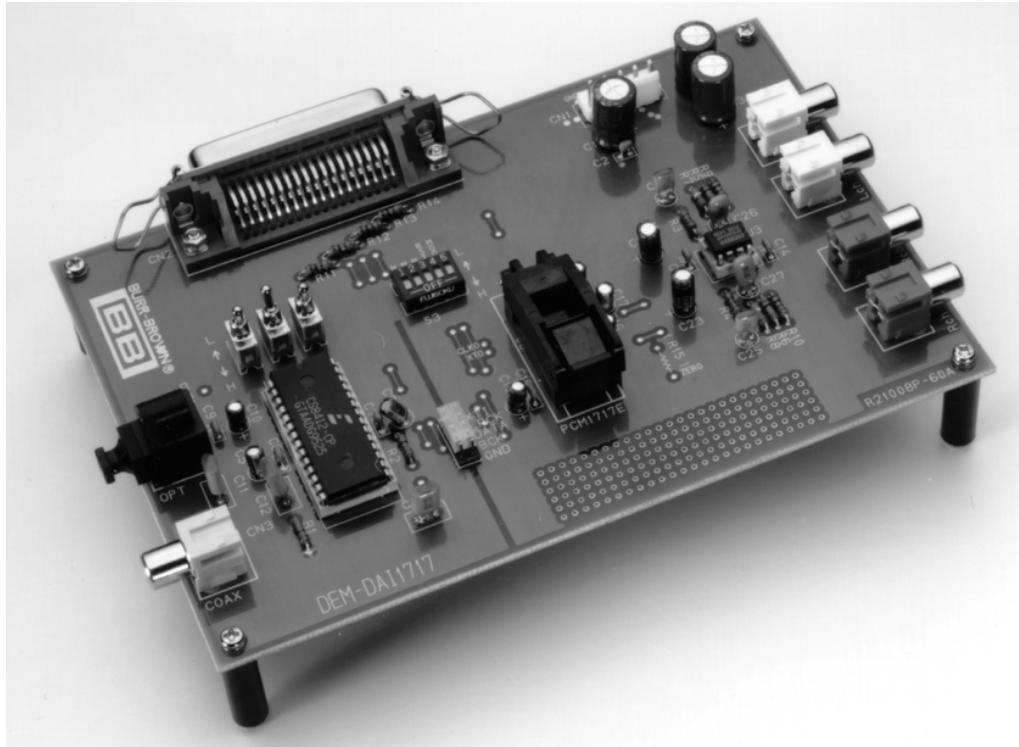




# DEM-PCM1717 DEM-PCM1717-1 DEM-DAI1717

EVALUATION FIXTURE



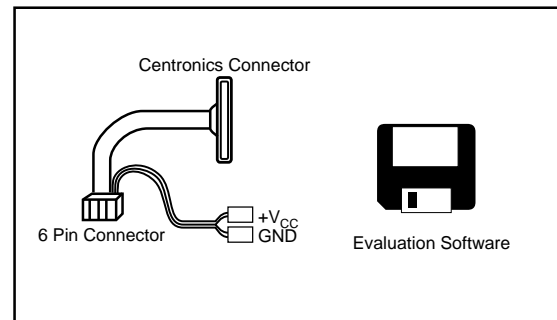
DEM-DAI1717

## FEATURES

- **DEM-PCM1717**  
Basic evaluation board for the PCM1717 requires an external audio processor for connection to digital audio source.
- **DEM-PCM1717-1**  
DEM-PCM1717 plus Windows evaluation software and connector.
- **DEM-DAI1717**  
Evaluation board for the PCM1717 including evaluation software and Digital Audio Interface.

## BLOCK DIAGRAMS

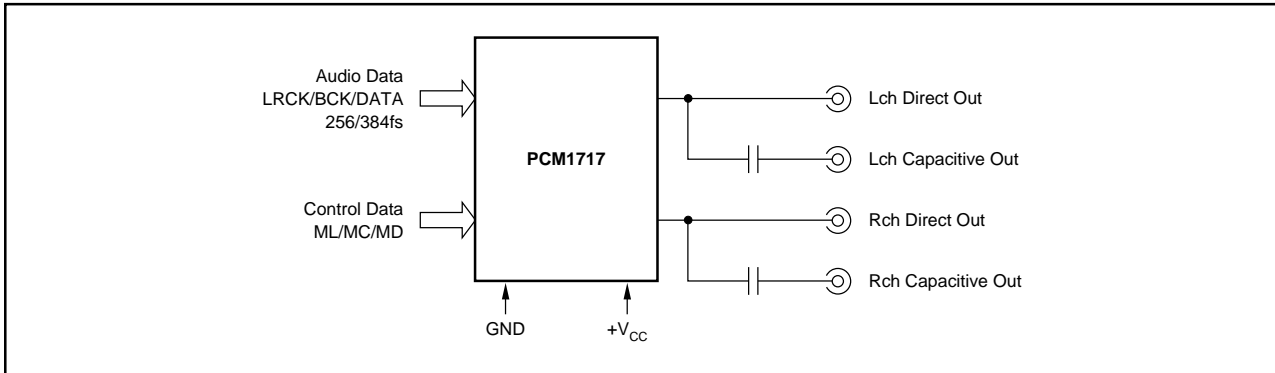
### EVALUATION SOFTWARE AND CONNECTOR



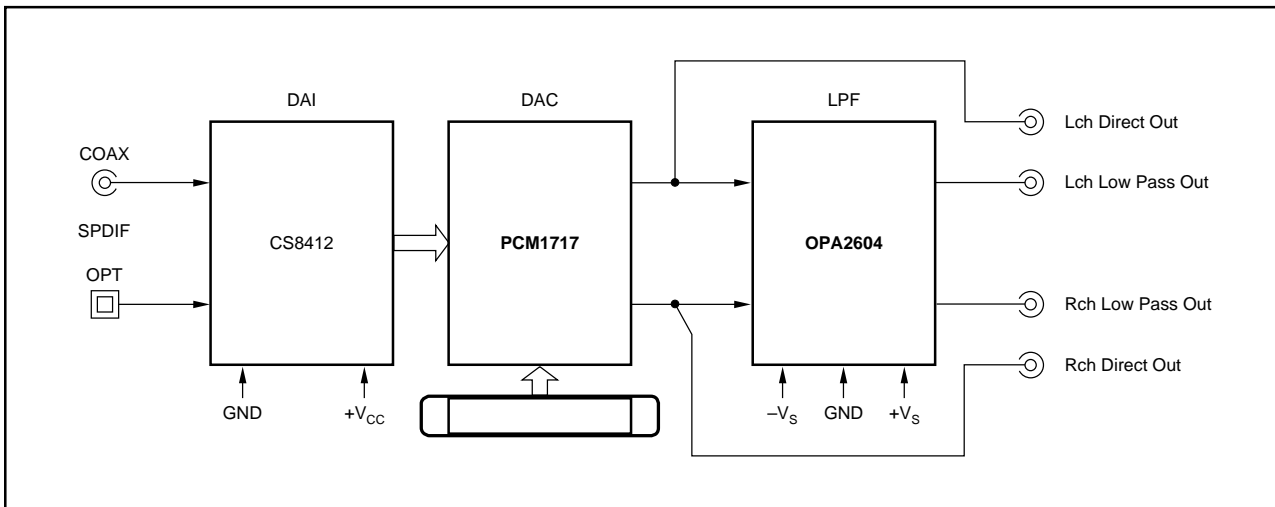
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# BLOCK DIAGRAMS (CONT)

## DEM-PCM1717



## DEM-DAI1717



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# DEM-PCM1717

The DEM-PCM1717 is the basic evaluation fixture for the PCM1717  $\Delta\Sigma$  audio DAC. This fixture provides an easy way to connect power, data, and interface signals to the DAC.

Figure 1 shows the block diagram of the DEM-PCM1717. The user must supply 4 digital audio signals, power, and mode control signals. The DAC will then provide two channels of either directly or capacitively coupled analog outputs.

The PCM1717 can be operated either in a hardware or software mode. In the software mode either external logic or a processor is used to program four registers internal to the PCM1717. (Consult the data sheet for additional information).

