

Sources:

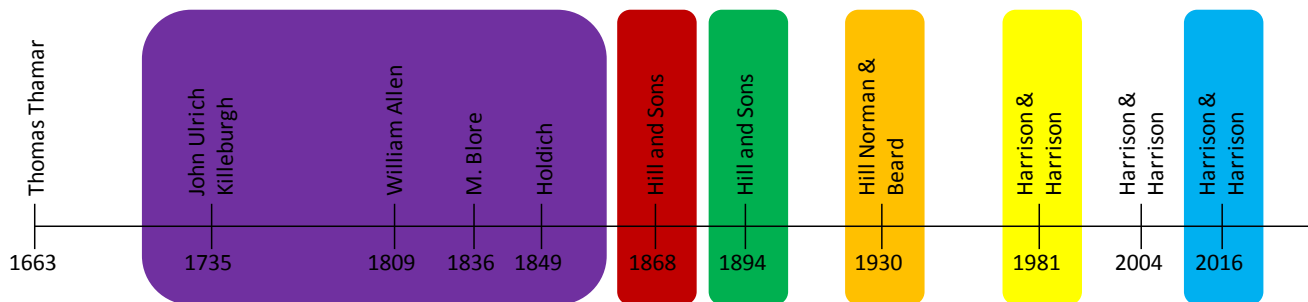
Harrison & Harrison: [Peterborough Cathedral Organ leaflet](#)

[Peterborough Cathedral Website](#)

Organa Britannica

With grateful thanks to [Harrison & Harrison Ltd.](#), Andrew Reid and Steven Grahl

## History of Pipework



Pedal	Great	Swell	Choir	Solo
Double Open Diapason 32	Double Open Diapason 16	Bourdon 16	Bourdon 16	Quintatön 16
Open Diapason Wood 16	Bourdon 16	Open Diapason I 8	Open Diapason 8	Viole 8
Open Diapason Metal 16	Open Diapason I 8	Open Diapason II 8	Dulciana 8	Viole Céleste 8
Open Wood 16	Open Diapason II 8	Rohr Flöte 8	Stopped Diapason 8	Unda Maris 8
Violone 16	Open Diapason III 8	Salicional 8	Principal 4	Concert Flute 8
Bourdon 16	Spitz Flöte 8	Voix Céleste 8	Flute 4	Octave Viole 4
Dulciana 16	Hohl Flöte 8	Principal 4	Nazard 2 2/3	Flauto Traverso 4
Principal 8	Stopped Diapason 8	Salicet 4	Fifteenth 2	Piccolo 2
Bass Flute 8	Principal 4	Wald Flute 4	Flautina 2	Double Clarinet 16
Violoncello 8	Geigen Principal 4	Fifteenth 2	Sesquialtera II	Orchestral Oboe 8
Gemshorn 4	Harmonic Flute 4	Mixture III	Mixture III	Clarinet 8
Twelfth and Fifteenth II	Twelfth 2 2/3	Cymbal IV	Bassoon 16	Vox Humana 8
Mixture III	Fifteenth 2	Contra Oboe 16	Trumpet 8	Tuba 8
Contra Trombone 32	Full Mixture IV	Hautboy 8		Tuba Mirabilis 8
Trombone 16	Sharp Mixture III	Double Trumpet 16		
Trumpet 8	Cornet IV	Trumpet 8		
	Contra Posaune 16	Horn 8		
	Posaune 8	Clarion 4		
	Clarion 4			

Grey = Added to / modified / Revoiced





# Pipe work photos – before repitch



Choir pipework



The Solo enclosure



Swell pipework



Swell pipework



The Pedal 32' Open Diapason with the Tuba enclosure above



The Pedal 32' Contra Trombone

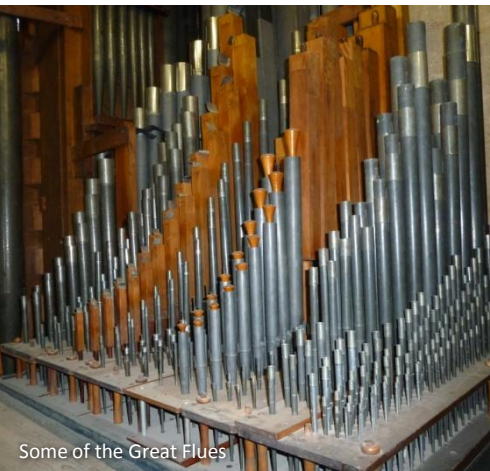


Pedal Open metal on the left and 8' and 16' Reeds on the right





# Pipework photos – after repitch



Some of the Great Flues



The Great reeds



Great reeds, with the Pedal Dulciana in the background



The Swell reeds



The enclosed HNB Tuba



The new Hill style Tuba Mirabilis



The Pedal Double Open 32'



The New Pedal Open Diapason 16' Extension

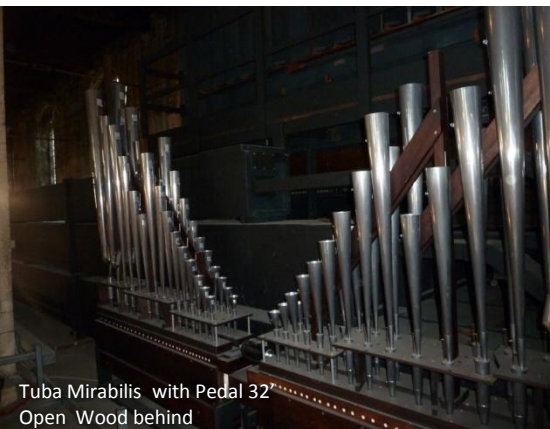


The Pedal Contra Trombone 32'





# Pipework photos – after repitch



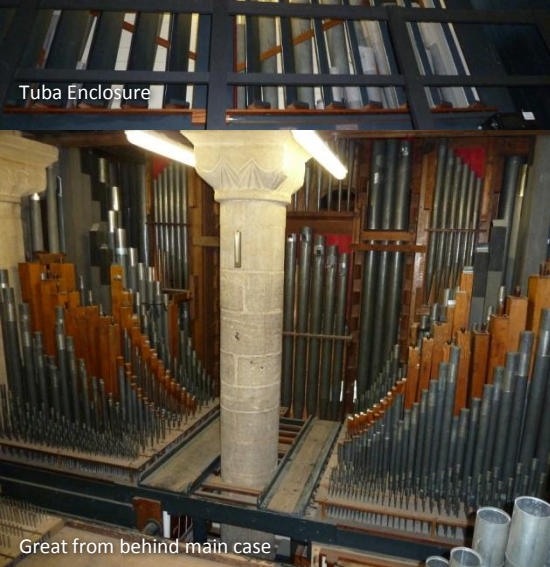
Tuba Mirabilis with Pedal 32'  
Open Wood behind



