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# Instructions for installing, testing and using Jamulus on a Microsoft Windows PC



With additional instructions for using with  
Zoom at the same time

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“Jamulus” is software designed to allow musicians to play and sing together remotely via the Internet. It is audio only, but does not suffer from the latency (lag, delay) associated with traditional video conference systems (such as Zoom). This allows musicians to play/sing together as if they were in the same room.

These instructions are for users who are Computer “Confident” (not necessarily “Competent”), with lots of detail about the installation and use of Jamulus, but many users won’t need to read everything, so the “Quick Start Express Route” is highlighted in YELLOW throughout the document. *Supporting information is given in italics.* Your group (choir, band or orchestra) may have some “Technical Friends” available for advice and guidance, but please try DIY first.

Some people may wish to have visual contact with their fellow musicians, so optional additional instructions for using Zoom (other systems are available) at the same time are given, but note that the video and audio will not be synchronised, with video lagging behind by around 0.5 seconds.

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1. Technical requirements

1.1. Hardware

Absolutely essential

1. **Windows, Mac or Linux computer** – sorry, Jamulus is not yet available for iOS or Android phones & tablets
2. **Good broadband** (Internet) connection (see notes below)
3. **Microphone** (mic) (this could be built-in, but USB might be easier – see notes...)
4. **Headphones** (a headset consisting of headphones plus mic is fine) – note that you **MUST** use headphones with Jamulus, or you'll get screeching feedback from (a) your speakers, and (b) other users!

Highly Recommended

5. **Cable (“Ethernet”)** connection between computer & router, because although Wi-Fi does work, it can introduce extra latency and dropouts... No Ethernet port? Buy a “USB adapter”. Router not close to your computer? Buy a long “Ethernet cable” (Cat5e/6/7/8). Adapters and cables are cheap (search your usual supplier) and plug-and-play (usually...). Ask for help if required.
6. **Cable connections for microphone and headphones** (because Bluetooth mics, headphones & headsets add latency). Again, ask for help if required.

Notes

- The minimum required internet connection speed is around 400 kbps in each direction, with short ping (*c. 10ms*) and minimum “jitter” (*c. 2ms*). Various methods are available for speed & jitter testing, e.g. <https://speed.cloudflare.com> and lots of others. Look specifically at the “upload” speed. “Jitter” arises because all the individual packets of data carrying the digitised sound can arrive at irregular intervals and/or in the wrong order. Jamulus deals with this, up to a point.
- Remember that every Internet-connected device in a household might be using up your bandwidth, for updates, films, games etc., and even if you have great broadband, some of those communications might cause jitter on your Jamulus audio...
- A separate Annex to this document is available which gives suggestions for appropriate hardware (headphones, microphones, headsets, USB connection devices, Ethernet adapters & cables etc.)
- It is possible that your computer may allow Jamulus to use a built-in microphone, and/or headset/headphones plugged in to the “normal” audio jack socket, but this combination can be difficult (and sometimes impossible) to make work, whereas USB connected devices (microphones and headsets) seem to be much easier to configure, and would also leave the built-in devices free for the Zoom part of a rehearsal, if required.
- Microphone/Headset/Headphones can come complete with USB connection built-in to the wire. Alternatively, a “USB Soundcard” (search your usual supplier) could be your choice – this is small USB device that allows you to plug in “normal” (3.5mm jack plug) microphones, headphones and headsets.

- The “ear bud” headsets (with mic) that often come with a mobile phone can work, but (a) they are 3.5mm TRRS (Tip-Ring-Ring-Sleeve) jack rather than USB, and (b) the mic is fine for speaking, but often cannot cope well with singing.
- An “Audio Interface” is a piece of external (USB/FireWire connected) hardware that can handle audio better than your built-in sound card. This is more important for instrumentalists, as a way to connect their instrument to the computer. It is not necessary for a singer to have an audio interface, but having one can reduce latency, and can make it easier to connect a separate external (quality/expensive) mic. Examples of Audio Interface manufacturers are Audient, Focusrite, Behringer, Steinberg, and many others.

1.2. Software

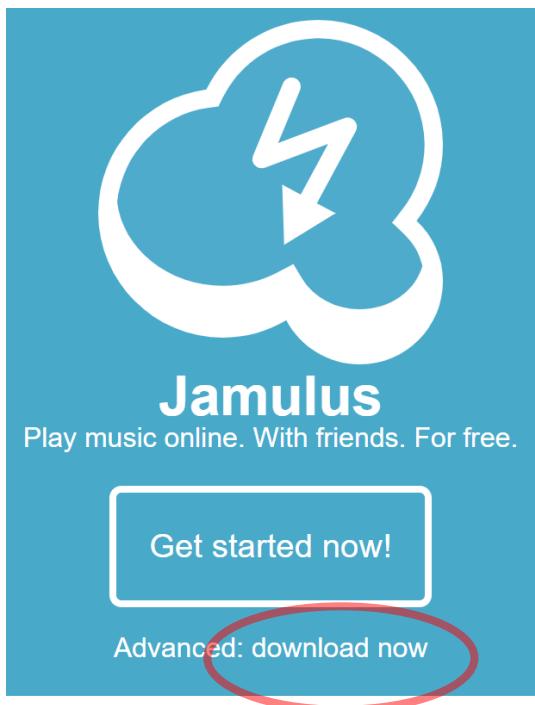
The main piece of software is Jamulus (for Windows, Mac or Linux), and for Windows an ASIO (Audio Stream Input/Output) driver is also required. The “ASIO4all” driver noted below is recommended, although your hardware may have its own driver – the two will usually play nicely together, and you can choose your favourite one during configuration.

