

## **WE M70**

### **Long Range Laser Microphone**

The WE M70 LASER MIC is a professional piece of equipment allowing the operator to carry out undetected surveillance from outside a building.

Thanks to its unparalleled features, the WE M70 LASER MIC is able to pick up room audio from a distance without even entering the target room: by demodulating the transmitter IR laser beam bouncing from the target window, this equipment can receive and subsequently convert into electronic signals the slight window pane vibrations caused by acoustic waves in the room (voice speech).

Laser beam bouncing off the target window is then converted into electronic signals, then filtered, amplified and fed into a dedicated recording unit connected to its own amplifier with speaker/headphones: real time audio monitoring and recording are possible at the very same time.

The whole system operates according to the Snell's law, which requires sharp alignment and correct aiming of both the transmitted and received laser beams: to simplify both set up and alignment procedures as well as ordinary operation of the system, we have provided the WE M70 LASER MIC with sturdy tripods and a special search tone device which proves to be outstandingly valuable and absolutely necessary owing to the fact that emitted laser beam is totally invisible to the naked eye.

Although the operating principles, performance, technical specification and accessories stay the same, two different models are available: basic and camera. When maximum concealment is paramount, the WE M70 LASER MIC camera (pictured aside) is to be preferred.



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## Integrated Security Solutions

### **Specification:**

#### **Laser Transmitter (TX):**

Laser Type : Semi-conductor laser Animated wave length :  
770 - 840 nm Output power : 25 mW, automatically  
controlled Power Supply : 8 x 1,5 V AA-type battery Current  
consumption : approx. 75 mA Beam focusing : 135 mm  
Target finder : through lens  
Connections & mounting: power supply and tripod Operating time  
: approx. 40 hours continuous Other features : switchable  
modulation for search tone

#### **Laser Receiver (RX):**

Receiving unit: noiseless PIN-Diode  
Wave length: Infra-red  
Power Supply: 12 V, 8 x UM 2 (baby cell-type battery)  
Current consumption: 50 - 300 mA  
Lens: 500 mm  
Amplifier unit : connected by cable with Laser Receiver (RX)  
Connections: Headphones, Recorder, Speaker  
Voice filter: Equalizer, adjustable  
Operating time of the amplifier with Laser Rec: 40 - 60 hours (depends on adjusted  
settings)  
Transport Case: 470 x 380 x 220 mm

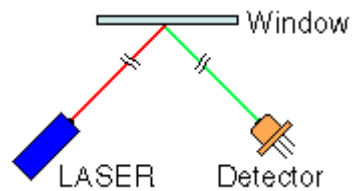
### **How it works:**

To detect sound within a room (having an outside window) at a distance. The principle being that sound vibrations will cause the window glass to move sufficient to deflect the LASER beam across the receiving photo detector.

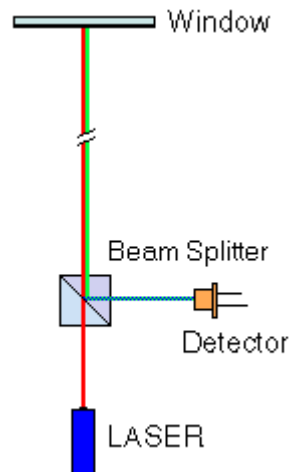
There are several methods that might accomplish this, with some fidelity; [1] however this page will describe the use of a LASER Microphone.

The use of a LASER to transducer sound from a window pane/glass is commonly used in movies which leave the mistaken impression that any such task is easy and the LASER Microphone, itself, is highly portable and easily set up. My recent experience is just the opposite.

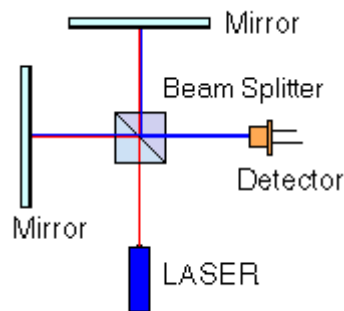
**There are several forms the LASER Mic. can take**



1) The one that is probably the most intuitive is a system that "grazes" a LASER beam at an angle to the plane of the glass (e.g., 45-deg.), with the photo detector at a complementary angle, and located at a near distance on the other side of the window, see fig. 1.

