Going Digital
A Guide for Bands

There must be a better way

INTRODUCTION

An increasing number of bands, groups and ensembles with 2 – 10 musicians and singers are looking at ways of moving from paper based music to digital music display. Many of the enquiries we get are from church based worship bands, but "Going Digital" is something all bands that play from paper music are considering - cruise ship bands, wedding bands, backing bands, cabaret bands, tribute groups as well as classical string quartets and wind ensembles to name but a few.

This document is designed to help you decide on the best setup for your band or group to make the move from paper to digital.

Part 1 of the document will pose the fundament question which will determine the optimum solution for your band setup.

Part 2 will go into detail of the hardware requirements and what is available to implement your band setup.

Part 3 will look at sources of music and how to get your music into a digital format.

The solutions are based on Power Music Professional, Power Music Software's music management and display software. There are editions of Power Music for Windows, Mac and iPad and a special edition, Power Music Accessible Format (AF) for visually impaired musicians. For band setups we recommend Power Music Professional for Windows as it is the most feature-rich edition.

If after reading this booklet you have any questions about "Going Digital", please feel free to contact Power Music Software. Contact details are at the end.

1: THE BIG QUESTION
Do all musicians in the band play from the same music?

Scenario 1: YES - Every member of the band plays from the same music.

The solution would be to use CLONED displays, that is, every screen displays the same music. A single computer runs Power Music and all the monitors are linked to this PC using either VGA or HDMI cables or wireless HDMI. If cables are used then a VGA or HDMI splitter would be required. Song selection and page turning would be controlled by one member of the band. Part 2 of this document deals with this fully.

Scenario 2: NO - Each musician in the band wants to see their own music for their own instrument.

The solution here would be for each musician to have their own device running Power Music. For example a MusicOne 16 which is good for most musicians and for conductors or musicians with complex scores, the MusicOne 22 and 24 has a screen big enough to display 3 pages in landscape mode or a full orchestral score in portrait mode.

But the devices can be any mix of Windows tablets or laptops, iPads or Macs running Power Music. Each musician would be responsible for song selection and page turning. If several musicians want to see the same music then a second cloned screen can be added.

All the music for the band could be centrally stored in Power Music Box – our secure, cloud storage system. Each band member can log into the Box and download to their iPad, tablet or laptop the playlist and any music required for the performance, if they don't already have it on their device.

Normally, all music is stored locally in the devices running Power Music and no internet connection is required for performing. However if all the musicians are using Power Music Professional for Windows, it is possible to put the Power Music database of songs onto a shared drive/folder and connect each device to this database over a wired or wireless WiFi LAN.

The advantage of this is that a single copy of the database exists and each musician selects their music from this central database. This makes updating music and adding new songs much easier to manage. This solution does not work across different platforms as the Mac and iPad Power Music editions do not use the same database engine as the Windows edition.

Scenario 3: MAYBE - Some of the musicians use sheet music and others use chord sheets.

This is a common situation in a church worship band. Guitarists want chord sheets and keyboard players and singers want to see a score.

The solution here would be to have 2 display systems – one displaying the sheet music and one displaying the chord sheets.

This would require 2 PCs running Power Music and one musician from each group of musicians could control song selection and page turning. Power Music Box would be used to keep both systems updated with the latest music. Multiple monitors would be linked to the PCs using either VGA or HDMI cables or wireless HDMI. If cables are used then VGA or HDMI splitters would be required. Part 2 of this document deals with this fully.

The use of a shared database, as in Scenario 2, could also be used in this situation. One of the PCs holds the database and the other one accesses a shared drive/folder on this PC to display the different type of music. Again, the advantage is having only one database to keep up to date.

2: Solutions

The information in this section is relevant to all three scenarios above but some information is aimed at scenarios 2 and 3.

Most of this document will concentrate on solutions that use Windows based systems running Power Music Professional. However, there is another solution worthy of consideration – Power Music App running on iPads.

iPads

With this solution each musician has their own iPad running Power Music App.

The songs for the band would be stored in Power Music Box – cloud storage which allows songs and playlists to be shared between any devices (Windows, Mac or iPad).

Each member of the band downloads the songs for the playlist.

For performing, they can then control their iPad individually or using the Master/Slave feature in the Power Music App, one iPad can be used to control all the other iPads – turning pages, selecting songs etc.