The hardware mode can be evaluated using this fixture by use of the on board DIP switches. These switches are connected to pins on the PCM1717 which force either power or ground to the pin. In the hardware mode some of the features of the PCM1717 can be exercised. The selection between the hardware and software mode is done using the mode switch on the DEM-1717. Figure 2 shows the switch settings and the resulting functions attained for the PCM1717. The switches operate in an active low condition.

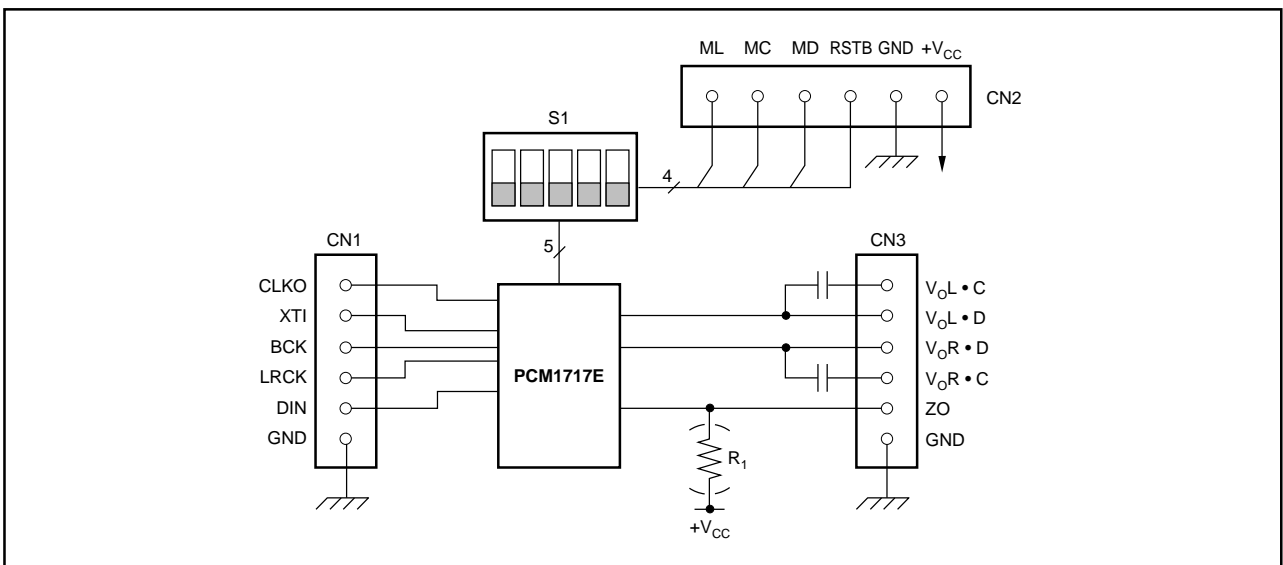


FIGURE 1. DEM-PCM1717 Block Diagram.

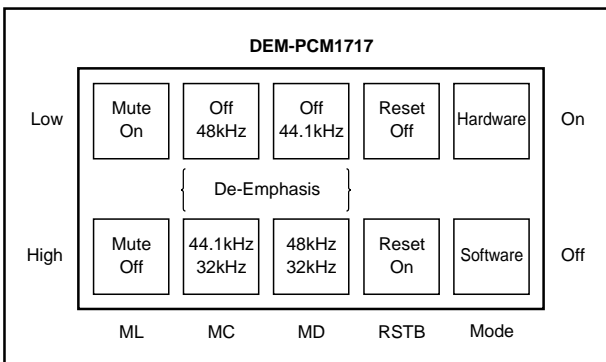


FIGURE 2. DEM-PCM1717 Switch Settings.

## HARDWARE DESCRIPTION

Figure 3 shows the schematic diagram of the DEM-PCM1717 evaluation board.

Figure 4 illustrates the PC board design and component placement for the DEM-PCM1717 evaluation board. Note on the parts layout that there are 3 connectors CN1, CN2, and CN3. CN1 is used to connect the digital audio signals to the PCM1717. CN2 is used connect the control lines for the PCM1717 as well as power and ground. CN3 is used to access the audio output from the PCM1717. The analog outputs are available as DC-coupled (VOR-D, VOL-D) or ac-coupled (VOR-C, VOL-C). The DC coupled output is referred to ground, and the AC-coupled output is referred to  $V_{CC}/2$ , typically 2.5V. There is also a connection for the output of the zero detect flag. Use of this pin requires a pull-up resistor,  $R_1$ . This resistor is labeled R1 on the schematic and the board and a typical value is 4.7k $\Omega$ .

The crystal (U1) is not included.

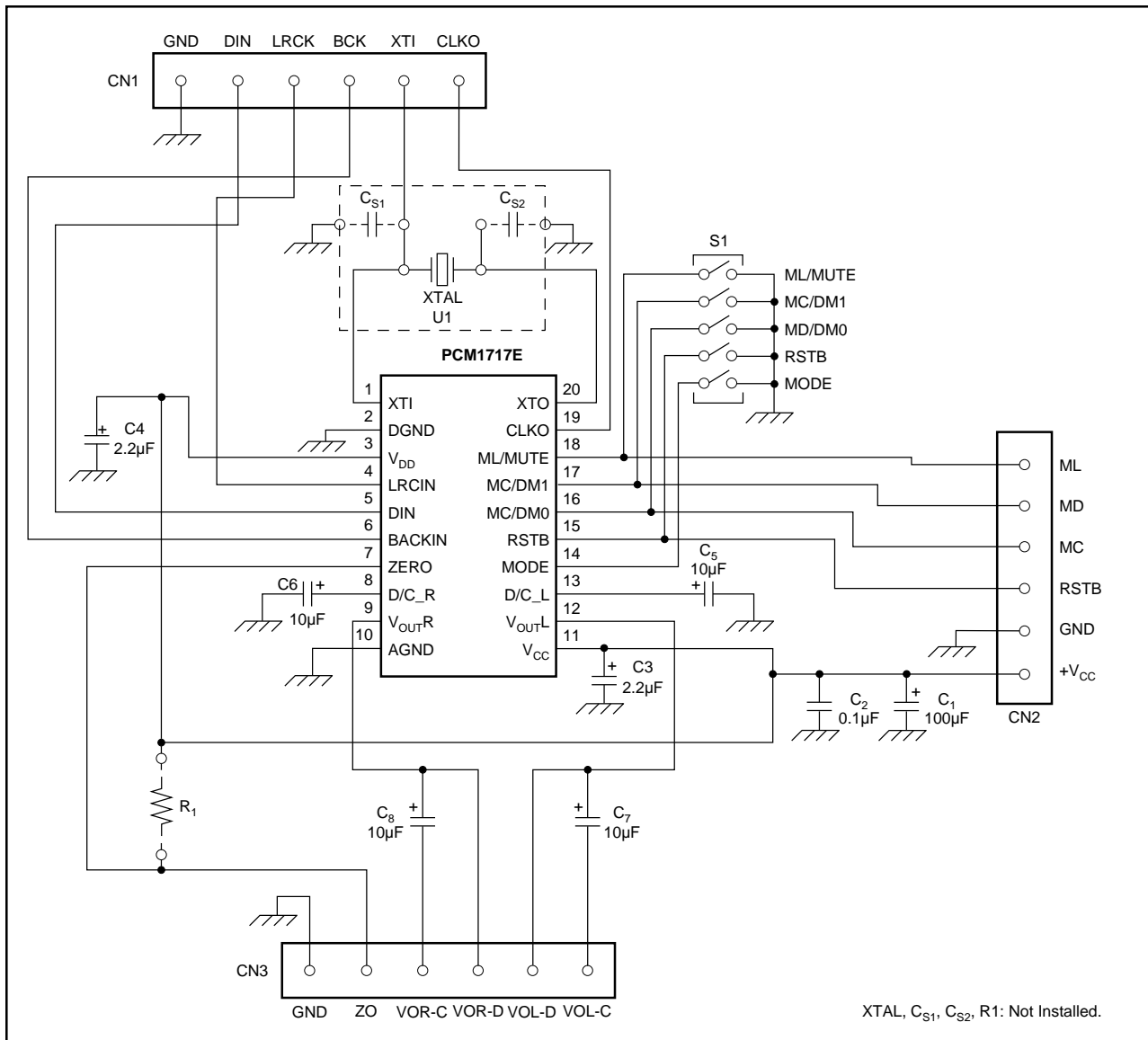


FIGURE 3. DEM-PCM1717 Schematic.