Pedal Reeds



Solo Reeds



Tuba Enclosure



Pedal 16' Open Wood



Great Reeds



Swell box interior



Swell Reeds



Solo Box





# Sampling Peterborough Cathedral Organ

## Background

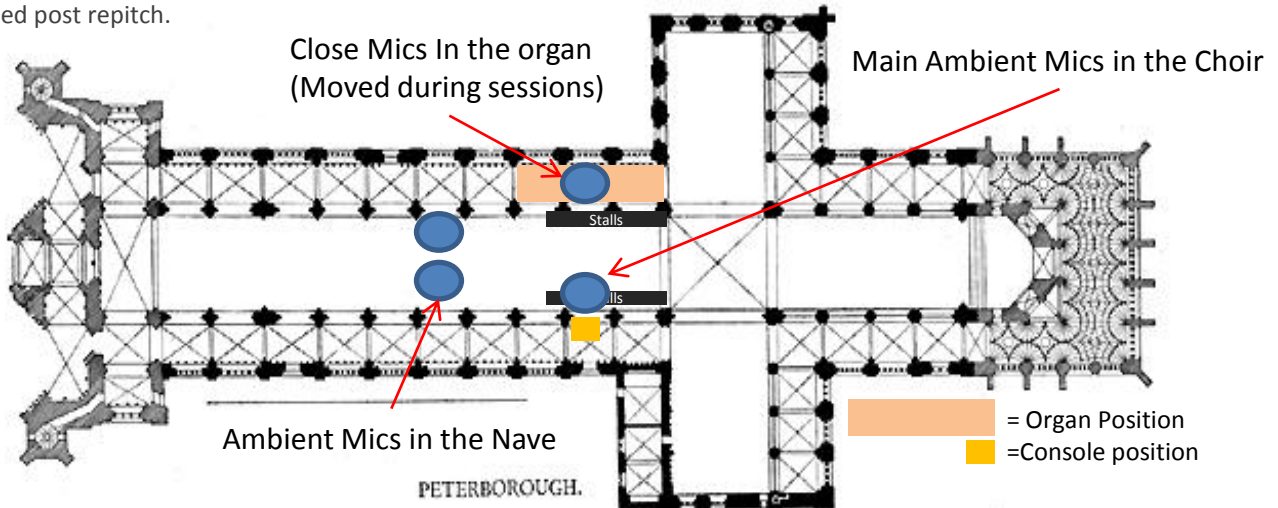
One of the pre-requisites for proceeding with the re-pitching of the instrument was that the sound of the instrument should be captured and archived in some way at its original pitch. Traditionally this would have been done by recording some reference pieces of varied repertoire, but with the development of the Hauptwerk virtual pipe, there is now the possibility of creating a playable archive recording. With this in mind, a few ranks of the organ were recorded in 2009, and it very quickly became apparent that this would be huge undertaking, involving the recording and processing of hundreds of hours of Audio.

A Robot was built in order to play the notes and select stops (using the built in combination system), which allowed sampling to be performed non stop right through the night, with absolute accuracy in terms of note lengths (for multiple releases), and ensuring sufficient gaps between all notes for the building acoustic to die away. As an added bonus, it is also possible to collect the marker positions for the note start and key release at the time of sampling, which saves time and effort in later processing.



## Recording

The recordings were made in nine overnight sessions over a period of a few months at the beginning of 2015, with an additional two nights of recording made in 2017 following the repitch to capture the tonal changes and some of repitched pipework. Sustain samples of at least 8 to 10 seconds were recorded for every note, with a minimum of 3 releases per note, with some ranks having up to 5 different lengths of release. Microphones were placed in the organ itself, right up close to the pipework, as well as ambient mics in multiple locations between the choir stalls and further down the nave. The main source used for the stereo set is based on a microphone in on the south side of the choir stalls, very close to the console itself, being around a few feet closer to the organ case, and a few feet lower than the bench. All audio was recorded and processed at 96KHz and 24 bit (32 bit floating point), using RME Octamic II and soundfield MKV / SPS422B preamps, with RME A/D conversion from a Fireface ufx. Microphones used were Soundfield MKV / Soundfield SPS422B, Core Sound Tetramic, Earthworks QTC40, ADK TL51, AKG C414, Rode NT4. Tremulant affected samples of all notes were recorded where possible, although the Swell tremulant was not functional in the original sessions, and so these were recorded post repitch.







