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Non-Profit Research and Development Corporation

EVM-RI

DSP56002EVM Interface Assembly Manual

This document was written July 1998. Rev 2, Jan 1999. ©1999 Tucson Amateur Packet Radio Corp.

Contents

Introduction

The EVMRI is a Radio Interface and enclosure kit designed by TAPR for the Motorola DSP56002 Evaluation Module (DSP56002EVM). The kit enables users to program the DSP56002EVM for radio modem applications. The DSP56002EVM is not included in this kit (see below for locations you can order the EVM from).

From the Motorola Semiconductor Products Sector (http://www.mot.com/SPS/DSP/):

The DSP56002 Evaluation Module (DSP56002EVM) is a low-cost platform designed to familiarize the user with Motorola's DSP56002 Digital Signal Processor (DSP). The 24-bit precision of the DSP, combined with the on-board 32k words of external SRAM and stereo CD-quality audio codec, makes the evaluation module ideal for implementing and demonstrating many audio processing algorithms as well as for learning the architecture and instruction set of the DSP56002 processor. The user need only supply a 7-9 volt calculator-style power supply and an RS-232 serial cable.

The DSP56002EVM comes with Motorola's DSP56000 cross-linker Assembler and Domain Technologies' debug software with windowed user interface. The software runs under MS-DOS on an IBM PC-compatible computer (386 class or higher) and communicates with the evaluation module over an RS-232 serial port.

Further information on the EVM is available from the Motorola Web site: http://www.mot.com/SPS/DSP/products/DSP56002EVM.html

DSP56002EVM Ordering Information:
The DSP56002EVM is not supplied in this kit. You will need to supply your own EVM, which may be purchased from Motorola Distributors. The cost should be around US$149.00. There have been reports of higher prices. Do not pay them! Shop around for the best deal. (TAPR provides this information as convince and does not endorse these distributors; your mileage may vary :-)

Part Number: DSP56002EVM

Monterey Tools
     http://www.montereytools.com
Arrow Electronics
     1-800-777-2776   http://www.arrow.com
Newark
     1-800-4-NEWARK   http://www.newark.com
Wyle
     1-800-943-7446   http://www.wyle.com

Acknowledgements

PARTS LIST

This parts list is organized by quantity and part type. Please verify that all parts are present, checking the space [ ] provided as you locate and verify it against this list. You may wish to take this opportunity to sort the parts into a compartmented container, such as an egg carton, muffin tin, or other container as you inventory them. This will aid you in building.

Resistors

1/4 watt, 5% carbon film:
[ ]   2   R1, R2 470 ohm
               (yellow-violet-brown-gold)

Single Inline Package (SIP) Resistor Packs:
[ ]   2   RP3, RP4   7x470 ohm SIP
[ ]   2   RP1, RP2   4x10K ohm SIP

Trimpot:
[ ]   2   R4, R6 1K ohm trimpot   (3006W 102)
[ ]   2   R3, R5 10K ohm trimpot   (3006W 103)

Capacitors

Capacitors may be marked in various ways. The typical markings are given but may vary. Find all that match the typical markings given and the remaining ones, if any, should become apparent by elimination.

[ ]   2   C1, C2 0.1 uF   (104)

Diodes

[ ]   2   D13, D14   1N4148 Silicon Diode
[ ]   3   Green LEDs
[ ]   6   Yellow LEDs
[ ]   3   Red LEDs

Integrated Circuits

Integrated Circuits come from various manufacturers and may have differing prefixes and/or suffixes. For example, if the part is listed as a 74LS00, it may be marked SN74LS00N or MC74LS00P or DM74LS00N or F74LS00P or some other variation. The key is that the sequence 74LS00 appears in the part number. A four-digit number, such as 8834, indicates the year and week of manufacture and should not be confused with the part number.

NOTE: Do not handle the ICs at this time! Carefully remove the black foam carrier with ICs from the bag and verify the ICs against this list. Do not touch the ICs!