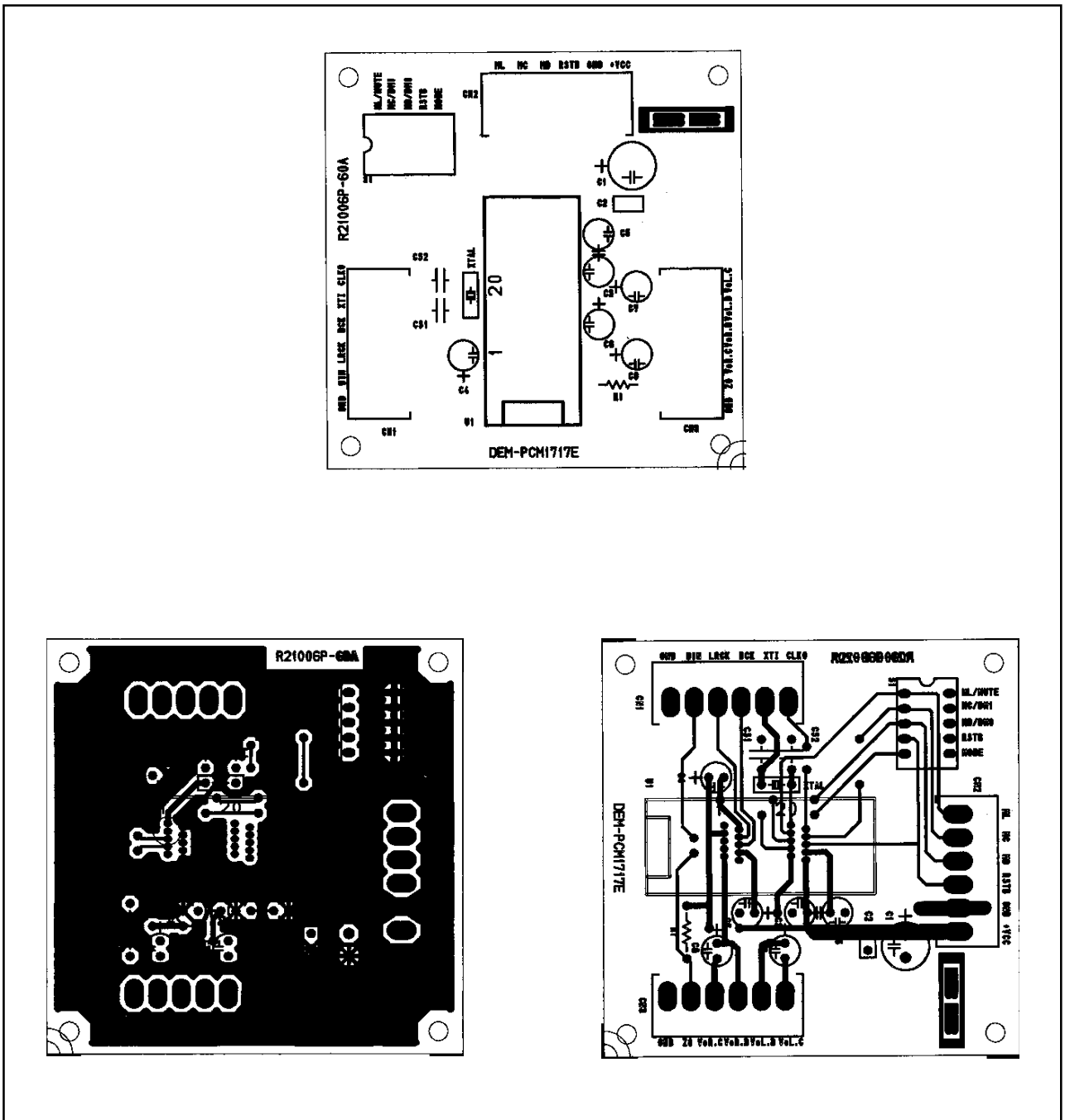


FIGURE 4. DEM-PCM1717 Parts Layout and Trace Design.

## DEM-PCM1717-1

This demo board kit consist of a DEM-PCM1717 hardware board, together with an interface cable, for connecting the DEM-PCM1717 to power and connecting the software control lines to an IBM-PC parallel port. DEM-PCM1717 also includes evaluation software, described later under Software Description. The interface cable connects to the connector CN2, a source of +5V and ground, and the parallel port of an IBM compatible PC. Figure 5 shows the block diagram and connection for the DEM-PCM1717-1.

## DEM-DAI1717

DEM-DAI1717 is a complete evaluation fixture, including an SPDIF receiver, PCM1717 and an analog post low-pass filter DEM-DAI1717 also includes evaluation software.

PCM1717 contains features which can be programmed externally. These features include a 256-step digital attenuator, data interface format, word length, output format, etc. Refer to the PCM1717 data sheet for a complete description of these special functions.

PCM1717's special functions are programmed via a 3-wire serial interface. This type of control is commonly referred to as serial or software control. The penalty for using this mode is that the DAC must be controlled via external microprocessor or logic. But since most digital audio systems usually contain a microprocessor or micro controller, component count is not always increased.

DEM-DAI1717 utilizes the parallel port of an IBM-compatible PC to implement the 3-wire serial programming interface. The evaluation software runs on Windows® Operating System.

The DEM-DAI1717 evaluation board consists of three main sections or functions. The audio interface section consists of an electrical (RCA jack) or fiber optics connector to the SPDIF input. The input signal is processed into a standard 3-wire serial digital audio interface with the SPDIF receiver. The DAC section consists of the PCM1717E audio DAC and its associated circuitry. The active filter section uses an OPA2604 op amp to implement a 2nd-order filter for reduction of out-of-band noise. Figure 6 shows the block diagram of the DEM-DAI1717 system board.

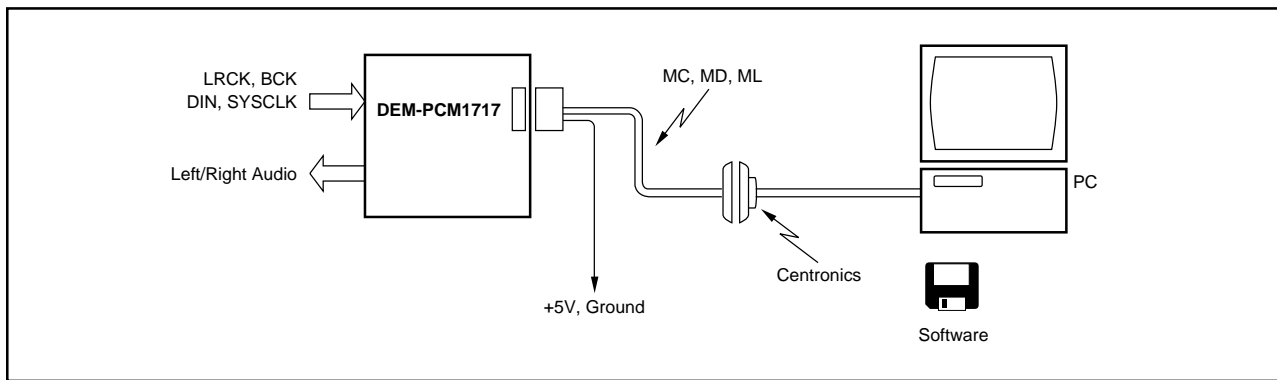


FIGURE 5. DEM-PCM1717-1 Interface Connection.

