

Digital Audio

Tone Control *with Remote Control*

8051

my hobby Educational Trainer
Heart Systems EAF² Electronics Series

- Trainer / Project -

Shareware User's Guide

Series #03

Inside!

- Basic Tone Control
- AV Home Entertainment
- Tone Control & Amplifier Integration
- DATC User Manual
- Block diagram & Schematic
- Design Rendering
- I²C protocol Communications
- Digital Audio Processors Interface
- Infrared Remote Interface
- VU Meter Interface
- Headphone Amplifier Interface
- Scanning of keys
- LCD Interface
- ATMEL AT89S52 (8051) MCU
- EXT control interface
- EEPROM interface
- <Project Management & Firmware Development not included>



PLUS:

DATC History <2004~2011>
.....Extras & EXTRA



The **DATC** Trainer Board / Project



Digital Audio Tone Control { DATC }

.....good for hobby, good for listening, good for learning 8051 firmware on Audio Applications, a self study to Learn Digital Tone control and MCU.

Shareware & Courseware CD ROM not included



F. Dandy Menor
Electronic Hobbyists

Digital Audio

Tone Control *with Remote Control*

8051



Educational Trainer
EAF² Electronics Series

- Trainer / Project -

Series #03

Help to Save the Environment
Think before you PRINT.

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on Adobe PDF. Thanks.

Dedicated to :

*my loving mother, my KIDDY - Christopher -
Christian and John Markus and to all MCU
DIY Learner and Audio Hobbyist*

F. Dandy Menor

Digital Audio Tone Control

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Video Files

If you have a copy of the Heart System's DATC CD-ROM, you can share those MPEG video files in its original form and tell your friends about Heart Systems - - Digital Audio Projects. All video files in the CD ROM are property of Heart Systems. Editing the mpeg video files is not permitted.

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Warning !!! 

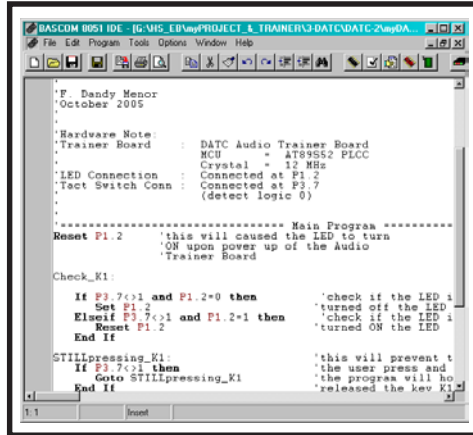
Important Notice

The **Digital Audio Tone Control** described in this Document involved the use of electricity. The user is advised to **observe all safety precautions** when doing the experiments described.

 **myhobby** Educational Trainer
 Heart Systems  **EAF²** Electronics Series

Who Should Read This

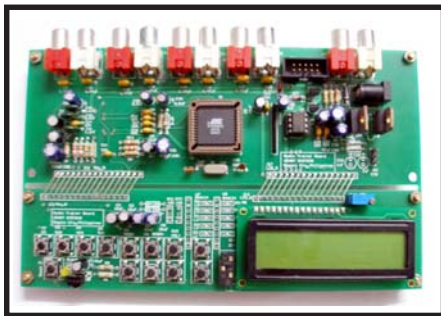
The **Digital Audio Tone Control is an Electronic Learning Kit** - dealing with Intel 8051 Microcontroller (MCU), Hardware design and Firmware development. I loved to call its nickname as **DATC Trainer Kit**. It is intended for 8051 user's who have initial knowledge or has been programming the 8051 MCU, specially the AT89S51 or AT89S52 MCU. For 8051 electronic hobbyists and DIYer's, Students, Electronic Engineers and Technicians who want to avail the Easy, Affordable, Fast and Fun [EAF² mark] Tools - - - Software and Hardware :



BASCOM 8051 Integrated Development Environment (IDE)
 A BASIC compiler by MCS Electronics, *The Netherlands*.
 Visit www.mcselec.com



and looking for a project in digital Music Control and reproduction using state of the art TDA7442 Digitally Controlled Surround Processor by SGS - Thomson



or simply looking for an adventure in 8051 MCU with Digital Tone Control

..... the DATC Trainer Kit is for you.

It is also possible to use this Trainer Kit by a MCU STARTER, however, he/she needs to have a cross reference on 8051 Microcontroller because the detailed 8051 Architecture, Registers, ROM, RAM, Input/Output topics were skipped in this Trainer Kit. A cross reference Trainer Kit for beginners of 8051 MCU is the :

my8051 Volume 2. Microcontroller Trainer Kit

which discusses the Architecture, Programming and its simple applications using the AT89S51 - the little brother of AT89S52.



Inspirations

"That's right! I am standing here, living proof that if you work hard enough..... and you want it bad enough..... dreams do come true. So follow your dreams man, follow your dreams because we all die young"

- From the Movie ROCKSTAR -

PREFACE

Thank you for selecting the DATC - your friendly Digital Audio Tone Control:

The aim of this Project is to support the user's of - **my8051 Trainer Kit**
STARTER MCU-EB8051-"2" Trainer Kit
and Future diy Trainer / Learning Kit

with a more complex 8051 programming samples and more interesting project than the simple circuits interfacing to the STARTER MCU-EB8051 Trainer Board. This is to provides solution to the demand of aggressive electronic students, technicians MCU hobbyists and electronic hobbyists who are not satisfied with a **simple projects**.

The original aim is to use this Project as a **Trainer Kit** for :

1. Inter IC (I²C) Communications Trainer
2. EEPROM
3. LCD
4. Infrared Remote Control
5. Using the Thomson Digital Audio Processor (TDA7442)
6. To use 8051 MCU to Control other device

These six (6) aims make this Project unique in nature. It is unique in its sense that, you can learn 6 topics in one project.

Unfortunately, I am too busy to make all the necessary dissected, small programs and explanations of each item described above, that, doing so will let me to release this project by next year. I decided then to released this project as a "Digital Tone Control Project" and not an "Audio Trainer Kit". I believe that, the 8051 community can utilized this project as **Trainer Kit** rather than as an Audio Equipment.

There are MCU hobbyists out there who can write a better program, concept a better protocol and can make the project more attractive than my DEMO software or hardware. Where are you guys? Hoping that these MCU friends and electronic hobbyists can share their work/hobby to me, to you and to other MCU hobbyists who are hungry of having a Digital Tone Control. Here it is.....

the **Digital Audio Tone Control - DATC**

I expected that this project will provide convenient and easy usage as compare to the analog Tone Control. The reason is that, this tone control can be remotely accessed using an Infrared Remote Control (IRC) like the remote control use in other Hi-fi. What makes it very attractive features is that, it has a build in real time clock, you can set the time to turn on and the time to turn off automatically. It can also able to control the Power Supply On/OFF and Speaker Systems of your amplifier. The other attractive feature is that, you can program the MCU to display your name on the LCD, provided that you know how to program the host processor - the 8051 AT89S52 MCU.

Lastly, Heart System will make an effort thru its own R&D or from good samaritan, individual, group or friends to make the original plan to makes use of this Project as **TRAINER KIT - a truly Digital Audio Trainer Kit.**

Acknowledgement

Project / Trainer #3 - DATC Trainer Kit will never finished without the support, help, guidance of individuals and companies and sources of inspirations and power. I would like to thank them.

Mr. Mark Alberts of MCS Electronics - *the Nederland* (www.mcselec.com), thank you very much for having the BASCOM 8051 Integrated Development Environment (IDE) software - demo version which I used to write the program, your permission and authorization to used and discussed in this Trainer Kit and share in the CD ROM.

Mr. Rand Liu - of Shenzhen China, thank you for your help on the HS AT89 Flash MCU Programmer, the official programmer to burn the firmware into the Flash ROM of the AT89S52 MCU. I am glad for your support and providing to me the "C source code" of decoding the the Remote Control.

Dr. Vinod Kumar - of Jabalpur India, thank you for your help, hints and kins for the Digital Audio Trainer Open Systems Design (DATOSD).

A big-BIG thanks to SGS Thomson, for having the TDA7442D Digitally Controlled Sound Processor and to ATMEL for having the nice AT89S52. I find these chipsets are ideal for Learning MCU.

Companies who developed solution and tools which I used to finished my Trainer Kits : HP Pavillon DV1000 and Mio for the notebook PC, Pinnacle for the Studio Video editing, Adobe for the Photoshop and Pagemaker, Canon for the nice microcapture camera, etc.

My dog (Golden Retriever) who love to stay with me during those night burning the oil (here is her picture below my desk), watching me curiously typing hard on the notebook PC and..... patiently "retrieved" back to me some prototype flown away when my ears feel like burning during the debugging of programs - - she thought I am designing some kind of flying toys for her, thanks for your cutee smile and keep me off from those mosquito.



The T6000 Intelligence AV Receiver by AVLight which provides some inspiration in the writing of this Technical User's Guide.

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Baguio City, Philippines

Buji Shenzhen
Republic of China
December 2005

Revive : Rev. 1.2
Hong Kong
February 2011

Digital Audio

Tone Control with Infrared RC

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CHAPTER 1

—The HISTORY of DATC

This chapter will narrate the life of DATC-
from analog Tone Control into digital, the hardship
of the Author to make a
Digital Tone Control



History :

Way back in the early 90's - the time I am in the university in Baguio City, Philippines, I am a plain Audio-Video hardware freak. The result of this attitude is shown in Figure 1. I able to design a synthetic analog process **Audio-Video (AV) Tone Control & Amplifier**. I cannot claim to be my original design, but I am glad I able to make it work after integrating "some" simple project into a working AV Tone Control. Basically, what I like is to have is an **AV with digital control using a push button to adjust the treble, bass and volume control** (but not using a rotating or sliding potentiometer). Unfortunately, there is no much technical and material resources on hand. At that time (late 80's and early 90's), the Internet is not yet popular in my place. If there is an available information, obtaining the parts (IC) is impossible. You can't imagine how difficult to make the dreams come true at that time. Finally, I still end up using a potentiometer to adjust the bass, treble and volume of my Tone Control, see Figure 1. It's a pity.

Anyway, I still enjoy using my AV and I am proud of using and showing it because it is my "piece of work". But now, it is just a "display" as it is obsoleted by the fast advancing technology in AV. Although it is still working I seldom use it, I prefer to use my DVD player with DTS / Dolby decoders plus a high performance Computer Audio Video Intelligent AV Receiver - better known as **CAV**, please jump to Figure 40.

Now is 2003, I say to myself, I need to make my dream come true. I'm in a different place now where opportunity is on hand - its just around the corner. Ok! With the power of the internet, I can do my research at home, I can contact the manufacturer and distributors by email or phone and I can get result faster. BINGO! I found a company with lots of AV decoders. This is it!

Unfortunately it is not so easy as anyone thought. The main AV decoder IC requires licensee. It's designer or manufacturer requires me to have a license before I can obtain or purchase the IC. To explain in commercial sense, you need to pay the royalty fee (means money) to them if you are going to use this IC. Also, they will not support for small quantity orders. Huh! They have a policy of what is known as MOQ (Minimum Order Quantity), sounds like the MOQ is 1,000 pcs.



■ FIGURE 1 : my Analog TONE CONTROL & AMPLIFIER project during University days

Let me explain further in the real world about the so called "royalty fee" and 'propriety rights". If you have a DVD player or Audio Equipment device with Dolby 5.1 capability, please see the manufacturer declarations at the back side of the device and you'll see that, they are license to use the IC decoders (like Dolby, etc.).

It's a pity, I am not a big guy with bulky wallet. So, I forget about this possible solution. Aaaahhh! In case you have that bulky wallet and wanna invest something for me (I mean, for the user like technicians, students, MCU and Audio hobbyists, etc.), please contact me personally at : my8051_ph@hotmail.com or danztherock@gmail.com.

Luckily, I find the SGS-Thomson (ST) Audio-Video chipset. The **TDA7442 - Tone Control and Surround Digitally Controlled Processor**. The TDA7442 Audio Processors is easily find in the market, there is no MOQ, you can purchase it piece by piece and the price (I think) is reasonable enough that most AV hobbyist can afford. You don't need to pay the license. The **search is over!**

Oh well, I need to make it sure of the price, availability, performance and quality. After some test on my first prototype, I found that it can meet my requirements as having digital control on

Bass, Treble and Volume

by using a push button to adjust the levels..... but it cannot able to perform as an AV 5.1 channels that can decode AC-3 Dolby Digital or DTS.

Finally, with an aim to make an Audio Trainer kit the soonest that is in conjunction with my popularizing 8051 Microcontroller (learning the easy, affordable, fast & fun ways [EAF2]), I decided to use the TDA7442 as the main Audio Processor in my Audio Trainer/Project - which I named here as **Digital Audio Tone Control** or simply **DATC** project. The final working version of the DATC is shown in Figure 3.

Here, for year 2011, I revive the DATC for our fellow Hobbyist. In the past, the DATC is voted by one University to be their platform to learn Hardware and Firmware programming, and since then, it is not so open to our Audio Hobbyist. For this year, it will be open and shareware for schemtic, dox, manual, PCB and parts with limitation on program code. I hope you like it.

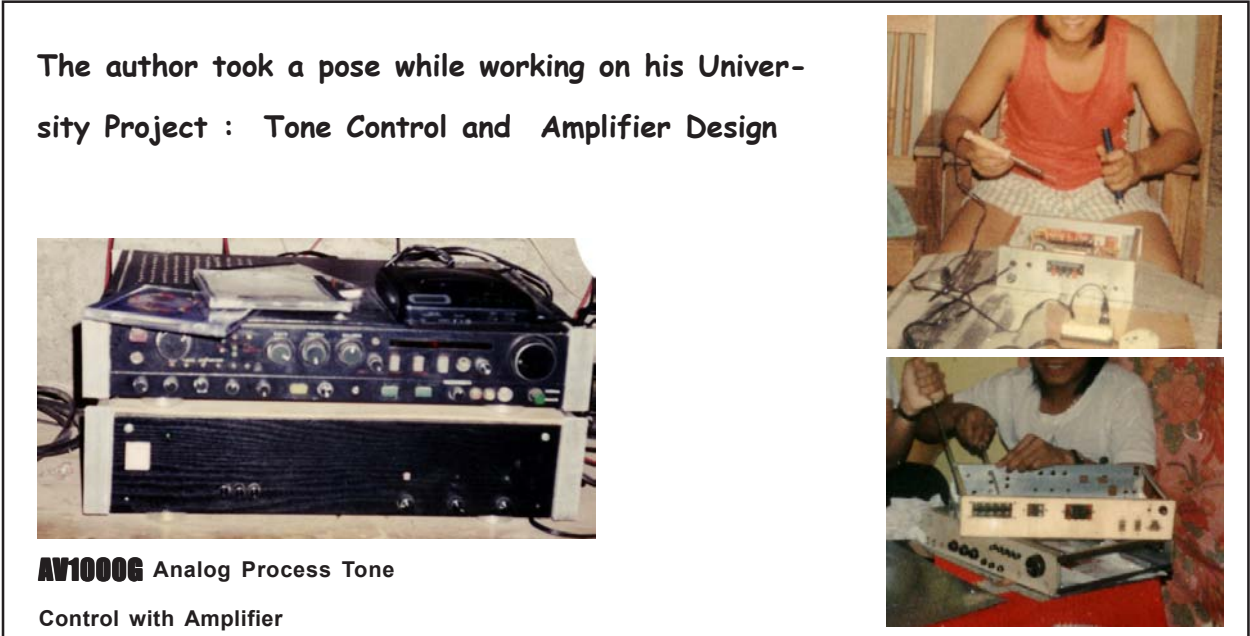
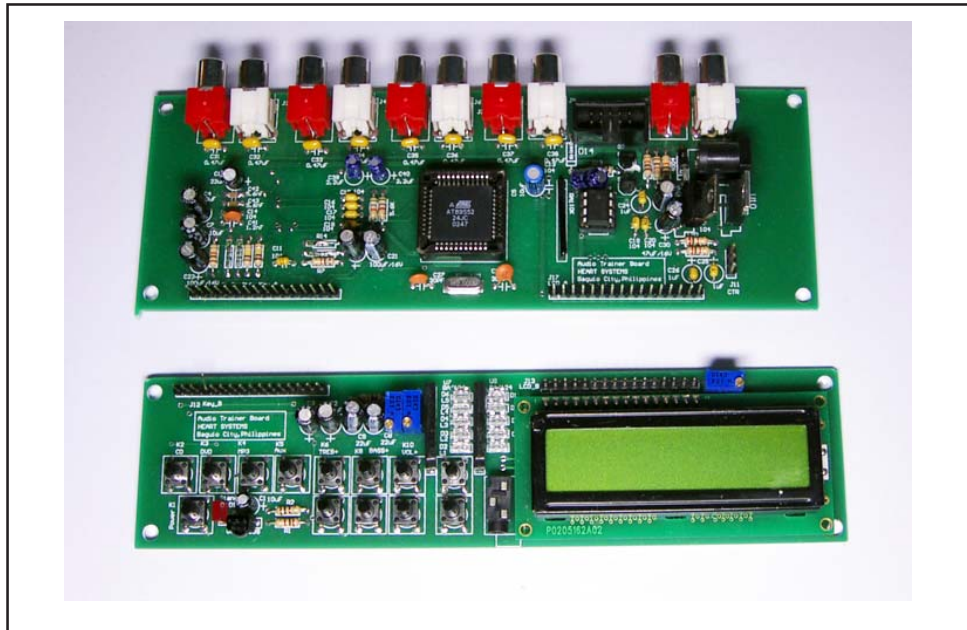


FIGURE 2 : THE AUTHOR WORKING on his AMPLIFIER & TONE CONTROL PROJECT



■ FIGURE 3: COMPLETE DIGITAL AUDIO TONE CONTROL - **DATC**

DATC Features :

- MicroProcessor Controlled using the ATMEAT89S52 (PLCC)
- Using Digital Audio Processors : SGS Thomson - ST TDA7442
- Push button adjustment of Volume, Bass and Treble
- Push button Power On/Off
- Push button Music / Surround Selection
- Infrared Remote Control
- 16x2 LCD with amber backlight
- Stereo VU meter
- Stereo Internal Headphone amplifier
- 14 dB of Boost/ Cut Treble
- 14 dB of Boost/ Cut Bass
- Music Surround Sound On/Off Selection
- Mode : Music / Simulated
- 4 Stereo Inputs - RCA Jacks
- 1 Stereo Outputs - RCA Jacks
- Last Setting Memory
- Real Time Clock
- Programmable Turn on
- Programmable Turn off
- User's Programmable Control (User can program the Processor)
- MCU programming on board (ISP)
- External Control via Relay of amplifier Power Supply
- External Control via Relay of Amplifier Speaker Systems
- Power Supply Requirements : 12 volts dc @ 500 mAmps

The features above makes the Digital Audio attractive and eventually will going to replace its analog predecessor.

CHAPTER 2

Audio

BASICS & the DATC

**This goal of this chapter is to present some Basic
information about Audio Equipment, Tone Control,
Equalizer and the AV 5.1 Channel Amplifier**

DATC - what for?

Where is the DATC applied for? Basically, the DATC is similar to an **Analog Tone Control** and perform the same function of boosting and cutting the sound quality of music. However, DATC is far superior than an analog tone control because DATC works digitally and includes new features to make the music sounds better to the ear.

See Figure 7 on how to Integrate the DATC into an existing **Power Amplifier**, or simply **PA** to have a friendly and smart audio equipment. To understand fully the function of the DATC as a Tone Control, let's have a quick and basic review of the functions of each components of a Basic Audio Setup. Please refer to Figure 4.

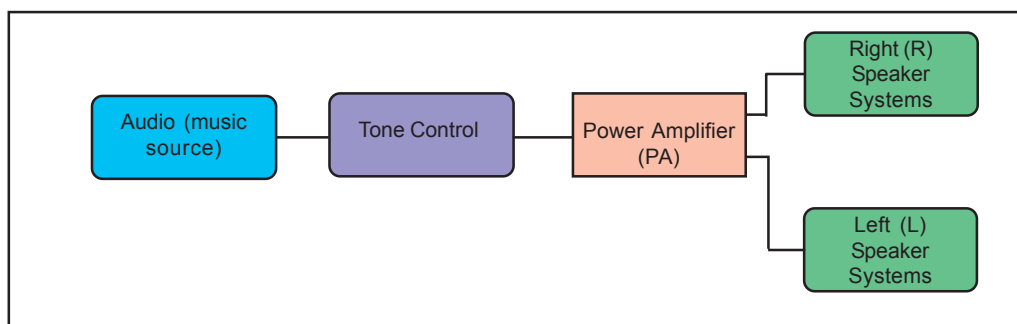


FIGURE 4 : BASIC AUDIO SETUP

Audio (music) Source :

You can use your portable CD player as the Audio (music) source. You can also use your DVD player as the music source, please make use of the normal L and R stereo output -- do not use the AC-3 output of your DVD. Of course, you still can use other audio sources like the VHS player, TV with stereo audio output and walkman but it cannot use the phonograph (or phono) because the phonograph equalization is not included. It is possible to use also DVR (Digital Voice Recorder) as the audio source.