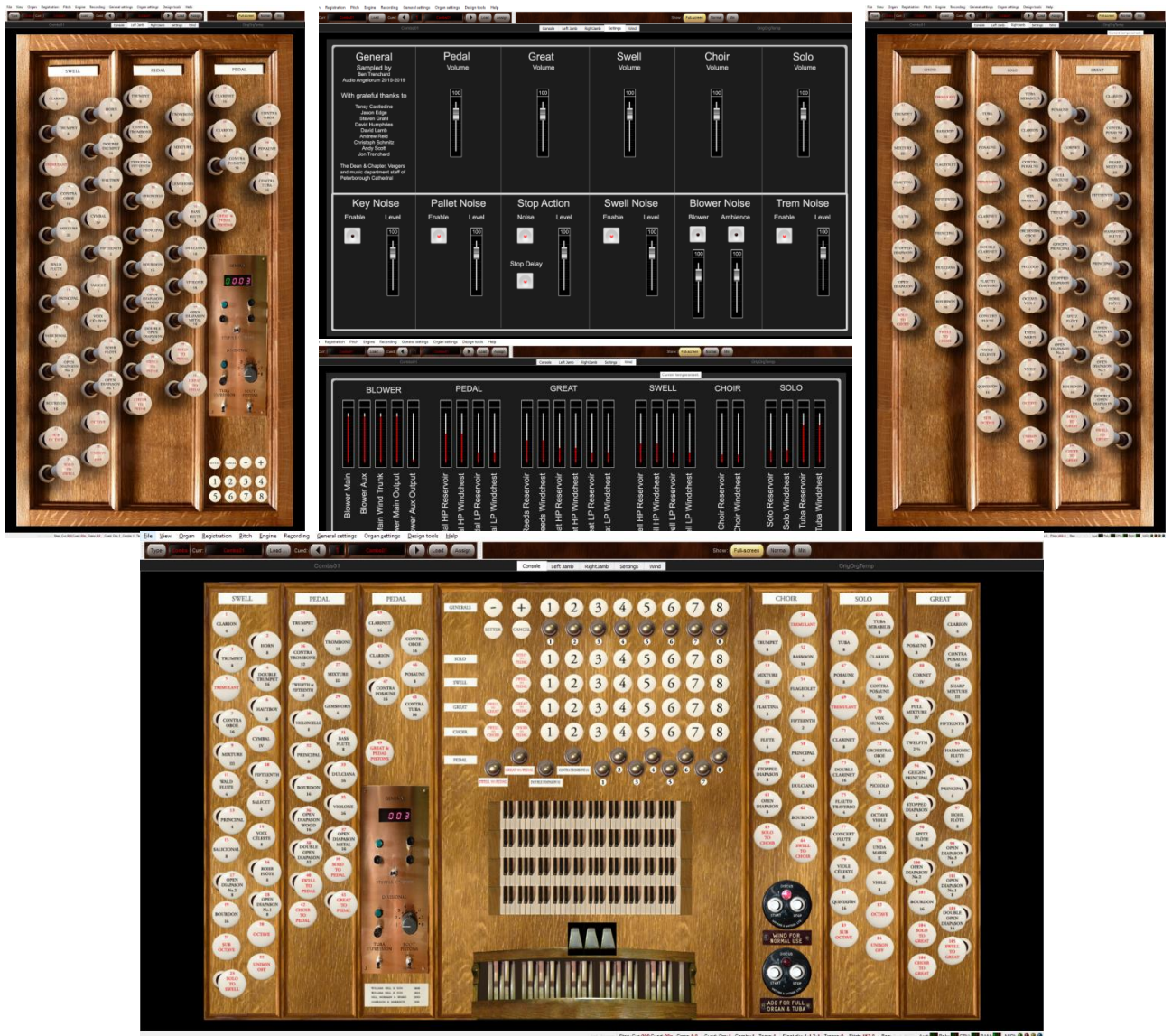
# Sampling Peterborough Cathedral Organ

## Processing

Considerable effort has gone into developing post processing methods and software to optimise the creation of the very highest quality samples. In particular careful consideration has been given to optimising the trade off between removing background noise and preserving the intricate detail in the sound to give it life. In addition to processing note samples, all blower, stop, switch, key, tremulant and action noises have been reproduced, and a significant number of impulse responses taken from various locations within the organ, which have been used to recreate parts of the reverb tail which were lost below the building noise floor.

The Tremulant affected ranks on the Choir, Swell and Solo use a combination of tremulant affected samples and hauptwerk modelled tremulants where required (mainly for the Swell, due to a malfunction during recording sessions), and where the Hauptwerk model is used, these use individual waveforms for every note and are programmed to match reference recordings. The enclosure models for the Swell, Choir and Solo are all carefully prepared on a rank by rank / note by note basis using reference recordings, and the wind system has been modelled based on measurements of the real organ and test recordings of the pipework. The samples have been programmed with multiple loops (up to 9) for added realism.

The Organ Controls are all faithfully reproduced and fully functioning, including the solid state logic Capture system with 128 general level memories and 8 divisional levels.





# User Instructions

## System Requirements

Note: This sample set is intended for use only with Hauptwerk Advanced edition version 4 and above. You will need a Hauptwerk advanced licence and enough free ram to be able to load all ranks.

In order to get the best performance from this organ, we recommend using a PC or Mac running a 64 bit operating system, with an up to date multi core processor (4 or more cores is ideal), and a minimum of 20Gb of memory, and at least 50Gb of free hard disc space. The approximate memory requirements for each volume are listed below.

Approximate Memory Requirements (Mb)				
Edition	Resolution	24 Bit	20 Bit	16 Bit
Volume 3	Uncompressed	44,947	-	22,776
	Lossless Compression	31,685	24,714	16,717
	Single Loops & Lossless Compression	27,028	21,572	14,265
Volume 2	Uncompressed	31,111	-	15,813
	Lossless Compression	22,097	17,296	11,710
	Single Loops & Lossless Compression	18,744	15,016	9,946
Volume 1	Uncompressed	16,330	-	8,378
	Lossless Compression	11,586	9,052	6,202
	Single Loops & Lossless Compression	9,817	7,873	5,280
Trial	Uncompressed	4,341	-	2,332
	Lossless Compression	3,091	2,480	1,757
	Single Loops & Lossless Compression	2,690	2,210	1,545

## Installation

Before installing volumes 1, 2 or 3 of the organ, you will need to have an update applied to your Hauptwerk dongle. Instructions on how to do this will have been sent to you when you purchased the set. If you have not yet applied the dongle update from Hauptwerk, please do this before proceeding.

The organ is built on incremental packages, and when installing a particular volume number, all preceding installation packages (N.B. including the trial version) should be re-installed first. For example, if you are installing volume 3, you should first install the trial, volume 1 and volume 2.

The Installation packages are mailed to you on a USB memory stick, with a free backup copy being available via download. If you still require a copy of the installation package(s), please visit [AudioAngelorum](http://AudioAngelorum.com).

To install a package, open Hauptwerk, and choose "Install Organ or Temperament" from the file menu. Navigate to the installation package you wish to install, and click open, then follow the instructions on the screen.

For more detailed instructions on how to install Hauptwerk organ Installation packages, please see the Hauptwerk user manual.

## Getting Started

There are two versions of the organ definition, the standard one has a 30 note pedal compass, and the Extended ("\_Ext") version, which has an extended 32 note pedal compass. Note that these organs are independent from a voicing perspective. When you first load the organ, you will be presented with the rank routing options screen. Please refer to the hauptwerk user manual for instructions on how to route audio, enable ranks and sounds, and select sample resolutions. Note that for the best level of realism, you should load all samples at 24 bit resolution.

This organ supports 7 screens, the main console window (which is best is you are viewing on a single Landscape monitor), the left and right stop jams, which will toggle between portrait and landscape layout (Portrait layout will display the controls as per the real instrument stop jams), a settings screen, and a wind model screen. There is also an alternate Left and Right stop Jamb with very clear and easy to read stops. When the organ starts up, the blower will automatically start.





# User Instructions

## Settings

The setting screen allows you to adjust the overall levels of each division, and switch various other features on or off. It is recommended that you use the organ with the default settings to start with and adjust the settings to suit your personal preferences.