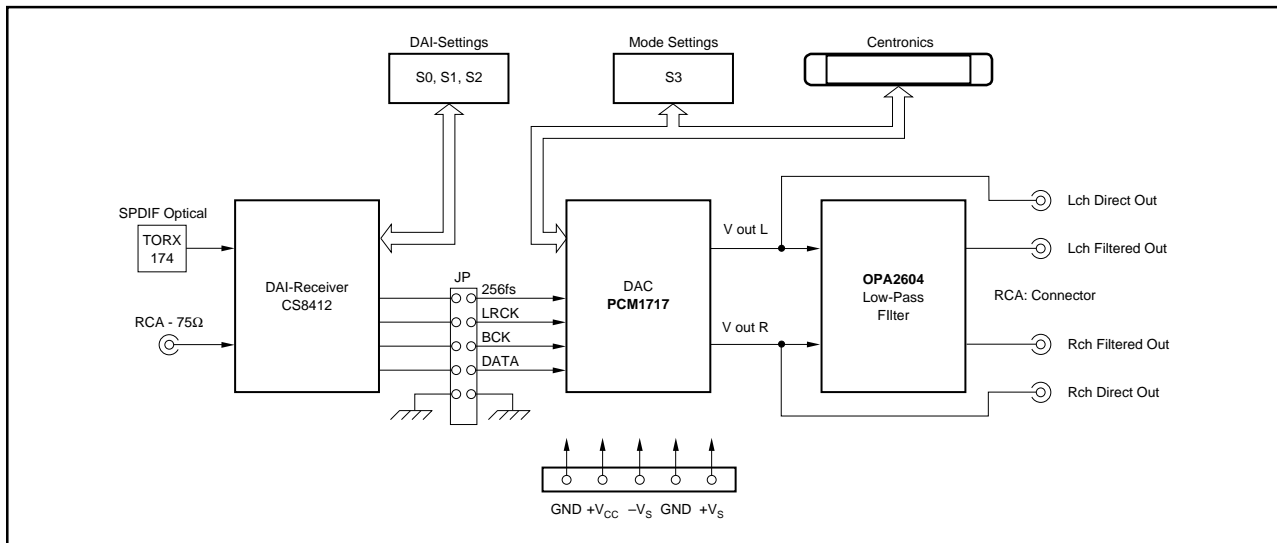


FIGURE 6. DEM-DAI1717 Block Diagram.

DEM-DAI1717 also allows for operation in the hardware mode. In this mode, the special functions are limited to de-emphasis frequency selection, soft mute and reset. These hardware features are controlled with DIP switches, and no PC connection is required.

### DEM-DAI1717 SYSTEM CONTENTS

- DEM-DAI1717 Evaluation Board
- DEM-DAI1717 Software on a 3.5" high density disc
- DEM-DAI1717 Evaluation Board contains a SPDIF interface, an interface for the IBM-PC, and an external low pass filter for the DAC itself.
- DEM-DAI1717 Software must be installed under the Windows version 3.1 or Windows 95.

### DEM-DAI1717 SYSTEM REQUIREMENTS

- An IBM compatible PC with a 386/25MHz processor
- Windows 3.1 or newer
- A parallel port with Centronics cable interface.
- A source of digital audio data in the SPDIF format
- Installed and working DEM-PCM1717 Software and System Board

### INSTALLING THE DEM-PCM1717 SOFTWARE

It is recommended to install the DEM-PCM1717 software to the hard disk drive. It is possible to run the program from the floppy, but not recommended due to operating speed considerations. It is also recommended to use a desk-top computer. Certain laptop PCs have non-standard parallel ports which may not be compatible with DEM-DAI1717.

From the "File Manager" select the "Create Directory" from the "File Menu" and create a directory called "pcm17dem" on the hard drive that the software is to be installed on. Copy all seven files from the floppy disk's "pcm17dem" subdirectory.

### CREATING AN ICON FOR THE DEM-1717 PROGRAM

The following procedure should be followed to create an Icon for starting the DEM-PCM1717 software.

- From the Windows Main Menu select Windows Setup.
- From the Windows Setup select Set Up Applications selection. From this Menu select the Ask you to specify an application selection.
- The next window will ask for the Application Path and Filename to be specified, assuming that drive C: was the drive the software was copied to then this path and filename should be typed in as C:/PCM17DEM/PCM17DEM.EXE.

- Also from the previous menu the Program Group that the icon should be added to can be selected. The default choice of Applications is a good choice for this selection.

For the rest of this manual it will be assumed that the software was installed from the A: drive to the C: hard drive and that an Icon was created for the software under the Applications program group.

### CONFIGURING THE PCM17DEM.INI FILE

The DEM-PCM1717 software controls the software mode of the PCM1717 by sending messages to the I/O address of the parallel port of an IBM compatible PC. In order for these control signals to reach the DEM-DAI1717 evaluation board the software must be configured for the parallel port to be used. The contents of the default pcm17dem.ini file is as follows:

```
[PCM17DEM]
    PCMIFADR = &H3BC
```

The last three characters of the second line of this program specify the I/O address will send instructions to the software. Typically the IBM-PC has three I/O addresses that are used for parallel or printer communications. The default address for the DEM-PCM1717 software is 3BC. If the port that is being used to control the DEM-DAI1717 system board is different from this default address then the 3BC address should be changed to that address.

Typical port assignments are as follows:

If the DEM-DAI1717 system board is connected to LPT1 on an IBM-PC made in the U.S. then the pcm17dem.ini should be modified to read

3BC	International Printer Port address
378	US LPT1 address
278	US LPT2 address

```
[PCM17DEM]
    PCMIFADR = &H378
```

If the DEM-DAI1717 system board is connected to LPT1 on an IBM-PC made in the U.S. then the pcm17dem.ini should be modified to read

```
[PCM17DEM]
    PCMIFADR = &H278
```

The pcm17dem.ini file can be modified using the windows program note pad.

# DEM-DAI1717 SYSTEM BOARD INFORMATION

## GENERAL SPECIFICATIONS

Table I lists the specifications for the DEM-DAI1717 system board.

SPDIF Interface	Optical via Toslink RCA with 75Ω impedance.
System Clock Frequency	256 times sampling frequency, fs
Digital Audio Interface	16 bits, Normal Format, MSB last 18 bits, Normal Format, MSB last I <sup>2</sup> S 16 or 18 bits
THD+N	0.004% typical, with internal 20kHz Low Pass Filter. 0.08% typical, direct out, with external 30kHz Low Pass Filter.
Dynamic Range	94dB typical, (EIAJ method, A-weighted filter)
SNR	100dB typical, (EIAJ method, A-weighted filter)
Maximum Output	2Vrms (using internal low pass filter out)
+V <sub>CC</sub> range	+4.5 to +5.5
+I <sub>CC</sub>	+60mA (no external load) to +120mA
±V <sub>S</sub>	±5V ~ ±15V
±I <sub>S</sub>	±15mA (no external load)

TABLE I. DEM-DAI1717 General Specifications.

## SPDIF INTERFACE OPTIONS

The DEM-DAI1717 employs a SPDIF receiver chip. This receiver extracts 4 signals from a two wire signal that is interfaced to the board. The receiver can supply these four digital audio signals in up to eight different formats. Of these formats only three are useful or valid for the PCM1717. The output format is commanded by the setting switches S0, S1, and S2. Figure 7 shows the switches and resulting output configurations from the settings. Only the three configurations shown will produce valid outputs from the PCM1717E.

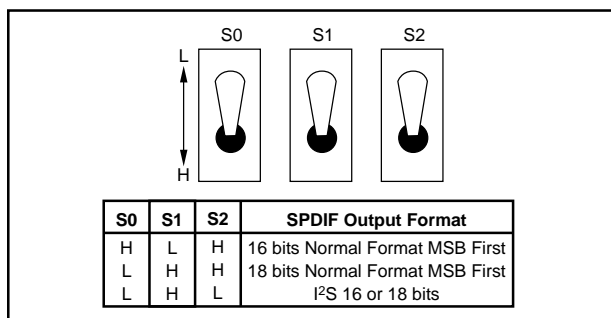


FIGURE 7. SPDIF Interface Options.

## JUMPER SETTINGS

The DEM-DAI1717 system board has 5 jumper blocks that allow the digital outputs from the SPDIF receiver chip to be connected to the PCM1717. The four jumpers that interconnect the four digital audio signals from the receiver chip are

installed by default. An optional ground connection can be made between the receiver chip and the PCM1717E. Refer to Figure 8 for the orientation of these jumpers.