For the DATC, what is the best audio source? Probably, any type of stereo music or even monophonic music as the TDA7442 audio processor used in the DATC can process monophonic music by converting mono into simulated stereo. In the past 5 years, Walkman, CD and Mini Disk players are the best source for music playback. But now a days, the "MP3" is the best "choice".

Tone Control :

The function of the tone control, as it name implies, will let you modify the quality of the music. The music quality I am talking here is the ability to increase (boost) or decrease (cut) the content of the music. If you need a more **"crispy"** sound on your speakers, you need to increase the Treble (Treble boost). If you are listening to a "rock" music, you can hear from the tweeter speaker a more crispy reproduction of the cymbals.

If you need a **"thundering"** sound in your speakers, you need to increase (Bass boost) the bass control. If you are listening to the same "rock" music, you can hear from the woofer speaker a more "depth" reproduction of the bass drum and the bass guitar. Normally, in the disco you can felt the effect of the bass. If you don't like heavy music because it is too noisy on your room, you can decrease the bass control (Bass cut).



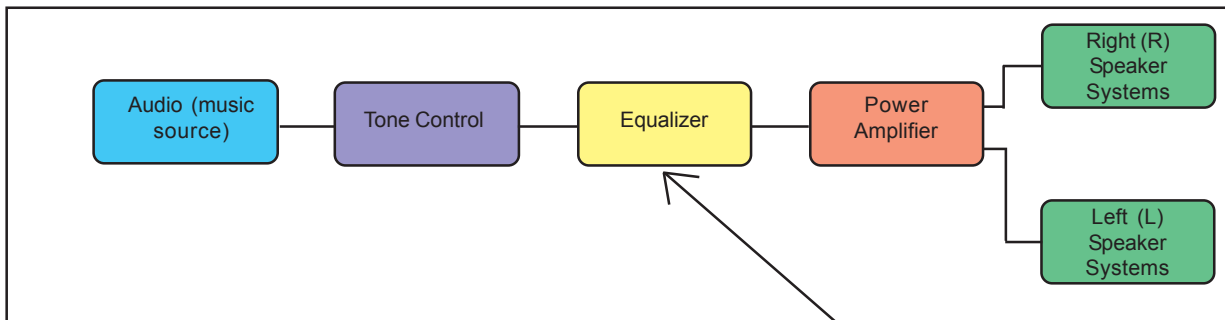
Power Amplifier (PA):

Technically speaking, the Power Amplifier (PA) have a flat response, which means it will not going to modify the quality of the music (Power amplifier do not introduce boost or cut). What it does is to increase the strength of the music so it can be reproduce into the situation as those in "live bands".

For the PA intended for the DATC, 10 watts stereo is good enough (my kind of taste). When I say 10 watts stereo, I'd like to mention that the Left channel is 5 watts and the Right channel is 5 watts. The unit "watts" I mentioned here is the RMS power (Root Mean Square) or I would say the real power that the amplifier can deliver. This is not PMPO (Peak Music Power Output) or other unit of specifying PA output power. Maybe (I say maybe), the 10 watts RMS stereo is equivalent to 100 watts PMPO. I am not sure if there is a standard for the PMPO specifications.

Speaker Systems :

The speaker will convert the electrical energy into sound energy. The sound energy (audio) is the form our ear can recognized. Yes! To have a "thundering and crispy" audio reproduction, you need to have a good quality speakers. *(Oh! This is one bottleneck of an audio hobbyists as speakers are quiet expensive. I should find a solution on how to have a good speaker even with that "thin wallet")*.



■ FIGURE 5 : BASIC AUDIO SETUP with EQUALIZER

Equalizer :

Ok! I'd like to mention here a gadget that is less hobbyists but a good equipment to add-on to an existing audio systems - **the Equalizer**. The Equalizer is normally located between the tone control and the PA to give additional means of modifying the quality of the music. In fact, the equalizer have a better means of modifying the music quality at different frequencies of : 40 Hz, 400 Hz, 1KHz, 10KHz and 16 KHz. You can individually increase (boost) or decrease (cut) the music strength at these 5 different frequencies. Tone control have only 2 frequencies to deal with (typically 40 Hz and 10KHz).

The less hobbyist audio equipment - the EQUALIZER. The Equalizer gives you a wider control range of music quality. You can have 5 different frequencies to boost or cut (increase or decrease). Normally for 5 band equalizer, the frequencies are : 40 Hz, 400 Hz, 1KHz, 10KHz and 16 KHz. A professional Equalizers may have 32 bands.



The DATC

From the above discussion, a Tone Control (like the DATC) will make your listening more attractive because you can adjust the music quality to your taste and can select different mode of the music. With DATC, you can modify the tonal quality of the music while you are working in your table or sitting in your sofa without the need to stand up when you want to adjust the treble, bass or volume. All you have to do is to use the DATC Remote Control (like the one you use to control your TV).

The DATC can also turn off your Audio Equipment (CD, PA, MP3, etc.) automatically and later - if you wish to turn it on for a specified time, it can automatically turn on and play your favourite music. Of course, you need to program the turn off time and the turn on time. In my applications, my DATC is use to wake me up in the morning with the loaded music on my MP3 - "You give love a bad name" - a rock music by Jon Bon Jovi. I choose rock music so it "wake me up" rather than make me more sleepy with a soft and slow music.

To realized having a "friendly Audio Equipment" - you need to integrate the DATC into a good PA and speaker systems. Recalling back the above discussion, to have a complete Audio System, you basically need a minimum of four (4) components :

1. Tone Control
2. Power Amplifier (PA)
3. Speaker Systems
4. Audio (music) source

Since you have your DATC and music source already, the only lacking now is the PA and Speakers. For PA, you can use the DATC internal headphone amplifier. If you like to have a real concert level, you may incorporate a 20W/channel (40 watts stereo) PA. My taste for my room is 10 Watts stereo. Maybe you say, the 10 watts stereo is not good enough but that is my preference! Really!

Ok! That is one reason why I did not yet build the PA for the DATC because I am sure that some user's will have different preferences. One may prefer to have 100 watts stereo or even 200 watts per channel (400 watts stereo). In my own experience, 20 watts per channel (40 watts stereo) is good enough for home use, this is also economical for the speakers.

For the speakers, I prefer to buy a good quality speakers than to build one. I have tried actually to build one as shown in Figure 1 but I am not a good carpenter, I mean I don't have the right tools to do so. If I am going to buy those carpenter's stuff and make myself just to prove of what I can do, it would seems to be expensive than to buy the ready made and fully working speakers. Oh well, it depend on your preference if you like to **Do It Yourself** (DIY) your speakers.

An alternative way to have the PA and Speakers in one is to buy the Integrated PA with speakers. See Figure 6. When you do so, you must buy the good quality one.



FIGURE 6 : SPEAKER SYSTEMS with POWER AMPLIFIER



System Integration :

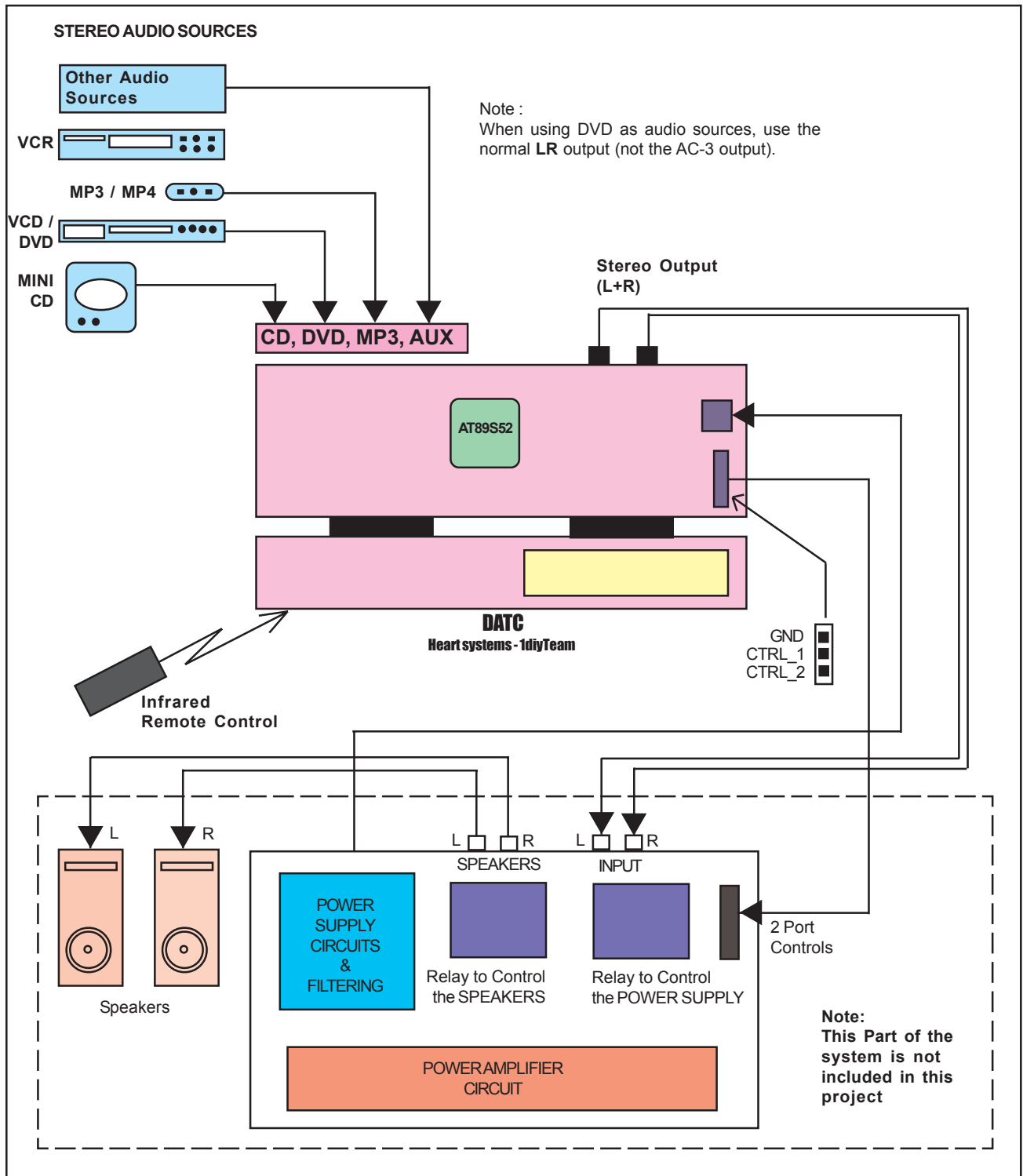
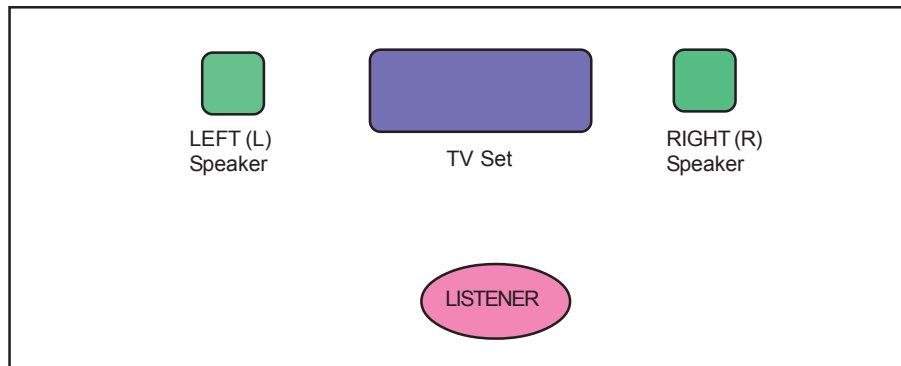


FIGURE 7 : DATC INTEGRATION TO AMPLIFIER BLOCK DIAGRAM

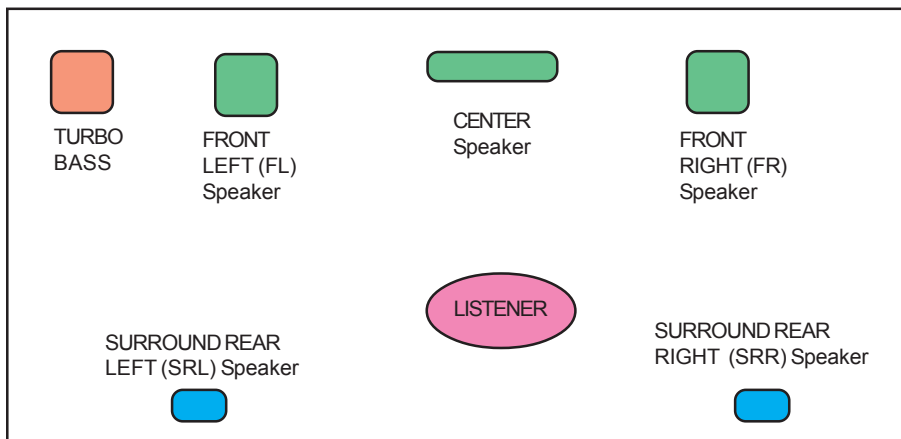


Home Audio - Video Entertainment :

For real **Home Audio-Video Entertainment**, the stereo music (with the **L** and **R**) reproduction, see Figure 8 is becoming obsolete as being replaced by the latest technology in this so called "Digital Era". Most Audio stuff coming out from the market now a days have more than the left and right stereo output. It include the Center (C) speaker, Surround Rear left (SRL) and Surround Rear Right (SRR) plusing the Turbo Bass (TB) speaker. All these audio equipment must have the capability to decode the Dolby Digital (called AC-3), DTS (Digital Theater System) or SRS (Sound Retrieval Systems) technique. Figure 8 and Figure 9 shows the difference between the Normal Stereo and the AV 5.1 Channel in term of speakers set up.



■ **FIGURE 8: STEREO AMPLIFIER in typical HOME Set-up**



■ **FIGURE 9 : AV 5.1 Channel in typical HOME Set-up**

What makes the AV 5.1 channel amplifier (Figure 9) different from the normal L-R stereo amplifier (Figure 8) is that, AV 5.1 channel amplifier is equipped with **AV decoders**. This AV decoders like the Dolby decoder will "decode" the information that is "encode" on the DVD disc (note that, it works only on DVD, not possible on VCD or SVCD).

If the DVD disc is a "crack" - I mean, it is not original or do not contain the 5.1 channel information, the resulting sound is even worst that the normal L-R stereo. In order for the "listener" to enjoy a fully operating AV 5.1 channel sound in his home, he must have a **DVD disc** that contain the information of Dolby or DTS and he must have a **DVD player** that can decode the Dolby or DTS that is encoded in the DVD disc. Normally with DVD, you can choose between Dolby or DTS. In some DVD disk and depending on the movie, live concert, sports, etc. , Dolby is better, in some disc DTS is better. I'm just glad that, I have a choice in case one decoding system fails my listening level.



What is important to note is that, even with AV 5.1 channel amplifiers, it still preserved the **Tone Control** like the **Bass** and **Treble** controls to modify the quality of the music. More expensive and sophisticated AV 5.1 channel amplifiers also include the Equalizers (of course, it is digital equalizers and tone controls)..

New generations Audio stuffs - called **Intelligent AV Receivers** will let you feel having in the future as seen on those futuristic movies. These Audio Stuff will have calibrating means that is incorporated in the system to automatically adjust the acoustical parameters based on your listening environment (like sala or bedroom) and the content of the DVD disk, this means that, you will always get the right listening pleasure from your audio stuff.

At one touch of a button - like **Cinema**, if you intend to watch movie, the AV Receiver will select the best possible setting for your Cinema. If you select Karaoke, the AV Receiver will select the best acoustical performance of your microphone and your environment to avoid feedback even you are close to the speaker and possible to make your voice more attractive to the ear.

There are some AV receivers that you can hook up to PC or to the Internet, so that you can download some settings. These settings are posted in the "accredited" website where professional people want to share what they have to fellow audio-video hobbyists.

Of course, these AV receivers comes with good price where only bulky wallet guy can take it home - or that guy with a VIZA card. In one **AV Store** in Guangzhou China, I can't believe that one "front speaker" cost a half million pesos, huh! Just to give you an idea of the typical price of an Intelligent AV Receivers; 80 to 100 thousand pesos (PHP 80 to 100,000.00) is the average price.

You may visit the following website to see some of the high tech. Intelligent Audio-Video Receivers :

1. <http://www.vifa.com.cn>
2. www.akai.com.cn
3. <http://www.gdbbk.com>
4. <http://www,nintaus.net>
5. www.fbbs.com.cn
6. www.danspeak.com
7. <http://www.cn-cav.com>
8. <http://www.ls-online.com>
9. <http://www.cav-audio.com>
10. <http://wwwwww.arden.com>
11. <http://www.avlight.com.cn>

CHAPTER 3

The _____ User's Manual

**This goal of this chapter is to present the User's Guide
where the User can refer on in case of
difficulty of operating the DATC.**

Thank you for choosing the Heart System's DATC - your friendly Digital Audio Tone Control.

Package :

Your DATC is composed of the following :

- 1 pcs : Fully Assembled Main board
- 1 pc : Fully Assembled Control and Display Board
- 2 pcs : 10 pins Flat Cable
- 1 pc : Infrared Remote Control
- 1 pc : RCA connector
- (- 1 pc : *Power Adaptor : 220Vac - 50~60 hz / 12Vdc @ 500 mAmp) ; optional*

Start Up - assembling the DATC

Connect J17 LCD_A of the Main board to the J13 LCD_B in the Control and Display Board.
Connect J12 Key_B for the control and display board to the J16 Key_A in the main board.