**Key Noise:** this is the noise made by the physical keyboard and pedalboard, and represents what you would hear from the keyboards if you were sitting at the console of the real instrument. I would recommend this is left off, as you would only hear this if you were sat at the console, unless you find it helpful to give a better sense of “positive action” when playing. (it is likely in any case that the keyboard you are playing will have its own action noise!)

**Pallet Noise:** this is the sound of the electro-pneumatic action in the instrument – this should normally be left turned on, as this sound is integral to the noise made by the instrument during pipe speech, and is certainly heard in the building.

**Stop action noise:** this is the sound made by each stop action coming on and off, which has been individually sampled for each rank. It should normally be left on for realism.

**Stop action delay:** This simulates the slight delay in stops being drawn due to the action delay.

**Swell Noise:** this is the swell engine action noise. This should be left on for maximum realism.

**Blower / Ambient noise:** the blower and ambient noise has been separated, and each can be adjusted individually. The Ambient noise in the Cathedral is particularly loud when heard on a recording, and my preference would be to listen with the blower noise on, and ambient noise removed.

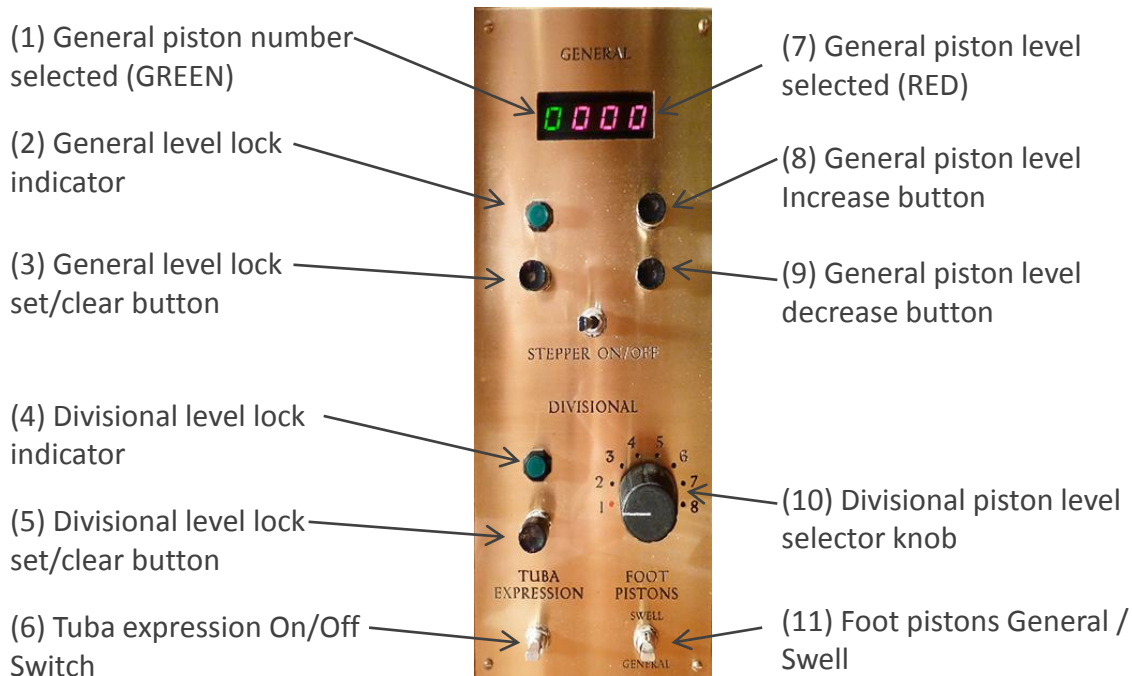
**Trem noise:** this is the noise made by the tremulant action, which should be left on for maximum realism. You can also switch between Tremulant affected samples (Sampled Trems) and Modelled tremulants (Modelled Trems), but this works only for Choir and Solo as the Swell tremulants are all modelled.





# Registration Sequencer Panel

The built in registration sequencer is a virtual model of the standard Solid State Multi level Capture system found on the real instrument.



The Capture system stores 128 memory levels of the 8 General pistons, and 8 memory levels of the divisional pistons. Each memory level has a complete and independent set of piston memories.

## Level Selection

General memory level selection is made by pressing the buttons 8 or 9 (General level increase / decrease). When one of these buttons is pressed and released, the Memory-level will move to the next or previous one, which will be indicated by the red LEDs in the Digital display (7). If an increase / decrease button is held ON, the level number will move to the next, then after a short pause, will "roll-over" to the highest level or that reached upon release of the button. The Green LED (1) indicates the current General piston frame selected (1-8)

The 8 divisional Memory levels are selected by the use of a rotary switch, the memory level in use at any time being indicated by the switch position.

## Locking

Each memory level may be LOCKED independently of all others to prevent the accidental or unauthorised alteration of settings.

To lock a particular level, select that level, push the lock set/clear button (button 3 for General, button 5 for Divisional), and the Respective green lock indicator lamp (2 or 4) will light to indicate that the level is locked. To unlock a level, select the level and push the lock set/clear button (3 or 5). *Note that if a level is locked, pistons may be recalled, but the setter button is disabled, preventing any memories being set.*





# Registration Sequencer Panel

## **Tuba Expression**

The Solo 8' Tuba (and its corresponding 16' extension in the pedal) is enclosed in a separate box. Button 6 enables / disables the shutters on this enclosure by linking or unlinking them to the Solo expression pedal. Expression is enabled in the down switch position

## **Foot pistons General / Swell**

Switch 11 toggles the function of the general foot pistons between the 8 generals, and the 8 Swell divisional pistons. In the up position, the Pistons link to the Swell divisionals, and in the down position they link to the Generals

## **Additional Controls**

Some additional controls have been added which are not part of the original instrument specification, but have been requested during Beta testing as helpful enhancements. These include:

Divisional Cancels (by clicking the Divisional labels at the tops of the stop jambs)

Coupler Cancel, Octave Coupler Cancel and Doubles off are implemented but do not have any screen controls (but can be assigned to a midi switch using the Organ Settings =>

Stop/Coupler/tremulant switches pistons/buttons... menu)

## **Notes on Organ Volume and possible clipping**

Due to the extreme dynamic range of a large organ, it can be challenging to set the default volume level to suit all preferences. Should you wish to adjust the playback level, this can be done using the Hauptwerk menu "Engine->Audio output volume (for this organ)" to increase or decrease the volume by clicking the respective "Turn up..." or "Turn down..." option (this setting can also be adjusted from the Audio, Midi and Performance control panel). In the unlikely event that the level is high enough to allow distortion when playing full organ, please turn the output volume down using this method until the distortion no longer occurs.



