

Kit 26. ONE-WAY AUDIO BY FIBER OPTIC CABLE

This Kit allows you to send sound through 1mm plastic fibre optic (FO) cable. On the transmitter (Tx) circuit board (marker KIT 26T) there is a microphone and a circuit to modulate the light emitted from an LED. The LED is contained in a plastic case which allows easy connection of the FO cable. On the receiver (Rx) board (marked KIT26R) there is the photo-darlington receiver unit, a speaker and a circuit to convert and amplify the detected signal back into a sound wave. Because the signal travels in the FO cable as a light wave it is unaffected by any electric or magnetic fields that it travels through. Each board requires a 9V battery. However, for continuous use plug packs would be advised.

Fourteen feet of 1mm diameter plastic (FO) cable is supplied. This Kit can be used to send a signal in well over 200 yards of cable. Note that the plastic FO cable used here is not the glass 1 micron FO cable which is used in long distance (say 20 miles) communications. However, plastic cable introduces most FO concepts, is far easier for the experimenter to use and certainly has definite uses for short distance communication in electrically noisy environments.

The kit is constructed on a single-sided printed circuit board (PCB). Protel Autotrax and Schematic were used to design the board.

ASSEMBLY INSTRUCTIONS

First of all check off the components against the Component Listing on the next page. Especially make sure to get the resistors correctly identified.

Note that the FO emitter & detector modules are very similar. The detector which goes on the receiver board has a red dot marked on its black case. The emitter which goes on the transmitter board has a pink dot on a blue case. The components for both boards are mixed together. Make one board at a time. Look at the circuit schematic diagram, identify the component then place it in the board. It is generally best to add the lowest height components first. So place the resistors first. The electret microphone must be inserted with the pin connected to the metal case connected to the negative rail (that is, to the ground or zero voltage side of the circuit.) This is marked with a '-' sign on the MIC on the transmitter circuit board. Make sure to get the electrolytic capacitors around the correct way.

To get the highest transmission efficiency make sure that the ends of the FO cable are square cut cleanly. You can experiment with different degrees of smoothness. You will find that the LED gives out so much signal that even with the worst cutting you will almost certainly get good reception over the 14 feet of cable supplied. But to get good reception over 200 yards

then the ends of the cable must be better finished.

After the units are built up, connect the 9V battery to the Tx unit. You must see the red LED on inside the plastic case. If you do not see it you may have mixed up the detector with the transmitter.) On the Rx unit connect the battery. It should cause the speaker to make a noise. Turn the volume down. Place the Tx in one room near a radio or the TV. Unwind the FO cable making sure there are no loop-backs or kinks. FO cable must not be bent too much - a radius of curvature of over 1 inch (2 cm) should be maintained.

At the Rx end check that the end of the FO cable shows red light coming from the transmitter. Wave it 1" - 2" in front of the receiver. You should hear sound which is being picked up by the Tx unit in the other room. Push the cable into the receiver and tighten the plastic nut. The sound should be very clearly heard.

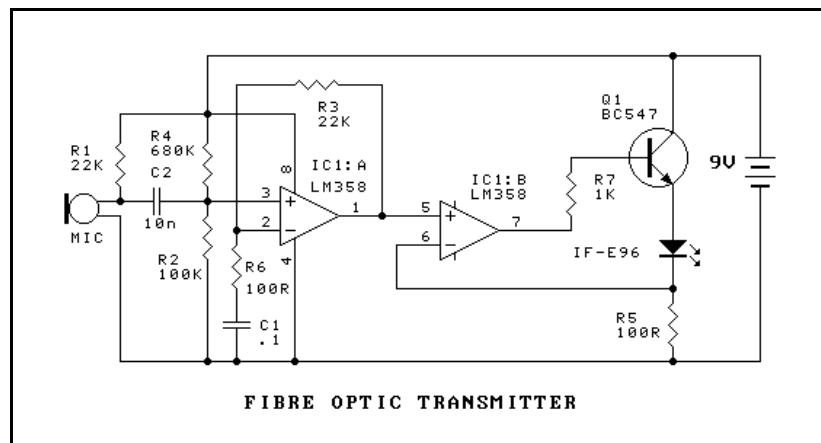
CIRCUIT DESCRIPTION

The voice signal begins as a sound wave. It is converted to an electrical signal by the electret microphone in the Tx circuit. This signal is amplified by the LM358 audio amplifier and converted to an optical signal by switching the voltage to the LED via a signal transistor. This optical signal is fed into the plastic fibre optic cable.

At the other end of the cable the optical signal is directed at a photodarlington in the receiver which converts it to an electrical signal again. The signal is amplified and fed into a speaker where it becomes a sound wave. A voltage regulator has been used in the circuit to overcome feedback in the circuit.

WHAT TO DO IF IT DOES NOT WORK

Poor soldering is the most likely reason that the circuit does not work. Check all solder joints carefully under a good light. Next check that all components are in their correct position on the PCB - the IC's, and the electrolytic capacitors. Thirdly, follow the track with a voltmeter to check the voltage at various parts of the circuit. Did you prepare the ends of the cable properly and insert it into the transmitter LED & receiver unit correctly.



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WHAT TO LEARN FROM THIS KIT

The Kit introduces you to fibre optics using plastic fibre optic cable. You can try an experiment. Cut the black shielding of the cable about 4 inches from the Rx unit when you are listening to some sound. Then gradually cut through the plastic optic cable itself and listen to the sound being cut off. Hold the two cut ends close to each other and note how much audio signal jumps the air gap into the other cable. Melt the two cables back together again using a flame from a cigarette lighter.

You can also experiment with how important preparation of the ends of the cable is to efficient transfer of the audio signal. Take one of the ends and rough it up badly. How much sound gets through as you gradually smooth and polish the end at a 90 degrees angle.

Background to FO Emitter & Receiver. These parts were originally made by Motorola. However, in 8/95 they ceased production. An ex-employee of Motorola then decided to take over the manufacturing of some of these parts privately. We are now buying these parts.

See our website for our other kits:

<http://kitsrus.com>

COMPONENT LISTING

Resistors 1/4W, 5%:	
100R (brown, black, brown)	2
1K (brown, black, red)	1
10K (brown, black, orange)	1
22K (red, red, orange)	2
100K (brown, black, yellow)	4
220K (red, red, yellow)	1
680K (blue, grey, yellow)	1
1M (brown, black, green)	1
100K Koa trimpot (104)	1
Capacitors:	
10 uF electrolytic	2
100 uF electrolytic	1
0.1 uF monoblock (104)	5
10nF mylar (103)	2
Fibre optic cable1	4ft
Speaker 8 ohm, 1/2W	1
78L05 regulator	1
BC547 transistor	1
IF-D93 detector - red dot on black case	1
IF-E96 emitter - pink dot on blue case	1
Electret microphone	1
9V battery snap	2
Nut & bolt set	1
LM358 IC	2
LM386 IC	1
8 pin IC sockets	3
Kit 26 Receiver PCB	1
Kit 26 Transmitter PCB	1
2 pole terminal block	3