Start Up - Power up the DATC

1. Plug the male adapter socket into the power plug of the DATC.
2. Plug the 220 Vac into the wall socket.. The LCD must light up and will display :

HEART SYSTEMS
Baguio City

Firmware V1.5
by: 1diyTEAM

3. The standby LED will light indicating that the DATC is in the standby mode. The display on the LCD is:

Heart Systems
DATC time 00 : 00

4. Press K1 momentarily. The standby LED will turn off and the LCD will display :

CD/Media 00:01
music SS- ON

Leave your DATC for a moment and move on to the next page to familiarize yourself on the functions of the :

1. Front panel control board
2. Remote control
3. Main board

PRELIMINARY

The Front Panel Control Board :

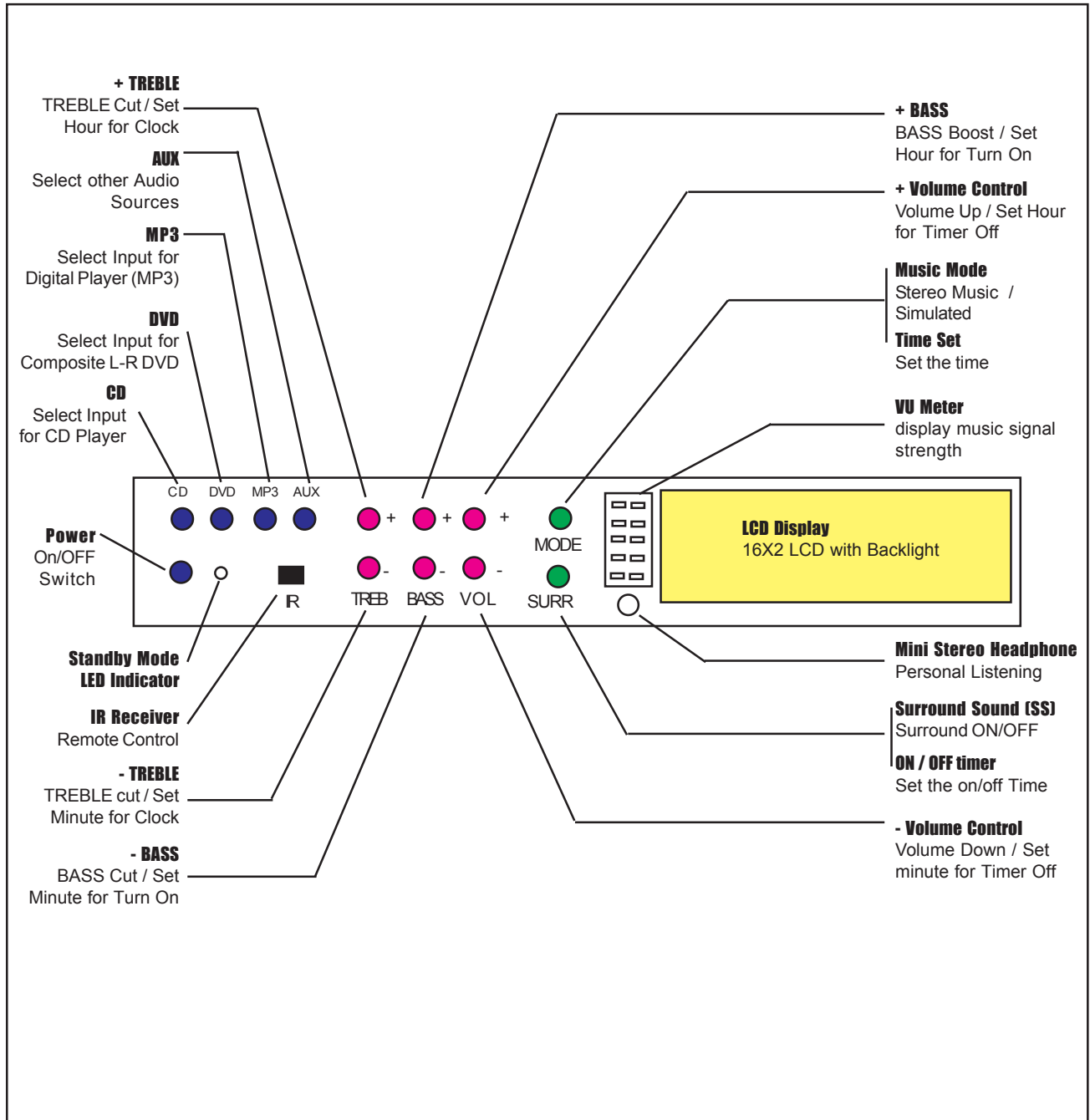


FIGURE 10 : DATC FRONT PANEL CONTROL

The Remote Controller :

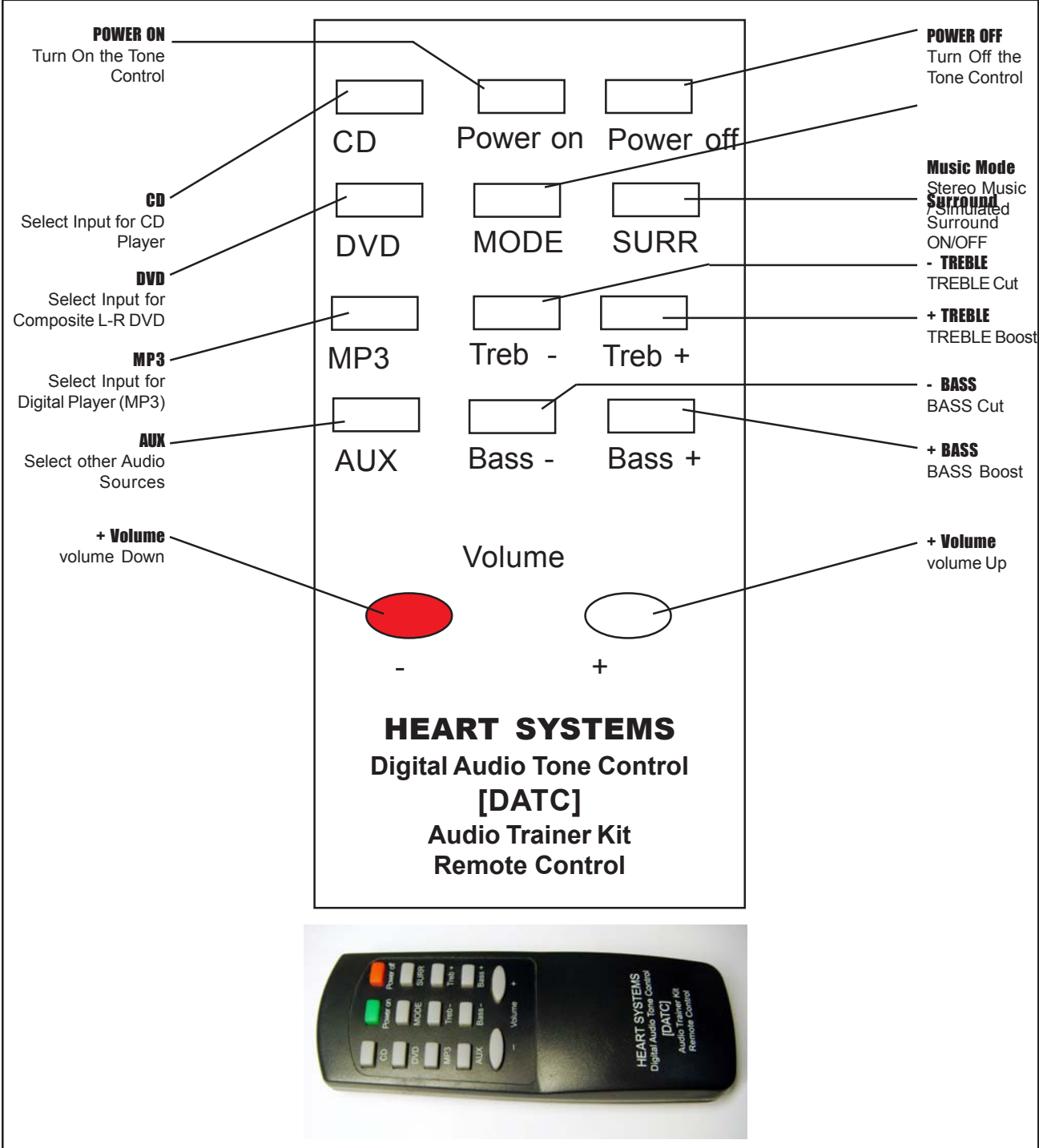


FIGURE 11 : DATC REMOTE CONTROLLER



The Main Board :

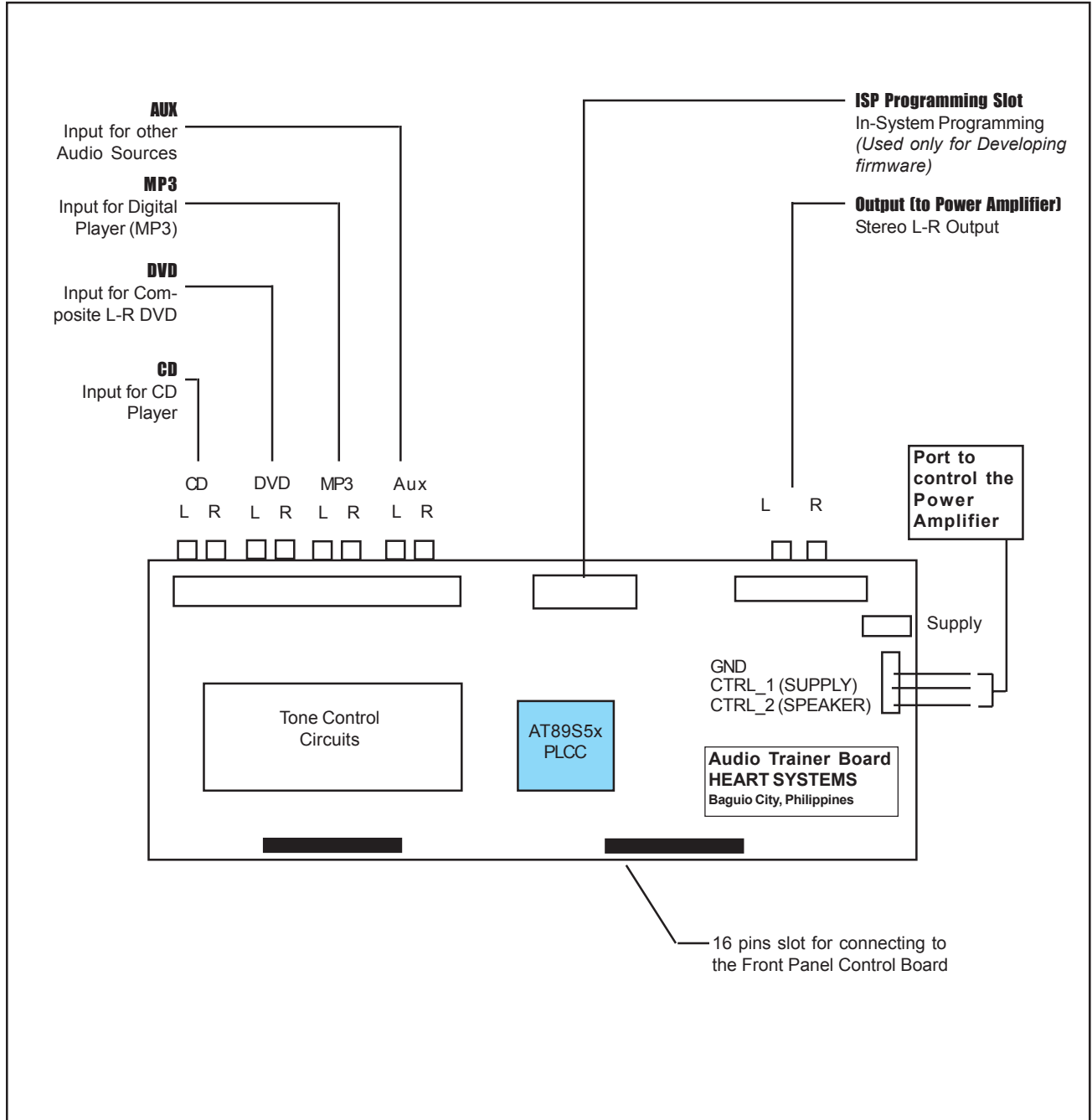


FIGURE 12: DATC MAIN BOARD



Setting the Time :

1. Press and hold **MUSIC MODE** key until the LCD display

TIME 00:00

Note:

When the DC power is remove from the DATC, the time is no longer correct.

2. Press **TREB+** to set the time. The time is increasing in one direction only from 00 to 23. Press and hold **TREB+** will increase the time counting up from 00 to 23 then back to 00. Press **TREB+** once will advance the time once in ascending manner.
3. Press **TREB-** to set the minutes. The minute is increasing in one direction from 00 to 59. Press and hold **TREB-** will advance the minute counting up from 00 to 59 then back to 00. Press **TREB-** once will advance the minute once in ascending manner.
4. When the correct time is set, leave the DATC to go back into the active mode, you don't need to press any key to go into the active mode, just wait for about 6 seconds.

Setting the Turn on and turn off Time :

1. Press and hold **SURR** until the LCD display

TIME ON : 00:00
TIME OFF : 00:00

2. Press **BASS+** to set the time to turn on. The time is increasing in one direction only from 00 to 23. Press and hold **BASS+** will increase the time counting up from 00 to 23 then back to 00. Press **BASS+** once will advance the time once in ascending manner.
3. Press **BASS-** to set the minutes to turn on. The minute is increasing in one direction from 00 to 59. Press and hold **BASS-** will advance the minute counting up from 00 to 59 then back to 00. Press **BASS-** once will advance the minute once in ascending manner.
4. Press **VOL+** to set the time to turn off. The time is increasing in one direction only from 00 to 23. Press and hold **VOL+** will increase the time counting up from 00 to 23 then back to 00. Press **VOL+** once will advance the time once in ascending manner.
5. Press **VOL-** to set the minutes to turn off. The minute is increasing in one direction from 00 to 59. Press and hold **VOL-** will advance the minute counting up from 00 to 59 then back to 00. Press **VOL-** once will advance the minute once in ascending manner.
6. When the correct time is set, leave the DATC to go back into the active mode, you don't need to press any to go into the active mode, just wait for about 6 seconds.

Connecting a music source to the DATC:

Your source of Music can be CD, DVD, MP3, PC, walkman, VCR, etc. as long as that device have an audio output that is compatible with your interfacing RCA cable. A good Music source is the MP3.

1. Make sure that you have the correct interface of your Music source (correct RCA jack, etc.).
2. You may use the DATC internal amplifier with a headphone to listen to the music or you may use the popular ready made speakers with Amplifiers. Low performance PC speaker is not recommended.
3. Plug in the audio cable to the output of your music source (example is MP3) into the input of the DATC (example is MP3 RCA jack input). See Figure 13.

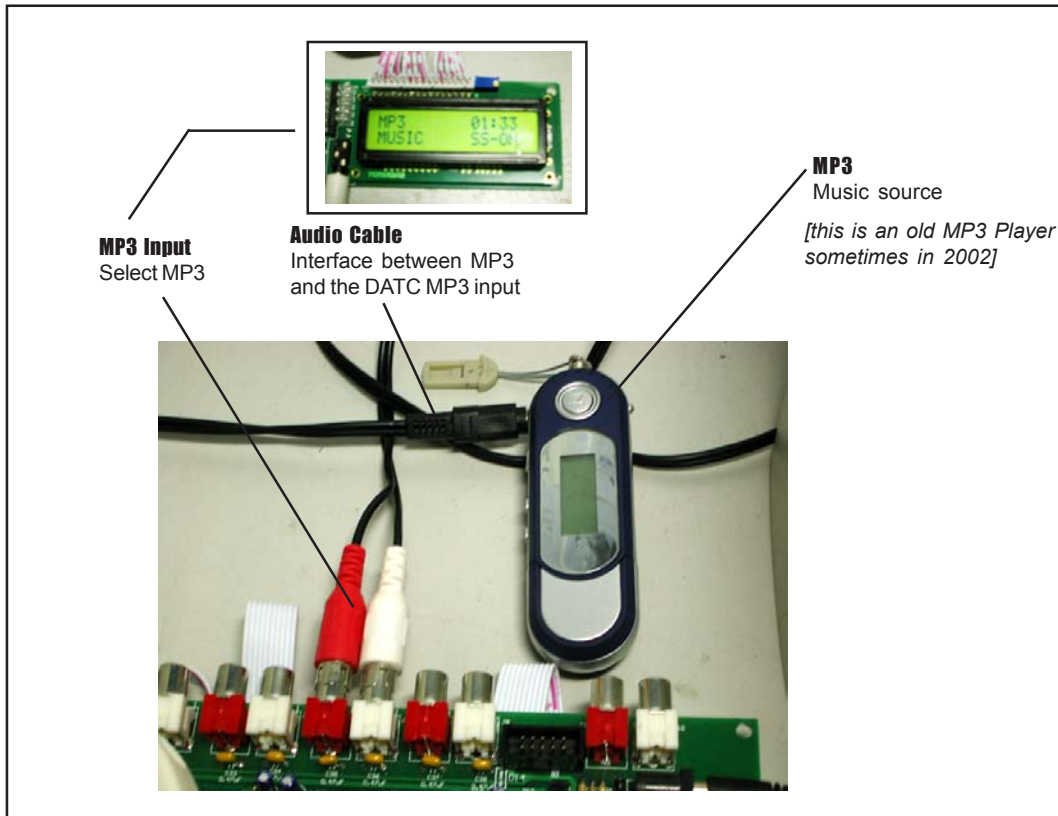
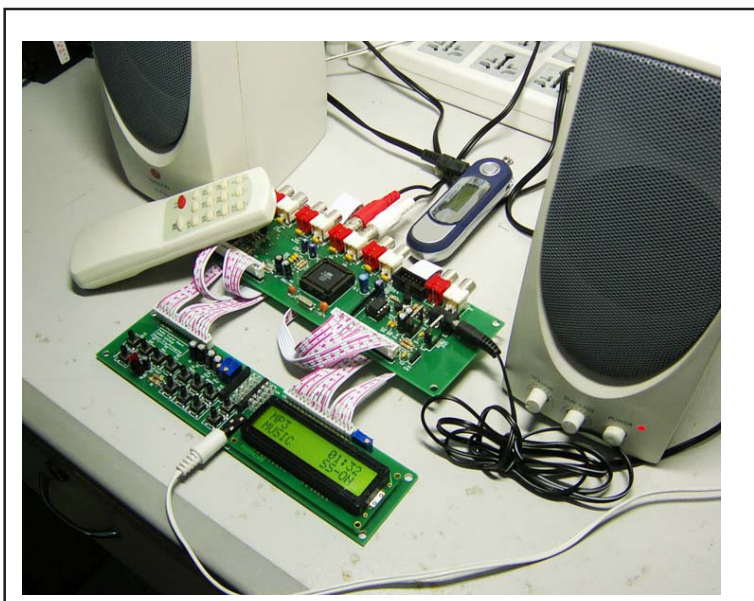


FIGURE 13 : CONNECTING MP3 TO THE DATC





Selecting the Input Music Source on the front panel:

1. Press **CD** button to listen to the music on your CD Player. Make sure that your CD Player is connected in the CD RCA jack input.
2. Press **DVD** button to listen/watch movie. If you use the DATC for reproducing the sound of the DVD player output, please use the normal L and R output of the DVD player. Make sure that you will connect it to the DVD RCA input jack of the DATC.
3. Press **MP3** button to listen to the music on your MP3 Player. Make sure that your MP3 is connected in the MP3 RCA jack input.
4. Press **AUX** button to listen to the device connected to the AUXiliary RCA jack of the DATC. The AUX input source could be the audio output of your Personal PC (laptop), you walkman, VCR, etc.

When you are using your PC or walkman, please control the volume so that it will not overdrive the DATC. If you hear distortion (not good sound) on the speaker, reduce the volume control of your PC or your walkman.

Adjusting the Treble, Bass and Volume on the front panel:

1. Press **TREB+** to increase the Treble boost. Press the **TREB-** to increase the Treble cut (decrease Treble boost).
2. Press **BASS+** to increase the Bass boost. Press the **BASS-** to increase the Bass cut (decrease Bass boost).
3. Press **VOL+** to increase the Volume level. Press **VOL-** to decrease the Volume. The display on the LCD is the volume attenuation, the higher the number the weaker the Volume and the lower the display number the stronger the volume. The display -32 means that it attenuate the volume by 32 dB. This display -2 means that the volume is attenuated by 2 dB. Thus, the display -2 dB makes the volume louder than the volume when it is at -32 dB.

Selecting the Music Mode on the front panel:

1. Press **MUSIC Mode** to select between **MUSIC** and **SIMULATED**.

Selecting the Surround sound (SS) on the front panel:

1. Press **SURROUND SOUND** to toggle the **SS On** and **SS Off**.

Selecting Active / Standby Mode on the front panel:

1. Press **POWER ON/OFF** to toggle between Active mode and Stand-by Mode. The stand-by LED (D1) will light when the DATC is in the stand-by mode. D1 will turn off when the DATC is in the active mode.



Selecting the Input Music Source using the Remote Control:

1. Point the Remote Control toward the DATC front panel. Press **CD** button to listen to the music on your CD Player. Make sure that your CD Player is connected in the CD RCA jack input.
2. Press **DVD** button to listen/watch movie. If you use the DATC to for reproducing the sound of the DVD player output, please use the normal L-R output of the DVD player. Make sure that you will connect it to the DVD RCA input jack of the DATC.
3. Press **MP3** button to listen to the music on your MP3 Player. Make sure that your MP3 is connected in the MP3 RCA jack input.
4. Press **AUX** button to listen to the device connected to the AUXiliary RCA jack of the DATC. The AUX input source could be the audio output of your Personal PC (laptop), you walkman, VCR, etc.

When you are using your PC or walkman, please control the volume so that it will not over-driven the DATC. If you hear distortion (not good sound) on the speaker, reduce the volume control of your PC or your walkman.

Adjusting the Treble, Bass and Volume using the Remote Control:

1. Point the Remote Control toward the DATC front panel. Press **TREB+** to increase the Treble boost. Press the **TREB-** to increase the Treble cut (decrease Treble boost).
2. Press **BASS+** to increase the Bass boost. Press the **BASS-** to increase the Bass cut (decrease Bass boost).
3. Press **VOL+** to increase the Volume level. Press **VOL-** to decrease the Volume. The display on the LCD is the volume attenuation, the higher the number the weaker the Volume and the lower the display number the stronger the volume. The display -32 means that it attenuate the volume by 32 dB. This display -2 means that the volume is attenuated by 2 dB. Thus, the display -2 dB makes the volume louder than the volume when it is at -32 dB.

Selecting the Music Mode using the Remote Control:

1. Point the Remote Control toward the DATC front panel. Press **MUSIC Mode** to select between **MUSIC** and **SIMULATED**.

Selecting the Surround sound (SS) using the Remote Control:

1. Point the Remote Control toward the DATC front panel. Press **SURROUND SOUND** to toggle the **SS On** and **SS Off**.

