Skills unofficial guide for remote use of the

THINKLABS ONE

digital stethoscope

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CONTENTS

TITLE	PAGE

All the guidance, ideas and suggestions included in the content of this guide are intended to inform readers about how to use their Thinklabs One digital stethoscope in a patient's own home or Care/Nursing Home or frontline NHS or care setting. While every effort has been made to include accurate and up to date information, knowledge and understanding of use of such a digital stethoscope is constantly evolving and being updated. So use the content of this guide to learn more about how you can adopt or enhance your use of this mode of digital stethoscope and weigh up the choices, information and guidance for your own circumstances. You should adhere to national requirements relating to IT and cyber security, clinical safety, data quality, use of patient data, data protection and privacy, and information standards.

This is an unofficial guide collating our experience of setting up and using the Thinklabs One digital stethoscope – and content has not been approved by the Thinklabs company. The guide collates the experiences of the co-authors in supporting other clinicians and carers to use the Thinklabs One digital stethoscopes at the frontline with their patients.

About the authors:

Rachel is national programme manager for digital upskilling of general practice nurses

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The authors would like to thank Dr Thanh Phan, consultant cardiologist and Rosemary Cage, quality nurse - Royal Stoke University Hospital- for their contributions and support.

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INTRODUCTION

The aim of this guide is to support your knowledge and practical skills in using the Thinklabs One digital stethoscope competently for the benefit of your patients via remote consultation. It is likely that the clinician or carer (or maybe student) will be initiating the capture of heart sounds or breath sounds whilst they are in person-to-person contact with a patient- maybe in their own home or a Care/Nursing Home. They will then place the digital stethoscope in relation to anatomical landmarks on the front of the patient's chest or their back; siting will be crucial for the effective interpretation of the outputs from the device by the clinician receiving the recordings that are then sent to them.

GETTING STARTED

To record and send sounds from the digital stethoscope you will need to download a suitable app to your smart phone/tablet.

There are a number of applications that can be used with the Thinklabs One digital stethoscope to record and send the sounds such as the Thinklabs Wave app (available on the android play store/apple IOS store)**, voice recorder app, WhatsApp etc.** There are a number of third-party apps that are compatible but may have costs.

NOTE: The Wave app allows you to visualise heart and lung sounds on both apple iPhone and tablets and android devices. If you have an apple device it also allows you to record, edit, save and email sounds and images and notes; however this feature is not available on android devices.

There are other apps available on the android play/IOS app store that provide many features suitable for phonocardiography, recording, teaching, sharing stethoscope sounds around the bedside or classroom; however whilst some elements are free, others must be paid for.

The WhatsApp Messenger can be used for the recording and transfer of heart/lung sounds and is free on both android and iOS platforms. It allows you to record heart or lung sounds and instantly send them directly to a recipient in your contacts, allowing you to get a second expert opinion in seconds.

To turn the digital stethoscope on, simply press and hold any button until the LEDs in the display illuminate. Connect the stethoscope to earphones via the earphone jack on the side of the device to use it. Adjust the frequency using the buttons on the stethoscope until optimum clarity is achieved (these are the top left button). Place it as you would a regular stethoscope – look at Figures 2 and 3 for the landmarks of the body upon which you should place your stethoscope when listening to a patient's heart and breath sounds.

To record – the device will need to connect with either a smartphone or tablet with a jack plug. If your smartphone or tablet does not have the right jack plug use the converter in the pack provided. If you are using a newer model of smartphone you may need to purchase a separate adapter. Use the black monitor box (shown below) to connect the stethoscope to a smartphone / tablet as in Figure 1.

GETTING CONNECTED

Figure 1 – Getting connected

earphone connection

connection to smartphone / tablet

connection to stethoscope
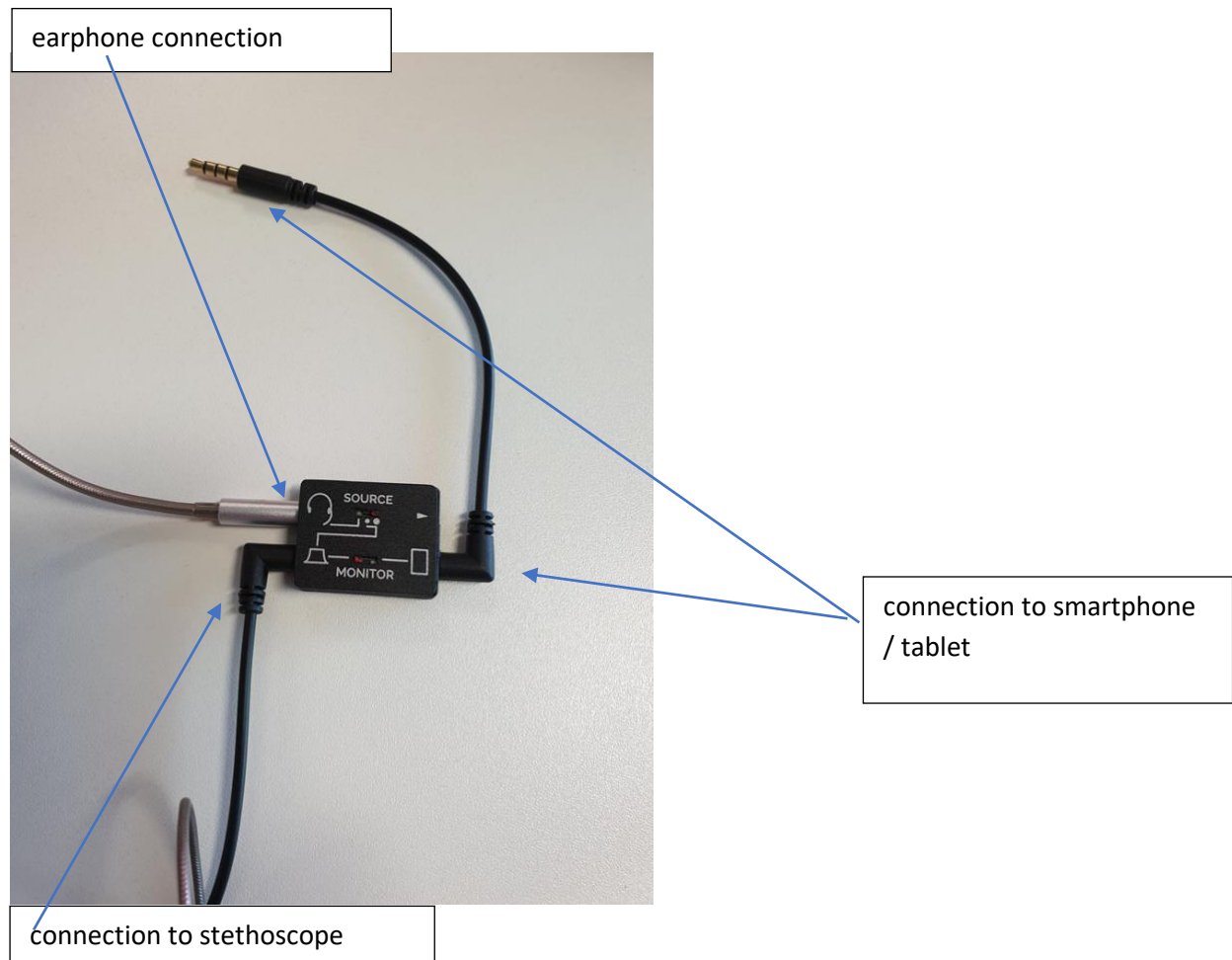
Connect the monitor box (Thinklink) to the stethoscope using the cable (one end in the monitor box and the other into the headphone jack on your smart phone / tablet). Move the monitor switch to the left – as in Figure 1.