Windows Computers

Operating Systems
Power Music Professional is a Windows based application. It will run on:
- Windows 8, 8.1 (excluding RT)
- Windows 10
- Windows 11

(Windows 7, XP and Vista is no longer supported.)
We recommend Windows 10. We have found it to be a stable and fast OS for digital music stands.

Form Factor
Desktop
For a permanent band setup probably the best system to use is a standard PC desktop. Since Power Music is a "mission critical" application the better the quality of the system the more reliable the system should be. Try to avoid "home brew" systems. Buy a base unit from a well-known manufacturer.

Power Music does not require a high spec computer to run. It will run on any modern multi-core processor, 4GB RAM and 400MB of hard disk space for the program plus space for songs. However, as with all applications, increasing the amount of RAM and using a faster processor will make the program faster to load and more responsive to use. At least 8GB of RAM is recommended for Windows 10. Typically an i3 Intel processor would be perfect.

We would also recommend using a Solid State Drive SSD for backing store instead of a conventional Hard drive (HD). There are three reasons for this:
1. SSDs are extremely fast. Making PC start up and page loading times very quick;
2. SSDs are very robust and are not easily damaged by knocks and bumps;
3. SSDs are silent – a vital consideration in recording studios or other quiet environments.

There are several form factors for base units and the smaller form factor PCs and mini PCs eg Intel NUC are ideal. It is unlikely that there will be a need for future expansion of the system, so space for additional hard/optical drives and expansion cards is unnecessary.

One thing to consider is the noise the processor cooling fan in the base unit produces. You should consider a system with quiet fans and if possible go for a passively cooled system. There is nothing more annoying that the hum of fans being heard during a quiet time in a musical performance.

You do not need a high spec graphics processor on the system, just check that it will display at the native resolution of the monitor(s) you are using. A standard VGA output is fine, unless you are considering using HDMI. Display Port output may require adapters for VGA or HDMI.

Make sure there are at least 4 USB ports – this should not be an issue on modern PC base units.

Laptops
Using a laptop is great for a single musician or a small group. As with PC desktops a reliable laptop is essential and the minimum specification of the laptop should be the same as that of a desktop.

A minimum screen size of 15 inches and a resolution of greater than 1024x768 is recommended to give a readable page of sheet music. Widescreen laptops are ideal for displaying two sheets of music side by side and giving enough screen area for two pages of music and the Power Music sidebar. If possible an HD 1920x1080 screen resolution would be best for Power Music and for driving external monitors.

Avoid using a netbook for running Power Music unless space is an absolute premium. While the software will run on a netbook, the small screen size of these devices, normally about 10 or 11 inches and the low resolution, often as low as 1024x600 makes displaying sheet music problematic.

The big advantage of using a laptop is the ability to add a second monitor very easily, as all laptops have an external VGA or HDMI output. Make sure you know how to "clone" the displays from the laptop screen to the external output. Usually a key combination like Fn+F5 toggles between laptop screen only, the external screen only and both screens. In Windows 10 it is usually automatic.

Two or three USB ports will be enough on a laptop.

Windows Tablets
At present only Windows tablets and iPads can run Power Music there is no Android edition of Power Music. Tablet PCs come in two forms – slates and convertible laptops. A slate tablet is a "true" tablet with no physical keyboard or touchpad. Convertible laptops are like normal laptops but the screen can be rotated and locked down to cover the laptop's keyboard and mouse pad. Most slate tablets allow an external keyboard to be either attached via a dock connector or by USB or Bluetooth.

All tablets are touchscreen devices. You control the software using either a stylus pen or your fingertip(s). Power Music has been designed to be completely compatible with the touchscreen interface of a tablet PC.

There are advantages and disadvantages to using Power Music on a tablet PC.

The advantages are:
- The saving in space, there is no keyboard;
- Tablets are ideal to sit on music stands of pianos or keyboards and mimic a paper music book;
- Moving to the next page of music simply involves tapping the screen;
- Tablet PCs can change their screen orientation so they can be used to display music portrait. This is a very natural way to view a sheet of music;
- They are usually silent with no fans;
- They are battery operated – no need for mains cables.

However, the disadvantages of tablet PCs are:
- Their small screen size – most have screens less than 12 inch;
- The cost of these devices – can be more that the equivalent laptop PC;
- They sometimes use low power processors;
- Entering any more than a few words of text, on a tablet PC, using the on-screen keyboard is cumbersome;
- The risk of the battery going flat.