Download & Install ASIO driver

Go to <http://www.asio4all.org/> and scroll down to “**23 MAY 2017: VERSION 2.14 RELEASED!**” just below which is a Union Jack and to the right of that there’s the link to [download “ASIO4ALL 2.14 – English”](#) then run the downloaded file to install the ASIO4ALL driver.

Download & Install Jamulus

Go to <https://jamulus.io/>. Near the top of that page, you should see:



Click on the link that says “**Advanced: download now**” and your download will start automatically from the well-known and trusted “Source Forge” site (where most Open Source software resides), having given a brief countdown. Problems/resolutions include:

- Source Forge is sponsored by adverts, so don’t get drawn into clicking anything in those adverts, including any “DOWNLOAD NOW!!!” or suchlike – the official download should start automatically

- If the download page prompts for cookie acceptance, then just do your usual thing, but note that the download may fail the first time, in which case just back to <https://jamulus.io/> and try again
- If you still have problems, try going to <https://sourceforge.net/projects/llcon/> and look for the big green “download” button:



Run the downloaded file to install Jamulus itself. (Once you have completed the download and found the file to install you can close your browser windows.) Jamulus may appear to your computer to be unsafe or suspicious because it doesn't have the same certifications as commercial software. You will need to override these safeguards to continue with the installation, but the mechanisms for doing this vary across systems, so are outside the scope of this document.

2. Setting up Jamulus

The instructions and screenshots here are based on Windows. The various Operating System flavours of Jamulus (Windows, Mac, Linux) look similar, although Mac and Linux will need to navigate different routes instead of the ASIO4ALL mechanisms shown here.

2.1. First Time – Setting to Work

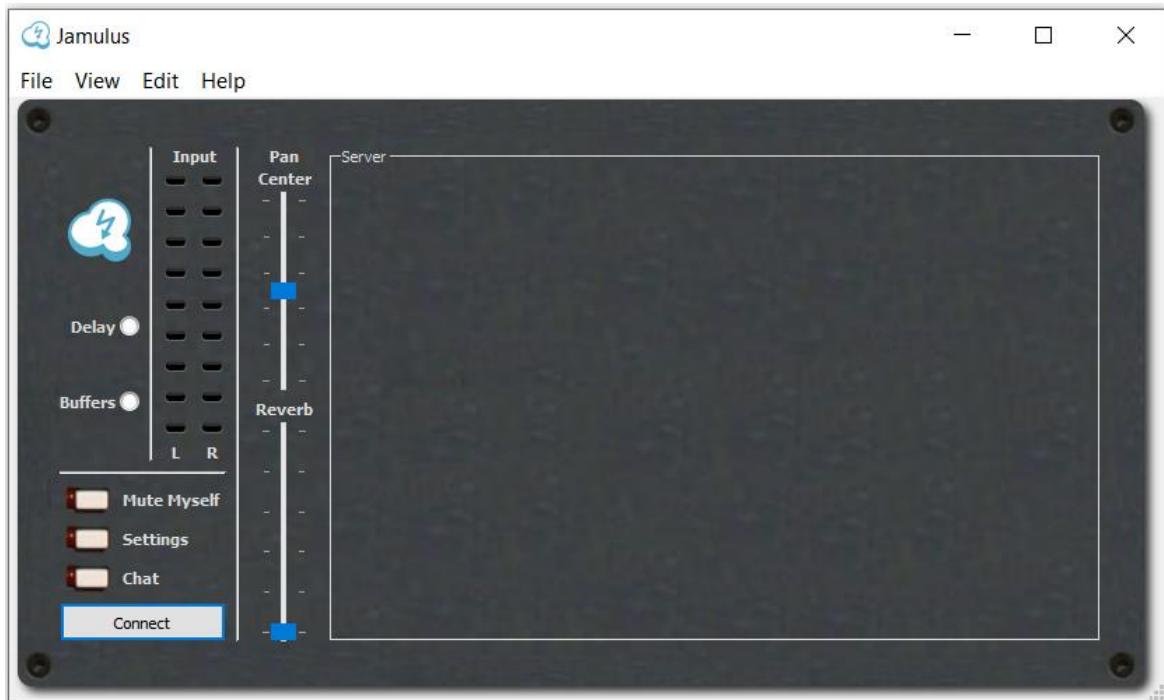
First plug in your Headphones/Headset/Mic!

NOTE: If you DON'T have your chosen equipment plugged in BEFORE YOU RUN JAMULUS then you run the risk of it all going horribly wrong... for instance, if you plug in your USB device AFTER you've started Jamulus then ASIO4ALL will NOT see your device, and you must close Jamulus and start again...

NOTE: If you have separate mic and/or headphones to plug in, either to built-in ports or a USB device, the associated jack sockets are often colour coded:

- Headphone socket: usually **GREEN**
- Microphone socket: usually **PINK**

Once you've got things plugged in, **run Jamulus (NOT “Jamulus Server”) by double clicking its desktop icon or via the Windows “Start” menu etc.** Your system may warn you that your Firewall has blocked access for Jamulus. You will need to override these safeguards to continue to use Jamulus, but the mechanisms for doing this vary across systems, so are outside the scope of this document. Once Jamulus is running you should see a window like this:



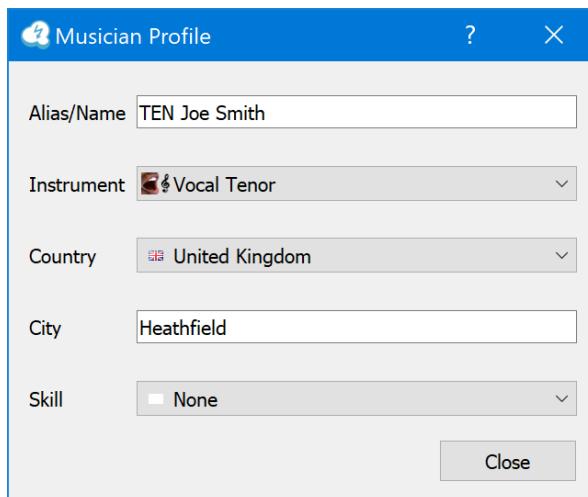
This is the main Jamulus window, which will start off with a blank area named “Server” (in which “sliders” will appear later when you get connected – **this will be your own personal mixing desk**). The various items on this window will be covered later.