Connect the earphones to the monitor box. Move the top switch (*source*) to the middle / far right position (when using the app, the far-right position works best / when using a voice recorder middle works – this will depend on the device though) as in Figure 1.

The centre position reduces the signal level to the mobile device. This is usually necessary, since the Thinklabs One digital stethoscope is usually too loud for most recording devices. You may also find that reducing the stethoscope's volume level to a 0 - 2 range is necessary during recording, to reduce clipping and distortion.

(Note that you can record from a headset microphone by switching the *source* switch to the left position. This will connect your headset microphone to the mobile device input, rather than connecting One as the audio source. This can be useful for dictating voice to annotate recordings. You must be using headphones that have a built-in microphone to perform this function.)

Connect the phone/tablet to the monitor (Thinklink) via the right-hand jack plug – see Figure 1. Open the app (e.g. Thinklabs Wave/WhatsApp/voice recorder) on your device.

Once you have identified the heartbeat/lung sounds and can hear clearly through the earphones (adjust frequency as required using controls) click record in your chosen app – you will see on the phone / tablet display what is being captured. You can record for as long as required.

Playback: to play back recordings and listen to your recording device via the headphones, set the monitor switch to the right (mobile).

Save the recording – for patient date security purposes we would recommend that you save the recording with no identifiable patient information – e.g. use term 'patient 1' and once you have sent the recording via email / chosen method, delete the recording from the device.

Sharing the recording- once the recording is complete you can share this instantly – click the *share* icon on the app and then you have the option to email/share via email or your instant messenger apps if you have used a voice recorder on your device (e.g. WhatsApp Messenger which is an encrypted end to end/ messenger).

If using a voice recorder click the share symbol (usually available in the menu – three dots in the right-hand corner) and options on how to share will appear on your device. Please select the most appropriate. If emailing to your NHS account, you will need to have a default email set up on the device (this may not be an NHS email).

If the person taking the patient's heart and/or lung sounds has an apple phone that can transmit sounds live to the remote clinician using the stream function. The remote clinician needs the PIN given by the sender (that PIN comes up on the stream) and can then access the recording(s) in real time. If the sender has an android phone they can transmit the recording; but they should go to the play store, access *Thinklabs Wave* (the app that should have already been downloaded on the sender's phone) – click on the icon and it asks '*What's New?*'. A click on that message triggers the *Thinklabs Live* link which then gives the functionality to transmit live heart and/or lung sounds to the remote clinician. An alternative is for the sender to record the sounds in usual way that they would do with other audio recordings and email them to the remote clinician, alerting the clinician that they are ready to review.

VOLUME CONTROLS

Volume control: the LED illuminated on the volume scale indicates the currently set volume. To increase the volume, press the button that corresponds with the + sign. To decrease the volume, press the button that corresponds with the - sign. It is recommended that people with normal hearing do not exceed a volume level of 4 - 5.

Using the digital stethoscope with hearing aids. The ability to use headphones means that the headphones can be worn over hearing aids. With the standard 3.5 mm jack, the digital stethoscope connects to any headphones and because it has over 100x amplification it is loud enough to compensate for hearing deficits. Further information regarding the use of the digital stethoscopes with hearing aids can be found at https://www.thinklabs.com/hearing-aids.

The Thinklabs One digital stethoscope can be directly connected to any headphone/earphones of your choice or you can connect them to a Bluetooth transmitter and have a wireless setup. The digital stethoscope does not have built in Bluetooth so if you want to do this you will need to attach a small Bluetooth transmitter to the headphone jack.

Please note, if you wear hearing aids that have Bluetooth capabilities, the sound quality may not be as good due to the limits of the sound amplification of the hearing aid.

MAINTENANCE OF THE THINKLABS ONE DIGITAL STETHOSCOPE

Wearing Thinklabs One digital stethoscope: Thinklabs One is easy to wear - much lighter and smaller than a conventional stethoscope.

Charging Thinklabs One is simple. Just plug the USB charger that's included with your digital stethoscope into the 3.5mm jack plug socket. One uses a rechargeable lithium ion battery that allows for around 4 hours of continuous listening (that should serve approximately 100 -125 patients) per charge. Battery level is indicated by a strobing LED light on the 1-10 scale when the unit is turned off manually. You can use the stethoscope again after just 30 minutes of recharging.

A thorough charge cycle can take as long as eight hours, however your One will have almost full capacity within four hours. The One operates on AC voltages worldwide and has a voltage range of 100 -240V, using a US-style flat-pin plug.

When charging, the Battery LED will flash. As the battery charges, the flash rate will slow. When the battery is fully charged, the LED will be on and stop flashing.

Battery life is estimated to be about 100 - 125 patients, depending on how long you keep your digital stethoscope on for and the loudness. Our tests, running the One at quite a loud volume, indicated battery life lasted for about five hours of continuous use.

Cleaning the digital stethoscope: it can be cleaned with most alcohol and bleach wipes that are commonly used, including: alcohol wipes, Cavi-Wipes, Sani-Cloth Plus and Dispatch.

Manual shut off: to turn the stethoscope off manually, simultaneously press and hold the *alt* and *minus* keys. You will see the LEDs scrolling from 0 to 10 on the volume scale and then the stethoscope will shut off.

CONNECTING THE THINKLABS ONE DIGITAL STETHOSCOPE TO EXTERNAL DEVICES

If you're connecting to an audio input jack or a microphone input, you can use one of the male-male 3.5mm cables provided with your Thinklabs digital stethoscope. Plug one end into the stethoscope and the other into the input jack of your device.

If you're connecting to a device with a *headset* jack (i.e., it provides both microphone input AND headphone output in one 3.5mm jack), use the monitor/Thinklink, which provides switching to facilitate changing the direction of signals - from the stethoscope to your device for recording and from your device to your headphones for playback.

Filter settings: the Thinklabs One digital stethoscope allows you to listen with multiple frequency filters simply by pressing the *filter* button (top left with audio jack facing right). You can even set two filters that you use most often as *favourites* making them super-fast and easy to select. You can do this by holding down the top left button (when the headphone jack faces right) until the LEDS are at the correct frequency and then release. This is similar to using the bell and diaphragm modes on a conventional stethoscope.

The filter choices on the Thinklabs One range from very low frequency sounds, like heart sounds (low-pitched sounds such as S3), to higher frequencies such as lung sounds. The

lowest frequency is a strong version of the bell mode but the next setting above is also very good for heart sounds and is a less intense version if preferred. The higher frequencies are more useful for lung sounds and removes lower sound frequencies and is similar to the diaphragm mode on a normal stethoscope.

The Hz scale on the stethoscope display indicates the filter range selected. LEDs on the left side of the scale indicate lower frequencies will be reproduced; LEDs on the right indicate higher frequencies will be reproduced. The more LEDs that are on, the wider the range of frequencies, the narrower the indication, and the narrower the range of frequencies.

In addition to filter settings, you can change the frequency response by applying pressure on the diaphragm. As you push on the diaphragm, the *gap* in the sensor changes, which modifies the sensor's response to lower frequencies.