Selecting Active / Standby Mode using the Remote Control:

1. Point the Remote Control toward the DATC front panel. Press **POWER ON/OFF** to toggle between Active mode and Standby Mode. The standby LED (D1) will light when the DATC is in the standby mode. D1 will turn off when the DATC is in the active mode.

Integrate the DATC into an existing Audio System:

1. Remove the 220 AC plug of your Power Amplifier. Make sure that your speaker are connected to the Power Amplifier output. You should have a good speakers.
2. Connect the RCA Jack to the L and R output of the DATC and connect the other end into the L and R input of your Power Amplifier.
3. Connect the power adaptor male jack into the DATC Power supply socket.
4. Turn on your DATC and set the volume to -10 dB.
5. Turn on your Power Amplifier. You should not hear anything, humming, motor-boating, distortion, etc.
6. Turn of your power amplifier. Turn off your DATC.
7. Choose your Audio source (music source). Connect your audio source to one of the inputs of your DATC. For example, if you want MP3, connect it to MP3 input See the Figure below. Turn on your DATC, your Power Amplifier and your music source. You should hear the music in your speaker systems.

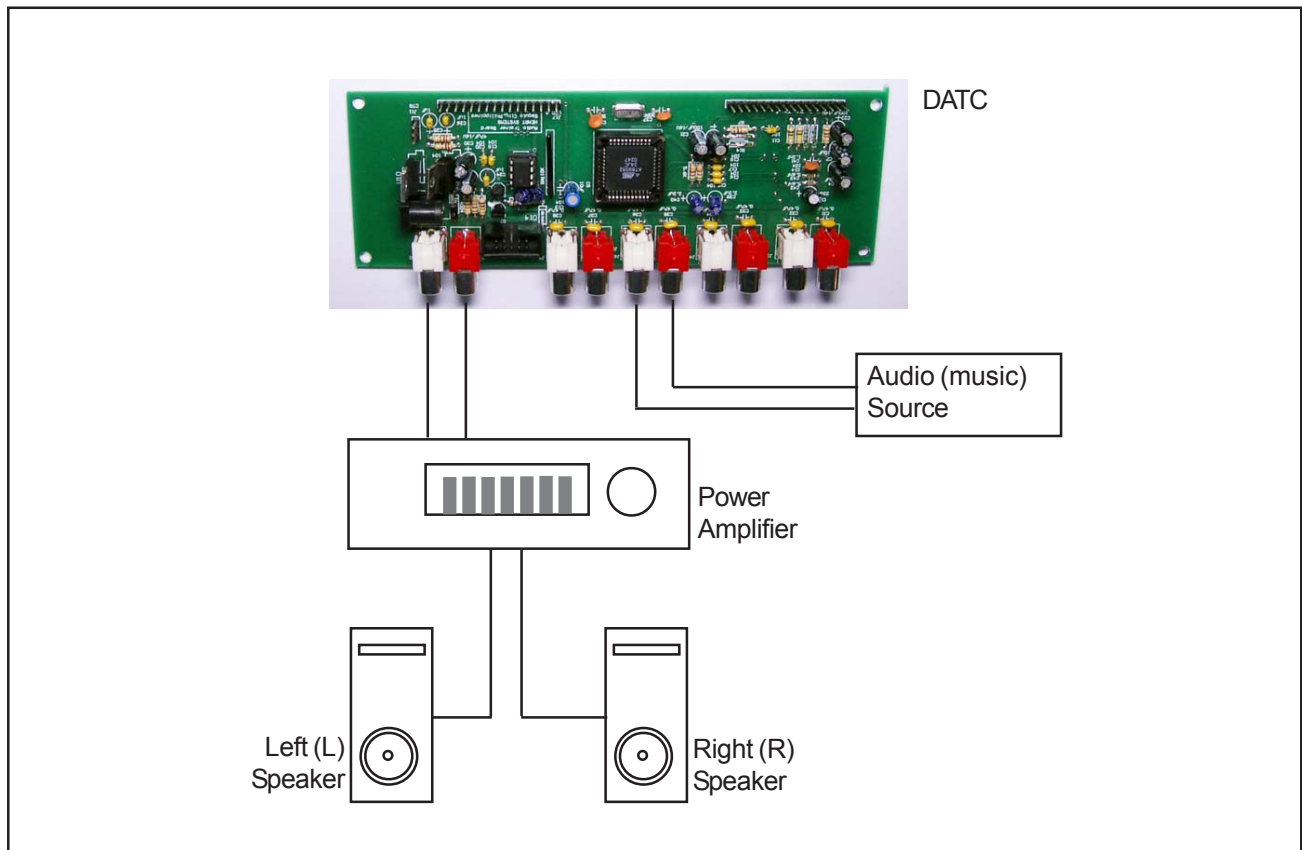


FIGURE 15 : INTEGRATE DATC INTO EXISTING POWER AMPLIFIER

CHAPTER 4

— The DATC Technical Info

This chapter will present the DATC design rendering



The DATC Block Diagram and Descriptions:

Basically, the DATC composed of 11 sections. They are :

- MCU
- EEPROM
- Adjust and Control
- Infrared Remote Control Receiver
- Audio Input /Audio Processor
- LCD Display
- Remote Control
- VU Meter
- Headphone Amplifier
- Power Supply

and finally the EXT Control port.

MCU :

The heart of the DATC is a Microcontroller (MCU) - the most popular Microcontroller in the world, the Intel's design MCU called the 8051 core, see Figure 16. I am using the 8051 derivative MCU manufactured by ATMEL, the AT89S52 - 8 bit CPU with 8 Kbytes Program ROM, an In-System Programming capability (ISP). This MCU is flexible that you can write program without removing it from the board. You can also erase program and then write again - it's like a diskette. This programming features is reserved for using the DATC as a **Audio Trainer Kit**. A MCU hobbyist can program the 8051 processor (like the AT89S52) fast and easy on the board.

I used a Microcontroller like the AT89S52 to control the different circuit sections. Without the MCU, the hardware design will be terribly complex and ugly. The use of MCU will simplify the hardware, but you have to write the logic in the program detailing the way you want to control the different section blocks.

Referring to figure 9, what the MCU does is to check the User's Interface (the Adjust and Control section) and then, it will command the other section to process the request. For example, if the user like the audio input to be DVD, the user need to press the DVD button on the front panel or press the DVD button on the Infrared Remote Control. The MCU detect this request and it will command the TDA7442 Audio processor to change its audio input to DVD. The MCU will command the TDA7442 using the I²C communications protocol. [I²C or IIC is the acronym for Inter IC Communications, this protocol is designed by Philips]

To know and learn about the 8051 core programming , you may avail of Hearts Systems :

my8051 - STARTER MCU EB8051 -2
Microcontroller Trainer Kit

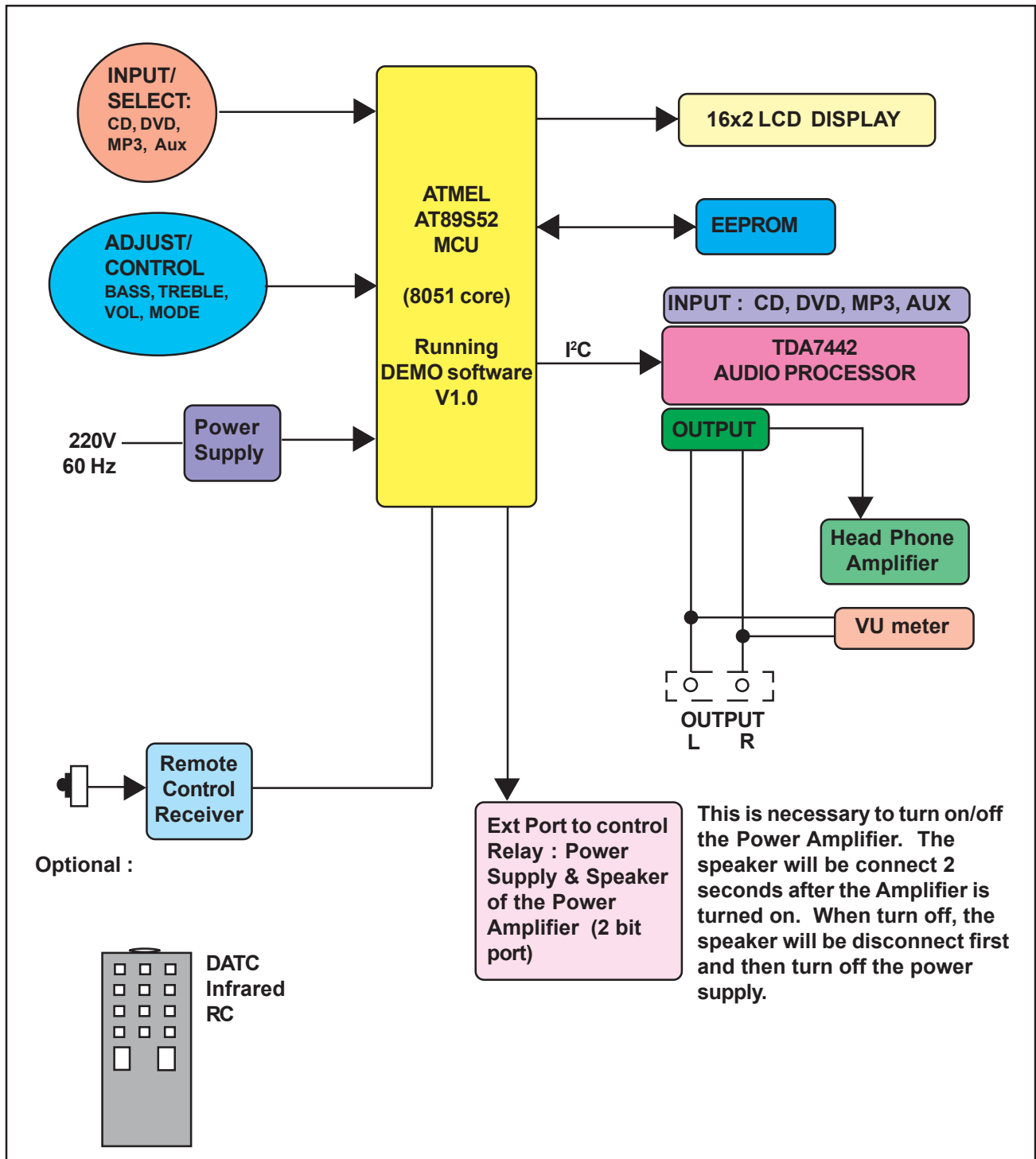
NE2ss - Night Eyes Security Systems V2
Microcontroller Trainer Kit

an, Easy, Affordable, Fast & Fun ways to learn and program the 8051 Microcontroller using ATMEL AT89S51/52 MCU. Visit <http://www.1diycentre.com>

The MCU perform also other task, like the real time clock. The 8051 core, like the AT89S52 (or AT89C51) have a build in timers that when configured correctly, it can be used as a real time clock. The MCU will keep track also of the turn on and turn off of the tone control. This turn on and turn of scheme is another feature of the which an analog Tone control without a processor cannot achieve. You can programmed the processor to turn on (or turn off) at a specified time. To be accurate, you need to set the clock to the real time of the day. With the use of MCU, you can also controlled the connection of the power amplifier speaker or power supply. See more details on the EXT port discussion.

What I would like to emphasized here is that, you can do all these features because you are using a MCU that you can "command" what it will do thru the applications of program.

DATC Block Diagram



■ FIGURE 16: BLOCK DIAGRAM



The functional Schematic Diagram of the MCU section is shown in Figure 18. I used the MCU PLCC package - 44 pins to make the DATC rugged and compact. The PDIP MCU, that 40 pins package I used in the Hob-COS project/Trainer Kit and the STARTER MCU-EB8051 Trainer Kit can also use, however it take a bigger space.

The major component in the MCU is the crystal X1, array resistor RA1 and the ISP Programming. The crystal used is 12 MHz, I choose this crystal mainly for one reason - so I can have an accurate real time clock. It is easy to configure the AT89S52 timer if you are using a 12 MHz crystal. In the Hob-COS and STARTER MCU-EB8051 Trainer Kits, I used only the 3.579545 MHz crystal which in this projects, I did not use the 8051 timer.

The array resistor of 10Kohms is used because the Port 0 of the AT89S52 (or the 8051 core) don't have the internal pull-up. If I will not pull this port to VCC, the port could be in floating condition.

In Figure 18, you can also see the ISP Programming section. Port P1.5, P1.6 and P1.7 shares the MOSI. MISO and CLK respectively. The acronym means :

- MOSI : Master data Output, Slave data Input
- MISO : Master data Input, Slave data Output
- CLK : Master Clock Output

Only the AT89S51, AT89S52 and the AT89Sxx series can have the ISP capability - the "S" in the AT89Sxx means ISP. The AT89C51 MCU I used in the STARTER MCU-EB8051 Trainer Kit don't have the ISP capability. The advantage of the MCU with ISP capability is that, you can program the MCU in the board without the need to remove it from the board. Basically, these features is reserved for anyone who would like to alter the program of the DATC.

I'd like to mention about the RESET circuit here. You may feel strange why I name the Resistor as D13, it should be R13, but because I already finished the PCB design when I discovered that, I should use a resistor instead of a 1N4148 signal diode in the reset. The diode reset as shown in Figure 17 works fine, however, there are some DATC board that cannot work correctly when programming thru the ISP and using the **Heart System ATMEL AT89 Flash Programmer**, so I modified the RESET circuit to solve. You can see that, there are "cut and connect" in the PCB revision 1.0 in the main board if this board is intended for ISP Programming for developing the firmware..

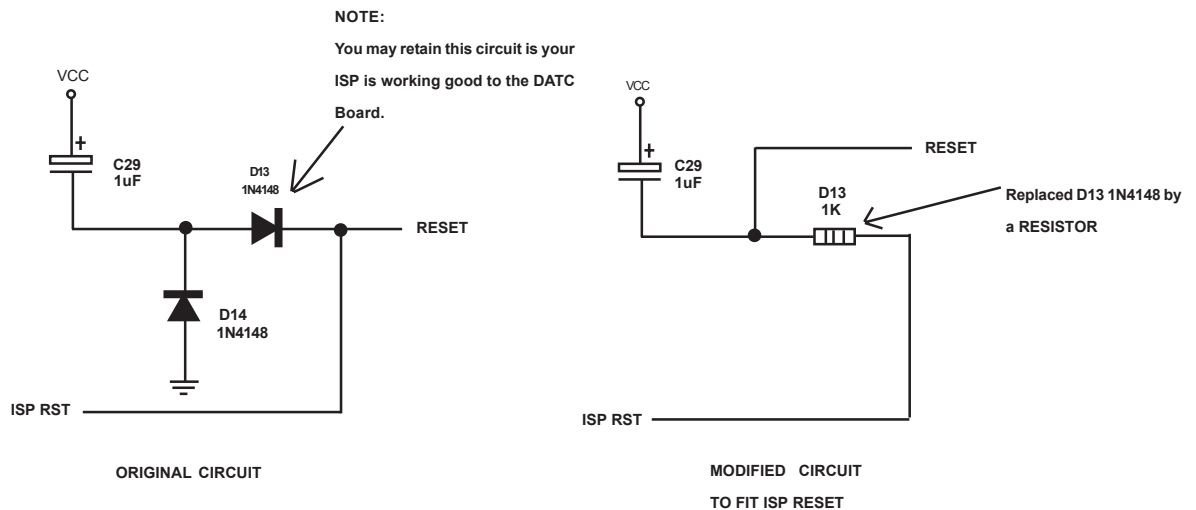


FIGURE 17: RESET CIRCUIT MODIFICATIONS

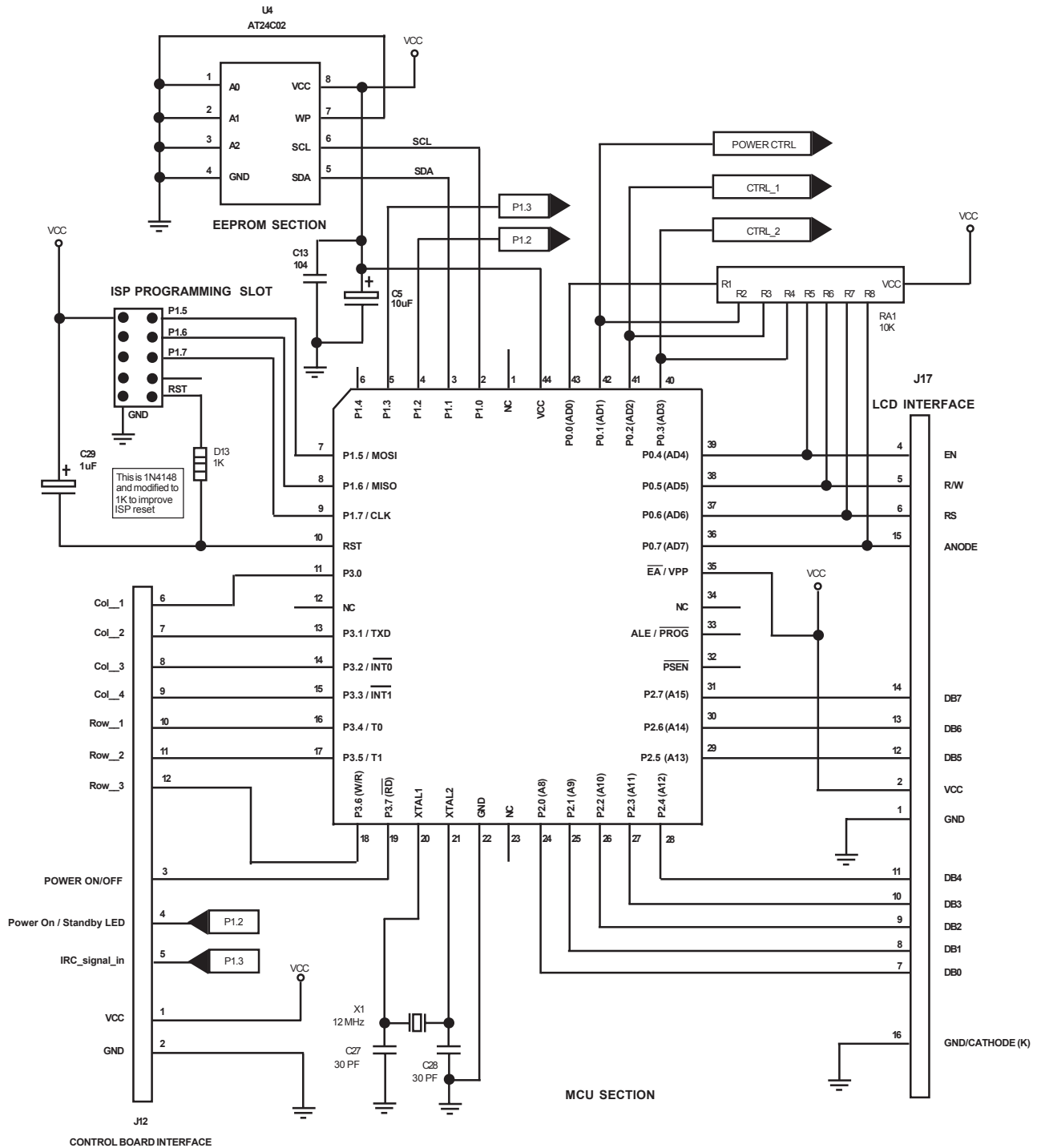


FIGURE 18 : MCU SECTION SCHEMATIC DIAGRAM



EEPROM :

Refer to Figure 18, the EEPROM is used to hold (save) the User's setting (like volume, bass or treble level) so that the user will not be going to set the DATC from time to time. If there is no EEPROM, everytime when the DC power is removed, all the user's setting will be lost. For example, if you set the DATC in MP3 input and the volume level at -10 dB and in the height of listening to MP3 song, the power shut off (brown own). If there is no EEPROM, when the DATC power up, you will not go back to the setting of MP3 as the input and -10dB of volume.

All User program data will be saved in the EEPROM. However, the EEPROM cannot hold the information for the real time clock. So, when there is a power failure or when you remove the DC power supply, the real time clock will not indicate the correct time. Thus, when you plug the DC power of your DATC, you must set the clock.

In Figure 18, it looks that the interface to the MCU is simple - by two wire line, the SDA and the SCL. Thru these wires, data is read from and written into the EEPROM. The EEPROM communications to the MCU is I²C protocol.

INPUT SELECT & ADJUST CONTROL :

In Figure 19, the user's interface (manual Input and adjust section) is basically a matrix switch that is connected to the AT89S52 MCU. The MCU detect the low logic condition of the matrix switch. Logic "0" means that the user depressed they key. Logic "1" means that the user did not press the key (or there is no activity in the matrix switch.)