# PETERBOROUGH CATHEDRAL

## *Pitch your opinion*

Andrew Scott

The pitch of the organ in Peterborough Cathedral has been the subject of great debate for some years, with many eminent church and cathedral musicians putting up their arguments for and against what would amount to an invasion of this masterpiece.

Successive directors of music who have lived with the organ on a daily basis have worked together with the Chapter to gain permission from the Cathedrals Fabric Commission (CFC) to flatten the pitch. The musicians felt that this monumental decision would finally allow a thriving modern-day cathedral to move forward with 'their' instrument in a way that would no longer restrict their musical vision. Announcement of the decision was immediately followed by many public expressions of distaste, alongside many others of support. Meanwhile at Harrison & Harrison (H & H) we were drawing breath at the gargantuan task that now lay ahead.

Pedigree and unaltered organs can and should be considered living and working examples of our heritage, and it is important to retain such important historic examples. Although the William Hill organ at Peterborough Cathedral has an honourably chequered pedigree, as you are about to discover, its musical quality is so outstanding that any interference with the pipework was not to be lightly undertaken, and we were very conscious of this.

William Hill built the Peterborough organ in 1868, and following the removal of the organ screen, rebuilt it in its present

form in 1894. In 1930 Hill Norman & Beard (HNB) enlarged it and carried out some revoicing. Though inevitably influenced by the style of the day, the work was very well done and they treated the original tonal concept with remarkable sympathy and restraint. H & H came on the scene in 1981, carrying out major restoration work and some tonal changes, though without disturbing the main tonal structure. Further overhaul and repairs, relocation of the Choir Organ, and renewal of the electrical system followed a serious fire which broke out in the north quire aisle in 2001.

The organ was built long before a universal standard pitch was established, and different builders preferred different pitches for their instruments. As worldwide travel became easier, a need for pitch standardisation arose, which was established at A=440 Hz in the 1950s. This left older instruments at odds with orchestras which adopted the newly-agreed concert pitch. Interestingly, today's orchestral conductors often favour an even sharper pitch, with many now playing at 441 Hz, and some up to 443 Hz.

It is no secret that H & H was not in favour of changing the pitch at Peterborough, and our view remains that a masterpiece is best left unaltered. As organ builders to the Cathedral we felt an obligation to argue the case for the status quo, and to raise our concerns about such an invasive and difficult operation. Nevertheless, we had to acknowledge the strong view of the Cathedral Chapter and musicians that the sharp pitch was a serious impediment to the Cathedral's

ministry, and it was against this background that we agreed to look into the question.

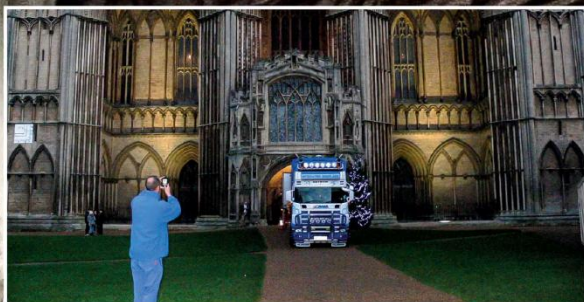
Accordingly, Mark Venning (then Managing Director, now Chairman) wrote a comprehensive report for the Cathedral. This dealt with the issues in depth and gave examples of pitch changes H & H had carried out at Westminster Cathedral (sharpening) and Southwark Cathedral (flattening), before covering the physical enormity of the task. Mark discussed in great detail the possible solutions, their individual challenges, and most importantly, the musical dangers involved in flattening the pitch of the pipework, most notably the reeds. He stressed the instrument's impressive quality and the need for acute musical judgement in overcoming the problems.

With the decision taken, our primary concern has always been preservation of the musical integrity of the Peterborough organ. This may seem a paradoxical statement, as the very nature of the work we are in the midst of has subtly changed the musical building blocks of the organ, and thrown up many challenges, not only for our site team and metalshop, but also particularly for the voicing team. However, having accepted the need to flatten the pitch, we were determined that it must be done consistently and in the best possible way, with every precaution taken not to deviate from the original speech and balance.

Before our work began, the Cathedral commissioned a sound engineer to sample and record every pipe in the organ so that



## Peterborough Cathedral – pitch your opinion

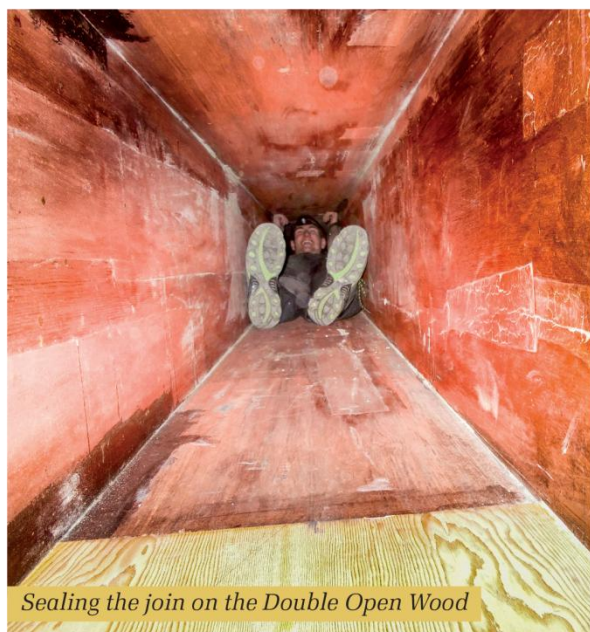


**Large picture:** Hoisting the Open Wood pipes up to the triforium

**Upper small picture:** Hoisting the Pedal 32ft Contra Trombone

**Lower small picture:** Loading the waggon outside the west doors





*Sealing the join on the Double Open Wood*



*Andrew Scott and Ian Bruce standing on the front Great Organ*

there is a historic record of how the organ used to sound. We have access to the samples for reference. Work on each stop has been individually documented, and all of the original material removed is labelled and stored in the organ, making it possible to unpick the evidence by using the documentation to reverse the process. This thorough approach is reflected in the associated cost.