All-in-one

All-in-one PCs are basically a hybrid of a desktop and a tablet. They can run desktop power processors and have a large built-in touchscreen. However unlike a tablet, they are mains powered, but can be used with an external battery pack giving 5 – 10 hours continuous use. Screen sizes of all-in-one PCs ranges from 16 inch to 27 inch.

All-in-one PCs have many advantages when used as a digital music display system, the main ones being the size of the screen and fewer cables needed. Most musicians find a 16 inch screen fine for viewing music and a 22 or 24 inch screen easily displays two or three A4 pages side by side. For conductors, or musicians like organists who use large pieces of complex music 27 inch screen all-in-one PCs can be used.

One disadvantage of the larger all-in-one PCs may be their weight which may be an issue if it is to be placed on a music rack of a piano or keyboard.

The all-in-one PC makes the perfect controller PC in a band setup. You can add additional monitors easily to most all-in-one PCs and the large touchscreen makes setting up playlists, annotating music and searching for songs simple. Usually no additional keyboard or mouse would be required for use during practice and performance.

If you want to mount the all-in-one PC on a stand make sure it has a VESA compatible mount – not all have this.

Digital Music Stands

A digital music stand is a device specifically designed for music display. It comprises of an all-in-one PC with touchscreen, floor stand with mount, page turning pedal and runs Power Music Professional.
We sell a range of digital music stands called MusicOne. MusicOne 16 and 20 are all-in one PCs. MusicOne 22, 24 and 27 use a NUC or Stick mini PC. They are mains powered with has ultra-quiet fans. The 16 and 20 can be run off an external battery pack for 5 – 10 hours.

Stick PC

This relatively new PC format is basically a fully functional Windows PC in a device which looks like an overgrown USB flash drive.

The Stick PC plugs directly into the HDMI socket of a monitor. The Stick PC is powered by a micro USB power adapter. Two full–sized USB port allows connection of a touch screen or a USB hub to the device. It has WiFi and Bluetooth 4 built in to allow connection to a network and various Bluetooth keyboards and pedals.

The relatively small amount of backing storage (32 - 128GB) can be increased by inserting a micro SD card (up to 128GB) into the card slot. The processor is relatively low powered but is sufficiently powerful to run Power Music Professional.

Using one of these devices, you can carry all your music and the Power Music software around in your pocket and just plug it into a monitor or TV to display your music.

Keyboard and Mouse

You can use the touchscreen to search for songs, set up playlists, add performance notes and type up chord sheets in Power Music but a wireless keyboard and mouse makes it easier. If you are using a laptop then you will be using the built in keyboard and mouse if however you are using a desktop then an external keyboard is needed.

A standard wired USB keyboard and mouse are the obvious solution but in an environment where the cables should be kept to a minimum and if there is the need to pass the keyboard or mouse to other band members then wireless solutions are recommended.

It is best to avoid "budget" wireless keyboards and mice as we have found that they often have a very limited range and are prone to interference from other electrical devices. By far the most flexible solution is to use a combined wireless keyboard and touchpad. These RF keyboard/touchpads have a range of only a few meters.

For longer range wireless use, Bluetooth solutions are best. They tend to be a bit pricier but they have a good range and are not affected as much by interference from other wireless devices. You can run multiple Bluetooth devices on one PC/tablet. Each device is "paired" individually with the PC.

However remember to always keep a spare set of batteries handy for these wireless keyboards and mice; they have a habit of running out at the most inconvenient times! One thing we have found with wireless keyboards and mice is that they all use a power-save system where the device powers down to maximise the battery life when not in use. To bring the devices out of power-save mode you have to tap one of the keys a few times to "wake" it up. As long as you are aware of this and don't panic when the mouse or keyboard appears to be inactive it is not a major issue.

STANDS

Laptop Stands

If you use a laptop, while it may be possible to balance it on the edge of an amp or piano, the best solution is to use a purpose build laptop stand. These come in various styles and fold down to a very compact size when not in use. They can easily support laptops up to 19 inch.

Monitor Stands, Mounts and Quick Releases

It is unlikely that, in most situations, there are suitable surfaces to place display monitors on for viewing music. So some type of monitor stand will be required.

The one thing you need to be sure of is that your monitors are stable and will not easily be toppled over. Some monitors have a separate power pack with only a low voltage feed to the monitor but most monitors have direct mains feed so care must be taken with this. Watch out for sharp edges on the stand where the insulation could be damaged. Also make sure there is RCD protection on all circuits you use.