I assigned a name on each switch. For example, K1 is the switch for the power on/off, K2 is the switch to select **CD** as the input music source, K10 for the **volume up (vol +)** and so on. So, when K2 is logic "0" at the time the MCU check the status of K2, it will command the TDA7442 Audio Processor to change its music input to **CD**.

If the MCU detect a logic "0" at K10 switch, it means that the user pressed the "Vol+" switch because the user want to increase the **volume**.

When the user press and hold K12, the MCU detect the pressing and holding for 2 seconds which permit the user to set the **"real time clock"**. When the user press K12 once, he is selecting the music mode : **simulated or music**.

INFRARED REMOTE CONTROL RECEIVER:

In Figure 16 and 19, the **IRC** (Infrared Remote Control) receiver is simple to interface to the MCU. The IRC Rx (Rx is the short for receiver) is manufactured by Vishay Semiconductor and it will output a stream of binary data. This makes simple to interface with the MCU.

*Regarding this **IRC Receiver (Rx)**, I can share to you a real life experience that you can judge that I am ignorant to Infrared signal, but let me test if you are like me or not.*

When I am dealing with my first prototype, I only work at night time. I used a flouorescent lamp in my work station. I am so headache because there is annoying continouos noise in the speaker. It is really irritating to the ear specially when I am using the headphone. Probably it took one month for me before I discovered that the cause of the noise is the Infrared rays emitted by the flouorescent. This make me work over the Internet on how to get rid of the noise, but before I search all the internet link, I suddenly realized the aircon in my room and the TV in the sala that, the IRC receiver were covered by a plastic that plated with dark red or something similar. I am so curious what's that for, and found out that this is used to filter the infrared rays normally coming from flouorescent or sun rays.

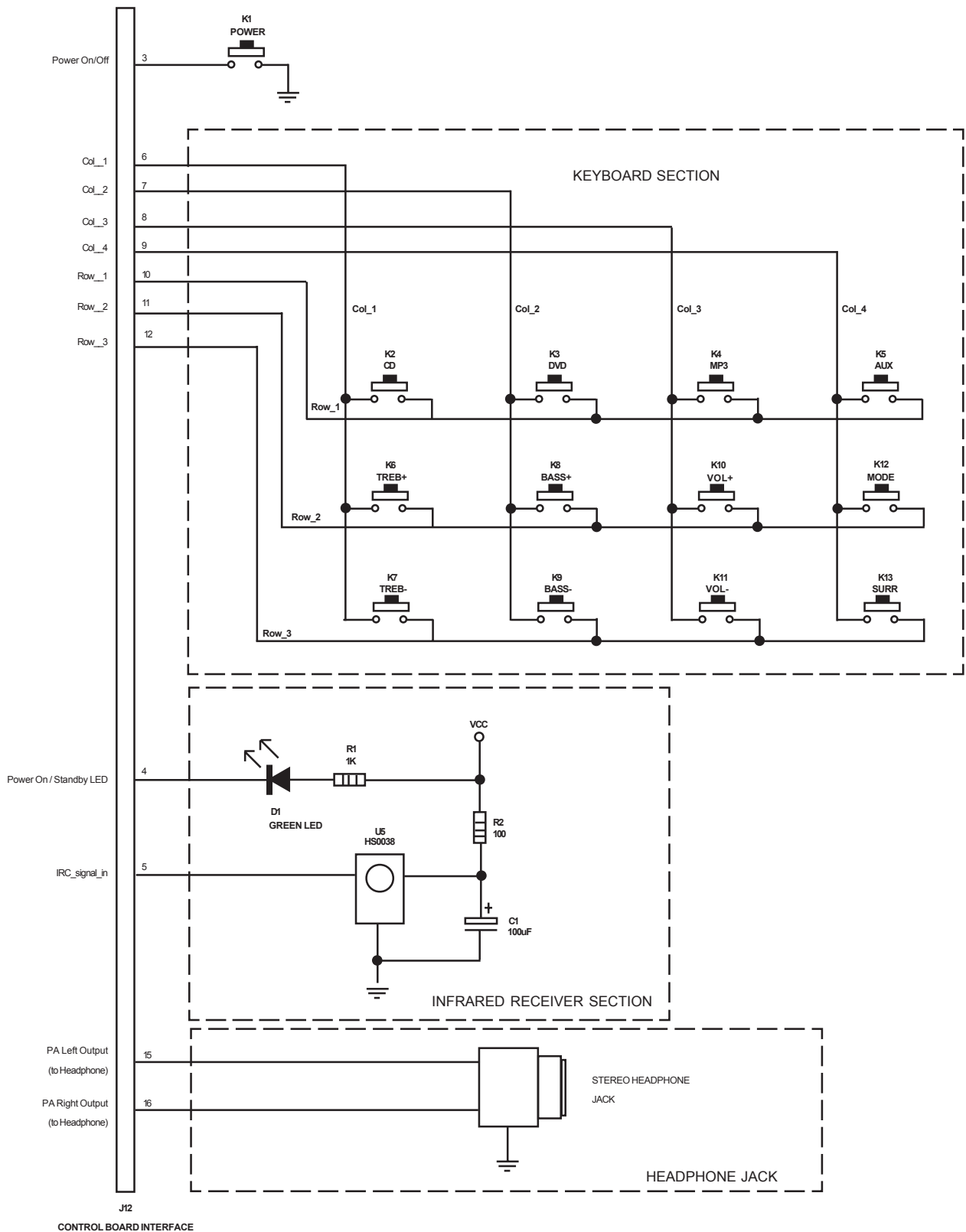


FIGURE 19: KEYBOARD, INFRARED RECEIVER AND HEADPHONE SCHEMATIC DIAGRAM



AUDIO INPUT / AUDIO PROCESSOR:

In Figure 16 and Figure 20, the heart of the audio processing is the TDA7442D - a digitally controller audio processors that is manufactured by ST. The audio inputs : CD, DVD, MP3 and AUX are a part of the TDA7442 standard 4-stereo inputs and can be selected by software programming. The AT89S52 MCU will handle the communications (serial bus interface) to the TDA7442D audio processor thru I²C protocol - please see the TDA7442D data sheet on page 6 to know more about the I²C protocol. You can find the data sheet in the CDROM under directory DATASHEETS. Of course, the AT89S52 MCU need the **control program** to be embedded into its program ROM. At present, the person responsible in the design of the control program is the "poor guy" of Heart System, but sooner or later, you will be the person to make your own control program, you can customized in the way you like to happen - of course you can do this if you know how to program the 8051 core MCU like the AT89S52 or AT89C51 or its other derivative.

Thru the serial communications SDA and SCL bus, by using the I²C protocol, the audio processor can be "driven" to perform task. Please see the IC data sheet starting from page 7 to page 11 to know how the TDA7442 processor can be "commanded". You can find the datasheet on the CD ROM.

In Figure 20, this schematic is 100% copied from the data sheet, please see page 2 of the TDA7442 data sheets, refer to the lower block diagram : TDA7442D, 28 pins SOIC package.

LCD:

The LCD is a standard LCD module that you can take home from most electronic store without the MOQ. It is 16 digits by 2 level (16x2 LCD module) with an amber backlight. The use of this LCD module will simplify my work, so there is no need for me to piece by piece construct the display (like the driver IC, STN LCD, PCB, backlight, etc.). In Figure 21, the schematic shown is not the exploded schematic of the LCD module. It is the compact schematic as I only show the I/O port. Please refer to the LCD datasheet - LMB162A. You can find the data sheet in the CD-ROM.

In Figure 21, I included transistor Q1 so that I can turn off the LCD backlight in the stand-by mode (by the MCU program). However I learned that, it is prettier and easier to look at the "clock" when the backlight is lighted in the stand-by mode rather than the backlight is turned off. The displaying of alphanumeric is controlled by the AT89S52 MCU thru the "bug free" control program. The communications between the LCD module and the MCU is in parallel mode, it makes use of one byte data (8 bits). These data were defined in the program and stored in the MCU program ROM. If you know (or later you'll know) how to program the 8051 core MCU like the ATMEL AT89S52, you can write a program and define your own LCD display. You may write your name moving from right to left when you power on the DATC or you may write anything like "I love ECE" which I used to write during my university days. This is possible because the LCD module takes only command from the MCU. If you like to learn 8051 MCU programming, see —————

Write anything on the LCD module? Hmmmmm! Probably my statement above is wrong, because in this type of LCD, you cannot write Chinese ,Greek or Russian character. In this case, if you have a Chinese "gf" and she want her name to be displayed in the LCD, how will you do it? Of course, you gonna do that or else.....! One way is to forget her and find another gf (that is not so demanding), the best way is to makes use of a **Dot Matrix LCD module** , that, you can display almost any alphanumeric and graphics.

To know and learn about the 8051 programming , you may avail of Hearts Systems :

my8051 - STARTER MCU EB8051
Microcontroller Trainer Kit

a simple, fast, fun and easy way to learn and program the 8051 Microcontroller using ATMELAT89C51 MCU.

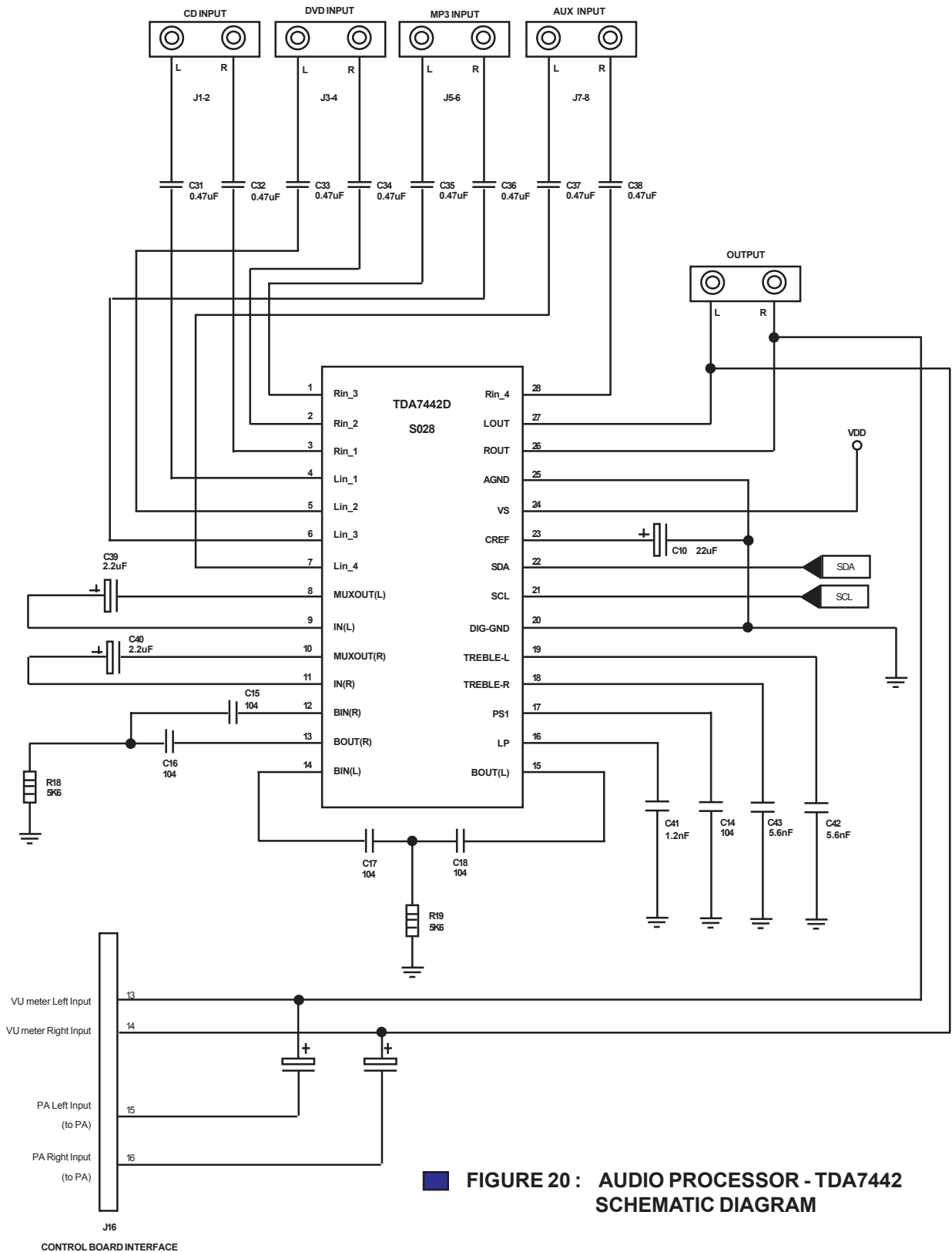


FIGURE 20 : AUDIO PROCESSOR - TDA7442 SCHEMATIC DIAGRAM

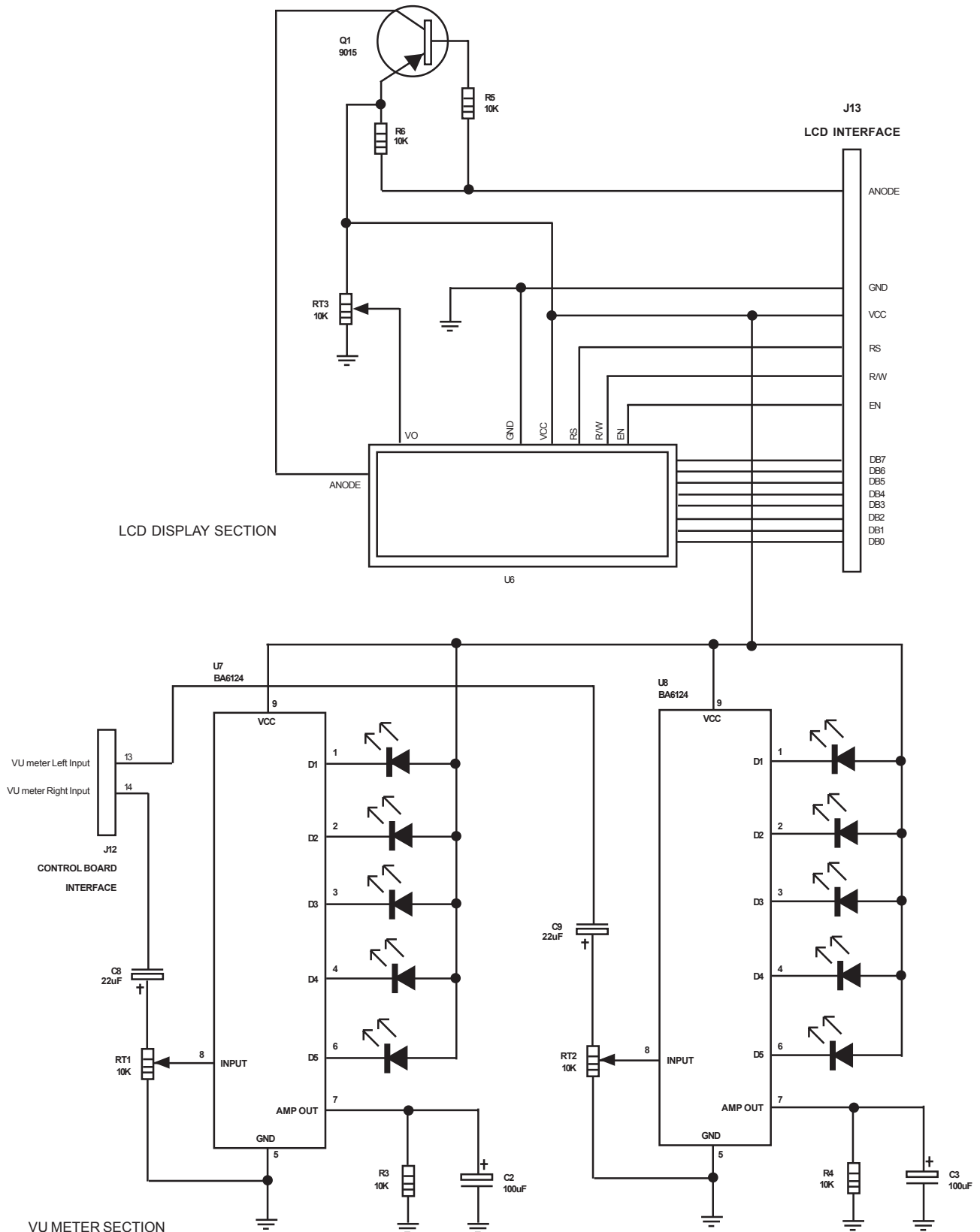


FIGURE 21 : LCD MODULE AND VU METER SCHEMATIC DIAGRAM



VU METER:

The VU meter (Volume Unit) is based on the Rohm Electronics dedicated IC for volume meter - the BA6124, a 5 points LED level meter driver. This IC is easy to use. I simply follow the recommended circuit except that I add variable potentiometer to "trim out" the input signal. Please see the BA6124 datasheet. You may find it in the CDROM under directory DATASHEET.

HEADPHONE AMPLIFIER:

The audio processor TDA7442 cannot drive headphone directly so I need to add a headphone Low Power Amplifier. Originally, I need the headphone for me to easily listen and distinguish the music characteristics during the development of the firmware. In this case, I don't need to make use of a PA with larger power output and speakers systems. The Headphone amplifier is the TDA1308 IC that is manufactured by Philips. The circuit used is the suggested circuit by the manufacturer. See Figure 22 (a).

POWER SUPPLY:

In Figure 22 (b), the power supply composed of two (2) sections : +9V and the +5V. The +9V is used to power the audio processor and the +5V is for the MCU, LCD and the Headphone amplifier. A typical input of 12~16 Vdc at least 500 mAmp is good enough to power the DATC.

INFRARED REMOTE CONTROL TRANSMITTER:

The IRC (Infrared Remote Control) is a standard product in this place and because it is made in China, all the labels and data sheet are in Chinese. To ease my "language shock problem", I ask one of my friends to do the program routine for me as he can understand the data sheets. Great! I have some friends who can help me when I am in need, makes my work easy!

EXT CONTROL Port:

The **EXT**ernal **CONTROL** Port, as earlier mentioned is intended to control the Power Amplifier : Power supply and speakers. I expected that some "Audio hobbyists" would like the DATC to integrate into their existing PA because DATC is definitely a hobbyists choice, and it is a smart idea to have it.

The EXT control **CTRL_1** will control the amplifier power supply while **CTRL_2** will control the speakers. The EXT control will ensure that, when K1 is pressed or when the "Power On" key on the Remote Control is pressed, CTRL_1 will turn on the amplifier while keeping the speaker turn off. After 2 seconds (the 2 seconds delay is good enough for the power amplifier to stabilize the Amplifier circuit), the speaker system will be turned on thru CTRL_2.

When turn off the DATC, the speakers will disconnect first and then turn off the amplifier power supply. This will ensure that the "pop sound" will not be heard from the speaker system during turn on and off of the power amplifier.

That is not only the main reason why I included this feature, the simple reason is that, you do not need to go closer to the DATC to turn off or turn on the power amplifier. Simply use the DATC Remote Control. If you are lazy, you can programmed the DATC to turn off or turn on at a specified time - makes you feel having a real personal and friendly "Audio buff".

Of course, there is an additional hardware you need to incorporate to your existing power amplifier in order for you to avail of this function. Yes! You need to build a relay matrix that control the power supply and the speakers. See Chapter 6.