USING THE THINKLABS ONE DIGITAL STETHOSCOPE FOR A CLINICAL PURPOSE

Heart sounds that you can hear by listening with a stethoscope reflect the turbulence that occurs in the blood flowing through the heart when the heart valves snap shut. The first heart sound heard **(S$_1$)** is the *lub* which represents the atrioventricular valves (bicuspid & tricuspid valves), closing. The second heart sound **(S$_2$)**, the *dup*, is shorter but louder and represents the semi-lunar valves (aortic & pulmonary valves) closing.

The most common abnormal heart sound is a heart murmur. A murmur is a blowing, whooshing, or rasping sound that occurs during the heartbeat. An abnormal murmur in adults is usually caused by problems with the valves separating the chambers of the heart. If a valve doesn't close tightly and some blood leaks backward, this is called regurgitation. When a valve has become too narrow or becomes stiff, this is known as stenosis. Other abnormal sounds include:
- galloping rhythms
- clicks or short high-pitched sounds
- rubbing sounds.

A *murmur* or any other abnormal heart sounds may be an early indicator of a serious heart condition. The patient may not previously have noticed any outward signs or symptoms or may have experienced:
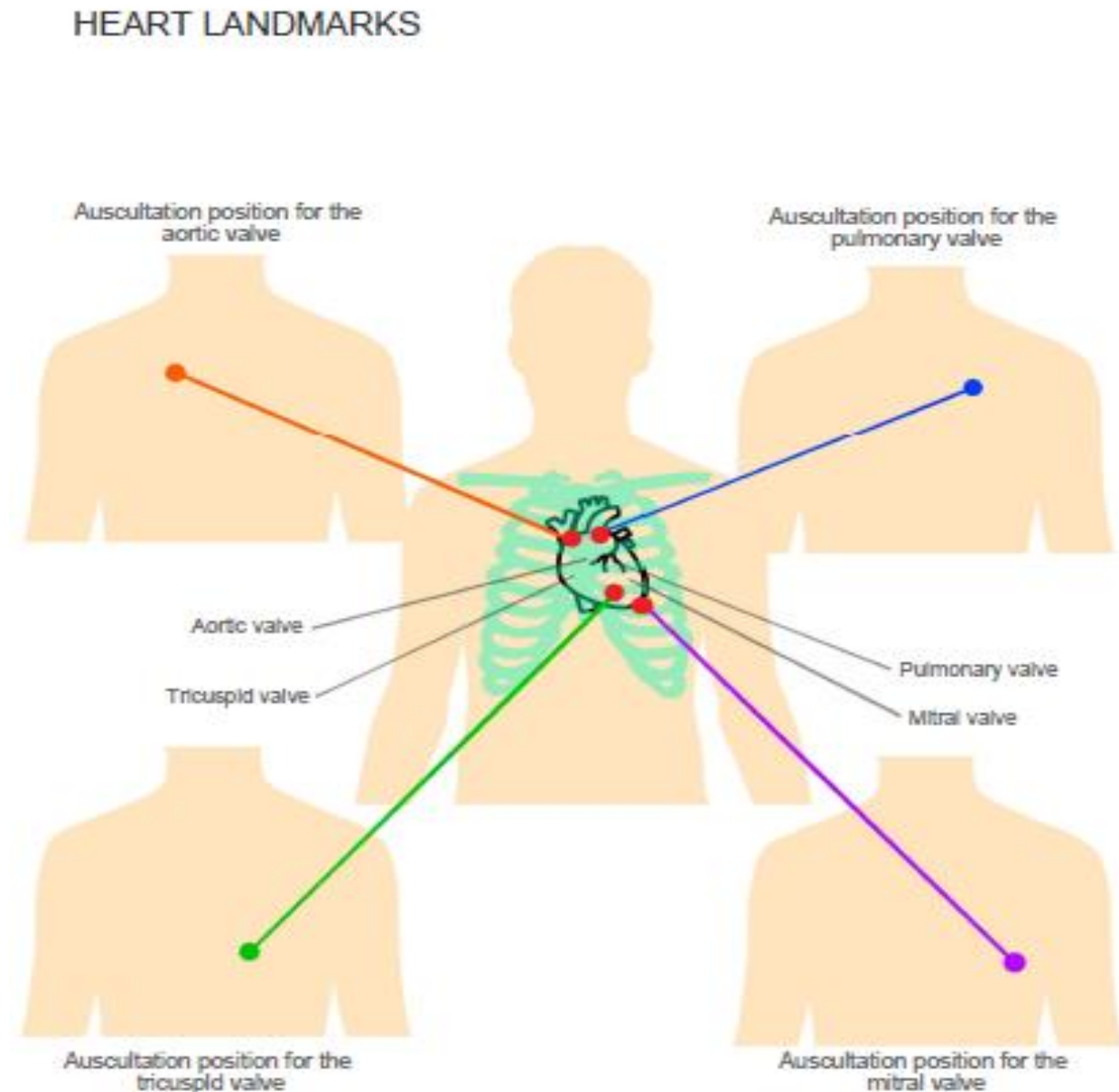

- chest pain
- shortness of breath
- dizziness / fainting
- heavy sweating after little exertion
- blueness on the lips or fingertips (cyanosis).

HEART SOUND LANDMARKS

Here are the landmarks where you should place the device onto the patient's chest in order for it to pick up the sounds effectively and accurately. Bony landmarks are used to locate these sites.

Figure 2 Landmarks upon which to position your stethoscope for examining the heart

HEART LANDMARKS

Auscultation position for the aortic valve

Auscultation position for the pulmonary valve

Aortic valve

Tricuspid valve

Pulmonary valve

Mitral valve

Auscultation position for the tricuspid valve

Auscultation position for the mitral valve

FLOWCHART FOR A HEART EXAMINATION

(by person in face to face contact with patient)

Explain to the patient how the examination of their heart will be conducted by you; and how you will link with the remote clinician and transmit their heart sounds securely and their identity will be pseudoanonymised. Their continuation of the examination with the digital stethoscope will be taken as implied consent.

General Inspection: Look for peripheral oedema and cyanosis, any clubbing of the fingers and any brown lines along the nails. Record the patient's radial pulse and see if it is regular. If any of these are present report this to the clinician overseeing the virtual examination of the patient.

Palpate the apex beat and check that it is regular and check for any thrills or heaves. Then check for any thrills (vibrations) in all four valve areas (see Figure 2).