[ ]   2   U1, U2   ULN2803A
[ ]   1   EVM-U10   AT29C256-12 Flash EPROM

Transistors

[ ]   6   Q1-Q6   2N3904 NPN

Sockets and Connectors

[ ]   2   U1, U2   18-pin DIP Socket
[ ]   1   EVM-U10   28-pin DIP Socket
[ ]   1   P2   1x3 male header
[ ]   2   J4, J5   2x5 male header
[ ]   1   P1   2x8 male header
[ ]   2   J1, J2   8-pin DIN female jack PCB mount
[ ]   2   8-pin DIN plug connector
[ ]   1   Assembly: 6" 16-pin IDC cable with 2x8
                  IDC jacks on both ends
[ ]   1   Assembly: 6" 10-pin IDC cable with 2x5
                  IDC jacks on both ends
[ ]   2   Cable assembly with 1/8"
            right angle stereo plug
[ ]   1   3" wire with a single
            pin connector on one end
[ ]   4   2-pin jumpers
[ ]   1   DE9S jack, right angle PCB mount
[ ]   1   2.1 mm coaxial jack, panel mount

Miscellaneous

[ ]   1   Assembly Manual (this document)
[ ]   1   Switch, push-on-push-off
[ ]   1   Printed Circuit Board: Front Panel
[ ]   1   Printed Circuit Board: Rear Panel
[ ]   6   small (#2x1/4") self tapping screws
[ ]   4   4x40 screws
[ ] 12   4x40 nuts
[ ]   1   Enclosure
            (base, front panel, rear panel, 12 screws)
[ ]   4   rubber feet
[ ]   1   15" wire
[ ]   1   DIN-8 Diagram sticker for rear panel

CONSTRUCTION NOTES:

You are now ready to begin construction of the EVM-RI. It is recommended that when assembling the EVM-RI, that you use a very fine pointed soldering tip on an iron of relatively low wattage (25 watts maximum, 15 watts is ideal). Due to the proximity of some of the traces on the PC board, solder bridges are a very distinct possibility. A low wattage soldering iron, fine pointed tip, clean rosin core solder (small size) is the order of the day. Following these points could eliminate several hours of troubleshooting (or worse). This is good practice when working on any kit.

In addition to the soldering iron and solder, you will need small flush or semi-flush cutting pliers and small-tipped long nosed pliers. A magnifying glass may prove helpful to identify the values of the small components.

Pay careful attention to the directions that follow. Keep the tip of your soldering iron bright and clean, wiping it frequently on a wet rag or sponge. Make solder joints carefully, but swiftly. Prolonged heat on a PC board, as well as too much heat, can be disastrous and can ruin a PC board. Two to three seconds should be enough time to apply heat to any joint. Joints that have ground pad connections may require a larger wattage iron to ensure faster heating for soldering.

The accompanying component placement drawings show the placement of all parts on the circuit board. Pay particular close attention to the following:

1) Read this entire document prior to starting construction of your kit.

2) Identifying the pins on headers - Pin 1 is identified by the square pad on silkscreen.

Electrostatic Protection
Observe anti-static precautions when assembling the kit. Keep your body and tools grounded. The integrated circuits and transistors are susceptible to electrostatic discharge.

CONSTRUCTION
Refer to the layout diagrams for clarification of parts placement.

DSP56002EVM
Starting with the EVM, you have a few parts to install and some jumpers to configure.

IC Sockets
NOTE: If any socket pins are bent, carefully straighten them with a pair of long-nose pliers before assembly. Some types of IC sockets have crimps in the pins to hold them in place when automatic wave-soldering is performed. These sockets may be tricky to install. If your kit contains these sockets, you may want to straighten the pins before attempting to insert the socket into the PC board.

When installing IC sockets, double check to ensure that the socket is seated against the board with the notch matching the silkscreen. Pin 1 (nearest the socket notch) has a square solder pad. Be sure that all IC socket pins are showing on the solder side of the board. Next, solder two diagonally opposite corners first (such as pins 1 and 8 on a 14-pin socket). Then solder the remaining pins of that socket before proceeding to the next one. If you find a socket is difficult to install, remove it and double-check for a bent pin.

NOTE: Take care to avoid solder bridges!

Install the following IC socket on the EVM:

[ ]   U10   28-pin IC socket

Now check your work. All leads should be soldered. There should be no solder bridges (a blob of solder that shorts two adjacent soldered connections) or cold (gray and/or grainy looking) solder connections.

[ ] OK so far.

Connector
NOTE: Some EVM's may not come with a DE9S connector in the Host (P5) location. If your EVM has two DE9S connectors, one in the OnCE (P4) location and one in the Host (P5) location, skip this step. Otherwise, install the supplied DE9S connector in the Host (P5) location on the EVM.