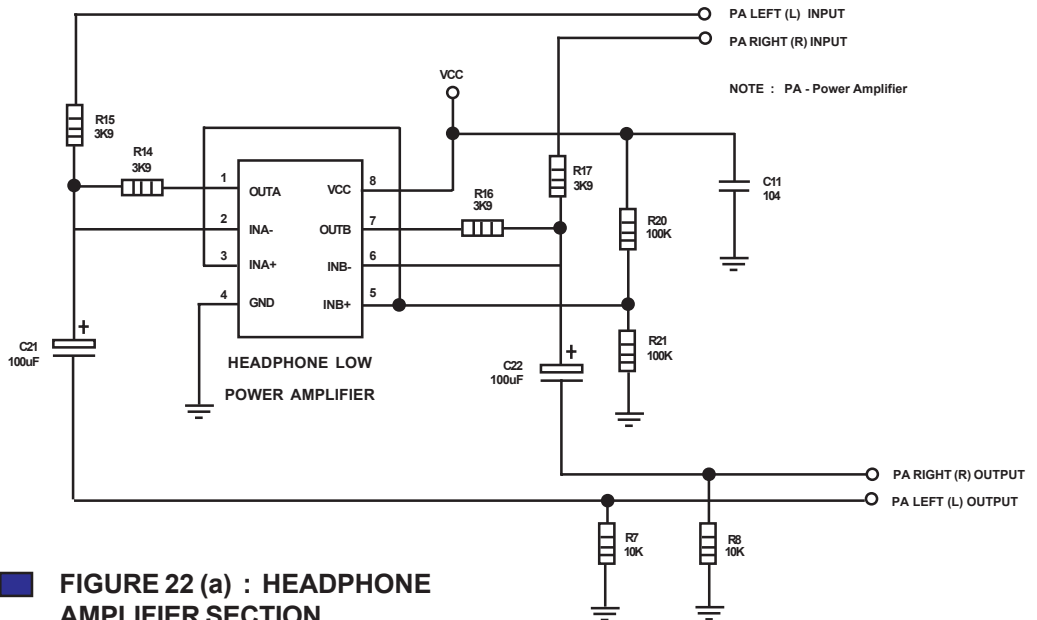


FIGURE 22 (a) : HEADPHONE AMPLIFIER SECTION

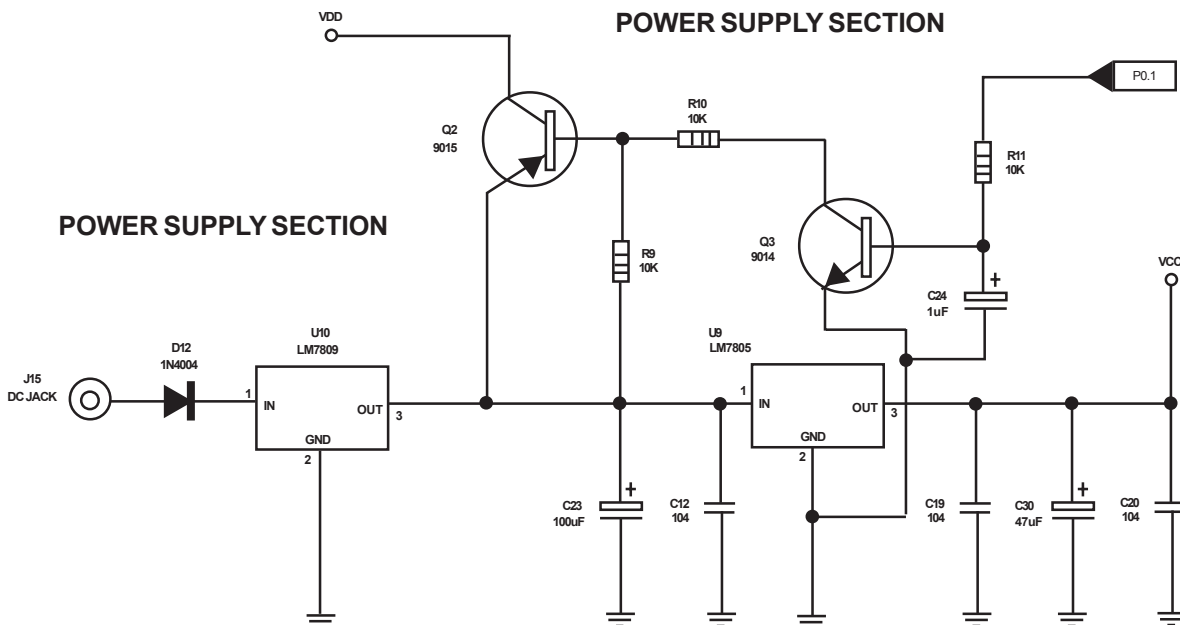


FIGURE 22 (b) : HEADPHONE AMPLIFIER and POWER SUPPLY

CHAPTER 5

— The DATC Outlook Rendering

This chapter will present the DATC design rendering

The Original Outlook :

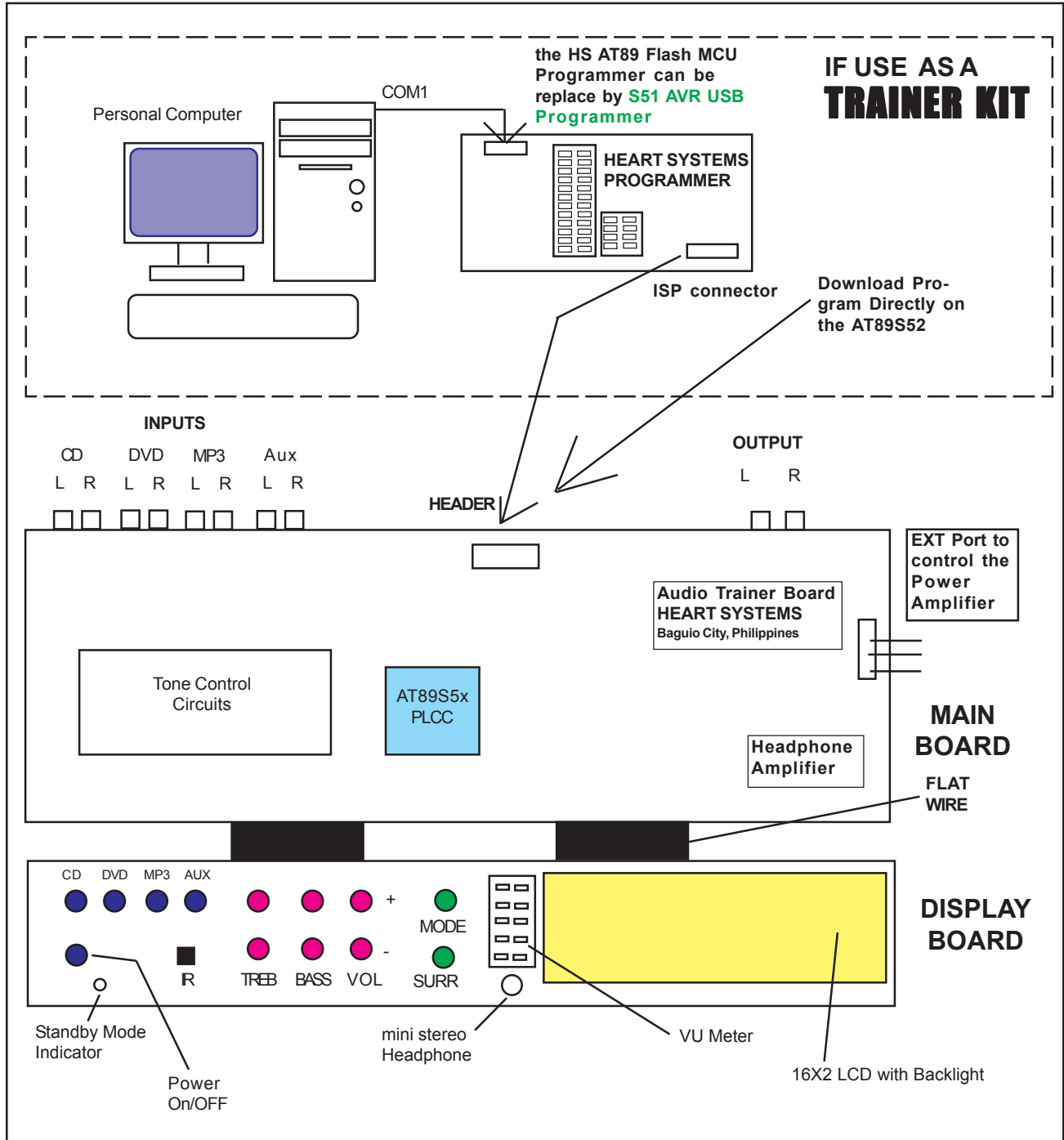


FIGURE 23 : DATC RENDERING - (Original Idea used as Trainer Kit)

The Control Board Design :

The Control Board is shown in Figure 23 and 24. It basically contain all the User's control interface, like how to select the input sources, set the clock, select the Surround mode, increase the volume, increase the bass or treble, etc. There are two ways the user can access the controls :

- a) depress the tact switch on the control board panel
- b) using the Infrared Remote Control

On the control board, you can see also the VU meter, the LCD display and the earphone jack.

The control board is placed on a separate kid-panel PCB and it is separated from the Main I Board so that it can be position vertically to give the user of the feeling and looks like a front panel of an Audio Tone Controls. The control board is connected to the Main Board thru two (2) - ten pins connectors.

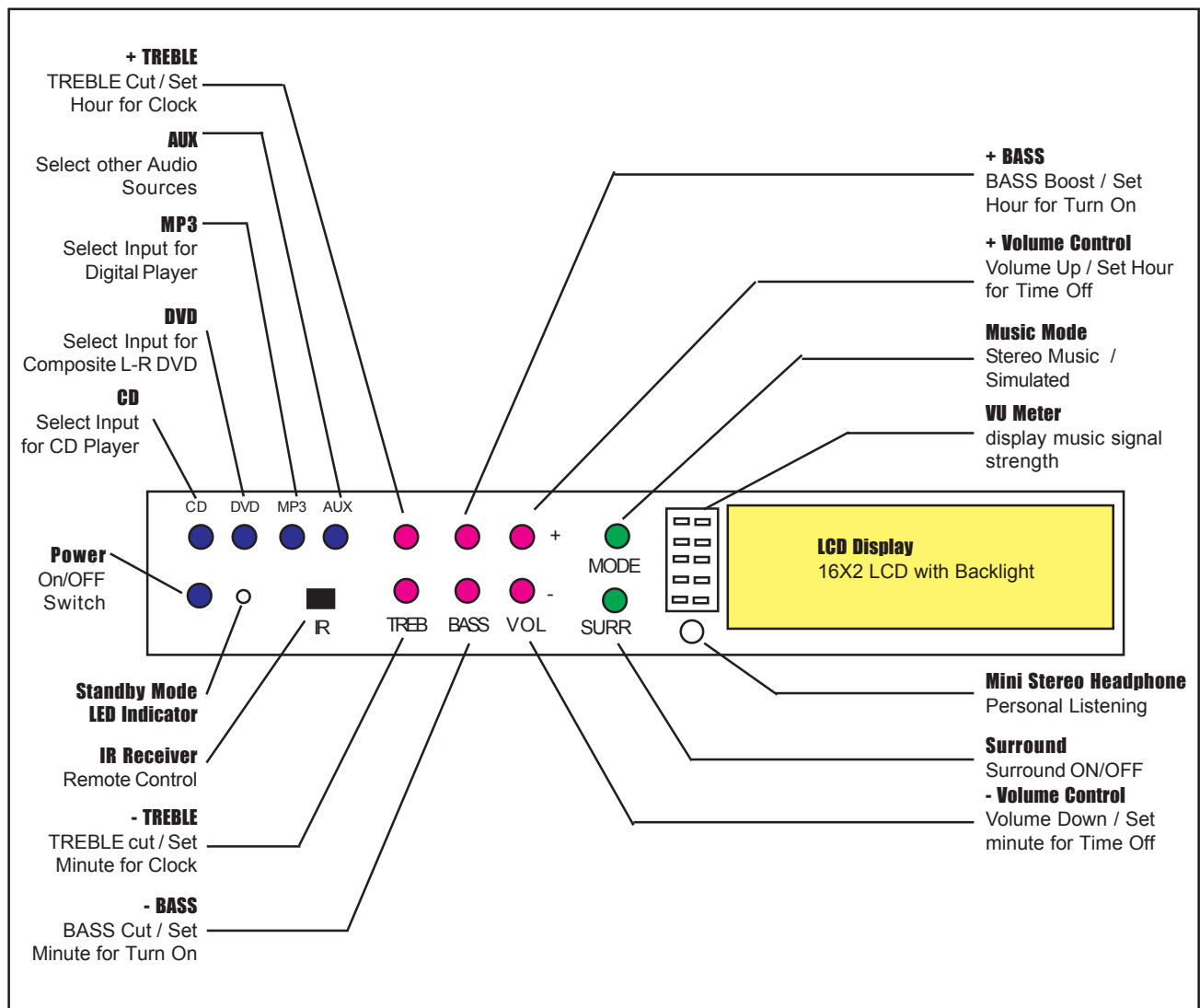


FIGURE 24: FRONT CONTROL BOARD RENDERING



The LCD Display Rendering :

One of the critical thing to design is the LCD display outlook, how the letters or character are to be displayed, will it move from left to right or from top to bottom, etc. It is the LCD display where most of the user will focus his eyes when setting the input source, adjusting volume, treble and bass specially when want to see the time.

The following display will show the different display mode of the LCD display :

- Power On Mode
- Active / Input Selection Mode
- Control Adjustment Mode
- Stand-by Mode
- Setting the Clock Mode
- Setting the Tun On/Off Mode

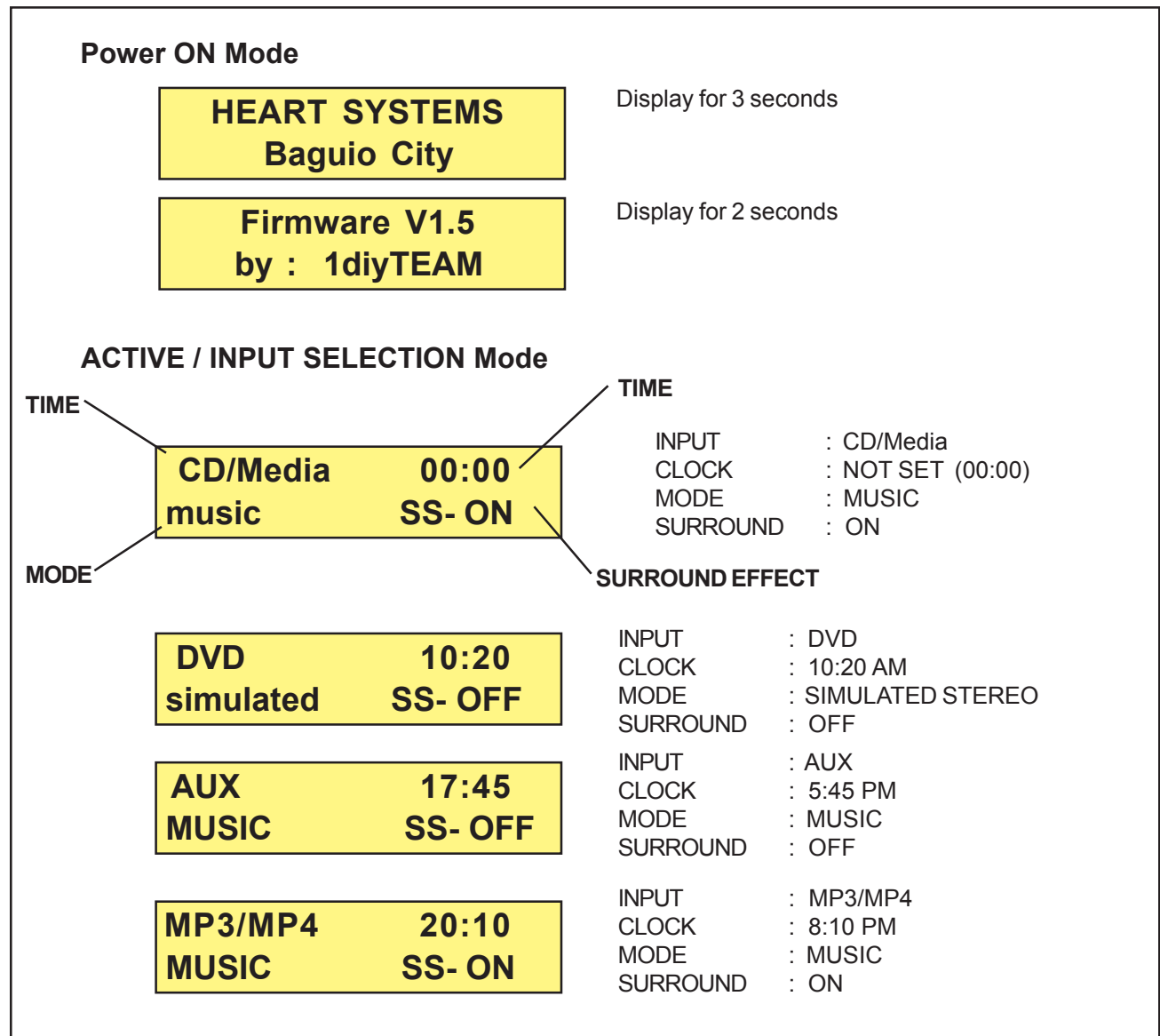


FIGURE 25-a: LCD RENDERING



CONTROL ADJUSTMENT Mode

BASS : + 12 dB

Display +12dB of BASS BOOST

BASS : - 10 dB

Display -10dB of BASS CUT

TREB : + 8 dB

Display +8dB of TREBLE BOOST

TREB : - 12 dB

Display -12dB of TREBLE CUT

VOLUME : -32 dB

Display - 32dB of VOLUME

Note:

When the mode is in the ACTIVE CONTROL Adjustment, the above will display. If there is no user activity, it will remain for 3 seconds and then display the ACTIVE INPUT SELECTION mode. For example is:

MP3/MP4 20:10
MUSIC SS- ON

STANDBY Mode

Heart Systems
DATC Time 10 : 30

Will display HEART SYSTEMS and the Time

blinking

Time of the day : 10:30 AM

HEART SYSTEMS
DATC Time 00 : 00

Back Light is Turn-ON

Clock is not set

FIGURE 25-b : LCD RENDERING (continue)



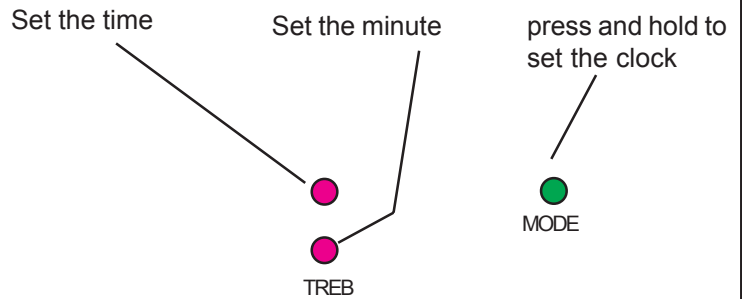
SETTING the Clock Mode <<< time of the da>>>

TIME 00:00

TIME 8:12

The clock can be set using the keys in multiplex with the control keys. It can only set manually. You cannot set the clock using the Remote Control

The time is 8:12 AM



SETTING the Turn ON / OFF Mode <<<Tone Control Auto turn On & auto turn off>>>

TIME ON : 00:00
TIME OFF : 00:00

TIME ON : 13:00
TIME OFF : 15:30

The TURN ON and TURN OFF can be set using the keys in multiplex with the control keys

The tone control is set to TURN ON at 1:00 PM and then TURN OFF at 3:30 PM.

This is one time setting and it will take effect each day.

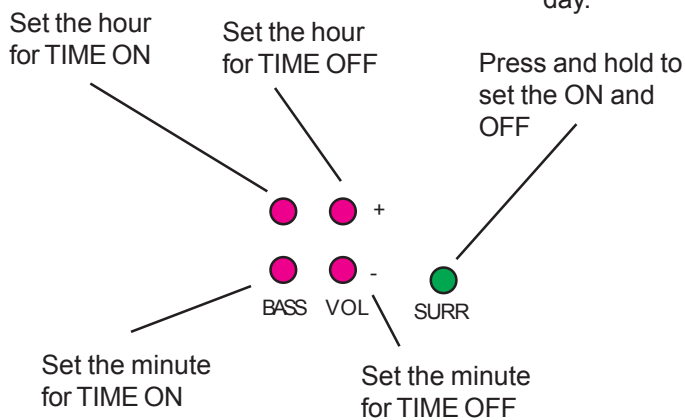


FIGURE 26 : CLOCK SETTING IN MULTIPLEX WITH THE CONTROL KEYS



Infrared Remote Control :

The Remote Control is a standard product that can be easily purchase in electronic store (in my place). I took advantage of this finished product to make my work simple, compact and rugged. It is also possible to make this project to make it more interesting (Ok then! That would be a future project).

The original sample I have comes with Chinese label. In case you are "lucky" to obtain this Remote Control, then you are sharing some of my difficulties. So, I am providing here the English version. Actually, there is always a problem in marketing sense to use standard product like this Remote Control. Ok! I can change the wording from Chinese to English in one condition from the manufacturer that, at least I should have a MOQ of 10K (ten thousands pieces of Remote Control for the first order) and at least 5K forecast order per month. Huh! Where is my wallet?