On the positions of the chest highlighted in Figure 2, place the diaphragm of the stethoscope on the patient's chest (or the bell for the mitral valve) and press record on your app. If you hear any murmurs or other odd sounds highlight this to the overseeing clinician when sending over the recordings.
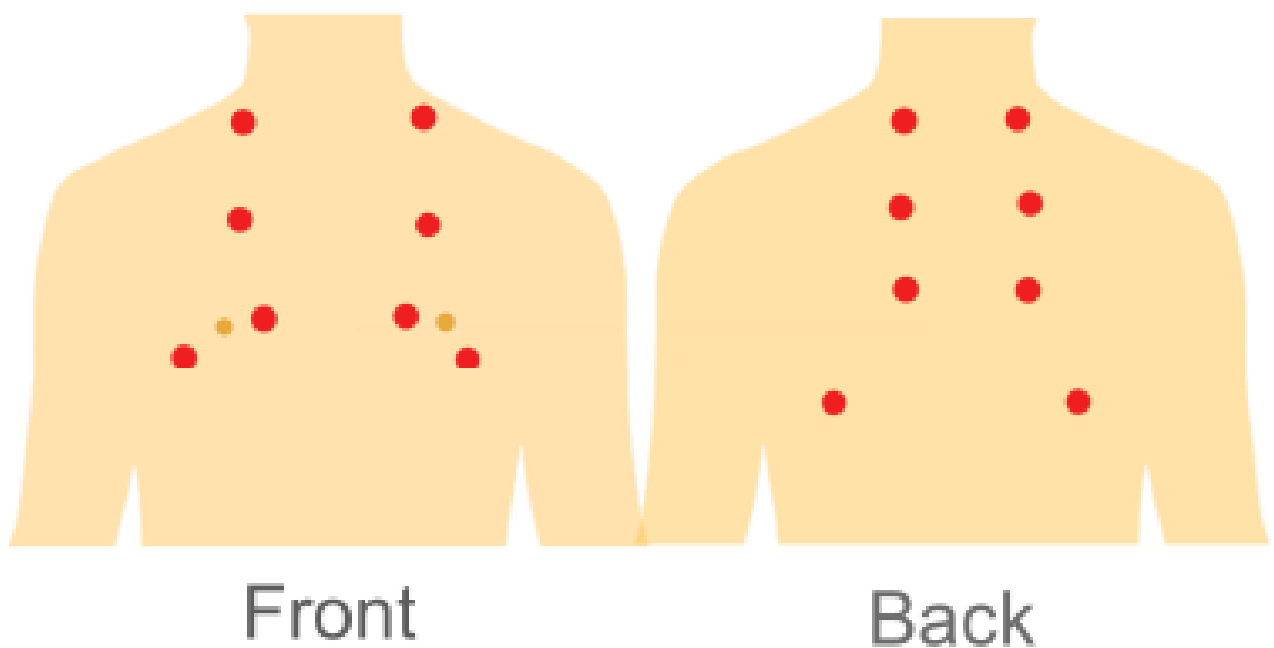
Send the recordings to the responsible clinician and any notes that you have made of bodily signs and symptoms. Check with the clinician later that the recordings have been received and are clear enough for the clinician to be able to make an intelligent clinical assessment.

LUNG SOUND LANDMARKS

Figure 3 Landmarks upon which to position the digital stethoscope for examining the patient's lungs

LUNG LANDSCAPE

Front   Back

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FLOWCHART FOR A RESPIRATORY EXAMINATION

Explain to the patient how your examination of their lungs will be conducted by you; and how you will link with the remote clinician and transmit their respiratory sounds securely and their identity will be pseudoanonymised. Their continuation of the examination with the digital stethoscope will be taken as implied consent.

⬇

General Inspection: Look for cyanosis (blue lips/fingers), wheeze,
flail chest, any scars and looking for clubbing of the fingers which can be useful in indicating certain respiratory problems + oxygen saturation level if possible.

⬇

Palpate the patient's trachea- warn the patient beforehand that is may be uncomfortable. Use your middle finger to gently go down the trachea to make sure that it is central – report any abnormal push or pull to the overseeing clinician.

⬇

Assess the patient's chest expansion from the front and the back.   Watch to see that the chest expands equally on both sides. If this is not the case report this back to the overseeing clinician.

⬇

On the positions of the chest highlighted in the diagram place your hand on the patient's chest and tap your middle finger and listen to the sound.
If the sound is not hollow report this to the overseeing clinician.

⬇

Send the recordings to the responsible clinician and any notes that you have made of bodily signs and symptoms. Check with the clinician later that the recordings have been received and are clear enough for the clinician to be able to make an intelligent clinical assessment.

TIPS & Views and tips from clinicians who have tried Thinklabs digital stethoscope

Dr Poonian (GP):

"I use WhatsApp to send recordings or email. They are sent as sound files.

The software I use to hear heart sounds is the programme Audacity."

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Dr Thanh Phan (consultant cardiologist):

"The best digital stethoscope on the market to record clinical signs and to electronically share with other health professionals – potentially a game changer for remote consultations in the era of digital health and social distancing."

xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx

Dr Jack Aw (GP):

"I use the digital stethoscope to compare what I am hearing and my interpretation of heart sounds with other practitioners – as teaching aid."

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APPENDIX 1 – Anastassia Volkov (clinical pharmacist digital champion) shares her experience of using the Thinklabs One e-stethoscope

The kit provides all the cables and connections to connect the stethoscope to iPhones, iPads, Android devices, computers, digital recorders and so on.

You can record sounds from One to your recording device (iPhone, iPad etc.) while listening via headphones. You can then listen to your recordings via the headphones. Thinklink allows you to do this with a simple connection configuration. Simply switch between recording or playback on the Thinklink switch.

Your One becomes an external microphone to your mobile device. It can therefore work with almost any app. Note, however, that the quality of recordings or stethoscope sounds depends on the device you are using, as well as the app.

Recording

To record, set the monitor switch to the left (monitor One).

Set the Source switch to the centre or right position. The centre position reduces the signal level to the mobile device. This is usually necessary, since the One is usually too loud for most recording devices. You may also find that reducing One's volume level to a 0 - 2 range is necessary during recording, to reduce clipping and distortion.

Note that you can record from a headset microphone by switching the Source switch to the left position. This will connect your headset mic to the mobile device input, rather than connecting One as the audio source. This can be useful for dictating voice to annotate recordings. Note that you must be using headphones that have a built-in microphone to perform this function.

Connections

There are four jacks on *Thinklink* - two on the left, two on the right. The arrows (>, <) show their positions. Follow the connection steps very carefully:

Before you start:
a. Set the SOURCE switch to the MIDDLE position.

b. Set the MONITOR switch to the left.

(1) Connect your headphones to the upper left jack.

(2) Connect Thinklabs One to the lower left jack via the long male-male cable supplied with your One.

(3a) Plug a short 3.5mm male-male right angle connector or short cable to the lower right jack (3). Do NOT connect to iPhone or iPad yet.

(3b) Turn on your Thinklabs One and set to a medium volume. Make sure all switches are set correctly.

(3c) Launch the Thinklabs stethoscope app on your iPhone or iPad. If needed, download the app and start these steps again.

(3d) Once the app is running, and the One is on, only now must you plug the connector or cable you plugged into jack (3) into your iPad or iPhone. AS YOU PLUG IT IN, a message on the upper left corner should say *headset*. This tells you that the iPad or iPhone is recording from your One, rather than recording from its built-in mic. If the message instead reads *built-in mic*, unplug from the iPhone/iPad and try again and if it doesn't want to cooperate, turn up the One and tap on the diaphragm as you plug it into the iPad/iPhone. (What's going on is that the iDevice makes up its own mind as to whether to use *built-in mic* or external, and the only way to coax it to use external is to have a sound signal active AS the plug is inserted.) Please note that other users have found similar issues and similar solutions with their android phone as Anastassia has described here.
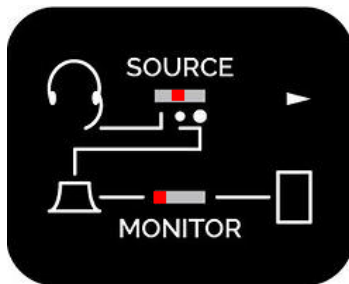
To headphones (1) >

Thinklabs One (2) > (3.5mm malemale)