The “First Time Only” tasks are:

Setup your profile

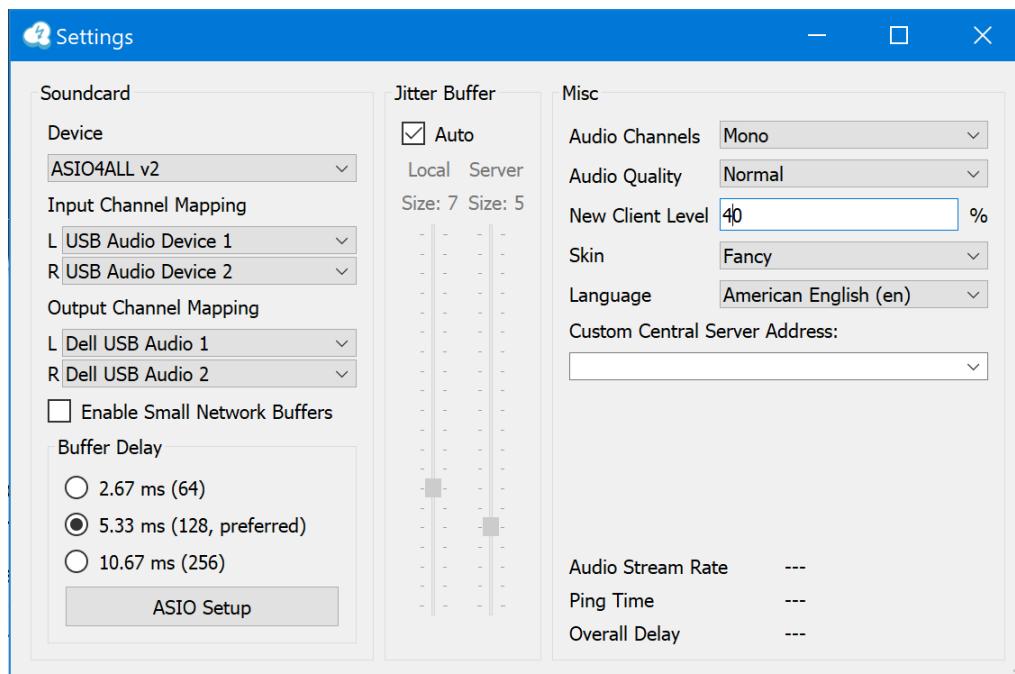
In the menu bar at the top of the main window, click View and then **My Profile**:

- The group may wish to make it easy to identify members, so for singers it is suggested that you type in your name preceded by the 3-letter abbreviation for your voice part in capitals (SOP, ALT, TEN, BAR, BAS) e.g. “TEN Joe Smith” or “SOP Joanna Smith”.
- For “Instrument” choose the voice part or instrument that fits you.
- Set your country so that the national flag icon appears correctly by your name.
- Leave the Skill level as “None” for now – other levels change the colour of your name box in the mixing panel which might be confusing when starting out. Your profile will now look something like this:



Audio Settings

Click the “Settings” button on the main Jamulus window to open the settings window:



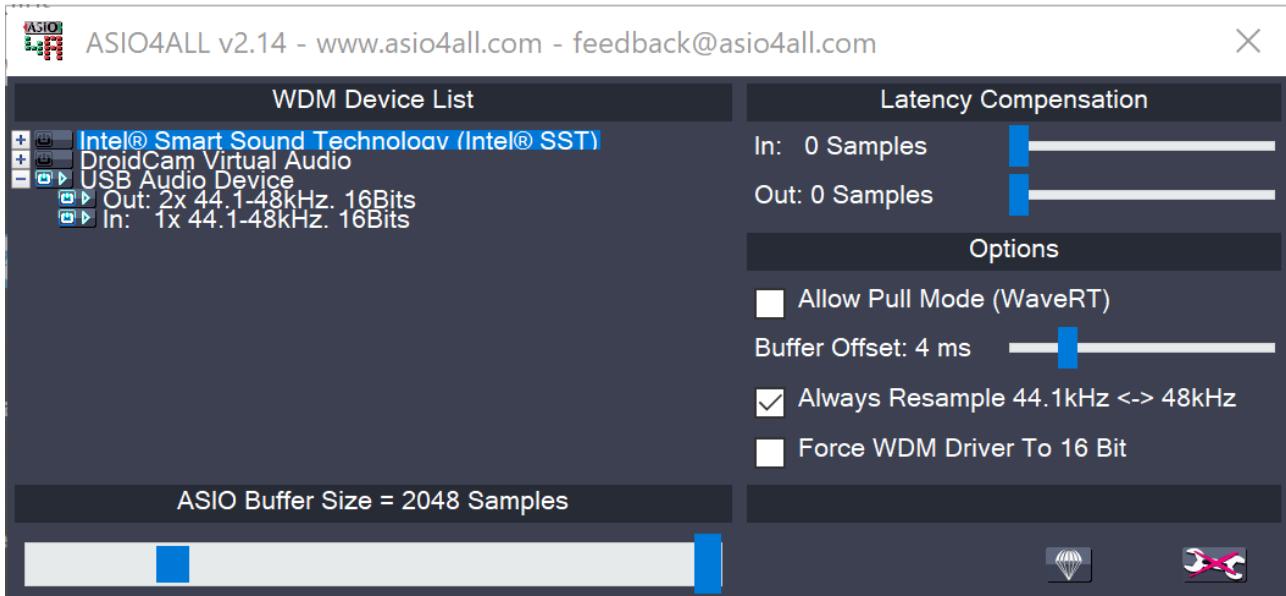
The default settings will, in general, be correct, except:

- **Audio Channels:** set to “Mono” (this keeps bandwidth use to a minimum)
- **New Client Level => 40** (this will save your ears in an emergency...)

The settings should then look like the picture above, with the possible exception of the Soundcard Device... and now comes **the trickiest bit of the configuration process...**

Under “Soundcard Device” you can **choose the ASIO driver to use**. If you have advanced hardware with its own ASIO driver then you can choose it here, and you’re then on your own (although ask for help if it’s troublesome!). For everyone else, **the device should be set to ASIO4ALL**, and we proceed as follows...

Click the “ASIO Setup” button (bottom left of Jamulus settings window), which opens the ASIO4ALL driver control panel, then **click on the white spanner** (bottom right of the ASIO4ALL control panel) and you’ll get something like this:



In the case shown above all is well – the computer’s built-in audio card happens to be an “Intel” device, but because, as recommended, a USB Headset/Headphones/Microphone has been plugged in, ASIO4ALL has selected the appropriate output (headphones) and input (mic). **The blue/green triangular icon to the left of the item’s name indicates it’s (probably) working ok, and the rectangular box-like icon to the left of the triangle shows that it’s selected (the icon is a tiny “power” button).** The example shows two devices (“Out” and “In”, corresponding to Headphones and Mic) as being “on” and “working” within the overall USB device, which is also “on” and “working”, but your system may vary.

If you are trying (for instance) to use your built-in mic instead of a USB device, then at this point you need to click on any “+” signs shown down the left side, to display the entries for the various devices on your system. You can then select (click the “power” button so it lights up) or deselect devices to leave you with only the ones you want. Further details on this kind of configuration are beyond the scope of this document, but “Technical Friend” help may be available.

Problems with any specific device or part thereof show up as either a red cross, or a yellow marker:



In this case, the “On” button for “DroidCam” is not lit, so it’s not selected for use, so it shouldn’t interfere, whereas an attempt to use the Intel device(s) listed is likely to be doomed.

It's easiest to end up with just the input (microphone) and output (headphones) that are right for your system, in which case the Jamulus Settings window will not give confusing additional options. However, if you enable multiple devices in the ASIO4ALL control panel then they will in turn show up in the Jamulus Settings window, and you will have to select appropriate devices therein.

The picture below shows an example where a single “in” (Intel Smart...Microphone) and a single “out” (Out:2x48kHz) are enabled and (apparently) working, and their parent device(s) are also enabled and working:



Your experience will almost certainly look different, but the basic idea still holds – ensure that one “In” and one “Out” (and their parents) are enabled and working.

If you can’t get to this state then first have a look at the Troubleshooting section at the end of this document, or you may need help from one of your Technical Friends, but if all seems ok then close the ASIO4ALL driver control panel. You can leave the Jamulus Settings window open for the moment, as it may provide useful information, or close it if you wish.

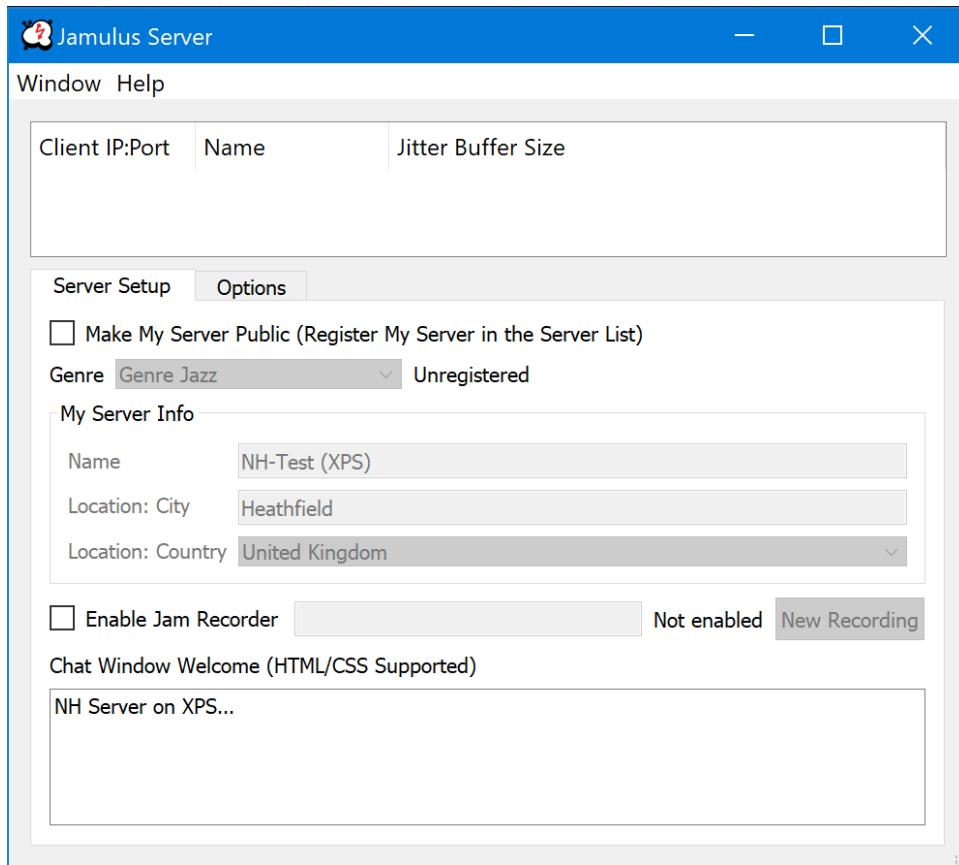
Congratulations on reaching this far on your own! At this point you have the choice of being adventurous and testing your own setup, or you can contact a Technical Friend so they can guide you to an appropriate server to test your setup. Decide now...

