Connecting Low-Cost External Electrodes to MED-EKG

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1 Introduction

This application note explains how to connect external electrodes to the MED-EKG board and increase the signal quality shown in the GUI. There are two different connections:

- First, connect a set of medical grade electrodes used in commercial electrocardiograph systems.
- Second, build low cost external electrodes based on copper pipes, to hold in your hands.

The purpose of connecting external electrodes to the MED-EKG is to reduce the noise and variations added when the signal is obtained via fingertips.

The connection uses three wires:
- A left electrode
- A right electrode
- A reference electrode

Contents

2 Connecting Medical Grade Electrodes

The electrodes in Figure 1 are not included in the MED-EKG box due to some country restrictions on export and import of medical components. However, you can visit your local

medical equipment store and purchase them. Please refer to Section 3.5 of the MED-EKG User Manual that includes a connection example of this type of electrode.

Figure 1. Medical grade cables for connecting electrodes

3 Developing Low-Cost Electrodes

This section explains how to make low-cost electrodes using a piece of copper pipe purchased at any hardware store. The measurements mentioned below are suggested and can be modified.

The required material is:
- 10" of 3/8" copper pipe
- 4" of 1/4" PVC pipe (or other isolating material)
- 3 screws
- 3 ft. of cable, caliber 22 or 24
- 1 connector CONN HOUSING VH 3POS 3.96MM WHT
- 3 terminals CONN TERM CRIMP VH/NV 18-22AWG

Steps to follow:
1. Cut three pieces of copper pipe: one at 4", the other at 2.5", and the last one at 1.25" (Figure 2).
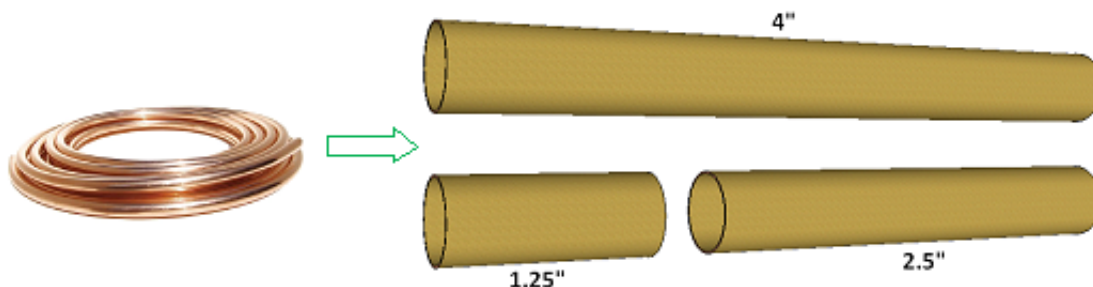

Figure 2. Copper pipe and the three required pieces

2. Perforate the three pieces of pipe, from one edge. Make sure that the perforation ratio is less then the screws diameter.
3. Place the copper pipe pieces of 2.5" and 1.25" in the PVC pipe. Then, perforate the PCV pipe in the same place as the copper pipe perforations.
4. Cut the cable in three parts, each 1 ft. long, and connect each part to the copper pipe segment placing the screws in the perforations, as shown in Figure 3.
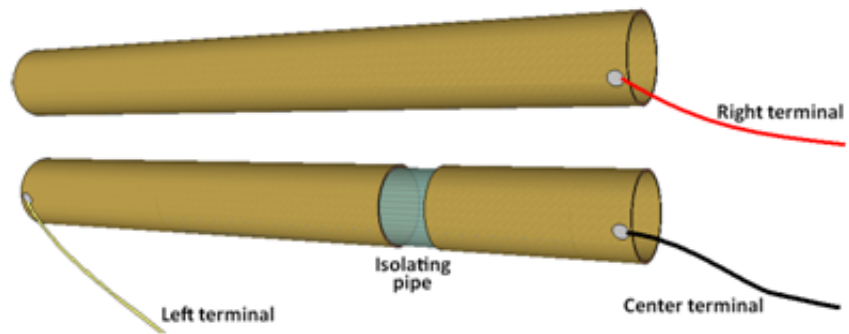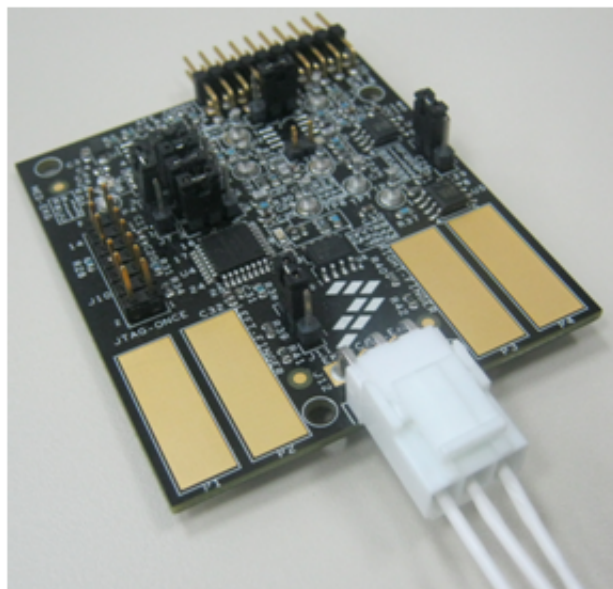
Figure 3. Electrodes and cable connections

5. Solder one terminal to the other side of each part of the cable and finally connect the terminals inside of the connector, as shown in Figure 4.
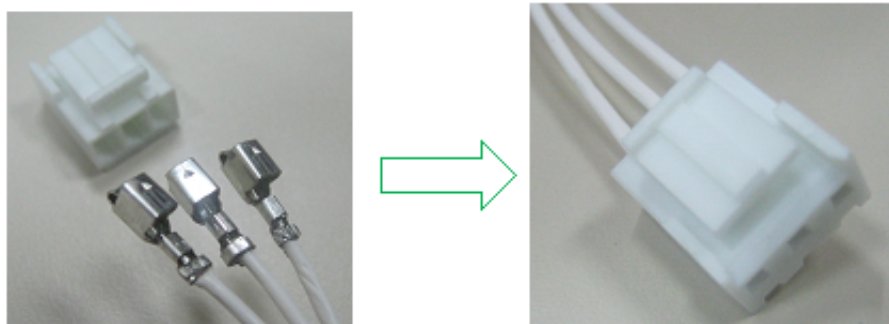
Figure 4. Soldered terminals on cables and the connector

6. Connect the electrodes to the J12 of the MED-EKG, Figure 5.

Figure 5. Electrode connections to MED-EKG

7. Finally, hold the electrodes with hands to obtain the heart signal.

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4 Conclusions and References

Medical grade electrodes can be purchased in a local medical store. Low cost electrodes can be made with material purchased from a hardware store to increase the signal quality and system stability. The pipe electrodes are similar to electrodes used in treadmills that include a heart rate monitor.

For more information about the MED-EKG visit the Freescale website and search the following documents.

- MED-EKG User Manual
- MED-EKG Schematics
- Quick Start Guide for TWR-S08MM128
- Quick Start Guide for TWR-MCF51MM
- TWR-MCF51MM-KIT and TWR-S08MM128-KIT Labs

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