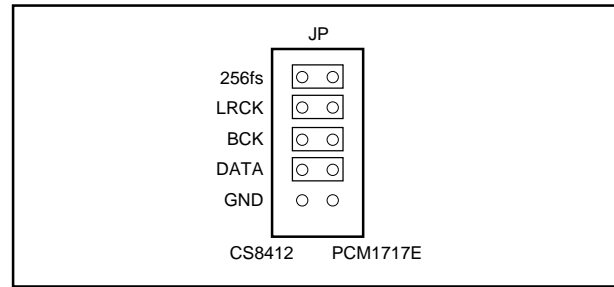


FIGURE 8. DEM-DAI1717 Jumper Configuration.

## MODE CONTROL SWITCH SETTINGS

The DEM-DAI1717 system board uses 5 switches, labeled as S3, to select between software and hardware control and to provide settings for the hardware mode. When the DEM-DAI1717 is to be used with the system software then it is necessary for all of the mode switches to be in the high or off position. Figure 9 shows the functions of all five of these switches.

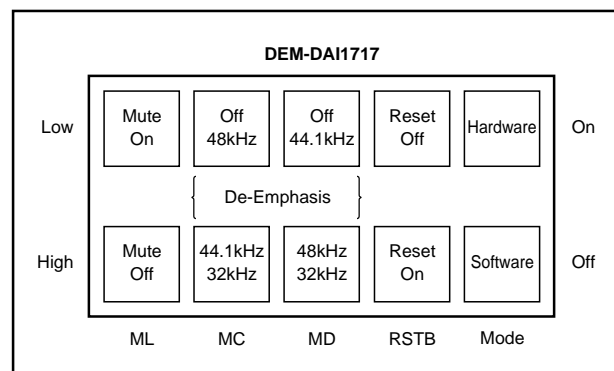


FIGURE 9. DEM-DAI1717 Mode Control Switch Settings.

## PARALLEL PORT CONNECTIONS

Figure 10 shows the connections made between the parallel port connector and the pins on the PCM1717.

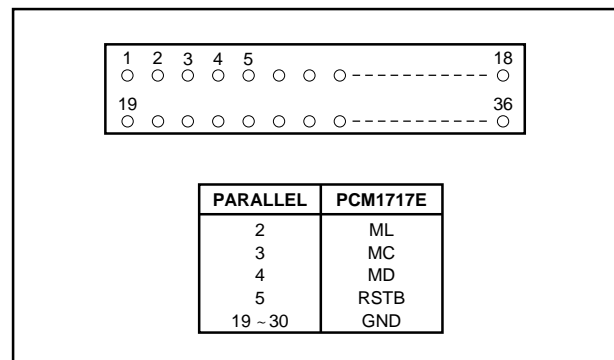


FIGURE 10. DEM-DAI1717 Parallel Port Connections.



## HARDWARE CONNECTIONS FOR THE DEM-DAI1717

Hardware configuration of the DEM-DAI1717 evaluation board consists of supplying a source of digital audio data, connecting the board to an IBM-PC parallel port, connecting the audio output to a speaker or measurement tool and supplying a source of power to the system board.

### Digital Audio Source

Figure 11 shows the “schematic” drawing of the DEM-DAI1717 evaluation board. There are a total of four connectors that must be used for the PCM1717 to reproduce digital audio data. Figure 12 details the parts location and orientation for the DEM-DAI1717 evaluation board. The PCB layer design for the traces and ground planes used in the DEM-DAI1717 system board are shown in Figure 13.

### Digital Audio Input Data

The source of digital audio data is connected via the coax connector labeled as “CN3” or “COAX.” This port is used if the SPDIF digital audio data comes from a RCA connector.

SPDIF data can also be provided to the DEM-DAI1717 system board via fiber optic connection. The “port” that is used for this form of data is connected to the U4 or OPT connection. The connection is made using a standard “Toslink” connector.

### Power Connections

A 5 pin connector labeled CN1 is used to connect power to the DEM-DAI1717. A separate +5V supply is used for the SPDIF receiver chip and the PCM1717, labeled as +V<sub>CC</sub>. The power connections +V<sub>S</sub> and -V<sub>S</sub> are used to provide for the active filter op-amp, OPA2604. This amplifier should not be run at power supply voltages greater than ±15V. The remaining pins are used for ground connections. These grounds are not isolated from each other electrically.

### Analog or Audio Connections

The analog outputs of the PCM1717 are brought out directly through RCA jacks CN6 and CN7 for the left and right channel respectively. These outputs are referred to 1/2 of the V<sub>CC</sub> voltage, i.e. the output swings symmetrically about 2.5V for a 5V supply.

## SOFTWARE DESCRIPTION

The PCM1717 demo software is used to control the internal register settings of the PCM1717 through a set of four windows. The main menu is brought up by clicking on the “D17CTRMK” icon in the applications folder.

### MAIN MENU

Figure 14 shows the main menu that is brought up when the “D17CTRMK” icon is selected. This menu has three areas of interest. The “Execute” option allows the user to either reset the PCM1717 to its default power-on state using the Reset command, or allows the user to exit from the PCM1717

software. The execute menu can be opened by either clicking on the “Execute” or by using the Alt-E key sequence. (All of the menus and commands can be activated by using the mouse and the left button or Alt key sequences). The Windows submenu (Alt-W) allows the Attenuation (Alt-A), Function (Alt-F), and Dataform (Alt-D) submenus to be opened. The function of these menus is explained in the next section.

The bottom of the PCM1717 Main or Control Menu contains the Hexadecimal value of the current contents of the PCM1717 four control or Mode Registers. For a more detailed description of these registers consult the product data sheet for the PCM1717E audio digital-to-analog converter.

A Pass/Hold selection is available for all three of these control menus. When the Menu is in the Pass mode then commands are sent to the PCM1717 as various selection or options are selected immediately. When the Menu is in the Hold mode the changes are held in the software for the DEM-PCM1717 until the menu is changed to the Pass Mode.

### ATTENUATE MENU

The PCM1717 allows the user to command 255 steps of noiseless attenuation into each channel. The left and right channels can either be controlled together, i.e. equal attenuation of both channels, or independent control over each channel. Figure 15 shows the attenuation menu.

To change the attenuation or volume of a channel use the mouse pointer over the bar in the attenuation level menu for the desired channel, press and hold the left button and drag the bar to the desired level. Pressing the Hold selection in the Control Data section of the Attenuation Control Menu will change the Hold section to Pass, and the necessary register settings for the desired attenuation level will be passed to the PCM1717. The level or volume will change. (Note that if the Left and Right channels have been chosen to be equal from the Format Control menu, then only the Left channel Attenuation Level will be selectable.)

### FORMAT CONTROL MENU

This menu allows the user to program the data input format, resolution, Left-Right clock polarity, output format, and Attenuation formats for the PCM1717. This menu is composed of six submenus explained below. Figure 16 shows the default menu for this section.

### FORMAT

This menu allows the PCM1717 to be programmed for either the standard or I<sup>2</sup>S format for incoming data to the DAC. The standard format is used when the incoming data is MSB aligned to the Left-Right clock or LRCK. The I<sup>2</sup>S format is used when the incoming data conforms the Inter-IC sound format. Refer to the product data sheet of the

PCM1717E for a more detailed explanation of these formats. Selecting either of these formats is done by clicking on the Format window and selecting the desired format.

### **WIDTH**

This menu controls the number of bits that the PCM1717 uses for digital audio conversion. The choices are either 16 or 18 bits.

### **LRCK**

This menu selection allows the user to specify the polarity of the incoming digital audio data when respect to the left/right or sample clock. The choices allow the user to specify whether the low portion of the left/right clock is coincident with either the left or right channel data.

### **L-OUT AND R-OUT**

These two menu selections allow the user to control the analog channels and formats through which the recovered digital data will be sent. The choices allow for either channel to be swapped or sent to the other channel allow the two channels to be summed together and the magnitude to be divided by two, mono, or allows either channel to be muted.

### **ATT CTRL**

This menu controls whether the attenuation controls affect each channel individually or whether both channels are of equal volume.

## **PCM1717 FUNCTION CONTROL**

This menu controls the De-emphasis, Infinite Zero Detection, and Operational Enable features of the PCM1717, as shown in Figure 18. These features are controlled by three submenus detailed below.