< PC Mic Jack
(Not required for mobiles) From

< (3) To mobile device headset jack

(Right angle connect /short 3.5mm cable)
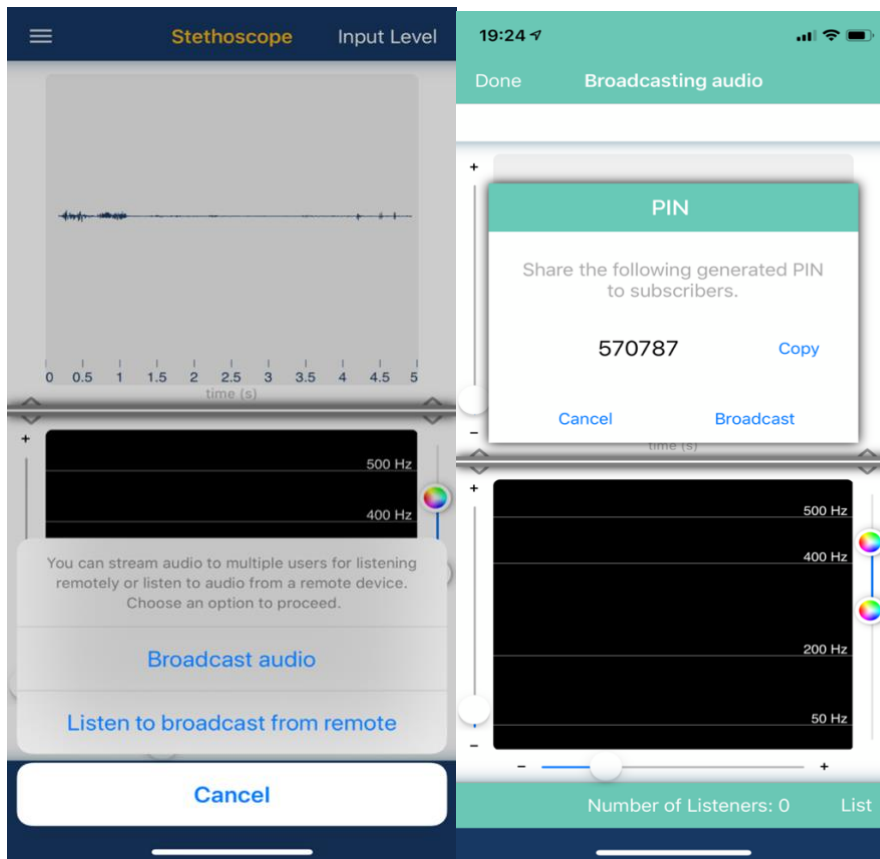
Thinklink - Playback
To playback the recording and listen to your recording device via the headphones, set the monitor switch to the right (mobile). Adjust the volume on the playback device itself.

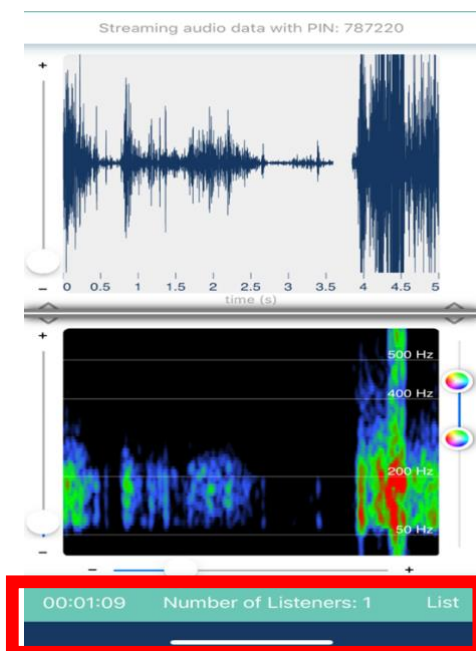© Rachel Hatfield, Gabrielle Johnson, Kevin McGibbon, Dr Ruth Chambers, Anastassia Volkov   June 2020

To stream/broadcast audio on the Thinklabs Wave app on the main screen at the right bottom corner you will need to press the **stream** icon.
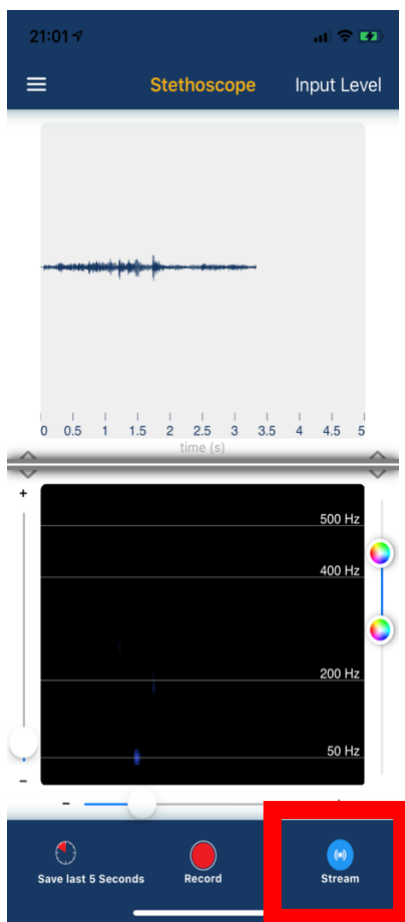

If you are sending sounds (examining the patient) press *broadcast audio*. Wait until you will see the PIN number on your screen. Ask the receiver (who you are asking to assess sounds) to open the Thinklabs Wave app and press *Listen to broadcast from remote*. Share the PIN number with the person receiving the recording. You can have more than one listener at the same time, as long as they put in the same PIN number.

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You will be able to see how many listeners are connected on your screen.
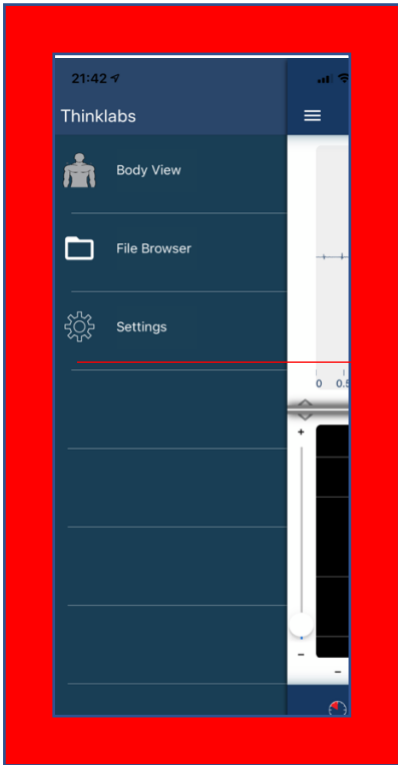

Using the same app you can also record your sound if the receiver is not available at the moment and then share the file as an email, text or WhatsApp message. To record the file press *record* at the middle bottom of the screen. Once you have recorded the sound and you are happy with the quality you can save the file and name it; by default it will be recorded by the date and time of the recording and will be organised in files.
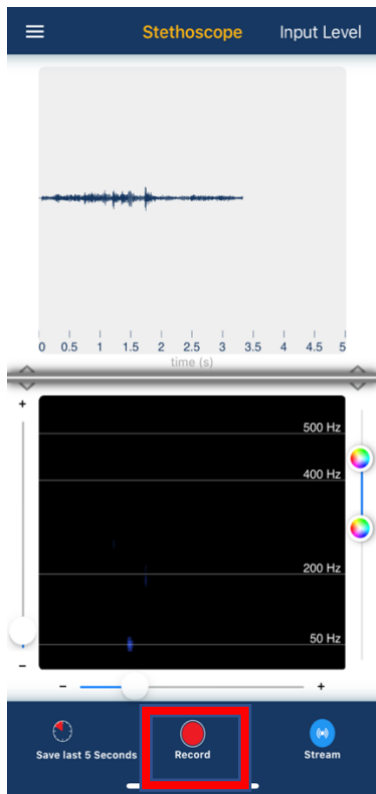
To see saved files press the top left corner of the screen. You will see the options: *body view*, *file browser*, *settings*. All saved files will be located at *file browser*.