All modern LCD screens have a set of four holes on the rear of the display for mounting them on stands and brackets – often called "wall mount" brackets. This standard is known as - VESA FDMI - Video Electronics Standard Agency, Flat Display Mounting Interface, (a bit of a mouthful!) usually just called VESA compatible. There are two common sizes used on LCD monitors - 75mm and 100mm. These sizes refer to the spacing between the holes for the screws that attach the mount or stand.

Monitor stands and quick release mounts are "universal", that is they have holes for both the 75mm and 100mm setups. The one thing to watch is the depth of the screw hole in the display. Be very careful not to insert a screw which is too long as this could damage the internals of the display.

The best solution is to use purpose-built LCD monitor floor stands with either folding tripod bases or a heavy solid bases. These allow pan, tilt, rotation and height adjustment of the screen. For Health and Safety reasons, trailing cables should be avoided by taping or using Velcro strips to attach them to the stand.

Quick Release mounts go "between" the display and the stand mount. They allow for the screen to be removed from the stand without having to remove the screws from the VESA mount. This is often necessary where the installation of the digital music stands is not permanent and the setup has to be broken down after each event.

Tablet and iPad Stands

Tablets and iPads can be placed on a conventional music stand, however the risk of them falling off and getting damager is enough to convince most musicians to protect their precious iPad by using a purpose built iPad/tablet mount and stand.

There are two alternatives:
- An iPad/tablet mount which hold the device securely and is then attached to a standard microphone stand. Usually this is some kind of clamp onto the pole.

- A purpose built mount and stand designed to hold the device. The advantage of this is that the device can easily be moved and its position adjusted independently of the mic.

PAGE TURNERS

Once a playlist has been set up in Power Music it is very easy to move backwards and forwards through the playlist displaying the music. Using a standard keyboard, the space bar, the arrow keys or Page up/down keys can be used to move through the playlist. If you are using a tablet PC or all-in-one PC with touchscreen, simply tapping on the right side of the screen will move to the next page and tapping the left side takes you to the previous one.

The drawback of both of these methods of navigation in Power Music is that you need to take your hand off the instrument you are playing to press a key or tap the screen. The solution is a foot pedal.

USB or Bluetooth?

In the past there were several good USB foot pedals available. The BiLiPro was very popular as it was very robust and did not require batteries, however being restricted to a 2m cable was an issue.

Unfortunately, production of the BiLiPro stopped several years ago. Searching on eBay might find one and there are a couple of other USB foot switches that can be used.

However, the vast majority of musicians use Bluetooth pedal for page turning these days. The newer Bluetooth 4 protocol is low power so the battery life is very good.

PageFlip Butterfly, Firefly and Dragonfly Bluetooth

These are all very well-engineered, robust page turner pedals. The pedal is powered by two non-rechargeable, AA batteries.   They are very easy to pair and configure using the set of switches on the pedal. The Firefly and Dragonfly have two LEDs built in to the pedals for use when the stage is in darkness. There is good mechanical feedback when operating the pedal. Battery life is several hundred hours of use.

Operation is silent with no discernible sound when the pedal is pressed.

The Dragonfly has the advantage of having 2 additional pedals giving extra functionality. Each additional pedal can be programmed to emulate any key on the keyboard. A Windows utility to program the pedals is available from the PageFlip website. For example in Power Music an additional pedal could be programmed to produce the character "A" when pressed, to start an audio backing track.

The PageFlip pedals require Bluetooth 3.0 onwards.

AirTurn BT-200 Bluetooth

This is a very modern, extremely light-weight pedal similar in style to a guitar effects pedal. Pages are turned by applying pressure to one of the raised switches. It can be programmed to a variety of modes to suit the application it is used with. Pairing and setting the mode can be a little tricky using the one button control but once setup it is very reliable.

It uses the newer ultra-low power, Bluetooth 4.0 sometimes called Bluetooth Smart on the device it is paired with. This gives it hundreds of hours of use from the rechargeable battery

AirTurn Digit BT-106 Based Pedals

DUO   StompKit   QUAD   StompKit XL   TAP

All these pedals are based on the BT-106 Digit module. This is a Bluetooth unit which allows a variety of pedals and page turners to be plugged into the unit. It can also be used hand-held for controlling, for example, PowerPoint presentations.

Buttons – Bluetooth and USB

These devices are programmable buttons which can be used to turn pages.

They are popular with organists whose feet are occupied on the pedal board.