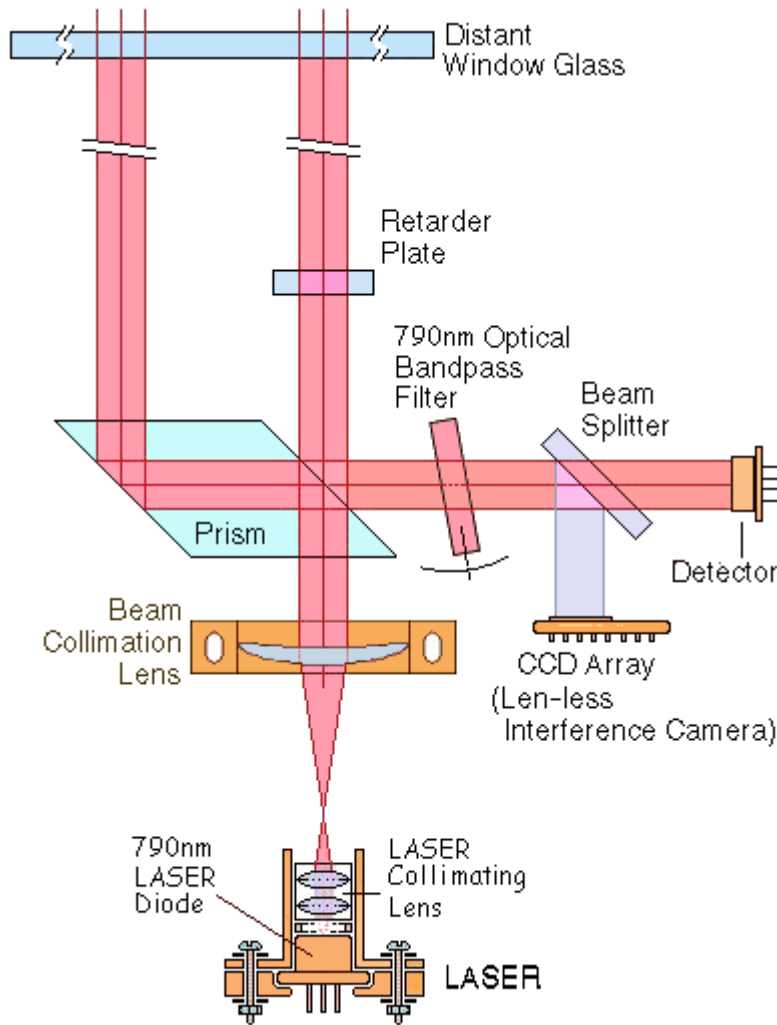


2) The second method might be the same as above, with the difference being the LASER and detector are co-located; either with a slight angle between the incident beam and the reflected beam; or boresighted where the incident and reflected beam share the same superimposed.



LASER Interferometer (Michaelson)

3) By using Interferometry, one stands the best chance for success (fidelity wise). However, the difficulty of use has increased somewhat. Also, this particular approach has several deficiencies--the most glaring one is the very large differences in the "leg" length. Ideally both legs of an interferometer should be of equal length. This is due to temporal or longitudinal coherence: where the phase coherence of a LASER beam changes over time. If the two jointly arriving beams are not synchronized the constructive and destructive interference is degraded, or nonexistent, thus limiting the device's sensitivity.