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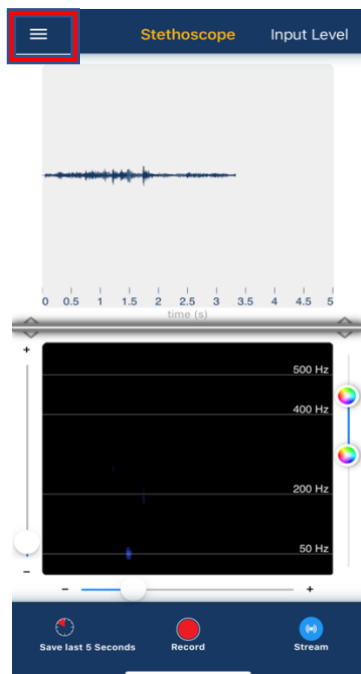
To share the file, choose the needed file from the list. You can play it before sending. To share press *share* in the bottom right corner, then press option *share recording*, then you can choose the option on your device - email, text message or any other suitable option.
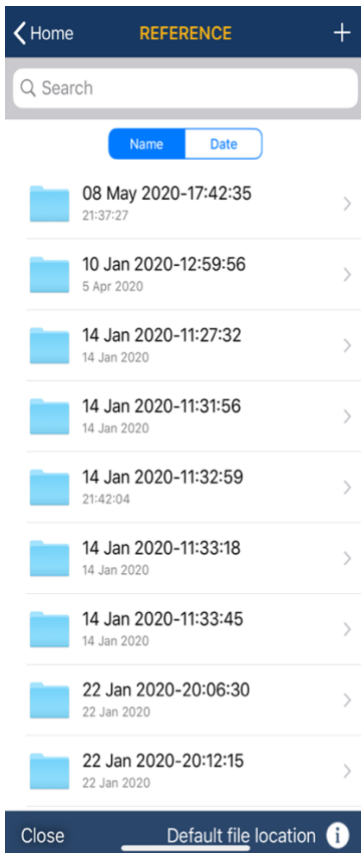
If you have one of the latest iPhone versions, you will need to buy the iPhone lightning to 3.5mm headphone jack adapter to use the earphones.

Overcoming any obstacles

To reduce ambient sound making skin contact will provide you with the best sound quality. If you do listen to the patient's heart or lungs through their clothing, avoid listening through thick garments. Consider the volume level and don't over-amplify it if you don't need to. Lower level sounds are sometimes better but check that the diaphragm is not loose if there is too low a sound problem.

Appendix 2 Thinklabs One - USB Computer Connection & Setup © Thinklabs 2018 - Instructions for USB Connection 1-1

This section of this guide has been relayed from the Thinklabs USA company's technology support resource. Thus the Macbook illustrated here carries a USB-C (not the usual USB type A) so it will need a converter. This section of the guide should help you to connect your Thinklabs One digital stethoscope to your PC or Mac computer via USB ports. While there seem to be many steps involved in the setup, most of the steps are just Windows or Mac settings that you do once.

FURTHER INFORMATION

Further information about using the Thinklabs One digital stethoscope can be found at www.thinklabs.com

USB Connection Option 1 - Recommended
Monitor stethoscope sound directly via audio splitter

When to use
If you're using headphones only for listening to stethoscope, can use loudspeakers to hear provider in a remote telemedicine encounter, and don't need to listen to stethoscope recordings from the PC.

Pros
> Simple. Always works. Stethoscope volume is louder.

Cons
> Can only listen to stethoscope on the headphones. Cannot hear computer audio such as videoconference or audio playback of recordings.

USB Port

Audio Technica
ATR2USB
USB audio device

Thinklabs
3.5mm 4- Conductor
male-male plugs

OR

3.5mm extension cables
(straight or spiral cable)

3.5mm stereo
audio splitter

Earbuds -
Optional for listening
to stethoscope.
(Recommended to ensure
that stethoscope is held
correctly with no movement.)

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USB Connection Option 2 -
Monitor stethoscope sound via USB headphone jack

When to use
If you need to hear *both* stethoscope sound and a remote provider *via headphones* during a telemedicine videoconference i.e. you do not have loudspeakers to hear provider, or you need to listen to PC via headphones.
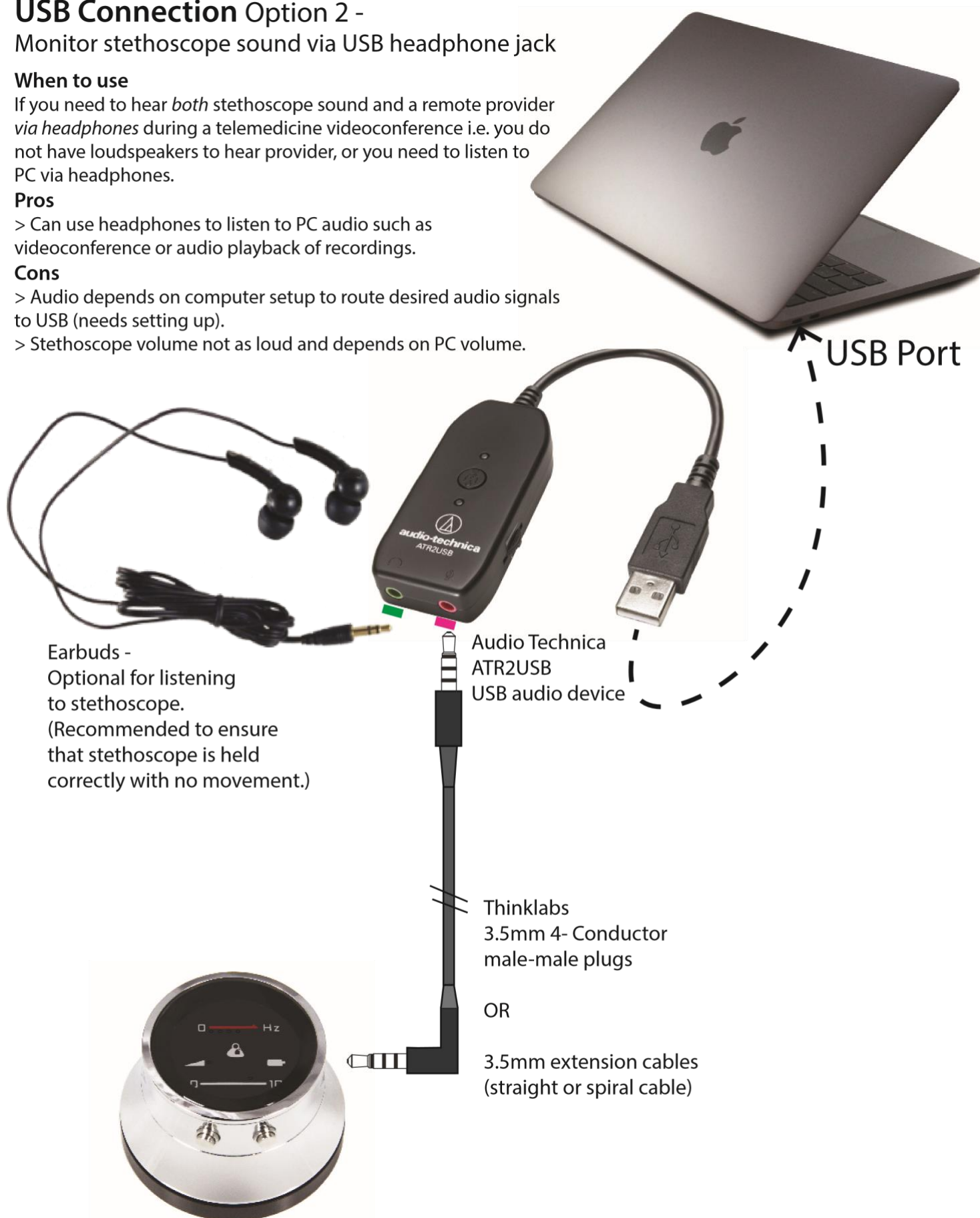
Pros
> Can use headphones to listen to PC audio such as videoconference or audio playback of recordings.