2.2. Testing your own setup

So, you're being adventurous? Ok...

Start your own server

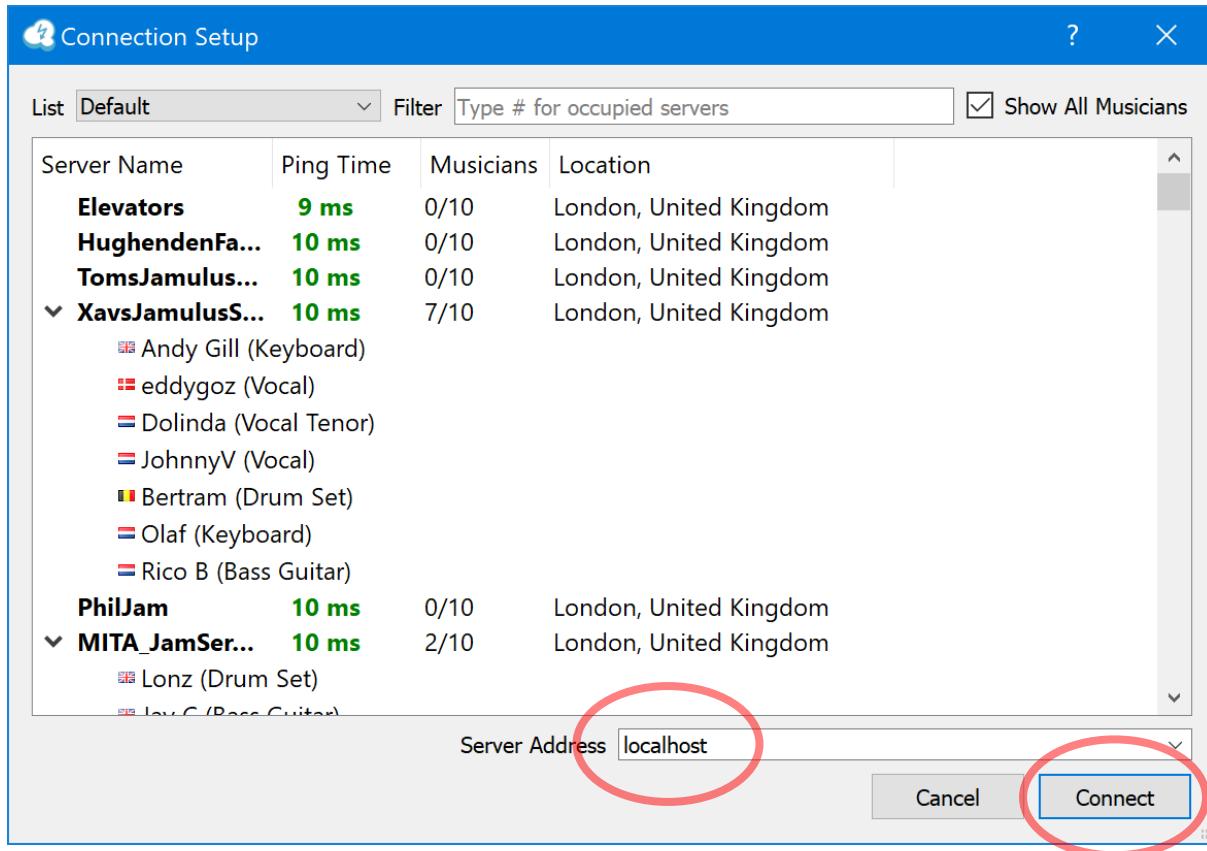
On Windows, the Jamulus installation includes a Start Menu entry to run a local Server. Run this, and you'll get something like:



The Name, Location and Country will be blank, but for test purposes that's fine. Do NOT make your Server "Public".

“Join” your own server

In the main Jamulus window, click Connect. You’ll get a window like the one given below, and in the Server Address box type “localhost” (without the quotes) like this:



Then **MAKE SURE YOUR HEADPHONES ARE PLUGGED IN** (they should be already!) and then...

...click the “Connect” button on this window (not the one on the main window). This connects you to a server running on your own machine. Open the Settings window from the main Jamulus window, and you’ll see that things like Ping time have been populated with lovely numbers for your delectation.

Test your audio

Speak into your microphone and you should (a) see the light bars on your Mixing Desk (main Jamulus window) move up & down, and (b) hear yourself in your headphones.

Congratulations, you’re up & running!

When you’re finished click the “Disconnect” button at the bottom left of the main Jamulus window, and close that window.