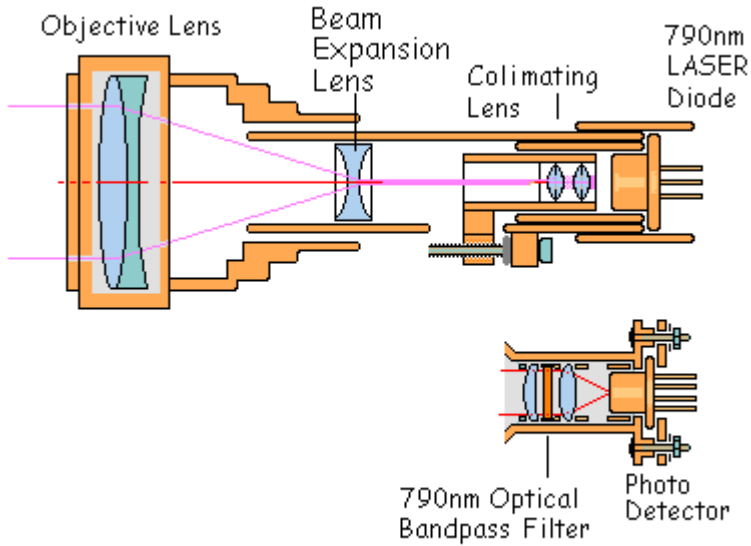


Dual Beam LASER Interferometer

4) The final approach is an interferometer similar to the one above, but having both legs of equal length-- the so called "Dual Beam LASER Mic."

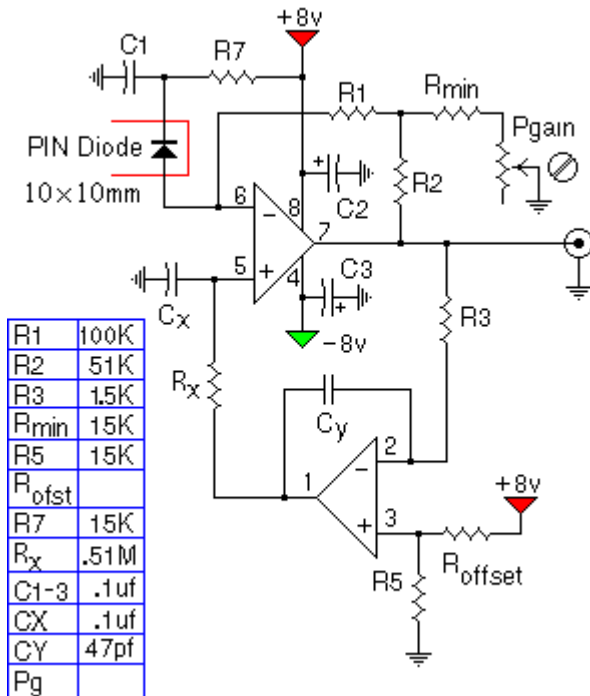
The main principle is the differential measurement of glass movement (acoustic vibration) across a small section of the glass pane.

This has the advantages of ~equal leg length for temporal coherence; common mode rejection of gross window movements, and some rejection of common-mode path disturbances.



**Suggested Optical Configuration**

### LASER Beam Collimation, Expansion, and Focusing



Circuit has Wide Dynamic Range

PIN Diode detector can be substituted with less expensive devices.

**PIN Photo Detector Circuit**



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### Frequently-Asked-Questions

**Q:** I would like to make an optical microphone using your method , but there is a thing that i don't understand (my teacher too): in the dual beam microphone, if both legs of the interferometer are on the window, they vibrate together, and there is no path difference?! (or just a little phase difference) and it would not be possible to get the frequency of the vibration.

**A:** There is a differential measurement between the beams. This tends to cancel the common mode sound waves, especially in the lower frequencies; caused by wind, elevator noise, heating and air conditioning, etc. Of course the wider the spacing of the beams, the lower the frequency response.

There are several other things that complement this situation:

1) the audio bandwidth for optimum intelligibility in a noisy environment is in the area of 400 Hz to 2800 Hz (military), and the telephone industry uses 300 Hz to 3600 Hz (all measured at -3 dBm).

2) The speed of sound in air is ~ 1100 ft/sec, in glass the speed of sound is in the neighborhood of ~20,000 ft/sec.

### Misc Notes:

Finding the components for this and other projects:

In the majority of cases, in today's consumer market, it is significantly cheaper to purchase either new or used devices and cannibalize them for the parts.

Also, and more importantly, this assures you of not being the victim of promises not kept by parts vendors.

In the case of the LASER microphone, finding an inexpensive red LASER pointer, of which there are many, would be a good starting point.

As for photo detectors, capable of detecting reflected LASER light, with voice frequencies impressed on it, TV remote control detectors (that reside in the TV set) might be a good source.

As I mention on this page, if possible use a RED **visible** LASER; as oppose to using an invisible Near Infrared LASER. Alignment is a **bitch** if you can't see the LASER light!! Of course, once you have perfected the system, then you can substitute the invisible LASER.

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