Cons
> Audio depends on computer setup to route desired audio signals to USB (needs setting up).
> Stethoscope volume not as loud and depends on PC volume.

USB Port

Earbuds -
Optional for listening
to stethoscope.
(Recommended to ensure
that stethoscope is held
correctly with no movement.)

Audio Technica
ATR2USB
USB audio device

Thinklabs
3.5mm 4- Conductor
male-male plugs

OR

3.5mm extension cables
(straight or spiral cable)

Setting Audio Levels - PC Windows

First, make sure your hardware is connected as shown on the Computer Connection instructions for Windows.

1. Open the Windows control panel.
(Can be found via Windows search function.)

2. In the Control Panel window, Select Hardware and Sound.

3. In the Hardware and Sound window, select Sound.

4. In the Sound window, select the Recording tab.

5. In the Recording tab window, select the ATR2USB Microphone. (This is the input connected to the Thinklabs One stethoscope.) Then click the Properties button.

6. In the Microphone Properties window, select Levels.

7. Push any key to turn on your Thinklabs One stethoscope. Then adjust volume to 3 or 4 out of 10 on the Volume scale.
(This is merely a starting volume level.)

8. Place the Thinklabs One over the heart on a patient (or yourself) to listen to heart sounds. (If you have headphones connected, listen to the sounds while adjusting):

9. Adjust sound levels for optimal result - not too low, not too high.
Total volume = Stethoscope volume + Microphone volume. You can adjust both stethoscope and Mic settings. To adjust Mic, make sure you're in the Levels tab (step 6). Adjust slider to 10~25 to start, and click OK. The Sound window will show vertical volume bars peak during heartbeats. Now alternately adjust stethoscope volume and click Properties to adjust Mic slider until volume bars reach about 75% of maximum during a peak beat.

If listening to headphones at the same time, try to adjust the One so that headphone volume is at a comfortable level, and then change Mic volume to achieve the ~75% peak level. This balances listening volume and computer setting.
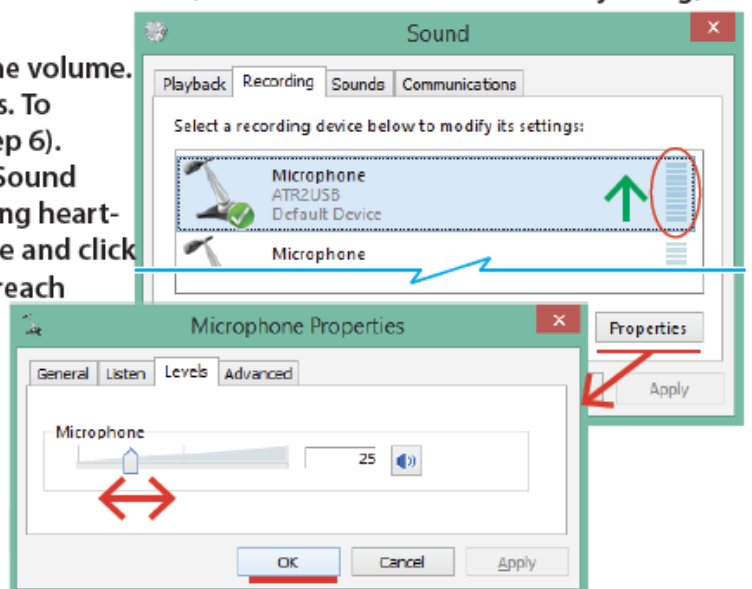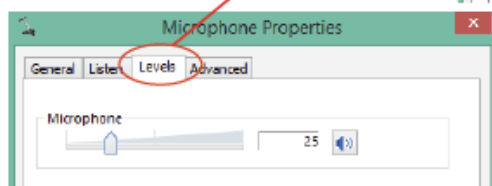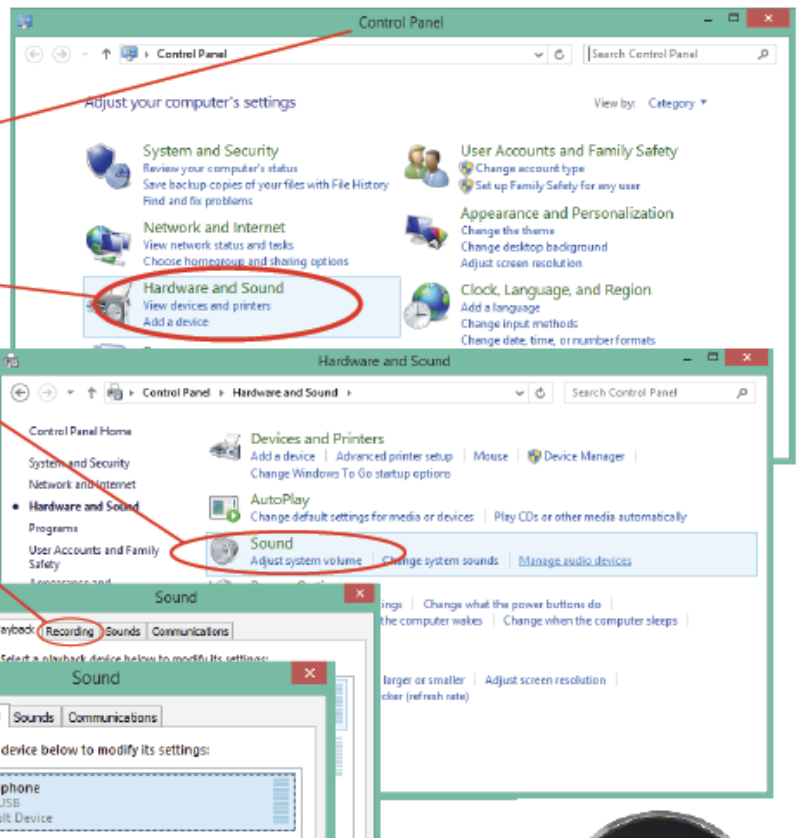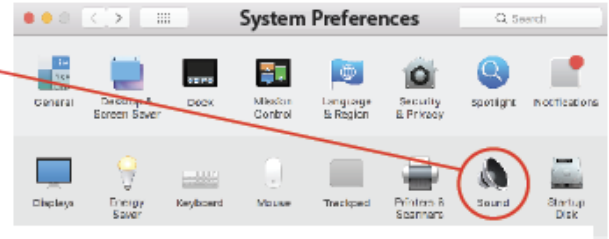
Setting Audio Levels - Mac OSX

