Microphone Connections: A Short Tutorial

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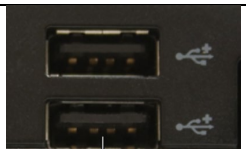
Introduction:

While connection of a headset microphone to a computer or mobile device is often quite straight forward, with an increasing variety of jacks on devices and plug arrangements on headsets, it is sometimes necessary to use a secondary adapter or series of adapters to successfully use your microphone with your device. This tutorial explores what you will need to make a successful connection.

Common Microphone Connections in the Non-Studio Setting

Keep in mind there are two components to consider: 1) your microphone and 2) the device with which you are connecting your microphone. In terms of the device, there are 4 general categories of connections jacks available to you.

	Device View	Microphone View	Notes
Traditional (separate) 3.5 mm connections for			Separate “TRS” jack for mic in (red or pink) and for stereo sound out. Common on most headset microphones. Notice the plugs have 3 connections
Integrated 3.5 mm TRRS connection			A single “TRRS” handles both mono microphone-in and stereo sound-out. Notice the plug has 4 terminals or connections.
USB Type A Connections			Comes in many version (1.0, 2.0,3,0,3.1,3.2,3.3 and 4.0) and provides a digital input. While some microphones export a digital signal, others require the

			use of a separate USB sound adapter.
USB C			Common on Macs, iPads, and some increasingly on mobile phones. Microphones don't have USB C connections, but with appropriate adapters most microphones can connect to one.
Lightning Port			A proprietary connection used on Apple devices (iPhones & iPads). Only a few mics have a lightning connection and for most will require an adapter.

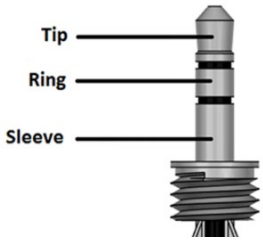
TRS vs. TRRS Jacks

Although devices are moving away from these traditional connections, many microphones still use these, and you are smart to understand the difference.

A quick sidebar on the jack versus plug terminology:

- A *jack* is generally considered to be the "fixed" part of a connection, i.e. the part that is housed on a piece of equipment that doesn't move as much. A jack is usually a female socket.
- A *plug* is the male connector on the end of a cable, which plugs into a jack.

The TRS Connectors

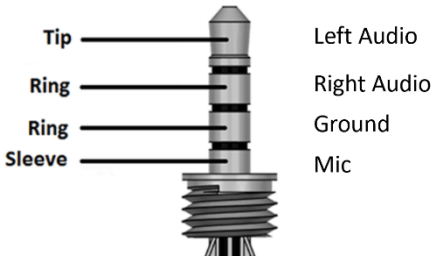


Historically, and often still today, computers have used separate jacks for sound-in and sound out. Although not visible to you, each of these jacks have 3 conductors or connections in the inside and are intended for use with a "TRS Plug". What does this mean? The "T" stands for tip, the "R" stands for ring, and the "S" stands for sleeve.. Such an audio plug is shown in the adjacent image. Notice that the plug has 3 electrically isolated connections corresponding with the tip, single ring, and the sleeve position.

What these different connections do depends upon whether it is for the microphone input or sound out functionality and is shown in the table below.

Assignment of function to connections in TRS Jacks/Plugs		
	Sound Out Device	**Microphone**
Tip	Left sound channel	Mic (-) signal
Ring	Right Sound channel	Mic (+) signal
Sleeve	Ground	Ground

The TRRS Connector

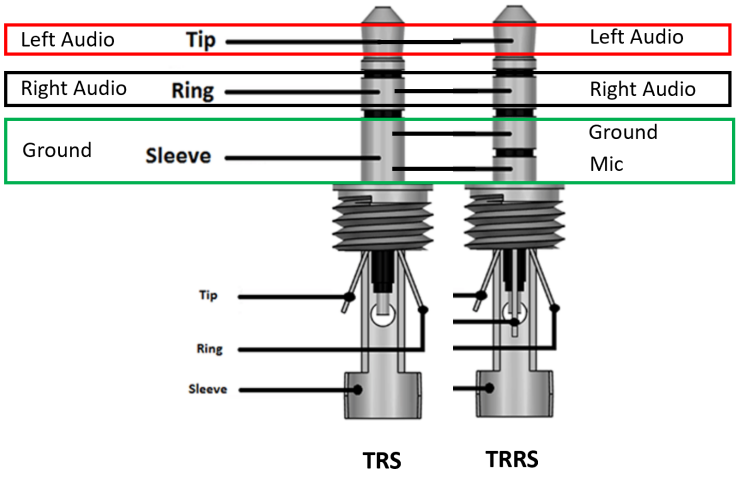


With the TRS connector explained, now let us consider the 4-conductor TRRS connector. Unique to this connector compared with the TRS is the presence of another connector – a second ring. Alas the Tip, Ring 1, Ring 2, and Sleeve or TRRS terminology. The usefulness of the TRRS connection is the ability to accomplish what two TRS jacks do in a single jack. The reason this is possible is because both the mic-in and stereo sound out functions can share a single ground connection. With this in mind, look at a typical TRRS connector shown to the right.