### **DeEMPH**

This menu allows the selection of three de-emphasis frequencies or allows the de-emphasis to be disabled.

### **IZD**

This selection allows the user to turn on or off the infinite zero detection feature. Because this feature is either on or off there is no menu for its selection. Clicking on the box places an x in its selection and turns off the feature.

### **OPE**

This selection allows the user to enable the operation of the PCM1717 this is equivalent to turning the PCM1717 on or off. As with the previous feature, this feature does not have a menu and the PCM1717 is enabled by clicking on the box and turning the PCM1717 on.

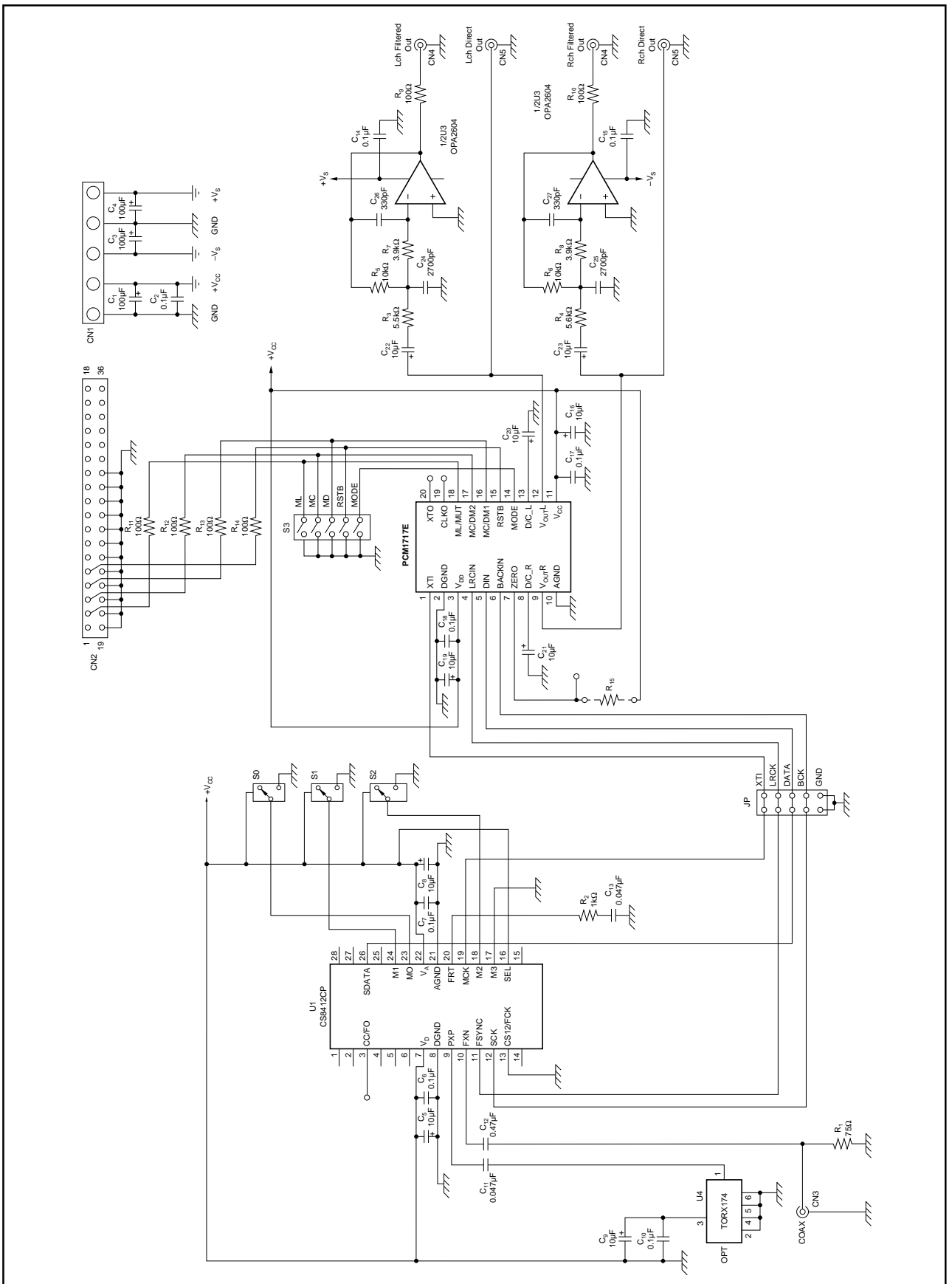


FIGURE 11. DEM-DAI1717 Schematic.

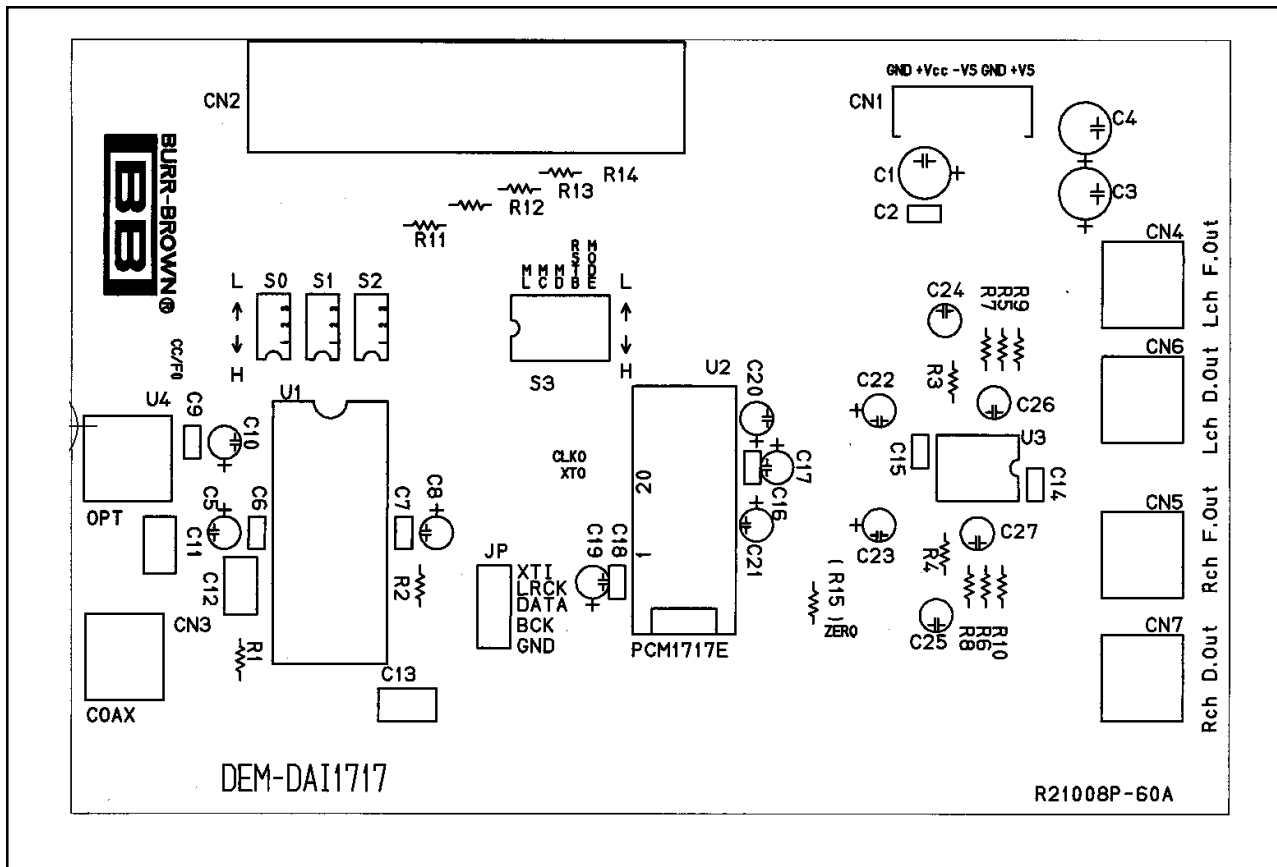


FIGURE 12. DEM-DAI1717 Parts Layout.