[ ]   DE9S right angle PCB mount soldered to the Host (P5) location of the EVM.

Now check your work. All leads should be soldered. There should be no solder bridges or cold solder connections.

[ ] OK so far.

Integrated Circuits

Observing static precautions and polarity, install the following ICs in their sockets. Pay particular attention to aligning the notch of the IC with the socket:

NOTE: Make sure all power is removed before installing ICs.

[ ] U10 AT29C256-12   Flash EPROM

Jumpers

Install 2-pin jumpers in the following locations on the EVM:

[ ] J8
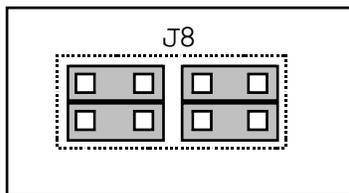
[ ] J10
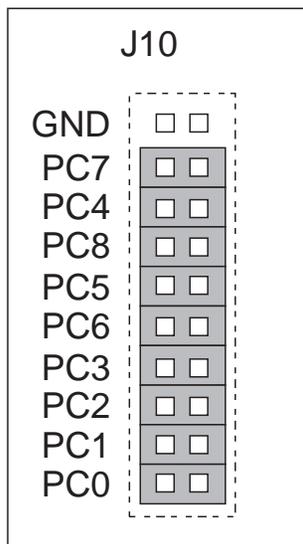
EVM Installation

Now install the EVM in the base of the enclosure. In the base there are several holes. Find the four that fit the EVM footprint. The holes nearest the edge is the rear of the enclosure. Place the EVM so that the DB9 connectors face the rear of the enclosure.

[ ] Using the four 1 /2" threaded nylon standoffs and 4 nylon screws that came with your EVM, plus 4 screws provided in the kit, attach the EVM to the base of the enclosure.

[ ] Visually inspect your work. Make certain that the DB9 connectors on the EVM are facing to the rear of the enclosure.

Set the EVM and enclosure assembly aside for the moment. Next you'll assemble the front and rear PCBs and attach them to the front and rear panels then to the enclosure.
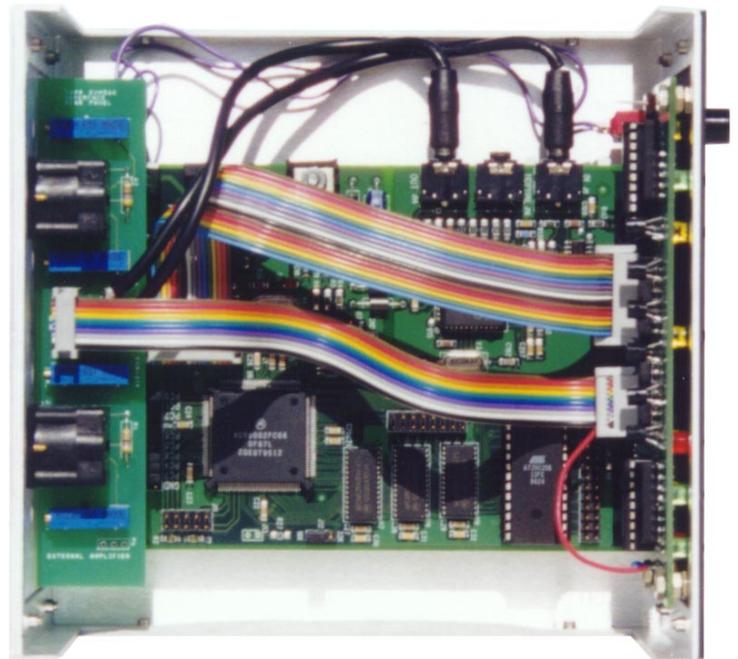
This photo shows the EVM placed in the enclosure. Although at this stage, the front and back panels HAVE NOT been installed yet.