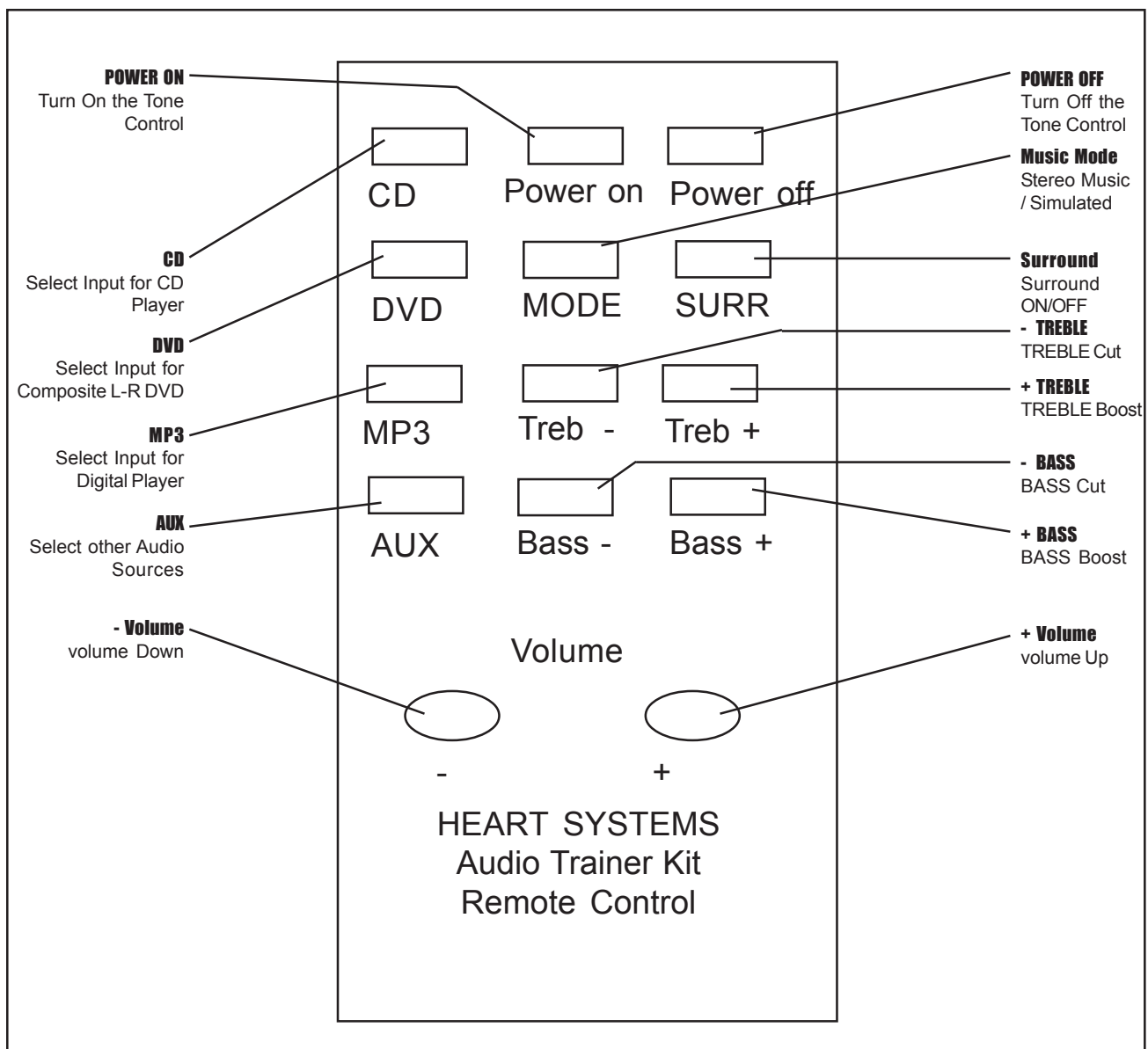


FIGURE 27 : REMOTE CONTROL RENDERING

Main Board :

The Main Board is shown in Figure 28 below. It is where the 4 inputs (CD, DVD, MP3 and AUX) is placed, the TDA7442 Audio processor, the Headphone Amplifier and the composite Output where you can tapped the signal to be connected to the main amplifier. The AT89S52 PLCC Package is also placed here. You may notice that, I used the AT89S52 - an 8051 derivative MCU which is an ISP capability (In-System Programming). As I mentioned earlier that, I originally intend this board for "training purposes", doing so will be convenient to use the ISP MCU like the AT89S52 because you can program it on the board (no need to take out the MCU from the socket). It is also possible to use AT89S51 - a 4K bytes program ROM. The AT89S52 is a 8K bytes program ROM - ISP MCU.

You can also find here 2 ports (CTRL_1 and CTRL_2) that is dedicated to drive a relay to control the Amplifier Power Supply and Amplifier Speakers.

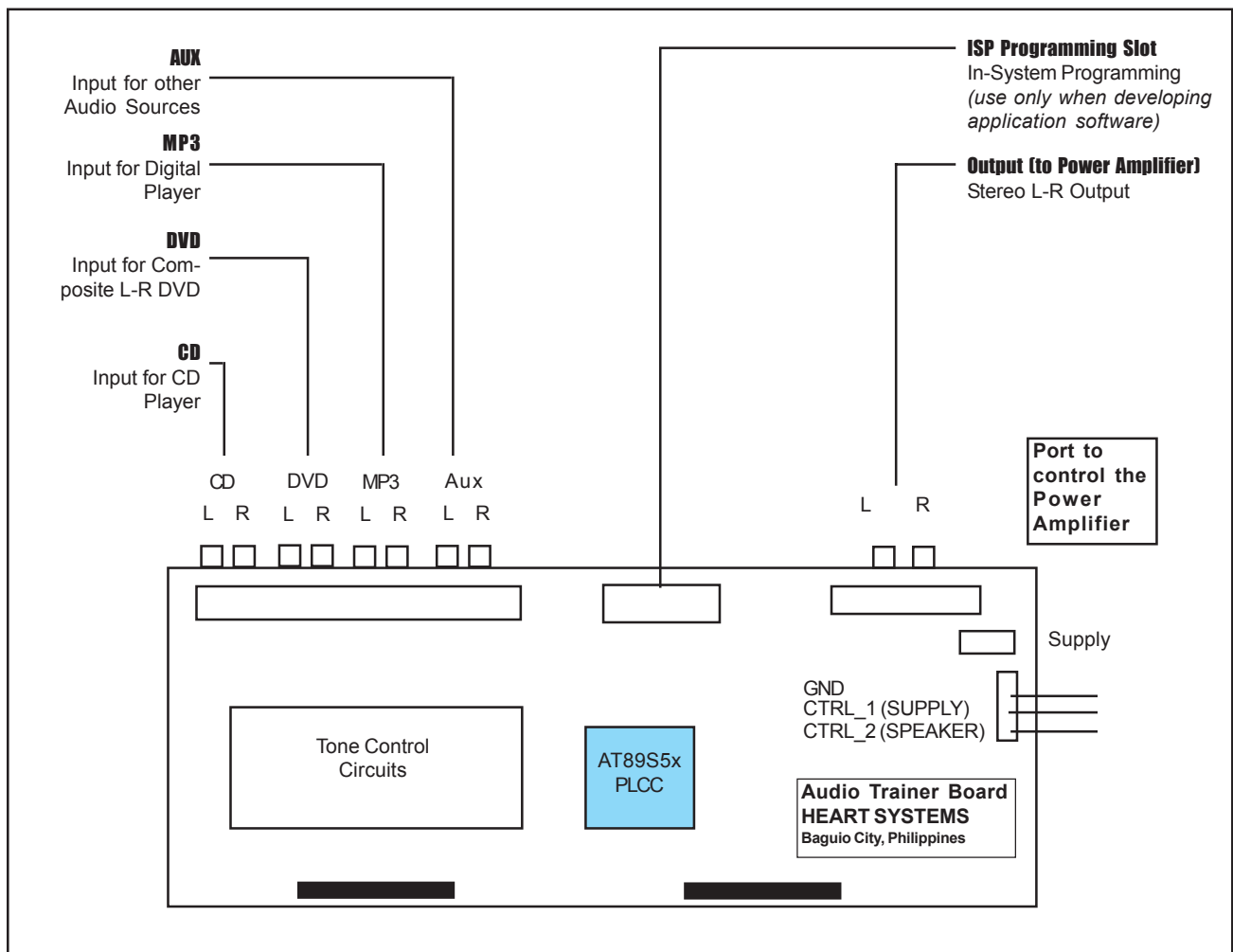


FIGURE 28 : MAIN BOARD RENDERING

CHAPTER 6

DATC

Integration

This chapter will present something you can "play"

around of your DATC : Intergartion & Low Cost



Power On / OFF - Speaker control :

If you **DIY** (Do It Yourself) your PA and intend to use the DATC as your tone control, you may include the circuit below to **activate the automatic turn on and turn off feature** of the DATC. Heart Systems will going to use (or put as options) this circuit in its future PA projects so that it will always compatible to the DATC.

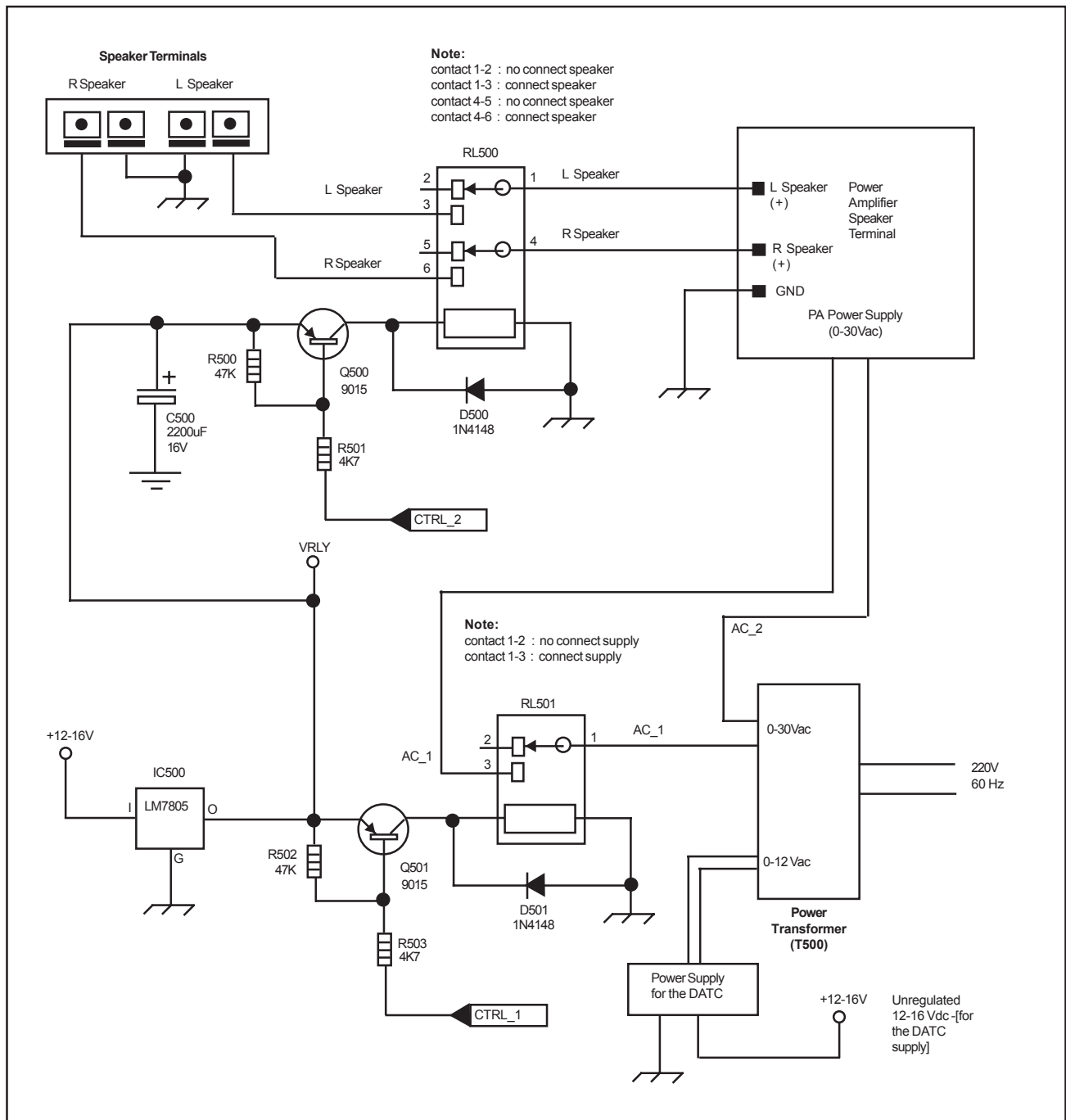


FIGURE 29 : POWER SUPPLY AND SPEAKER CONTROL CIRCUIT



The circuit shown in Figure 29 operates when Power on the DATC as, CTRL_2 will off (not active) for 2 seconds while CTRL_1 will turn on immediately. The CTRL_2 is use for controlling the speaker while CTRL_1 is use to control the PA power supply. As earlier mentioned, the 2 seconds delay will allow the amplifier to stabilized so that you will not hear the click or pop sound in the speakers.

When turning off the DATC, CTRL_2 will turn off immediately while CTRL_1 will be turned off after 2 seconds. Again, you will not hear the oscillation or "pop noise" that sometimes appears in some PA.

When using the relays to be controlled by the MCU, you will prevent the "noise" in the turn on and turn off of PA which is a concerned to the user. The obvious reason why you need to make use of a relay to control the PA power supply is to effectively controlled by the MCU during the auto turn on and auto turn off.

The circuit in Figure 29 is not applicable for bridge type output power amplifier. If your power amplifier is a bridge output scheme, you probably need 2 relays. See Figure 30.

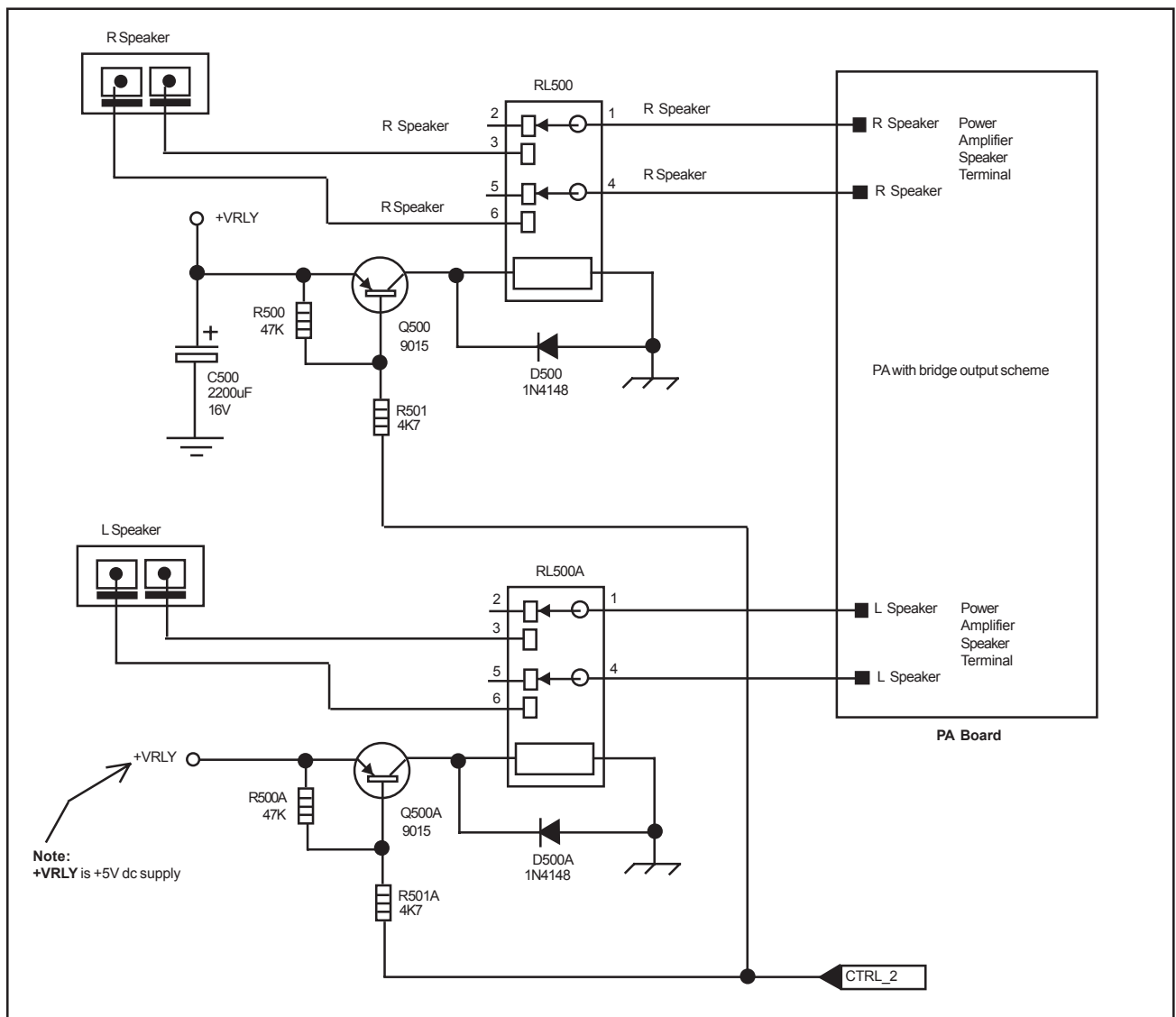


FIGURE 30 : SPEAKER CONTROL CIRCUIT with Bridge Output Amplifier



If your PA is using a split power supply, you need to use of a DPDT relay. The solution is shown in Figure 31.

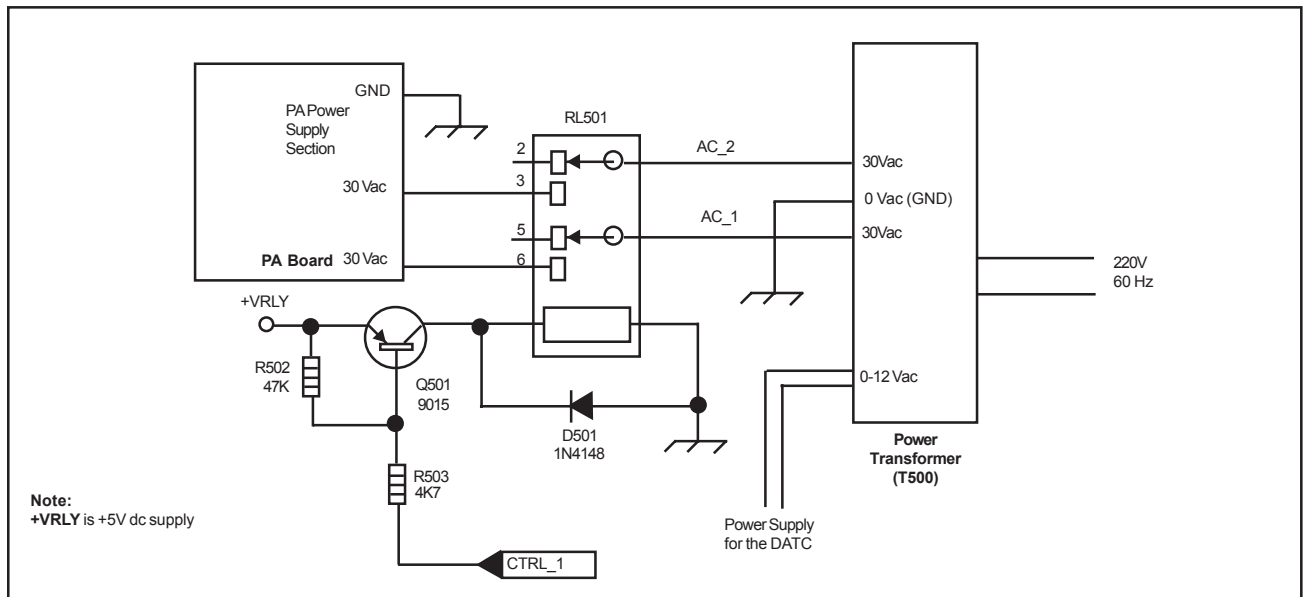


FIGURE 31 : POWER SUPPLY CONTROL CIRCUIT - Split Power Supply

If your Power Transformer do not have the supply for the DATC, you need to use low power and smaller transformer. I include the main power switch SW500 so that you have the option to completely turn off your Audio Systems other than plugging off the 220V male socket on the power supply female socket. See Figure 32.