We began the process of examining the pipes during 2002 with a view to incorporating the pitch change as part of the 2003/4 clean and overhaul should the required permission be granted. Peter Hopps's initial examination went as far as retuning a large selection of pipes across the whole organ, and taking note of how many pipes needed to be removed for lengthening. These notes formed the backbone of the estimate for doing the work.

By now many of you will be thinking of organs that have had their pitch altered, and will be asking yourselves what all the fuss is about at Peterborough? The modern world of social media, armchair experts and personal opinion paved the way for a lot of public comment about the pitch

change, and many people have voiced their opinion of the various methods that could or couldn't be employed, the most common of these being:

- Leave the organ alone and add a new bottom note and action for every stop, and provide a transposition switch on the console to allow the organ to be played at both pitches whilst preserving the pipework at the original pitch.
- Transpose all of the pipes up one note, add a new bottom note to every stop and rack the pipes in to the new holes.

However, the problem with these simple solutions is that the original pitch of A=451 Hz is just less than a quartertone sharp to A=440 Hz, meaning that transposition with no change to the pipework would leave the pitch sitting too flat at A=425.7 Hz. (For simple transposition to work the pitch would need to have been even sharper at A=466.2 Hz.) The transposed pipes would then need to be shortened. This approach would have been much quicker, and therefore cheaper, than lengthening, but it was ruled out because the pipes would have to be

cut shorter by a larger amount than they would need to be lengthened – a more invasive approach. In addition, transposition as described would have been difficult and compromising.

The pitch of any pipe organ is variable depending on temperature and humidity. The pitch of the fluework moves around 0.8 Hz per degree Celsius, with the reeds moving much less. In warmer weather the pitch will rise, and it will fall when it is cooler. To find a base temperature at which to set the new pitch, we collated the temperature and humidity readings recorded in the tuning book over several years and worked out the average temperature.

When we began work in July 2015, Ian Bruce (Team Leader) and I arrived at the Cathedral fully aware of the monumental task ahead of us. With the exception of the Choir Organ, Pedal 16ft Bourdon and 8ft Bass Flute which are housed in the first bay of the north quire at ground level, all of the organ is up in the north triforium. Prior to our arrival, a scaffold with a traversing lifting beam was erected to allow the pipework to be lifted down from the triforium.

Before the team arrived from





Durham, the first step was to spend three days retuning the whole instrument where possible down to A=440 Hz and make a final decision on the method that would need to be adopted for each stop, how many pipes would need to be lengthened, and how many could be re-tuned without extending them. While doing this we were also looking at consistent methods that would not only be easy to carry out on the bench so that the physical integrity and natural speech of the pipes would be respected, but how the changes could be reversed in the future.

As I write we have the organ of King's College, Cambridge, in our workshop for rebuilding. The 1934 H & H organ has a high volume of pipework inherited from the previous Hill organ that was reused and revoiced in the customary Mr Arthur (Harrison) way. Interestingly, all of the Hill pipework at King's was lengthened (or transposed) to flatten the sharp pitch in the same manner as our own approach at Peterborough which I am about to describe.

At the beginning of any organ project the voicer determines the pipe scales. These are the relative dimensions of the pipe diameter/cross-section and length, which vary depending on builder, building and tonal output required. By changing the pitch at a later stage, these fundamental building blocks of tonal architecture are subtly altered. The distance that the pitch moves in either direction determines the extent of this effect. At Peterborough we are flattening the pitch, and the lengthening of the pipework to achieve this results in a slight narrowing of the cylindrical or square section pipes, and a widening of the conical reed pipes.

What does this do to the tone and speech?

Changing the pitch of fluework is less invasive to tone production than in the case of reeds, which have many unknowns until they are on the voicing machine where exacting tests can be carried

out. This article does not allow sufficient space to go into full technical detail, but there are things that a trained ear can hear by comparing lengthened pipes to unchanged pipes. Using a broad brush, the main aspects of these changes are

- Widening of scale = broadening of tone and very slightly softer
- Narrowing of scale = squeezed tone and very slightly louder

Whilst there is an element of this at Peterborough, these changes are infinitesimal due to the small distance of a quartertone that the pitch is being flattened. In practical terms the effect is undetectable if the pipes are correctly treated by the voicer.

By now you will be asking yourself how we have gone about these changes and what has been done to achieve them whilst preserving the organ's musical integrity?

### Wooden pipes

Wooden pipes are by far the most difficult pipes to extend. With stoppered pipes it is important that the tuning point of the stopper does not fall over the new joint and this may require more material to be removed at the outset to ensure that the stopper fits correctly. Open wood pipes have the complication of tuning slots, and many of the larger pipes had been cut dead length, with various wedges of wood hand-cut out of the pipe tops to get them into tune. The full-length Pedal 32ft Contra Trombone is also constructed of wood, but has tapered resonators. This added a further complication to the lengthening process to match the taper.

The technique we applied for all wooden pipes was the same. The pipe body sides were left at the original length, which leaves a clear indication of that, whilst the face and back of the pipe were cut away to insert a new piece to

extend the pipe to the new length. The body sides were then filled in to continue them upwards to meet the new length. Once lengthened, the tuning method of stoppers, lids or slots was replicated accordingly.

The most difficult pipes to lengthen were those of the Pedal 32ft Double Open Diapason Wood and Contra Trombone due to their sheer size and weight.

### Metal flue pipes

Most of the fluework is made of metal and is fitted with tuning slides. During the initial retuning we established which pipes needed to be lengthened. Fortunately many of the smaller pipes could be acceptably flattened at the tuning slide. Where the tuning slide was sitting too high at the new pitch and the physical integrity and speech were compromised, those pipes were lengthened. This generally meant that pipes of just under 2ft and smaller remained unaltered.

Slotted pipework that was lengthened was cut off at the bottom of the slot, leaving the slot width and position clearly visible for replication. A new extended end was fabricated using the old end piece as a pattern, and once the new end was attached the slot was replicated. Some slotted pipework could be retuned with the slot extended upwards to retain the slotting dimension.

### Front pipes

The celebrated casework of Dr Arthur Hill is adorned with spotted metal pipes with gilded mouths. All of the lower pipes in the case are speaking and are from the Great 16ft Double Open Diapason, the upper flats being sham. Façade pipes are often made in pairs and are cut to architectural lengths so that they fit the geometry of the case. To get the pipes down to the correct speaking length they have windows cut into the back of the bodies to make the pipe effectively shorter. Flattening the pitch required removal of each pipe to have the window filled in and the tuning slots recut. This





**Main picture:** regulating the Pedal pipework in the triforium  
**Top left:** Great 8ft Posaune hoods  
**Top right:** Pedal Open Diapason lengthening  
**Bottom right:** Swell 8ft Horn extensions



operation required a substantial scaffold platform in front of the case for pipemaker Kelvin Kent to work from.