Front Panel PCB

The next step is to assemble the Front Panel PCB, attach it to the front panel, and install the assembly to the enclosure base. The Front Panel PCB will be electrically connected to the EVM via a 16-conductor ribbon cable and a single power connector. The photo below shows the final attachment of the front panel PCB to the enclosure.
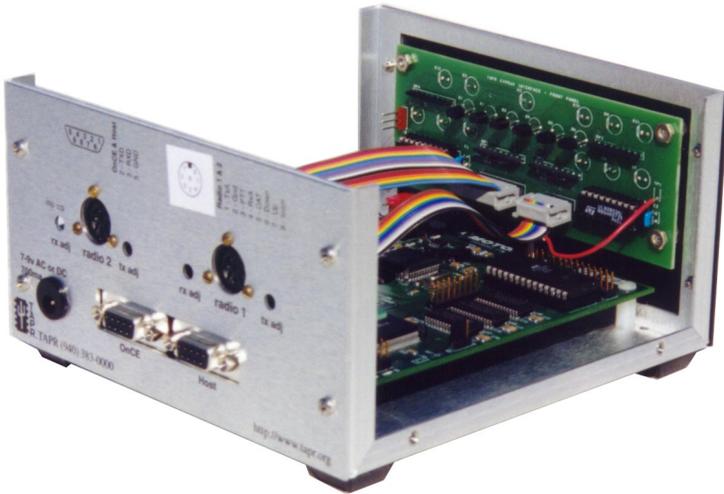
IC Sockets

Install the following IC socket:s:

[ ]   U1   18-pin IC socket
[ ]   U2   18-pin IC socket

Now check your work. All leads should be soldered. There should be no solder bridges or cold solder connections.

[ ] OK so far.

Capacitors

All capacitors should be mounted as nearly flush to the board surface as practical without stressing the leads.

Install the following capacitors:

[ ]   C1   0.1 uF   (104)
[ ]   C2   0.1 uF   (104)

WARNING! Be careful when clipping leads, as they have a tendency to fly towards your eyes! Take appropriate precautions (grasp leads and wear eye protection).

[ ]   Solder and clip the leads (4 total)

Now check your work. All leads should be soldered. There should be no solder bridges or cold solder connections.

[ ]   OK so far.

Diodes

NOTE: Diodes are polarity sensitive devices. Diodes are mounted flat near the surface of the board like resistors. The cathode end of the diode is banded and corresponds to the banded silkscreen legend and the square pad on the PCB.

Install the following diodes:
[ ]   D13 1N4148
[ ]   D14 1N4148

[ ]   Solder and clip the leads (4 total)

Now check your work. All leads should be soldered. There should be no solder bridges or cold solder connections.

[ ] OK so far.
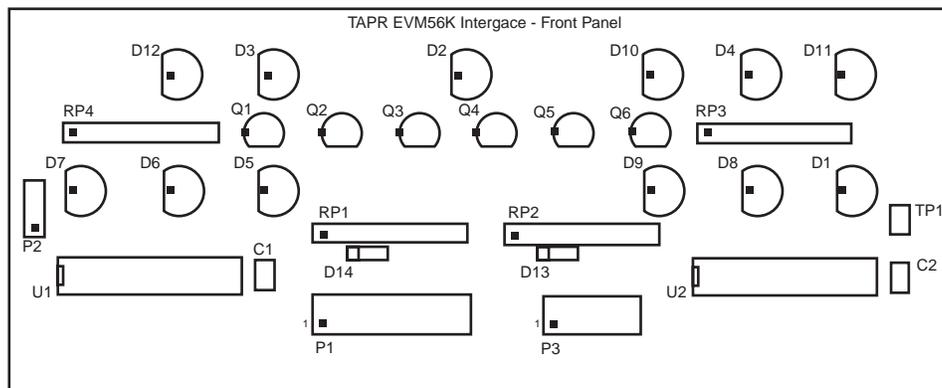
Figure 1. Front Panel PCB Layout

SIP (Single Inline Package) Resistors

Resistor SIP networks are polarized parts; the end with the dot or stripe goes into the square pad. The resistors should end up flush with the circuit board. It is easiest to solder the end pins first, then inspect the placement, and then solder the other 6 pins (just like you did by soldering the corner pins on the IC sockets).

NOTE: The end with the dot or stripe goes into the square pad.

Install the following SIPs:
[ ]   RP1   4x10K ohm SIP
[ ]   RP2   4x10K ohm SIP

[ ]   RP3   7x470 ohm SIP
[ ]   RP4   7x470 ohm SIP

Now check your work. All leads should be soldered. There should be no solder bridges or cold solder connections.

[ ]   OK so far.