While combining both the sound in (mic) and sound out (stereo sound) into a single jack may be compelling from the perspective of simplicity and conservation of space, such a jack has some limitations in practical use when the connecting plug is not also a TRRS. This is reviewed below.

Interfacing a TRS Plug with a TRRS Jack

If you paid attention to the discussion above, you may have noticed sound out devices (devices such as headphones, earbuds, etc.) which use a 3-conductor TRS arrangement, use the same tip and ring 1 connections presented in a 4-conductor TRRS jack. Although the ground and mic function in the TRRS connector are both contacted by the sleeve on the TRS connector, this doesn't stop the sound-out function from working properly. This is why you can plug an accessory speaker or headphone into the single jack on your mobile phone, MacBook Pro, or any computer with a single jack, and you hear sound. Consider yourself lucky! This arrangement is shown below:



Key Point: Due to the wiring, earbuds or other audio-out devices with a 3-conductor TRS plug will work fine when plugged into a 4-conductor TRRS jack.

Unfortunately, the same innate compatibility does not occur when you plug a microphone with a TRS connector into an integrated TRRS connector. In this situation the TRS mic connectors (tip and ring) are

connecting to the two sound out connectors on the TRRS connector and both the mic and ground connectors on the TRRS jack are touched with longer ground sleeve on the TRS plug. Needless to say, such a connection is ill-fated and will not input microphone sound into your device, whatever it is. The solution in such a situation is the use of an adapter that can separate out the mic-in and stereo sound out into separate TRS connectors. Adapters that accomplish this come in all shapes and forms, but accomplish the same thing.

Key Point: A TRS plug representing the microphone connection will not work when plugged into a TRRS jack. For such an arrangement, an adapter is required.

Adapter to Interface Between TRRS and TRS Devices

If you are needing to interface a microphone alone or both a microphone and speakers to a TRRS jack you need an adapter to split the TRRS connector into its component mic-in and sound-out functions. Such examples come in many forms and several are shown below:

Examples of commercially available TRRS male to dual TRS female adapters



Key Point: if you have a device with a single integrated mic-in/sound-out jack, it is a TRRS connector and it will successfully provide *sound out* but cannot be used with a TRS *microphone* plug on a headset microphone. For the latter, you need an adapter to divide the TRRS adapter into its two components: sound in and sound out.

The Audio Connections on your Headset and how to interface it with your computer, phone or other device.

Typical Headset Microphone with Two TRS Plugs

The traditional headset microphone comes with two plugs – one for microphone-out and one for sound-in (either mono or stereo depending upon the device). Such a headset will have two TRS jacks as shown in the adjacent image. Notice that one plug is pink, and one is green, indicating the assignment to microphone-out and audio-in functions respectively.

This arrangement is still the most common and is easily dealt with if the computer or USB sound adapter has separate input for mic-in and sound-out. This type of arrangement will not work with a mobile phone, tablet, or a computer with a single integrated jack. For use with such devices you will need to use an adapter to combine the two separate TRS plugs into a single TRRS plug. Such adapters are widely available and fairly inexpensive.

Using a Headset with Separate TRS Plugs for Mic-Out and Sound-In	
Computer with separate mic-in and audio-out jacks or external USBS sound adapter with dual ports.	Nothing to do; you're all set
Computer or mobile device with single integrated 3.5 mm audio jack	Obtain a dual TRS to TRRS adapter as shown here: 
Device with USB C Port	Obtain a USB C to Audio adapter and Dual TRS to TRRS adapter as pictured below.   Alternatively, purchase a single USB C to dual TRS adapter (rare and variably reviewed):

	
Apple mobile device with lightning port only	Obtain both the Apple Lightning to Audio Headset adapter AND the Dual TRS to TRRS adapter.  

Headset with Single Integrated TRRS Plug

Although still somewhat rare these days, some headset microphones are manufactured with a single TRRS plug. This is particularly common among gaming headsets. Although not readily apparent from the image to the right, the plug on such headsets has 4 connections which is the requisite for a single jack to deal with both microphone and stereo sound. This is more obvious in the enlarged view of the plug alone shown below.