Even great masters make mistakes, and although not visible from the Cathedral floor, testament to this is one of the large 16ft front pipes which was cut up too high in 1894 and has had a piece of metal inserted on the upper lip to lower the cut-up. No doubt some ripe Victorian language was used! As a young voicer, I myself made a similar mistake on one of the St David's front pipes. I didn't resort to such a rough quick fix, and, alongside some modern colourful language, begged the metalshop to remove the foot and let the mouth down to hide my error!

### Reeds

There are two kinds of reed stop used in a pipe organ; open reeds and covered reeds and each needs a different approach. Covered reeds (those with a lid/cap and perhaps a bell) are much more difficult to work with in the metalshop and for the voicer. To ensure that the voicer had something to match, when the pipes were removed to Durham, the C# pipes of each stop (flues included) were immediately set aside and stored, whilst after tests in the voicing room, the remainder went through their respective cleaning, lengthening and repair processes in the metalshop.

To avoid the awkward and untidy job of having to fill in and solder up regulating slots, lengthen the pipes and then recut the slots, our approach was to cut the pipe top off at the bottom of the regulating slot, leaving the hook marks of the original voicer visible as evidence of the slot position and proportion. The piece removed was then cut open and flattened out to make an exact pattern of the tapered scale, and a new piece fabricated to extend the pipe by half a note so as to follow the scale progression. In the case of hooded reeds, details



of the slot proportion and position were taken, the hood was cut off at the first cut, and a new hood made half a note longer. The pipes now being slightly over long were then cut down to the correct speaking length by a voicer.

### Voicing

As expected, apart from the physical nature of lengthening, the fluework all responded well to the pitch change, and little adjustment was needed to correct the speech and volume. Many of the new pipework extensions are hidden underneath the tuning slide, or, where they are visible, will eventually dull down to match the already oxidised pipe metal. Wooden pipe extensions have been stained or painted so that the

changes don't draw attention to themselves but are still visible as evidence of what has been done.

Where the work has been most interesting is in the reeds. All of the trumpet-style open reeds have been lengthened and matched to the unaltered C# pipes, before the latter were themselves lengthened and matched. Putting the tuning spring onto the original tuning point, evident through an aged tidemark on the tongue and a discolouring of the tuning spring outside the reed block, allowed the new resonator length to be matched to the beating length of the tongue.

In the case of covered reeds, we have been able to achieve a flattening of the pitch by a combination of altering the tuning point, closing the regulating slot

## Peterborough Cathedral – pitch your opinion

or adding additional loading to the tongues, while still maintaining the tone quality.

The above methods merely serve as an overview of the physical work involved, but having had the pipework back in Durham and on the bench, we have been able to see the changes much of the pipework had already gone through prior to the present pitch change. This is perhaps a good place to explain why I described this organ as having an ‘honourably chequered pedigree’. In an organ of 89 stops, 57 are the work of Hill (or older), 16 are by HNB in 1930, with a further 16 stops added by H & H in 1981 and 2016. This makes for only 65% of the instrument dating from the Hill specification.

Most stops have been through at least one or two changes in their lifetime, which include transposition, extension, cutting down, and revoicing. Some reed stops have had an extra note provided at the bottom, most likely from the HNB work, and pipework extensions already evident from a previous flattening of the pitch were of a different material to the pipe itself. The current pitch change work gave us the opportunity to replace many of the pipework extensions executed in non-matching material, although the additional bottom notes have been retained. In addition, many reed shallots and tongues had been transposed, with the Great reeds having seen the most alteration. All of these physical changes have resulted in a musical instrument of great distinction, but it is by no means an original period piece when viewed up close.

During the pitch change work, we have reinstated the 16ft extension of the smaller Pedal Open Diapason (Wood) with new pipes, and replaced the 1980 Choir 1ft with a new 2 $\frac{2}{3}$ ft Nasard, which also forms one rank of a new II rank Sesquialtera. The present Tuba 16ft and 8ft, enclosed in its own swell-box, is every inch a 1930 HNB rank, a stentorian voice recalling a great ship at sea but stylistically at odds

with the rest of the organ. It will now be joined by a new unenclosed Tuba Mirabilis in the fiery style of Hill.

By the time you read this we will be three quarters of the way through the work, with only the Solo Organ still outstanding. The Pedal, Great and Swell Organs were brought back into selective use in June, and the Choir Organ will join in September when the organ will be formally back in use. The whole organ will be back in time for Christmas. When complete, it will no doubt become the subject of hot debate once again, with our work being critically appraised. The arguments for and against the pitch change may perhaps subside when the organ is heard again in all its glory – albeit with a slightly deeper voice, a bit louder (new Tuba), and with pipework that is now of the length shown on the stop knob.

I look forward to hearing and reading the forthcoming comments about how the organ sounds different/better/worse/brighter/duller/softer/louder/sharper/flatter. Delete as applicable or add your own adjective. It will still be one of England’s great organs.

*You can follow the project in more detail by watching the Peterborough Cathedral Pipewatch videos: <http://www.peterborough-cathedral.org.uk/pipewatch.aspx>*