 They can be connected via USB or wirelessly using Bluetooth.

Displays

One of the developments in computer hardware that has made on-screen music display possible is the availability of low cost, large, light weight, high resolution, wide screen LCD monitors. The use of e-paper or e-ink screens would have huge advantages over LCD screens in the weight, power consumption and use of reflected light, but as yet the page refresh speed is too slow for music page turning.

So what should you look for in a monitor to use with Power Music?

Resolution and Size

A 16 - 22 inch LCD monitor is the ideal size of monitor for a musician standing playing, for example a guitar or wind instrument.   For situations where a musician or composer has complex scores to display a 24 inch screen can be used. Depending on the style of music either a sing page in portrait or multiple pages side-by-side in landscape can be used. Power Music supports both orientations.

We would always recommend using wide-screen monitors as their aspect ratio lends itself to displaying 2 or 3 sheets of music side-by-side and leaving enough room on the display for the Power Music playlist sidebar. The diagram below shows the relative sizes of common screens:

Screen Size Comparisons
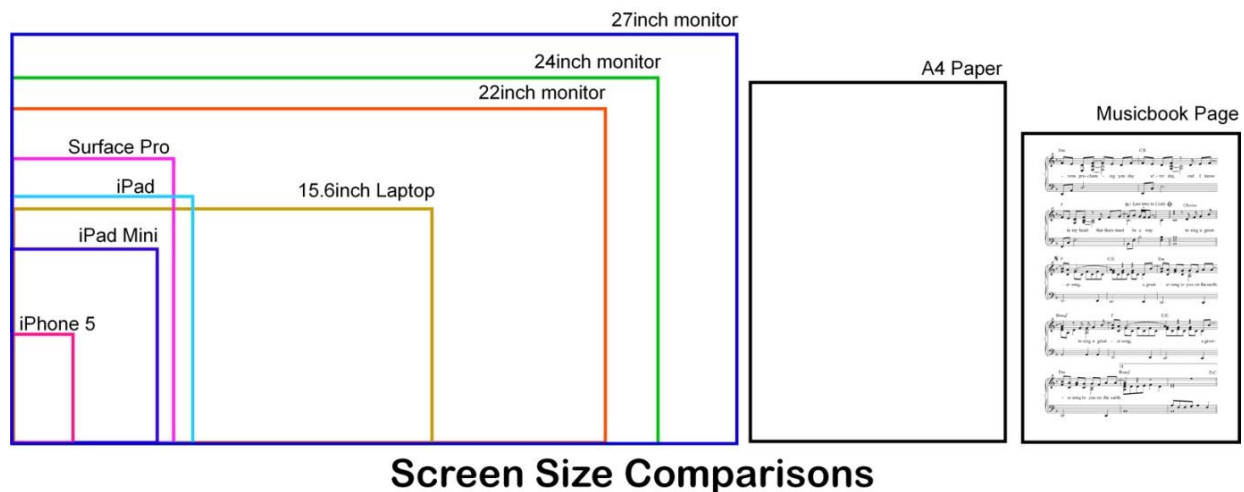
It is possible to project the output from Power Music onto a projection screen using an LCD or DLP projector, for example for classroom use.

As important as monitor size is the resolution of the monitor(s). If you are using multiple monitors driven from the same source it is best to get monitors which all have the same native resolution. The "native" resolution is the maximum resolution that the monitor can display. You should always run monitors at their native resolution as this gives a direct pixel to pixel mapping on the display. Running a monitor capable of 1920 x 1080 at 1366 x 768 will result in a slightly "fuzzy" display.

The resolution of monitors below 20 inch is usually 1366 x 768 which is adequate for Power Music. Monitors of 22 inch and larger are normally 1920 x 1080 (full HD) giving a very sharp display. The new 4K Ultra HD resolution of 3840 x 2160 is "over-kill" for music display and Display Port splitters for multiple monitors are expensive.

Check the specification of the graphics card in the PC to be used for Power Music to make sure it can output at the native resolution of the monitors.

Another consideration is using glass fronted or "hard" LCD monitors. These tend to be a little more expensive and heavier than the equivalent "soft" screens but have the advantage that they will not be damaged if a musician decides to use a pen to point at something on the screen with a little too much enthusiasm!