Before commencing this procedure, make sure your hardware is connected as shown on the Computer Connection instructions for Mac. Then follow these instructions:
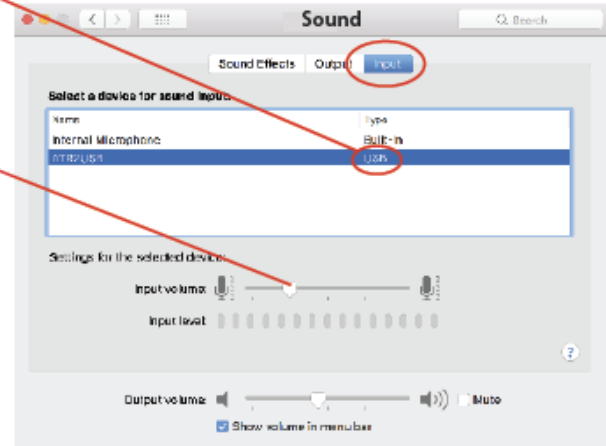
1. Click the icon in the top left corner of your display and select **System Preferences**:

2. Click in the top menu bar: . When the window below opens, select **Sound**:

3. Select **Input** from the top menu tabs, to show the input devices on your computer. One of the hardware devices should be the USB audio device. *(The exact Name will depend on the specific USB device brand and model.)*:

4. Adjust the Input Volume slider to the midpoint position as a starting point.

5. Push any key to turn on your Thinklabs One stethoscope. Adjust the volume to 3 or 4 out of 10 on the Volume scale. (This is merely a starting point.)

6. Place the Thinklabs One over the heart on a patient (or yourself) to listen to heart sounds. If you have headphones connected, listen to the sounds while adjusting as follows):

7. Adjust sound levels to get the best result - not too low, not too high.

The Total volume = Stethoscope volume + Input volume. So you can adjust both stethoscope volume and Input volume slider and many combinations of the two levels can provide good results. If you're listening on headphones, you may want to first adjust stethoscope volume to a desired level and then adjust Input level.

The Input level scale will help you set the optimal level. During the peak of a heartbeat, the ideal level is about three quarters of maximum on the scale. Avoid allowing the levels to reach the maximum since this will cause distortion and "static" sound. However, avoid setting signal levels too low during peaks. See the FAQ (page 6) for recommendations.

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Sound Levels and Connections - FAQ

Q: What is the "optimal" level for balancing stethoscope volume and the Input Volume setting on the computer? It seems that I can increase one and decrease the other and still get about the right level, so what's best?

A: If you're listening to headphones while placing the stethoscope on the body to monitor the stethoscope sounds, especially when using an audio splitter, the volume to your headphones is determined by the stethoscope volume only. You will therefore want to first set the stethoscope volume so you can hear the stethoscope well on the headphones. Then, adjust the Input volume setting on the computer so the sound level is just right - not too high to cause clipping and not too low such that you cannot see the volume bars jump over halfway on the scale.

Q: What do you mean by "clipping"?

A: An audio signal is a waveform with peaks and troughs. There are signal amplitude limits in any electronic system, and if the maximum or minimum peaks in a waveform hit those limits, the signal peaks are "clipped", as shown here. Clipped signals tend to sound "scratchy" or sound like "static" during the peaks.
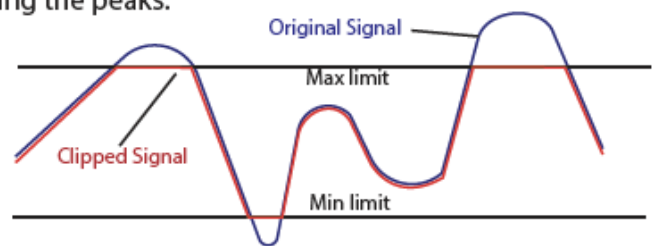
Q: You show headphones plugged into a USB device or into a splitter, so there are two ways to connect. Which do you recommend?

A: We recommend using the splitter so the headphones are connected to the stethoscope as directly as possible. This is best for basic recording. For videoconferencing (such as live telemedicine), you will want to hear the stethoscope AND the remote provider (doctor, nurse etc). We recommend routing the videoconference speaker sound to your computer speakers, while you listen to the stethoscope on headphones connected via a splitter. So the remote provider will be heard via speakers, and the headphones will *only* be used to monitor the stethoscope sound while auscultating.

Q: So why do you also show the USB audio device connection as an option?

A: If you connect the headphones to the headphone jack on the USB device, you can route BOTH stethoscope sound AND videoconference speaker sound to the USB headphone jack. So you can listen to both stethoscope and th remote provider via the same headphones. However, the stethoscope sound is somewhat quieter than it would be via a splitter connected directly to the stethoscope.

Q: I've connected everything correctly, but I cannot record; or the remote provider cannot hear the stethoscope. What might be the problem?

A1: Is the stethoscope powered on? Push any key on the stethoscope.

A2: Once everything is connected, you have to make sure that the app you're using, such as a recording app, or a videoconference app, has the correct audio settings. Specifically, has the audio input or mic input on your actual app been set to the USB audio device when you want to listen to the stethoscope? You have to make that selection within your app.

FAQ - continues on next page...

FAQ - ... continued from previous page.

Q: Can I use any USB audio device or only what you recommend?

A: The USB audio devices we recommend have been tested and do not distort or add noise to heart and lung sounds. Most USB audio devices do not handle body sounds well and add artifact. You may find others that we have not yet tested that perform well, however we caution against making judgments without a highly qualified clinician's opinion.

Q: When doing a videoconference, I want to speak to the remote provider, then switch to the stethoscope so the provider can listen, and then switch back to the voice mic so I can talk to the remote provider. How do I do that, and how do I get good stethoscope sound?

A: WITHIN your videoconferencing app, find the Audio Input, or Mic settings. Set that to internal mic when you want to speak, and switch to the USB device when you want to send stethoscope audio.

Note that most videoconferencing apps provide good voice audio, but may not transmit stethoscope sounds as well. You must use an app designed to transmit clean stethoscope audio, such as Zoom, Vsee, or WebRTC with "clean" audio channel. These channels or mode settings are named differently by various videoconferencing vendors, so contact them for more details or contact Thinklabs for assistance. If you're setting your videoconference app correctly AND using the clean audio setting for stethoscopes, check the audio level settings as recommended in these instructions.

Q: What happens if the level is too low?

A: The provider at the other side of your patient exam will not be able to hear the stethoscope as loud as desired by the clinician.

Q: What if the level is too high?

A: The sound will be distorted and "scratchy" or have "static" specially during the peaks of the hearbeat sound. (See previous answer and diagram regarding clipped signals.)

Q: When I launch my videoconference or audio recording application, the sound level is too loud or too quiet, even though I've already adjusted it. What now?

A: Some applications take over the settings and change them. Once you launch the application, you may need to either adjust the input again using the above process, or use a slider on the app screen, or buried inside an audio settings menu in the app. Usually the system settings above are tied directly to the settings within the app itself, so adjusting in either place is fine.

Q: The setting is fine for heart sounds but not lung sounds, or it's good on some patients and not others.

A: Sound varies across the human body and from patient to patient. Simply adjust the stethoscope volume to accommodate the specific situation. That's why we provide volume adjustment on the Thinklabs One.

Q: What about the filter adjustment? Will this affect sound level?

A: Most definitely. For heart sounds, use a low filter setting (LEDs light on the left side of the red scale). For lung sounds, use a middle setting. See the Filters section of Thinklabs One User's Manual or search "filters" at support.thinklabs.com