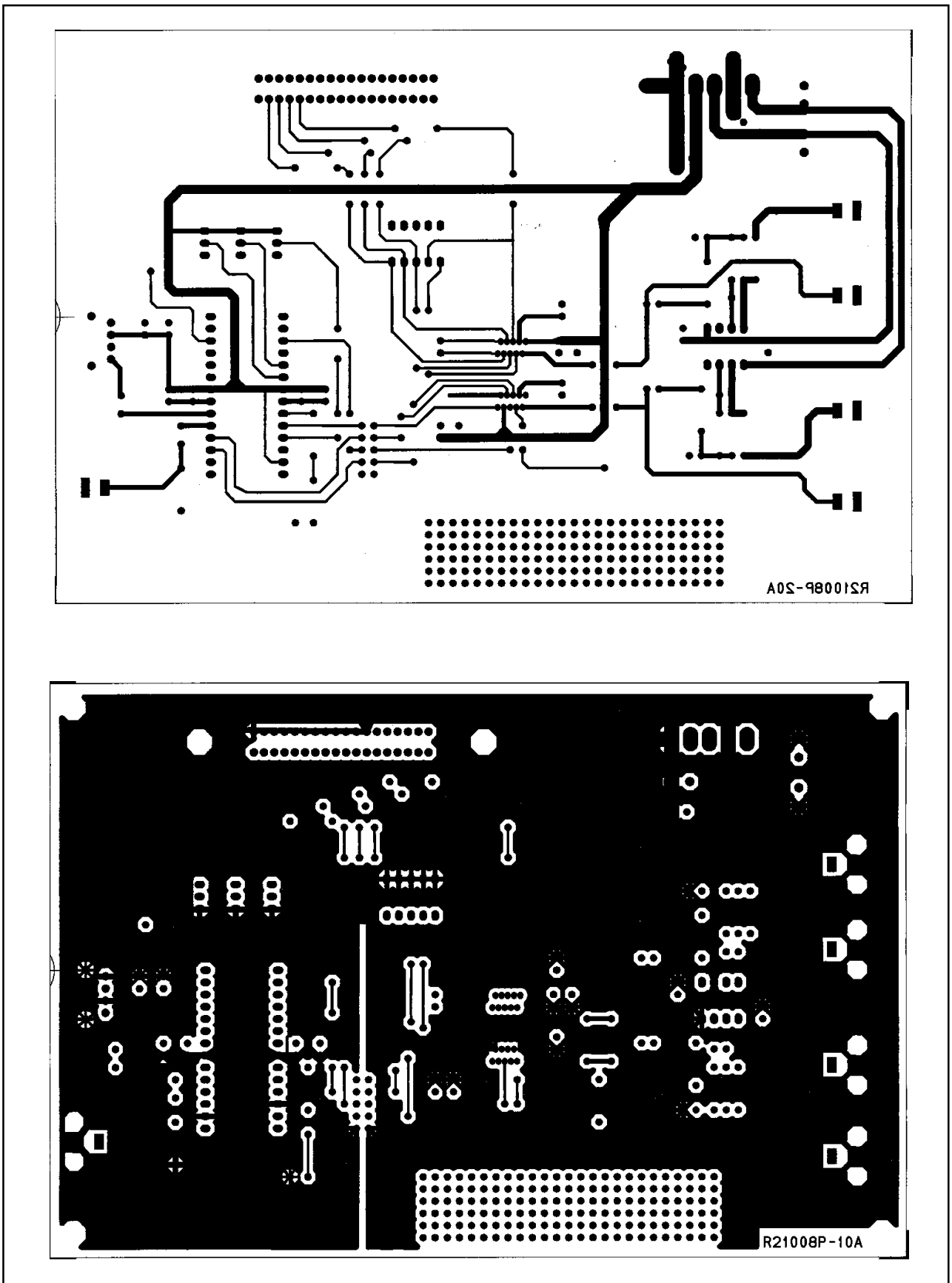


FIGURE 13. DEM-DA11717 PCB Design.

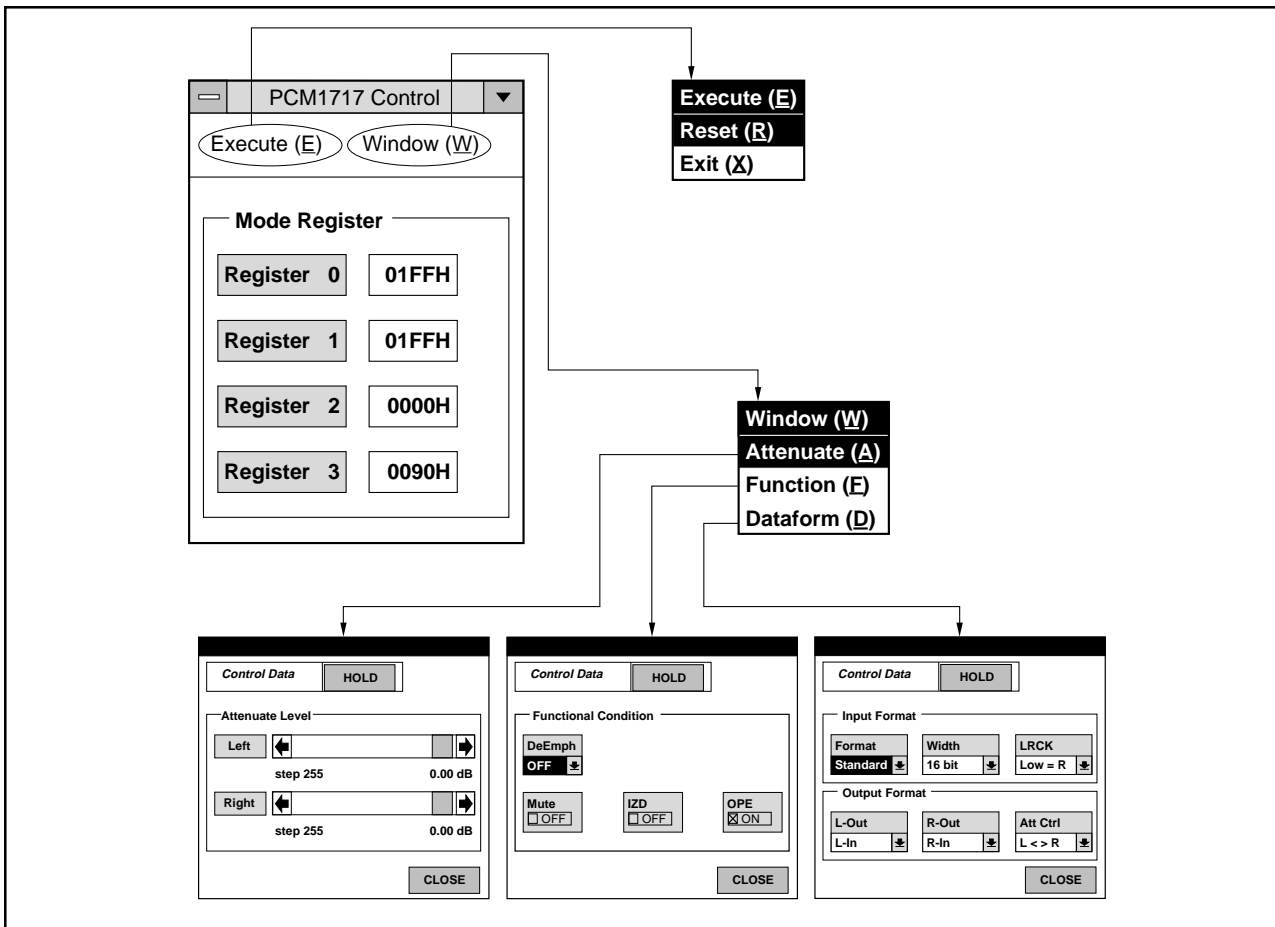


FIGURE 14. Demo Software Main Menu.