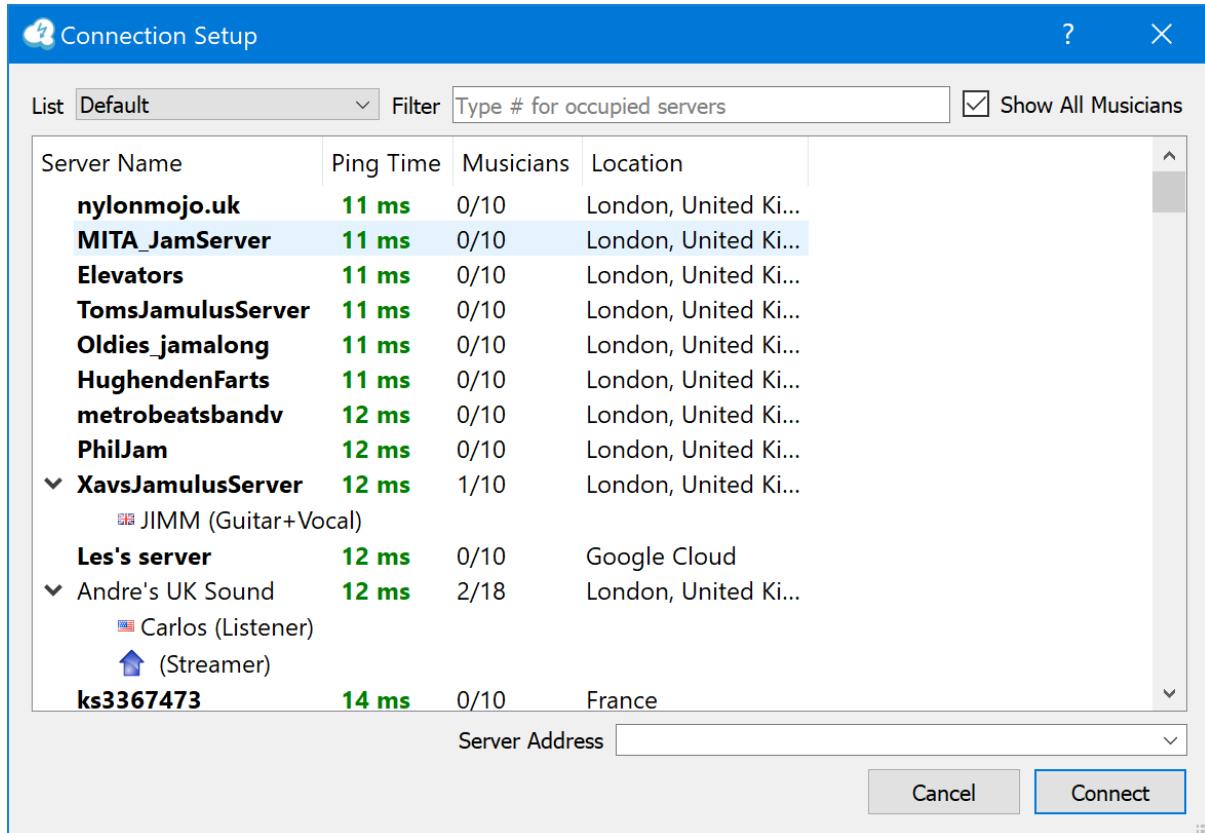
At this point it would be a good idea to test your system with someone else – contact your Technical Friend for details.

3. Using Jamulus “for real”

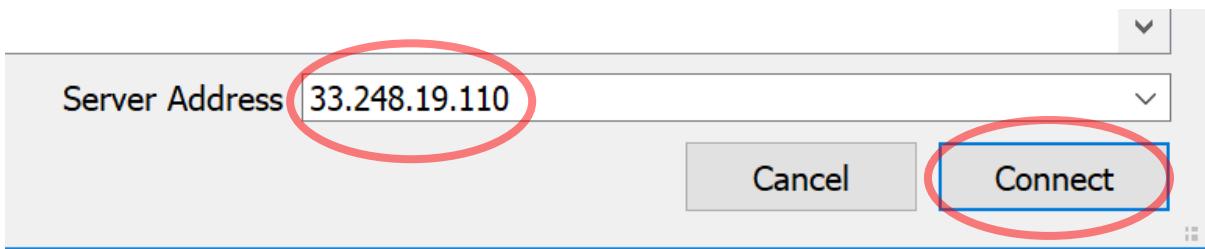
In theory you could join any server, anywhere in the world, and join in the music-making with the people already there. By all means try if you like! For normal use, you “Join a server” as follows:

3.1. Joining a Server

Click the “Connect” button in the main Jamulus window. This will show a list of available Public Servers:



If your group is using an entirely “private” server then you will be given an IP address (e.g. “33.248.19.110”) to type in to the Server Address field, for instance:



Once you’ve typed in the IP address, press the “Connect” button at the bottom of that window (not the “Connect” button in the main Jamulus window). The Connection setup window will disappear and you will instantly be “in the room” with your fellow musicians.

Jamulus also has the concept of a “Central Server” which simply lists the individual “Jamulus Servers” that are publicly available. A number of Central Servers are available on the “List” dropdown box, generally categorised by “Genre” such as “Genre Jazz” or “Genre Classical/Folk/Choral”, however group organisers often find that the “proper” genre for their

activity is full, so they simply choose another Genre. If your group is using a Public Server you will be told the details so you can choose the correct Genre then click to select (highlight) the correct Server, then press the “Connect” button at the bottom of that window (not the “Connect” button in the main Jamulus window).

Note that once you've connected to your designated server, the “Connect” button in the main Jamulus window changes its name to “Disconnect”, ready for the end of your session. The Chat window will probably automatically open – more about that later.