Transistors

NOTE: Transistors are polarized components. Match the body of the transistor with the silkscreened outline and carefully bend the transistor leads to match the hole pattern in the PC board. The bottom of the body of the transistor should be not more than 1/4" above the PC board.

[ ]   Q1   2N3904 NPN
[ ]   Q2   2N3904 NPN
[ ]   Q3   2N3904 NPN
[ ]   Q4   2N3904 NPN
[ ]   Q5   2N3904 NPN
[ ]   Q6   2N3904 NPN

[ ] Solder and clip the leads (18 total)

Male Headers

The male headers will be installed next. The plastic body of the part should rest flush with the top surface of the PC board. The short end of the pins goes into the PC board, the long end sticks up.

WARNING! Do not hold these parts with your fingers as they quickly get very hot while soldering in place.

[ ]   P1   2x8 pin male header
[ ]   P2   1x3 pin male header
[ ]   P3   2x5 pin male header

Light Emitting Diodes (LEDs)

The LEDs are installed on the <u>reverse</u> side of the PCB so that they will face toward and protrude slightly through the holes of the front panel. The LEDs set flat on the PCB and make sure the LED stands straight up and down. Take care to not apply too much heat, the LED will melt.

Color placement of the LEDs is not critical. The colors listed below are a suggested installation. Each of the LEDs (except the Power LED) is programmable. Arrange the LEDs however you like. You can purchase LEDs from any electronics store if additional colors are needed

NOTE: LEDs are polarized components. A flat side on the body of the part indicates the cathode of the LED. Match the body of the LED with the silkscreened outline. LEDs also have their cathode lead shorter than their anode lead. The cathode lead goes into the square pad on the PCB.

Install the following LEDs <u>flat</u> on the <u>reverse</u> side of the PCB:

[ ]   D1 Red
[ ]   D8 Yellow
[ ]   D9 Yellow
[ ]   Solder and clip the leads (6 total)

[ ]   D5 Red
[ ]   D6 Yellow
[ ]   D7 Yellow
[ ]   Solder and clip the leads (6 total)

[ ]   D11 Green
[ ]   D4 Green
[ ]   D10 Red
[ ]   Solder and clip the leads (6 total)

[ ]   D2 Yellow
[ ]   D3 Yellow
[ ]   D12 Green
[ ]   Solder and clip the leads (6 total)

Now check your work. All leads should be soldered. There should be no solder bridges or cold solder connections. Double check that the flat side of the LED matches the silkscreen.

[ ] OK so far.

This completes the LED installation. You should have no remaining LEDs.

[ ] No LEDs remaining.

Power Lead

The 3" wire with a single pin connector is used to tap into the EVM's +5VDC.

[ ] Solder the bare end of the 3" wire with the single pin connector to TP1.

Integrated Circuits

Observing static precautions and polarity, install the following ICs in their sockets. Pay particular attention to aligning the notch of the IC with the socket:

NOTE: Make sure all power is removed before installing ICs.

[ ] U1 ULN2803A
[ ] U2 ULN2803A

That completes the assembly of the Front Panel PCB. Now check your work. All leads should be soldered. There should be no solder bridges or cold solder connections.

[ ]   OK so far.

Next you will assemble and install the on/off switch and the PCB to the front panel; then install the entire assembly to the enclosure base.

Front Panel PCB assembly and installation

Cut the supplied 15" wire into three pieces:
[ ]   7"
[ ]   6"
[ ]   2"

[ ] Solder the 7" and 6" wires to the power on/off switch.

[ ] Cut the supplied 1 1/2" heat shrink into four equal pieces. Apply 2 heat shrink tubing to the connections on the switch.

[ ] Install power on/off switch to the front panel.

Mount the Front Panel PCB to the front panel by:

[ ] Install two nuts on each threaded stub on the rear of the front panel. Hand tighten the nuts. These will provide a stand-off for the front panel PCB.

Note: Tolerances will be tight. You may want to enlarge the holes on the PCB with a 1/8" drill bit

[ ] Install the front panel PCB on the threaded studs of the front panel. Carefully align the LEDs into the holes of the front panel.

[ ] Install four nuts to secure the front panel PCB.

[ ] Plug one end of the 16-conductor cable assembly into P1. Observe that pin one of the connector (indicated by an arrow) connects to pin one of P1 (indicated by a numeral one).