Touchscreen Monitors
Touchscreens are commonly built into tablets, all-in-one PCs and some laptops. Stand-alone touchscreen monitors are also available to connect to any PC or laptop. The video signal is sent by the usual VGA or HDMI cable but an additional USB connection between the monitor and PC carries the touchscreen data. This allows any PC to be controlled by a touchscreen.

Touchscreens come in two types:
- Simple, single-touch screens which often require the use of a stylus. This technology is called a resistive touchscreen. This is an older technology which is disappearing.
- Multi-touch screens can use several finger tips to control the PC. The multi-touch devices use a technology called capacitive touchscreens. Multi-touch allows techniques like pinch and zoom using 2 fingers.   Multi-touch is necessary if you run Windows 10 or 11.

Power Music has been written to allow full control of the software from a touchscreen.   You can set up playlists, annotate, move forwards and backwards through songs and page turn using taps on the screen.

In a band setup only one touchscreen is needed. This screen would be connected to the controlling PC via USB. This means that the touchscreen needs to be fairly close to the PC as USB cables should not be longer than 5m. If the PC was further away from the screen you should use an active USB extension for reliable touchscreen operation.

Cable Types VGA/HDMI
The decision to use VGA or HDMI wiring is usually determined by the monitors you are using. Modern LCD monitors all support HDMI. There is no significant difference in quality between VGA and HDMI wiring. In most setups, you will be using VGA cabling between the PC or VGA splitter and the display monitors. VGA cables are terminated in either male or female 15 pin connectors.
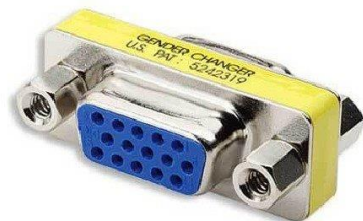
If you cannot get the correct type of cable or you need to extend a cable, "gender changes" are available to convert male plugs to female sockets and vice versa. If possible try to avoid using these as they introduce another two connections into the cable run which can fail or be disconnected by accident. There is also a slight reduction in quality when using these. VGA plugs and sockets should always be fixed in place using the screws at either side. If joining together 2 cables or using a gender changer use the barrel nut to make the connection solid.

To wire up a VGA splitter you normally require a single male to female cable from the PC to the splitter and several male to male cables from the splitter to the monitors. However this may vary depending on the make of the splitter.

VGA cables are available in a wide range of qualities and prices. The most important factors when buying VGA cables are the quality of the screening and the plugs/sockets being "fully wired". In a fully wired cable all 15 connectors are used – this is important as modern monitors exchange data (eg native resolution) with the PC using the wires that are sometimes not connected in lower priced cables. Screening cuts down interference caused by crosstalk between cables, each of the 15 individual cables must be screened in addition to an overall screen for the VGA cable.
VGA and HDMI cables are available in a wide variety of lengths from 2m to 50m.

Try not to run a very long cable directly from the VGA/HDMI output of the PC and keep long cable runs away from mains cables.

VGA/HDMI Splitters

VGA and HDMI splitters allow a single output from a PC to be replicated on up to 8 or more monitors without any loss in quality. Exactly the same display will appear on all the monitors. (Note the previous comment about all the monitors having the same native resolution.)


Splitters come in 3 types – 2, 4 and 8 outputs/ports.

Splitters are active devices which amplify the signal from the computer to allow it to be displayed on multiple monitors. The other advantage of using splitters is that the maximum length of cable that can be used is greatly increased.   You should not run a VGA or HDMI cable with a length of more than a few meters directly from the video output on the computer. Using the splitter the cable length can be increased up to 50m.

VGA splitters should be rated as at least 150MHz bandwidth to allow good quality display from Power Music on HD resolution screens. Never use passive VGA splitter cables, these will result in poor quality display, always use active splitters.

Splitters can be daisy chained for more efficient cabling solutions.
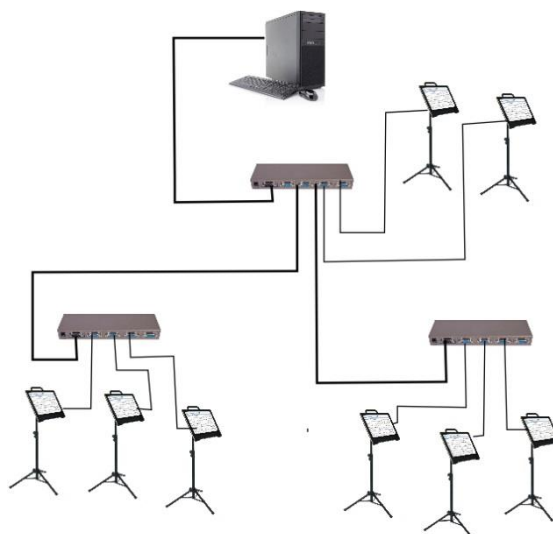
VGA/HDMI over Cat 5

A fairly recent development is the introduction of VGA and HDMI over Cat 5. Cat 5 cable is the cable used for wiring up Ethernet networks. Cat 5 cable is inexpensive, much thinner and more flexible than VGA or HDMI cable. It is terminated in an RJ45 plug.