The main Jamulus window will now show an entry for each person in the room, with a volume slider for each – this is your own personal mixer desk, so you can vary the volume of each person that you hear (but this does NOT affect what other people hear – they each have their own “mix”). Here's an example of what the window might look like:



3.2. Your Own Mixer Controls

Mixing sliders

Each person in the room is allocated to an individual mixing slider. These sliders control the sound that you hear – they have no effect on what other people hear. For instance, if a certain tenor is bellowing loudly, just move their slider down to give a more optimal experience for yourself. Or even mute them altogether with the “MUTE” button below their slider. Power!!!

NOTE: To the left of each slider is the volume (loudness) of that person, shown as a set of green lights, with two red lights at the top. If the green lights dance up & down with the occasional single red light in the loud bits, then they are providing a perfect feed to the server, and hence to you. If the second (topmost) red light comes on that means that they are “clipping”, i.e. going beyond the maximum volume. Note that your own slider’s lights reflect your “Input” volume lights, which are the two vertical rows of lights towards the left of the main Jamulus window, with the word “Input” above. Keep an eye on your own “Input” – if it’s too low people will have difficulty hearing you properly, and if it keeps clipping then you’ll sound horrible. Change the distance between your mouth and the mic to control this, and/or use the Windows Sound controls to help. Details are beyond the scope of this document.

NOTE: At the bottom, under each person's slider, is their name, the flag of the country they're in, and an icon representing the instrument/voice they selected in their Profile. The colour of the name box corresponds to the skill level they chose when setting up their profile. Hover over a box to see a popup summarizing their information.

Pan Dial

There may be a Pan dial above a slider to allow you to change where the person's sound comes into your headphones. For example, if you're singing alto in a quartet, you could put the tenor on one side and the soprano on the other. If you hold Shift and click on a Pan dial, it will reset to equal L/R balance.

GRP Button

This allows you to assign a participant to a "Group" (e.g. all Sopranos in Group 1, all Altos in Group 2) so that changing the volume on one of that group changes them all together in one fell swoop.

Mute Button

Use the Mute button on a person's slider to mute just that person, just for you. For example, maybe someone with too big a delay is screwing up the tempo for you, in which case you could mute just them to try to stay together. If you're hearing yourself echoing, you can use the "Mute" button or slider in your own column to remove or reduce the sound of your own voice in your headphones.

Solo Button

The "Solo" button can be used to listen to just one participant, or a set of participants if each one is set to Solo. If a disruptive sound is coming from somewhere, you could Mute or Solo people one by one till you identify the culprit. It's also possible to Solo multiple people at once. For example, you might Solo the accompanist and all your colleagues of your voice. The flipside is that you won't hear anyone else until you either Solo them as well, or turn off ALL of the Solo buttons. Be careful not to leave Solo on when you're done, because when you return to that room, the program will remember who you previously set to Solo and do it automatically, so you'll have to clear it to hear others. You can clear all previous Solo and Mute decisions with a command under the Edit menu to Clear All Stored Solo settings.

Mute Myself

The "Mute Myself" button in the bottom left is used to stop sending your sound to the server. Use this when the dog barks, the phone rings, or you have a sneezing fit. This is NOT the same as using the Mute button that lives with "your" slider – that merely controls how much of your own voice you hear in your headphones.

3.3. Other Items on the main Jamulus Window

Moving people around on the Mixing Desk

To get all the singers on the same part together on the screen, go to Edit => Sort Users by Instrument. Within a single voice part, the singers are listed in alphabetical order. Other groupings and layouts are available under the Edit command and the "GRP" button described above.

NOTE: As the number of participants grows you may wish to widen the main Jamulus window (usual Windows "grab the edge of the window" controls). If you still need more width, try going to Settings and change the "skin" from "Fancy" to "Compact". This reduces the width of each "slider", but also changes the way that "clipping" (noise is too loud!) is shown. Your choice.

Delay and Buffer lights

The Delay and Buffer lights tell you how well you'll be able to synchronise with other people in the group. Green is good, yellow is fair, red is bad (but even if it's red, keep going!).

Other Controls

The “Pan Center” (sic), “Reverb” and “Left/Right” sliders/buttons are best left alone.

3.4. The Chat Window

The Chat window allows the person hosting the server to put in an automated welcome message telling you something about the server. You can also use the chat window to communicate in text with all the participants in the room, as long as they are paying attention to the chat window. Use the “Chat” button in the main Jamulus window to show/hide the chat window. If you send a chat message, it will be visible to anyone in the server, when they open their chat window. There is no private chat with single individuals. Hyperlinks to https sites are functional in the chat window.

3.5. Settings

Once you're in a room and you can hear other people, now is a good time to look at your Settings. If it's not already up (an orange light showing next to the button) click on the “Settings” button in the bottom left of the main Jamulus window to bring up the Settings box. In the bottom right of the Settings window the audio stream rate, ping time, and overall delay are displayed, and lights (green, yellow, red) will give an indication of how “good” your “jitter buffer” and “delay” are – your organiser may want you to look at these to help diagnose problems.

3.6. Tips & Hints for Singing in a Jamulus Room

When you're actually singing, try to drive the beat forward, and don't listen for pickups and other people's entrances. If you do try to listen for others, the tempo will just get slower and slower because of the latency.

Try not completely muting your own return sound. Yes, it's annoying to hear your echo, but if you can sing ahead of the beat such that your return sound is lining up with everybody else's sound, then you are actually singing in time, because that's what you sound like to everyone else when they're hearing your sound coming to them from Jamulus.

And when you're all finished with Jamulus, please remember to click the “Disconnect” button at the bottom left of the main Jamulus window, and close that window.