[ ] Feed the wires through the enclosure base and install the Front Panel Assembly to the Enclosure using 4 screws. See Photo below.

[ ] Plug the single wire plug into the EVM J2 Pin 2 (Pin 1 is indicated by the beveled edge on the silkscreen).

Pin 2 ⟶
Pin 1 ⟶

[ ] Plug the 16-conductor plug into the EVM J7. Observe that pin one of the connector (indicated by an arrow) connects to pin one of J7 (indicated by the beveled edge on the silkscreen).

Rear Panel PCB

Now you will assemble the Rear Panel PCB, attach it to the rear panel, and install the assembly to the enclosure base. The Rear Panel PCB will be electrically connected to the EVM via two stereo plugs and the Front Panel PCB via the 10-conductor ribbon cable. The photo below shows the final attachment of the rear panel PCB to the enclosure.

Resistors

Resistors lie flat on the PC board and have a lead spacing of 0.5". You may wish to use a lead former to pre-form the resistor leads for neatest appearance.

Install the following resistors:
[ ]   R1   470 ohm   (yellow-violet-brown gold)
[ ]   R2   470 ohm   (yellow-violet-brown-gold)

[ ]   Solder and clip the leads (4 total)

Now check your work. All leads should be soldered. There should be no solder bridges or cold solder connections.

[ ]   OK so far.

This completes the resistor installation. You should have no remaining resistors.

[ ] No resistors remaining.

Trimpots

Install the trimpots according to the silkscreen layout on the PCB. The screw adjustment should face the rear panel. Take care to install the trimpots in the correct holes.

Note: Be careful, there are two through-plated holes that are near the holes intended for the trimpot R3.

Install the following trimpots:
[ ]   R3   10K ohm trimpot   (103)
[ ]   R5   10K ohm trimpot   (103)

[ ]   Solder and clip the leads (6 total)

[ ]   R4   1K ohm trimpot   (102)
[ ]   R6   1K ohm trimpot   (102)

[ ]   Solder and clip the leads (6 total)

Now check your work. All leads should be soldered. There should be no solder bridges or cold solder connections.

[ ] OK so far.
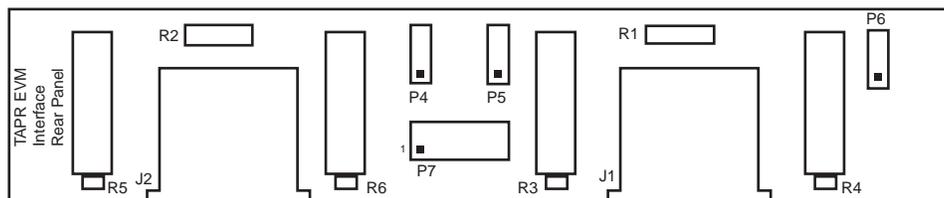
Figure 2. Rear panel PCB Layout

Male Headers

The male headers will be installed next. The plastic body of the part should rest flush with the top surface of the PC board. The short end of the pins goes into the PC board, the long end sticks up.

WARNING! Do not hold these parts with your fingers as they quickly get very hot while soldering in place.

[ ]   P7 2x5 pin make header

Connectors

Install the following connectors:
[ ]   J1 8-pin DIN jack, panel mount
[ ]   J2 8-pin DIN jack, panel mount

Stereo Cables

Supplied in the EVMRI kit are two packages of stereo cables. Each cable assembly has two right angle mini stereo plugs, one white and one green. The white right angle plug is the only one that is wired correctly for the EVMRI. You need to seperate the white connector from the green connector (DO NOT CUT THE END OFF THE CABLE WHILE DOING THIS) and then after you seperate the cables, cut off the wire attached to the the white connector plug about 6-7 inches away from the plug. Use the two white right angle mini stereo plugs for your kit.

These stereo connectors cable will electrically connect the Rear Panel PCB to the EVM according to the table below:

Rear Panel PCB	EVM
P4	J9 - IN
P5	J14 - OUT

[ ]   Cut the cable approximately 6 to 7 inches long.