By using a pair of VGA or HDMI to Cat 5 adapters, video signals can be sent very long distances, up to 300m, using Cat 5 cable.

VGA to Cat 5 adapters are also available with 2 outputs – acting like a 2 way splitter allowing 2 monitors to be connected to a single RJ45 output.

For a permanent installations floor or wall mounted RJ45 sockets could be installed at various places on the stage/band area and wired back to a patch panel. Monitors could then be set up, as required, by using drop leads from these sockets to the adapters and monitors.

AirTame Wireless HDMI

This technology uses a WiFi network to send HDMI video signals to monitors without the need for wires. (This is not to be confused with what are generally known as "video senders". Video senders require a transmitter connected to the PC and a receiver connected to the monitor. They use RF signals not a WiFi network and are a one-to-one system, so you cannot "broadcast" the display to multiple monitors.)

The AirTame "dongle" plugs into the HDMI socket of a monitor or TV. It also requires power via a micro-USB socket. An app must be installed on the PC used to transmit the display. This sends the display data over WiFi to the AirTame receiver. Apps are available for Windows, Mac, iPad or Android. The app allows you to configure the way the AirTame devices work. You can connect multiple AirTame device to one PC to "broadcast" the screen. The AirTame works best using full HD monitors (1920 x 1080) and over a high speed (802.11n) 5GHz WiFi network, ideally with a router dedicated to handling the display data.

This is not a low cost solution but it removes all the issues of using splitters and running VGA/HDMI cables to the monitors and it allows flexibility in the positioning of the monitors. Obviously mains power is still required!

There may be a slight delay between page turns on the PC and AirTame monitors, but using a strong, fast WiFi signal can reduce this to an imperceptible level.

USB Monitors

A alternative method of connecting monitors to clone a display is using USB monitors. These monitors are connected to the computer using only a USB cable – no mains power or VGA/HDMI. Both the video signal and the power are sent over the USB cable. These monitors are quite small 14 – 16 inch, very light and only 1366 x 768 resolution. They are not a bright as conventional monitors but are a very easy way to connect an additional monitor to a laptop or PC.

Some have VESA mounts – the AOC E1659FWU is one which has VESA.

USB3 is required for good video performance. I believe it is possible to connect multiple USB monitors using a USB hub – but I suggest you check with the manufacturer/supplier before attempting this!

USB to VGA/HDMI Adapters

The final method of connecting up multiple monitors is using USB to VGA or USB to HDMI adapters. There eliminate the need for VGA/HDMI splitters. These devices have a USB input and a VGA or HDMI output to connect to a monitor. You can plug multiple USB adapters into the controlling PC or run multiple USB adapters through a mains powered USB hub.

For use with HD resolutions monitors, USB 3 is required and a moderately powerful PC is needed (Intel i5 or above).

One of the advantages of these USB adapters is that instead of configuring them to clone the main display, you can display different desktops on each adapter. However at present Power Music does not support multiple desktops.

3: Digital Music

In this section we deal with the sources of digital music for use in Power Music.

Power Music Songs

A piece of music in Power Music is called a "Song". Power Music uses its own internal method of storing these Songs. Power Music allows several different ways of importing music into Songs. Although PDF files can be imported, music is not stored internally in Power Music as PDFs.

In Power Music a Song is the term used to describe everything in a single piece of music. A Song is a container for all the Meta data for a piece, not simply the music score or chord sheet.

A Power Music Song can contain:
- Multiple Parts – by instrument or by key (the default is a single Part)
- Multiple pages of music scores for each Part
- Multiple pages of transposable chord sheets
- Lyrics*
- Annotations per page
- Performance notes*
- Song Titles* – more than one allowed
- Author/composer* information
- Copyright information*
- Key
- Tempo
- Archive number*
- First line of lyrics*
- Melody*
- Categories*
- Libraries
- Link to an audio file – eg a backing track
- Bible references - for church music*
- CCLI number - for church music*

* All data in these fields are searchable

We will look at sources of chord sheets and sheet music in the following section.