With such a headset, you are all set to go if you are plugging it into a computer with a single TRRS jack or when using with mobile device with a single audio jack. With newer Apple devices, you will need to utilize the Apple "Lightning to 3.5 mm Headset Adapter" discussed above. If you are planning to use such a microphone with a computer using separate 3.5 mm TRS jacks or with an external USB sound adapter, you will need to use an adapter to convert the single TRRS plug into twin TRS plugs, dedicated for mic-our and sound-in respectively. Such adapters are readily available and inexpensive. Such an adapter is pictured below. You can find a variety of such adapters if you search

“TRRS to dual TRS”.

Using a Headset Microphone with a single 4-conductor TRRS plug	
Computer with separate mic-in and audio-out jacks or external USBS sound adapter with dual ports.	Get a TRRS to dual TRS adapter as shown below. 
Computer or mobile device with single integrated 3.5 mm audio jack	Nothing to do but plug it in!
Device with USB C Port	Obtain a USB C to 3.5 mm Audio adapter. 
Apple mobile device with lightning port only	Obtain both the Apple Lightning to Audio Headset adapter and plug your microphone into the 3.5 end. 

Using a headset with microphone only function

Microphones in this category are limited to high-end products such as the SpeechWare FlexyMike Dual Ear Cardioid, the SpeechWare Single Ear, and the Sennheiser ME3. In most regards, such microphones are handled identically to the typical headset microphone with two plugs, but in this case, there is only one TRS plug for the microphone function. If you have a device with a single integrated TRRS jack, such as an Android phone or personal computer, it may be tempting to plug the device directly into the jack, but this will not work. As discussed in the "Anatomy and Physiology" section above, plugging a single TRS plug into a TRRS jack has the effect of joining the ground and microphone connectors and prevents it from working. To get around this, you need to use the jack splitter as discussed earlier and shown in the table below.

Microphones with Microphone-Only Functionality (no speakers)		
FlexyMike DEC	FlexyMike SEC	Sennheiser ME3
		
Common to all three of the above microphones is a single 3.5 mm TRS plug which has 3 conductors and which provides only a microphone out signal. Even though the jack will fit into an integrated 3.5 mm TRRS jack, the microphone will not function in this situation.		

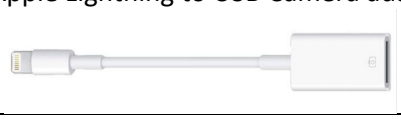
Using a Headset Microphone with Microphone-Only Functionality (no speakers)	
Computer with separate mic-in and audio-out jacks or external USBS sound adapter with dual ports.	Plug it into the pink mic-in jack and you are all set!
Computer or mobile device with single integrated 3.5 mm audio jack	Get the Dual TRS to TRRS adapter and plug the microphone into the pink or mic-in jack; leave the sound-out (green) jack alone. Plug the adapter into the integrated jack on your device. 
Device with USB C port	Obtain a USB C to Dual 3.5 mm Audio Adapter and plug mic jack

	 Or, obtain a USB C to Audio jack and a TRRS to Dual TRS Adapter and plug the mic into the mic port of the latter adapter.  
Apple mobile device with lightning port only	Obtain both the Apple Lightning to Audio Headset adapter and dual TRS to TRRS adapter shown above. Plug your microphone into the pink or red jack; plug the adapter into your Apple Lightning to Audio adapter, and plug this into your Apple device.  

Microphone with a USB Connection

If your microphone includes the circuitry to accomplish the analog to digital connection, almost certainly it has a USB plug and seeks a USB jack to properly connect to your device. Common microphones with such a set-up include the Nuance PowerMic 3, the Philips SpeechMike series, hand-held microphones from Olympus and Grundig, the TableMike series from SpeechWare, SpeechWare TravelMike, and a variety of headset microphones. For connections to a computer with standard USB A ports (the ones you've been seeing for years), this is a breeze; simply plug the microphone into an available USB port and, possibly, wait for drivers to install.

Below is a review of your connection options

Using a USB microphone or USB sound adapter with you device	
Computer with USB Port	Plug it in and use it! Nothing more to do.
Mobile device with USB C Port but no USB A port	Get a USB C to USB A adapter. We've tried this with a variety of USB microphones, USB sound adapters, and it works well. 
Mobile Device with Lightning port (Apple Device)	Get an Apple Lightning to USB Camera adapter 

But what if you have a newer computer, such as a new MacBook Pro, and it only has the newer USB C ports. For this, you need to obtain a readily available USB C to USB A adapter. If you don't want to buy this from Speech Recognition Solutions, simply search the term on the Internet or Amazon, and you'll find lots of choices.

What if the device you want to connect your USB microphone doesn't have a USB port, such as a tablet or mobile phone? Honestly, this can get tricky, because many USB microphone require a certain amount of voltage from the USB port and your mobile device may or may not be up to the task.

References:

https://components101.com/connectors/35mm-audio-jack

https://www.smartphonefilmpro.com/what-are-the-best-usb-c-microphones-for-smartphone-filmmaking/