[ ]   Strip the cut end 1 /2" and strip the ends of the wires 1/8"

[ ]   Using an ohmmeter, ring out the cable to determine the color of wire to the mini-stereo plug:

TIP _____

RING _____

SLEEVE _____ (Shield)

Solder the cable to P4 following the directions in the illustration:
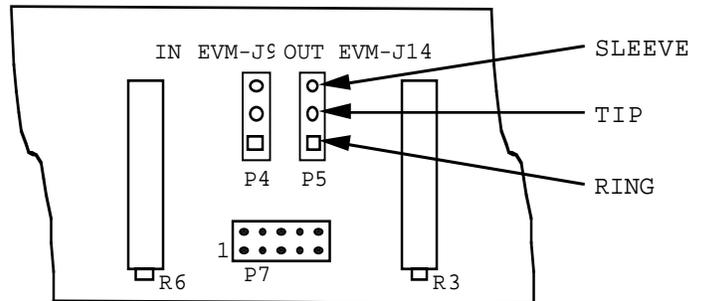
Stereo Cable Wiring

[ ]   Solder the wire that goes to RING to the square pad.

[ ]   Solder the wire that goes to TIP to the center solder pad.

[ ]   Solder the wire that goes to SLEEVE (Shield) to the outer solder pad.

[ ]   Repeat the above three steps for the cable to P5.

That completes the assembly of the Rear Panel PCB. Now check your work. All leads should be soldered. There should be no solder bridges or cold solder connections.

[ ] OK so far.

Next you will assemble and install the power connector and the PCB to the rear panel; then install the entire assembly to the enclosure base.

Rear Panel PCB assembly and installation

[ ] Using the remaining 2" wire, solder one end of the 2" wire to tab A of the coaxial power connector (see Figure 4).
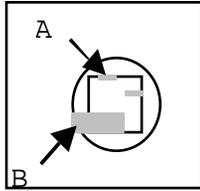
Figure 4. Power Coaxial connector solder tab locations.

[ ] Install coaxial power connector to the rear panel. You will need to thread the wire through the hole and slip the connector nut over the wire to secure the connector to the rear panel.

[ ] Install rear panel PCB to rear panel using six #2x1/4" self tapping screws. The self tapping screws fit into the holes in the face of the 8-pin DIN. **Caution:** Do not use excessive force, the plastic holes will strip out.

[ ] Plug one end of the 10-conductor ribbon cable into jack J5. Observe that pin one of the connector (indicated by an arrow) connects to pin one of J5 (indicated by a numeral one).

[ ] Feed the wires through the enclosure base and install the Rear Panel Assembly to the Enclosure using 4 screws.

[ ] Plug the other end of the 10-conductor ribbon cable to P3 of the Front Panel PCB. Observe that pin one of the connector (indicated by an arrow) connects to pin one of P3 (indicated by a numeral one).

[ ] Plug both stereo plugs into the EVM in accordance to the table below:

Rear Panel PCB	EVM
P4	J9 - IN
P5	J14 - OUT

Completing Assembly

Complete power connections by:

[ ] Solder the end of the 7" wire from the on/off switch to Tab B of the coaxial connector (see Figure 4).

[ ] Attach the ends of the two remaining wires to the screw terminals (power) on the EVM.

Complete assembly of the enclosure by:

[ ] Place the enclosure top in the base and secure with four screws.

[ ] Take the sticker for the DIN-8 connector and attach to the rear panel covering over the incorrect diagram.
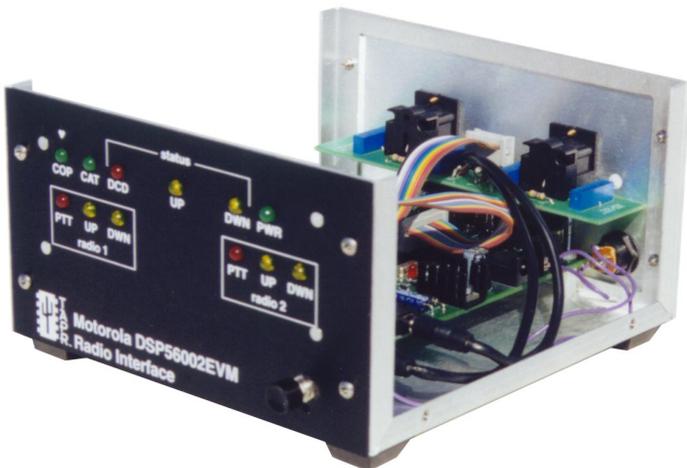
Schematic Diagrams

For schematics visit:
http://www.tapr.org/tapr/html/dsp56002evm.html