Chord Sheets

Chord sheets can be created using the built-in chord sheet editor in Power Music. They can simply be typed in directly or pasted for another document or a web page. Powerful chord sheet editing, and formatting tools are built into the editor.

In addition, chord sheets can be imported from text files or PDF and from ChordPro (OnSong) files. And there is integration with WorshipReady.com – a web site which supplies high quality worship chord sheets (account required).

PDF Chord Sheets

There are two types of PDF files.

- PDF files which contain the TEXT of the Chord sheet, as individual characters;
- PDF files which are images or pictures of the chord sheet.

If the chord sheet you want to import is of the second type you need to perform OCR (Optical Character Recognition) on the PDF before you import the chord sheet. Otherwise you will not be able to transpose or edit the chord sheet. Power Music Professional has OCR built in.

If the PDF chord sheet is of the first type then the text can be extracted from the PDF and put into the chord sheet editor in Power Music. Some minor editing may be necessary to "line up" chords over lyrics due to the way PDF works.

Sheet Music PDF Files

Individual piece of music as a PDF file

PDF files are the most common way of distributing music scores and chord sheets. Sources of PDF files are music publishers or public domain resources like IMSLP. Musicians who compose or arrange their own music using Sibelius or Finale can export the music as PDF, then import into Power Music.

PDF files can easily be imported in all editions of Power Music. In Power Music Professional or Mac simply browse to the PDF file and import. To import PDF files into the iPad app put them into Drobox or some another on-line storage, tap the file and open in Power Music. Tools for cropping, rotations etc are available in all editions.

Power Music Professional has a tool which allows a folder of PDF files of sheet music to be automatically imported into Power Music.   Each PDF file will contain one piece of music, with the file name being the title of the piece.

For musicians with a visual impairment, Power Music lets them split the page of PDF music up into sections which can then be displayed full screen. Colour changes can be used to make to music more visible to these users.

This is a screen shot of Power Music AF, the special edition of Power Music for visually impaired musicians.

Books of songs in one PDF file

Often a complete book of music is sold as a single PDF file. The whole songbook can be imported as a single song but, this makes finding a particular song in the book difficult. To split up the book into separate songs, Power Music Professional has a tool to help achieve this.

Scanning

Flatbed scanner

To use a flatbeds canner to import music into Power Music in the Windows or Mac editions, there must be a TWAIN driver installed for the scanner. This is usually installed automatically when the scanner software is installed.

The main disadvantages of using a flatbed scanner to import your paper sheet music are:
- Getting the music, which may be in a book, to lie flat on the glass plate. Otherwise the scan will have distortions and shadows at the edges;
- The time it takes repositioning the music and waiting for the scanner to transfer the image to the computer;
- The size of the scanner usually A4, may limit scanning of larger music books.

It is important not to scan your music at too high a resolution. Many scanners will scan up to 4800dpi, but creating images at this resolution will result in very large image file sizes which may slow down page turning in Power Music. A scanning resolution of 150dpi of sufficient for screen display and results in smaller files size and faster page turns.

Music document scanner
This is effectively a camera which captures a live image of the music book placed below it.   Software for using this type of scanner is built into Power Music Professional.

If we look at the disadvantages of the flatbed scanner above, we see how this scanner overcomes them:
- It is easier to lay the open book below the scanner;
- Image transfer in instantaneous and turning the page of the music book is much quicker;
- The scanner can simply be raised up to scan any size of book.

Virtual Songbooks
These are books of music which have been converted into Power Music format and can immediately be use in Power Music. The Virtual songbooks are stored in Power Music Box and can be downloaded to any edition of Power Music. At present, a limited range of music is available in Virtual songbook format – mainly worship music from Spring Harvest (over 1000 songs) and organ and piano music from Kevin Mayhew.

Copyright Issues
Before using any music for digital display you must ensure you have the right to make and use a digital copy of the piece. Copyright law varies across countries and types of music. In the UK and USA a large proportion of worship music is covered by CCLI MRL agreements and the CCLI website gives guidance on how to be legal in your use of such music. IMSLP is a vast on-line library of Public Domain classical music.

Final word of warning – just because a piece of music is available for download on the Internet does not mean you have the right to use it! Vast amounts of music are illegally downloaded every day.

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