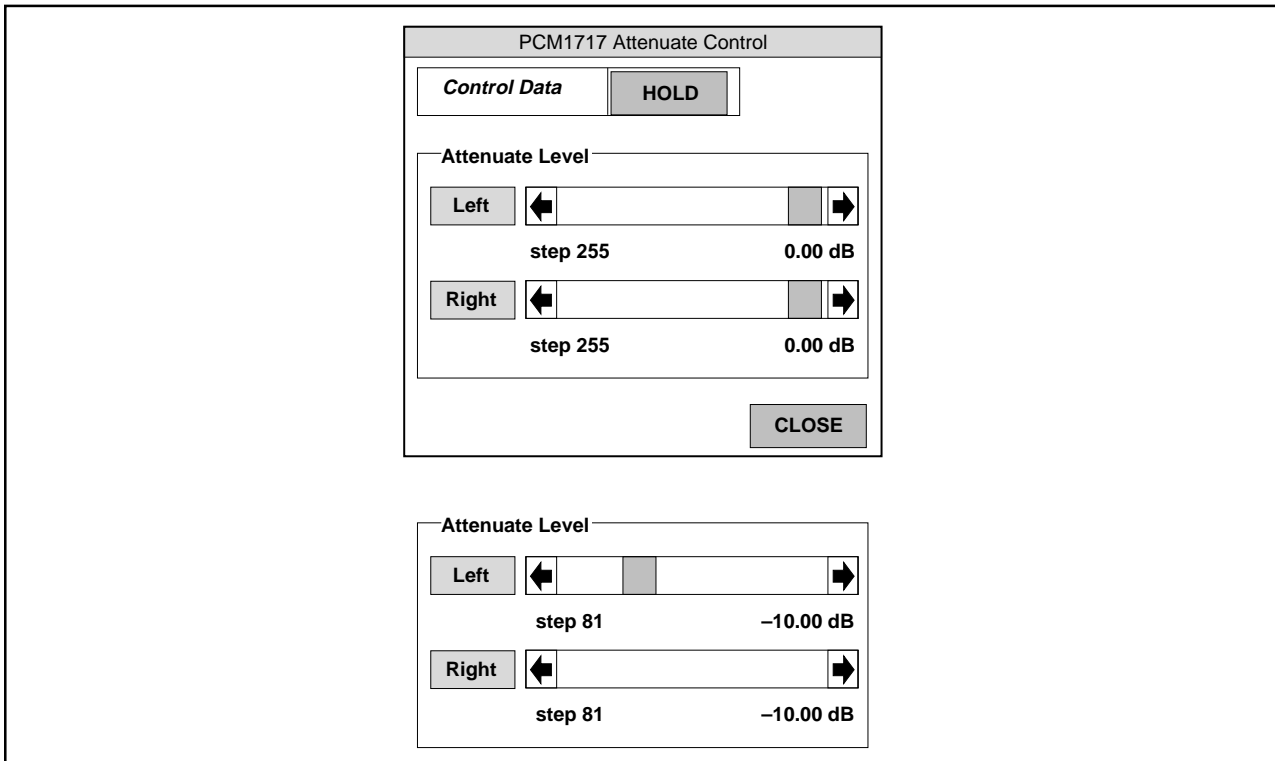


FIGURE 15. Demo Software Attenuation Menu.

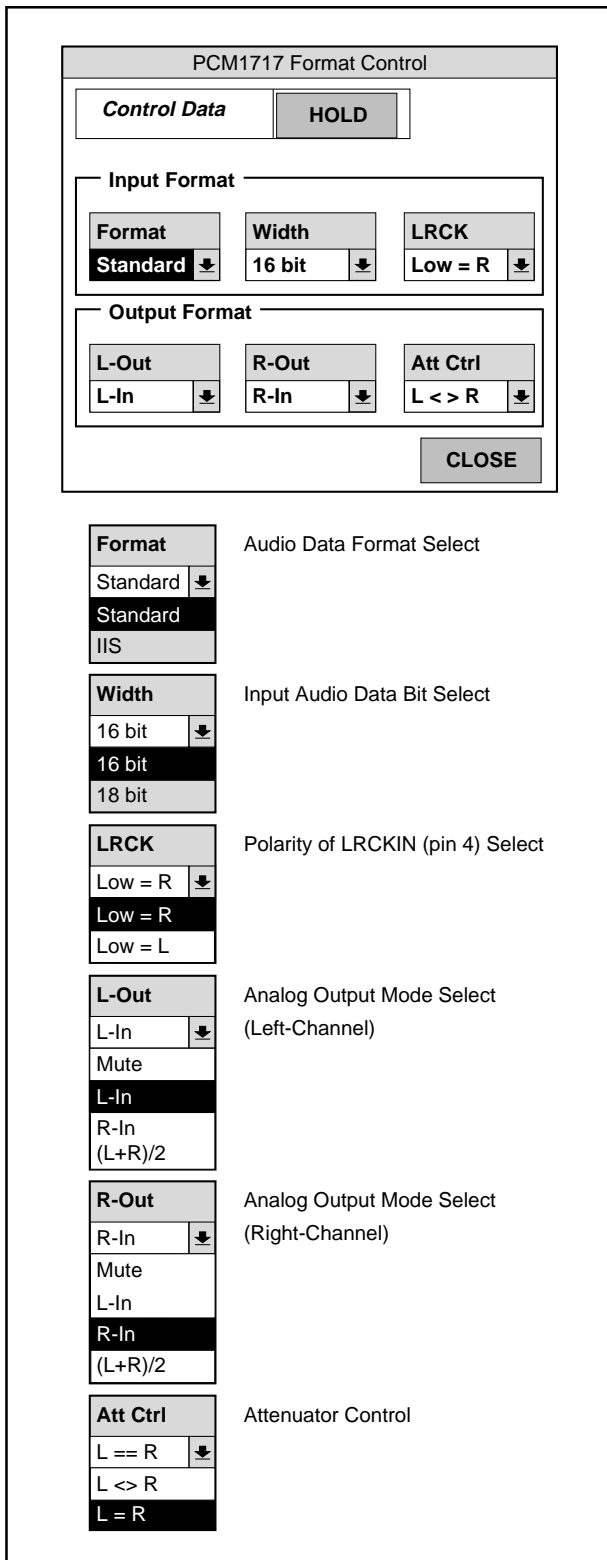


FIGURE 16. Demo Software Format Menu.

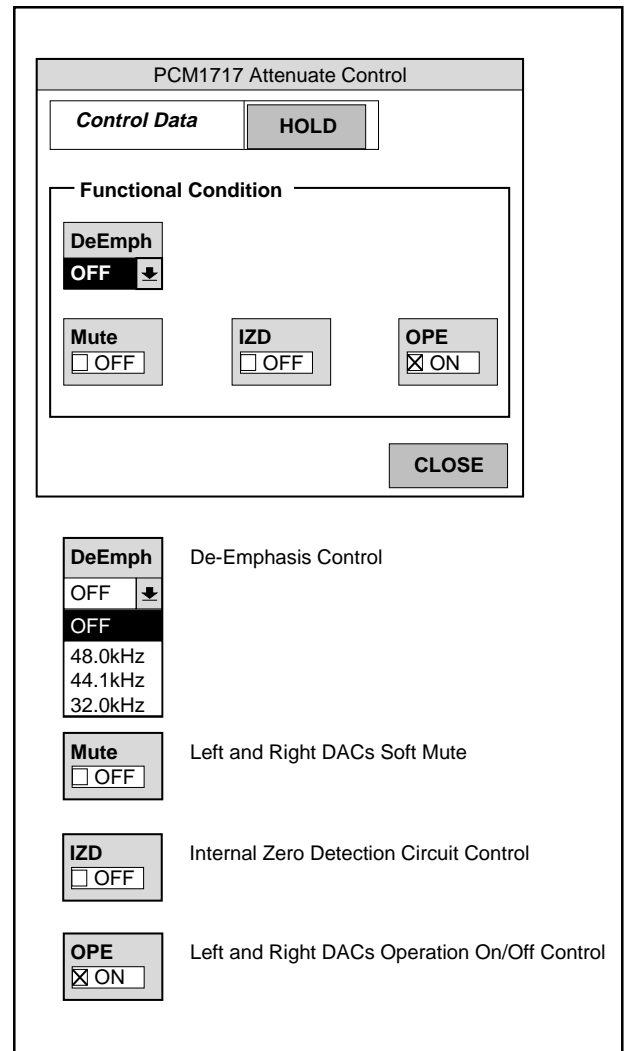


FIGURE 17. Demo Software Function Menu.

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