4. Using Zoom at the Same Time as Jamulus

One excellent solution is to use a separate device for your Zoom session!

You'll need to **mute your Zoom microphone, and turn your Zoom speakers down to zero** (if your device won't let you go all the way down, the Zoom settings might let you...)

But if you want it on the same device as Jamulus then...

You'll need a fairly "capable" machine, and don't be surprised if you get some strange "artefacts" on your sound (in both directions), especially if you're doing extra activities like moving windows around the screen.

It may not be possible to get Jamulus to use your built-in microphone at the same time as Zoom wants to use it, in which case you'll need a "USB Headset" of some sort. The style is a matter of personal choice (over-ear, on-ear, single sided, long/short boom etc.), but the good thing is that 99% of USB Headsets will play nicely with Jamulus.

Many combinations of Zoom plus Jamulus are possible. One route to try on a Windows Laptop, using USB Headset for Jamulus and "built in" microphone & speakers for Zoom, is as follows:

1. Boot up laptop (USB Headset **NOT** plugged in)
2. Run Zoom, join the meeting
 - a. Join with Video
 - b. Join with Computer Audio
 - c. Chat with people if required, then when ready...
 - d. Change the View (top right) to "Exit Full Screen" (so you can see Jamulus controls!)
 - e. **Mute Zoom microphone**
 - f. **Turn (Zoom) speakers right down to zero.** If your speakers won't go all the way down on your machine's controls, you may be able to control them from within the Zoom app
3. Plug in USB headset into the USB port on the PC (always use the same USB port, as Windows remembers the settings!).
4. Check USB Headset levels (if you've plugged in to the correct socket these should be ok every time!):
 - a. Right Click on Speaker icon in the Windows System Tray, bottom right of screen, then click on "Sounds" which brings up the "Sound" window...
 - b. On the Recording tab, double-click "Microphone USB Audio Device" (or whatever your device is called), then Levels tab, ensure mic setting is 90, then OK.
 - c. On Playback tab, double-click "Speakers USB Audio Device" (or whatever your device is called), then Levels tab, ensure speakers setting is 90, then OK. (Any "Microphone" setting on this window is immaterial.)
 - d. OK out of the Sound window
5. Run Jamulus
 - a. Click "Connect"
 - b. Connect to your designated server (see earlier instructions)

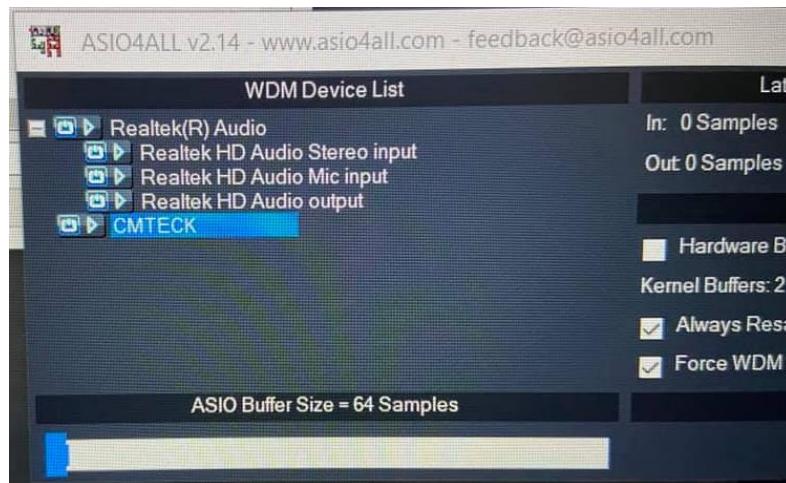
- c. Use the sliders on the main Jamulus window to set the volume of other people
- 6. You're in!!!
- 7. All your sound will be coming via Jamulus – your Group may route sound from Zoom to Jamulus by magic, so you hear (a) Zoom sound (e.g. Our Leader's voice and/or backing track or accompanist), and (b) all other Jamulans. Your voice is routed to all other Jamulans, but (unless your Group works yet more magic) NOT onto Zoom.
- 8. When finished with Jamulus just click Disconnect on the main Jamulus window, then close the window. Similarly if Jamulus “goes wrong” then close it and run & connect again as above.
- 9. If Jamulus fails permanently, close it down, and go back to Zoom – leave yourself on mute, of course, but turn up your speakers. Ho hum...
- 10. When all finished, and you've closed Jamulus, you can remove the USB Headset from the PC if you wish. You may wish to return your speakers to an appropriate level for your next non-Jamulus usage.

5. Troubleshooting

5.1. Getting the right Active Mic

"My external mic is not recognized by Jamulus even though it works in other programs"

The most common Windows problem is not having the correct active microphone or speaker. In Jamulus Settings, click ASIO Setup. One user with this problem had these settings:



The two Realtek input devices in the indented list are the computer's built-in microphone. His Jamulus was not recognizing his external mic. When he tried disabling those two inputs – so that his external microphone (CMTECK) was the only available input device – he reported that it fixed the problem:



If (on Windows) you want to check that your microphone is working at all, go to Start => Control Panel and select "Sound". On the Recording tab, check that:

- Your microphone exists as one of the entries. If not, try unplugging & plugging it back in.
- Your microphone shows "dancing bars" when you speak into it. If not, double-click it to get Properties, and check that the recording level isn't zero or such like. You could go to the Listen tab, tick the box for "Listen to this device", set the "Playback through this device" to your headphones, click the "Apply" button, and see if your mic now relays your voice to your headphones (and don't forget to untick the "Listen to this device" box and Apply, before you leave!)

Good luck!