**Andrew Scott** is Head Voicer at Harrison & Harrison Ltd. Here he is standing by the Pedal 16ft Trombone.





# Specifications

## Volume 3 (87 Stop)

Pedal	Choir	Great	Swell	Solo
Double Open Diapason 32	Bourdon 16	Double Open Diapason 16	Bourdon 16	Quintatön 16
Open Diapason Wood 16	Open Diapason 8	Bourdon 16	Open Diapason I 8	Viole 8
Open Diapason Metal 16	Dulciana 8	Open Diapason I 8	Open Diapason II 8	Viole Céleste 8
Violone 16	Stopped Diapason 8	Open Diapason II 8	Rohr Flöte 8	Unda Maris 8
Bourdon 16	Principal 4	Open Diapason III 8	Salicional 8	Concert Flute 8
Dulciana 16	Flute 4	Spitz Flöte 8	Voix Céleste 8	Octave Viole 4
Principal 8	Fifteenth 2	Hohl Flöte 8	Principal 4	Flauto Traverso 4
Bass Flute 8	Flautina 2	Stopped Diapason 8	Salicet 4	Piccolo 2
Violoncello 8	Flageolet 1	Principal 4	Wald Flute 4	Double Clarinet 16
Gemshorn 4	Mixture III	Geigen Principal 4	Fifteenth 2	Orchestral Oboe 8
Twelfth and Fifteenth	Bassoon 16	Harmonic Flute 4	Mixture III	Clarinet 8
Mixture III	Trumpet 8	Twelfth 2 2/3	Cymbal IV	Vox Humana 8
Contra Trombone 32	Tremulant	Fifteenth 2	Contra Oboe 16	Tremulant
Trombone 16		Full Mixture IV	Hautboy 8	Contra Posaune 16
Contra Posaune 16		Sharp Mixture III	Tremulant	Posaune 8
Contra Tuba 16		Cornet IV	Double Trumpet 16	Tuba 8
Clarinet 16		Contra Posaune 16	Trumpet 8	Tuba Mirabilis 8
Contra Oboe 16		Posaune 8	Horn 8	Clarion 4
Trumpet 8		Clarion 4	Clarion 4	
Posaune 8				
Clarion 4				
<i>Great &amp; Pedal Pistons</i>	<i>Solo To Choir</i>	<i>Swell To Great</i>	<i>Octave</i>	<i>Octave</i>
<i>Great To Pedal</i>	<i>Swell To Choir</i>	<i>Choir To Great</i>	<i>Sub Octave</i>	<i>Sub Octave</i>
<i>Swell To Pedal</i>		<i>Solo To Great</i>	<i>Unison Off</i>	<i>Unison Off</i>
<i>Choir To Pedal</i>			<i>Solo To Swell</i>	
<i>Solo To Pedal</i>				

## Volume 2 (61 Stop)

Pedal	Choir	Great	Swell	Solo
Open Diapason Wood 16	Open Diapason 8	Double Open Diapason 16	Bourdon 16	Quintatön 16
Open Diapason Metal 16	Dulciana 8	Open Diapason II 8	Open Diapason II 8	Viole 8
Violone 16	Stopped Diapason 8	Open Diapason III 8	Rohr Flöte 8	Viole Céleste 8
Bourdon 16	Principal 4	Spitz Flöte 8	Salicional 8	Concert Flute 8
Dulciana 16	Flute 4	Hohl Flöte 8	Voix Céleste 8	Orchestral Oboe 8
Principal 8	Fifteenth 2	Stopped Diapason 8	Principal 4	Clarinet 8
Bass Flute 8	Mixture III	Principal 4	Salicet 4	Tremulant
Violoncello 8	Trumpet 8	Geigen Principal 4	Wald Flute 4	Contra Posaune 16
Gemshorn 4	Tremulant	Harmonic Flute 4	Fifteenth 2	Posaune 8
Twelfth and Fifteenth		Twelfth 2 2/3	Mixture III	
Contra Trombone 32		Fifteenth 2	Cymbal IV	
Trombone 16		Full Mixture IV	Hautboy 8	
Contra Posaune 16		Sharp Mixture III	Double Trumpet 16	
Posaune 8		Cornet IV	Tremulant	
		Contra Posaune 16	Trumpet 8	
		Posaune 8	Clarion 4	
<i>Great &amp; Pedal Pistons</i>	<i>Solo To Choir</i>	<i>Swell To Great</i>	<i>Octave</i>	<i>Octave</i>
<i>Great To Pedal</i>	<i>Swell To Choir</i>	<i>Choir To Great</i>	<i>Sub Octave</i>	<i>Sub Octave</i>
<i>Swell To Pedal</i>		<i>Solo To Great</i>	<i>Unison Off</i>	<i>Unison Off</i>
<i>Choir To Pedal</i>			<i>Solo To Swell</i>	
<i>Solo To Pedal</i>				



# Specification continued....

## Volume 1 (33 Stop)

Pedal	Choir	Great	Swell	Solo
Open Diapason Metal 16 Bourdon 16 Dulciana 16 Bass Flute 8 Contra Posaune 16 Posaune 8	Dulciana 8 Stopped Diapason 8 Flute 4 Tremulant	Double Open Diapason 16 Open Diapason II 8 Open Diapason III 8 Hohl Flöte 8 Stopped Diapason 8 Principal 4 Twelfth 2 2/3 Fifteenth 2 Full Mixture IV	Open Diapason II 8 Rohr Flöte 8 Salicional 8 Voix Céleste 8 Principal 4 Salicet 4 Fifteenth 2 Mixture III Hautboy 8 Tremulant Double Trumpet 16 Trumpet 8 Clarion 4	Clarinet 8 Tremulant Contra Posaune 16 Posaune 8
<i>Great &amp; Pedal Pistons</i> <i>Great To Pedal</i> <i>Swell To Pedal</i> <i>Choir To Pedal</i> <i>Solo To Pedal</i>	<i>Solo To Choir</i> <i>Swell To Choir</i>	<i>Swell To Great</i> <i>Choir To Great</i> <i>Solo To Great</i>	<i>Octave</i> <i>Sub Octave</i> <i>Unison Off</i> <i>Solo To Swell</i>	<i>Octave</i> <i>Sub Octave</i> <i>Unison Off</i>

## Trial (8 Stop)

Pedal	Great	Swell
Bourdon 16 Bass Flute 8	Open Diapason III 8 Principal 4	Open Diapason II 8 Principal 4 Fifteenth 2 Hautboy 8 Tremulant
<i>Great &amp; Pedal Pistons</i> <i>Great To Pedal</i> <i>Swell To Pedal</i> <i>Choir To Pedal</i> <i>Solo To Pedal</i>	<i>Swell To Great</i> <i>Choir To Great</i> <i>Solo To Great</i>	<i>Octave</i> <i>Sub Octave</i> <i>Unison Off</i> <i>Solo To Swell</i>

All Versions come with the following accessories

8 Divisional Pistons per division, each with 8 levels of memory  
 8 General Pistons with 128 levels of memory (Capture system)  
 Swell / General Foot pistons switch  
 Solo Tuba Expression on/off switch  
 General Cancel / Setter / General Frame + / -

Reversible Pistons:

Great To Pedal  
 Swell To Pedal  
 Choir To Pedal  
 Solo To Pedal  
 Swell To Great  
 Swell To Choir

Reversible Foot Pistons for:

Great To Pedal  
 Swell To Pedal  
 Double Diapason 32  
 Contra Trombone 32





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Organists' Review



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