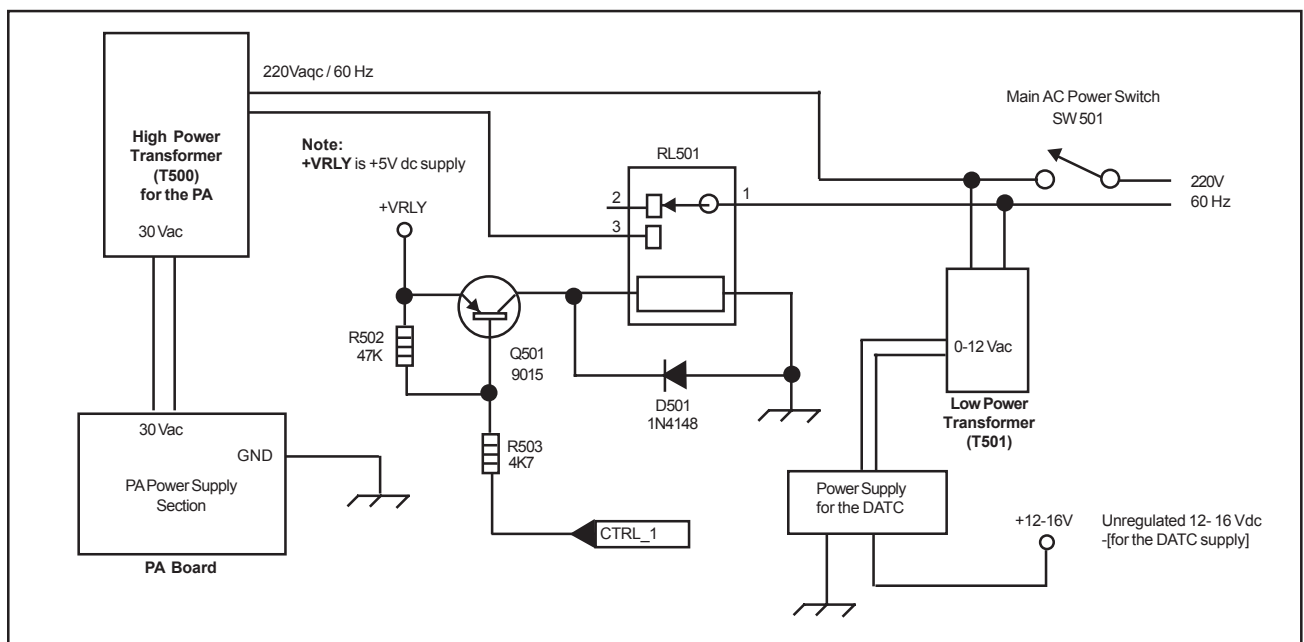


FIGURE 32 : SEPARATE POWER SUPPLY for the DATC and Power Amplifier



MORE Info.....

If you are interested and would like to see how the "control program" is implemented only for controlling the Power supply and the speaker of your PA, please see :

my8051 - STARTER MCU EB8051
Microcontroller Trainer Kit
USER's GUIDE VOL. 1.0

pages 103 to 107. The Block Diagram and assembly codes presented in these pages.

HOW TO USE THE DATC with EXISTING POWER AMPLIFIER

Although, the DATC on/off and speaker control is intended for new design of PA, it can be also applicable to an existing and fully working PA. See Figure 33 below.

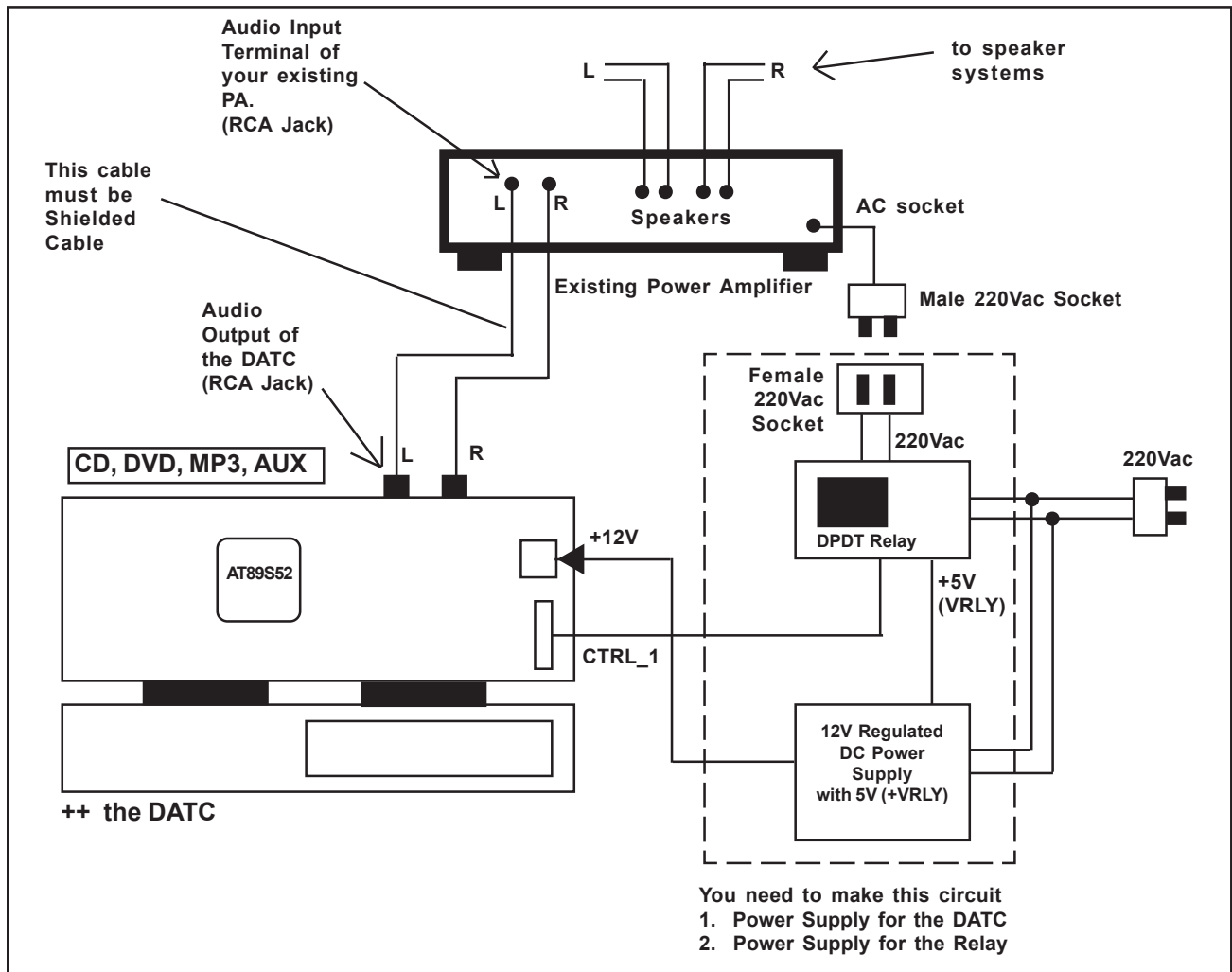


FIGURE 33 : SEPARATE POWER SUPPLY with existing Power Amplifier



In Figure 33, only the PA power supply is controlled. The speaker is not control. Since your PA has been build into its enclosure, you might build a new enclosure for your DATC. In here, you can include to build the :

1. Power Supply for the DATC
2. Relay Power Supply

Since the components is few, you may construct it in the Universal PCB. Please see the schematic below.

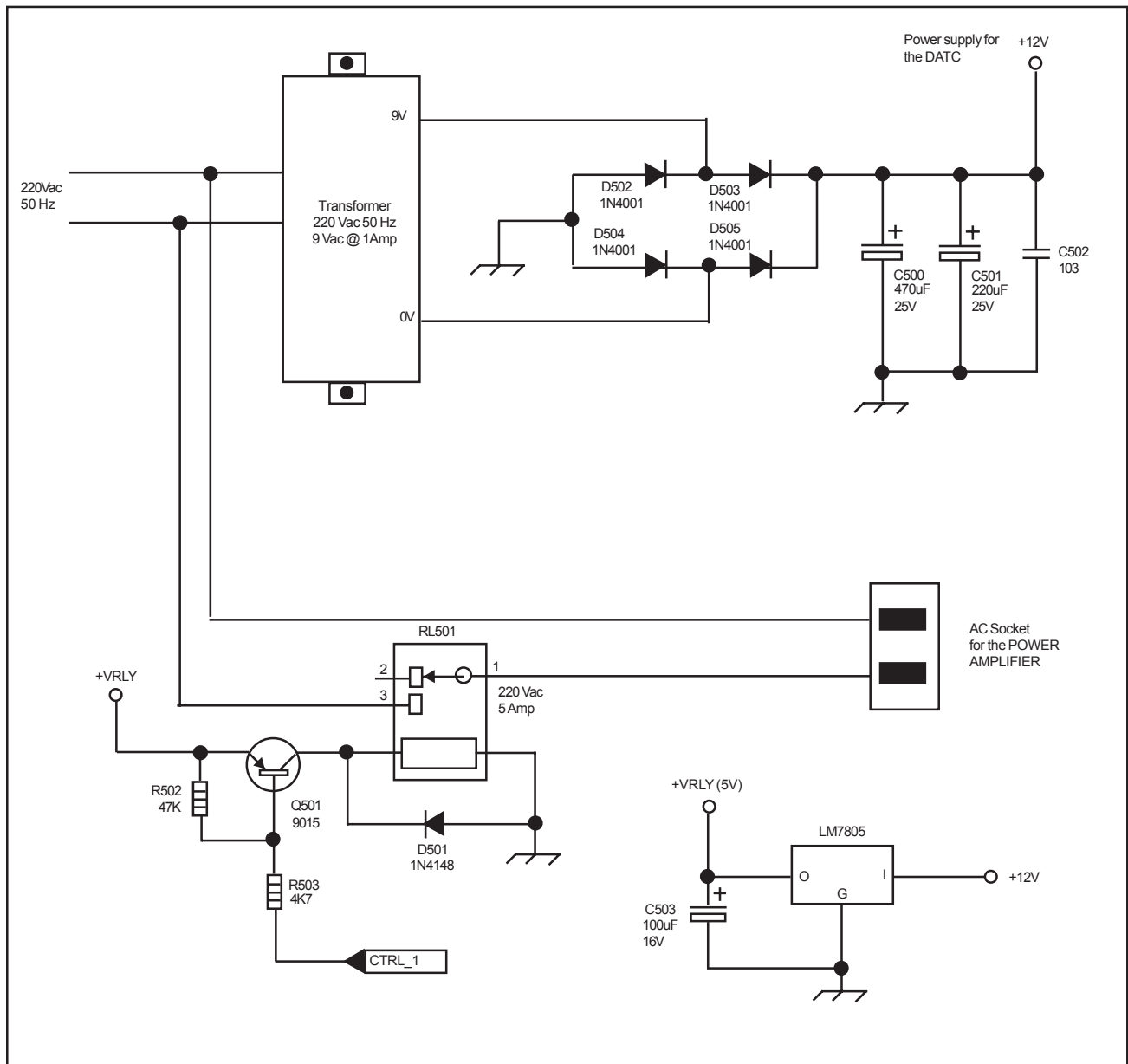


FIGURE 34 : SCHEMATIC DIAGRAM with the POWER SUPPLY CONTROL



The schematic in Figure 34 shows that, you need to have a supply for the DATC internally to the casing. The power supply is composed by the bridge rectifier D502 to D505. The filtering section composed of C500 to C502. The expected unregulated output voltage is about +12V.

The VRLY supply is used to supply the relay voltage. The relay that I am using in most of the project I am doing have a standard operating voltage of +5 Volts. The relay circuit is composed of Q501 and its associated standard components for driving a relay. The relay RL501 is used as a PA power on/off switch which is being controlled by the DATC CTRL_1 port.

You can try the setup as shown in Figure 34 and see for yourself the outcome. Take note that it is only the power on/off relay is used here. The control for the speaker is not use here. If the result is positive, you can enjoy the listening right away. If there is a problem like motor-boating or high frequency oscillation when you turn on or turn off your Power amplifier, try to fix it first the grounding. What I mean here is that, try to see the grounding condition of the RCA jacks when they are inserted. If you got it right, you may want to include the speaker control CTRL_2. See Figure 35.

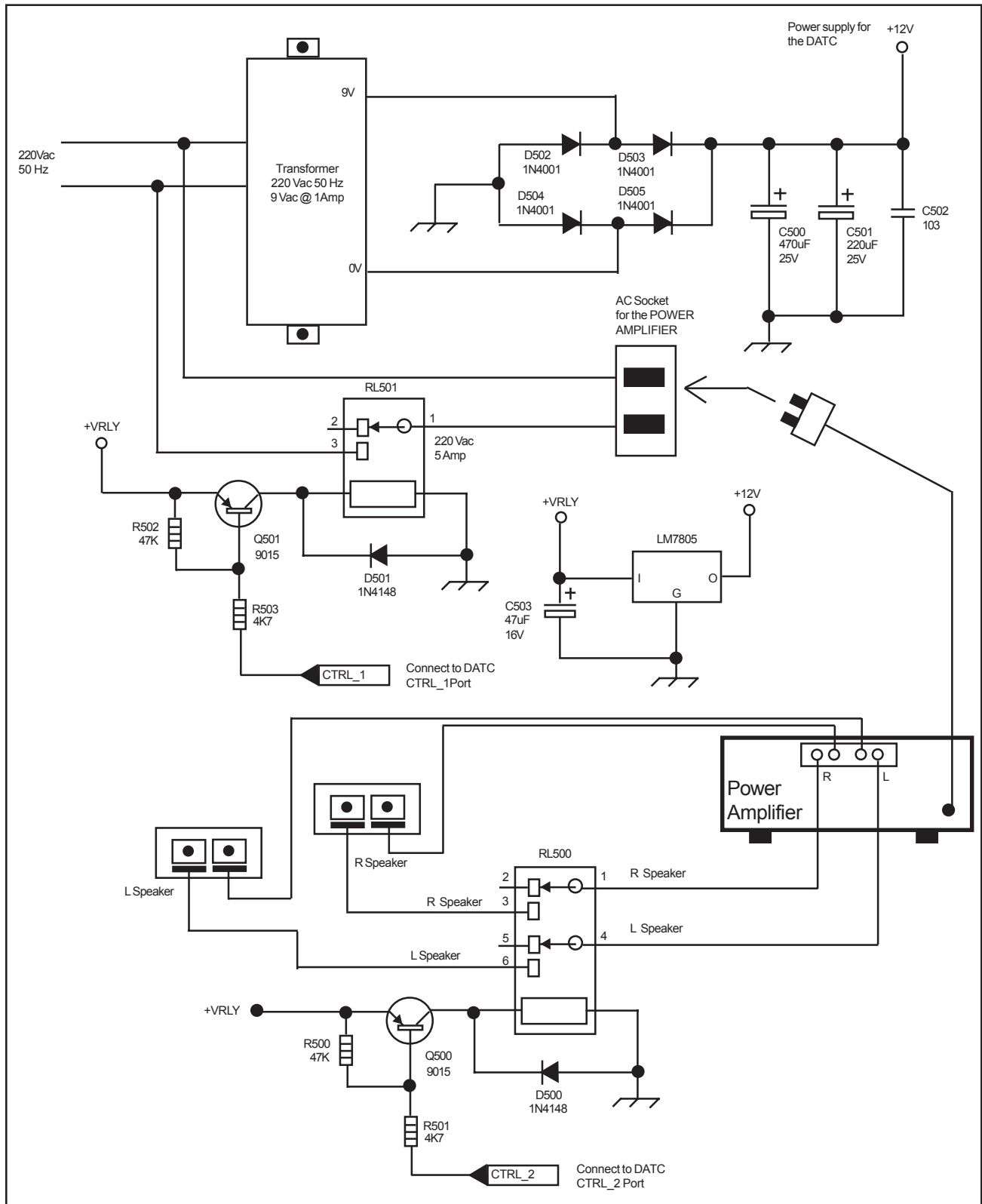


FIGURE 35 : SCHEMATIC DIAGRAM with the POWER SUPPLY and SPEAKER CONTROL



The DATC Low Cost

This idea of "operating the DATC" in the Low Cost mode is suggested by one friend who tried the DATC in his apartment (living room). He said that, the DATC can still work good even if you do not put the front panel control. What you need to retain is the Infrared receiver. You can easily "hand wire" this receiver into the Main board. See Figure 36 below. His idea is something weird. I do not like it at the first glance but I tried to understand and open ears to user's preference and comments. I constructed one unit with only the main board and rewire the Infrared receiver. I also add the power on/stand-by mode LED.

You need of course to use the Remote Control to operate the DATC. It does work but you have to sacrifice the features on :

- 1. Displaying the real time clock
- 2. Selecting the timer on and off
- 3. Displaying the Treble, Bass, Volume and Mode
- 4. Displaying the VU meter

His reasoning is that, most of the time you do not look into the LCD display. Probably, he's saying some feeling or user's style. But look at his point. If you adjust the treble, volume or the bass, you are actually listening to the response of your adjustment and probably not seeing the volume level on the LCD. Probably you do not care the level of the Volume being display on the LCD. By hearing, you can actually judge when the Treble or Bass is in the minimum cut or maximum boost setting. You can also judge by hearing which one is your preference for the mode : music or simulated. He said that, he don't often change the setting of the Treble, Bass or Surround mode as they are in its optimum levels for his type of music. He often used to press the **volume up**, **volume down**, the **power on** and **power off** buttons.

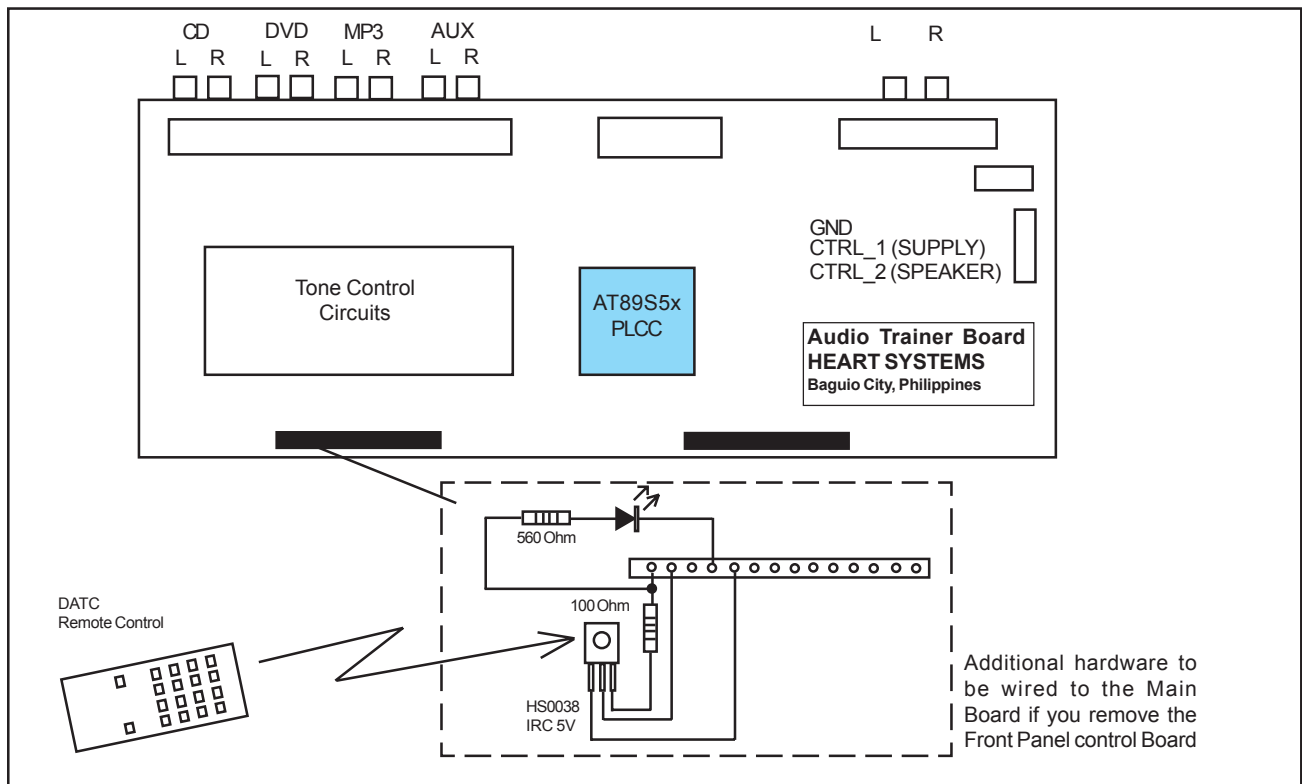


FIGURE 36 : THE DATC using only the MAIN BOARD



The Infrared Receiver is directly soldered on the Main Board

The STANDBY LED is also soldered on the Main Board

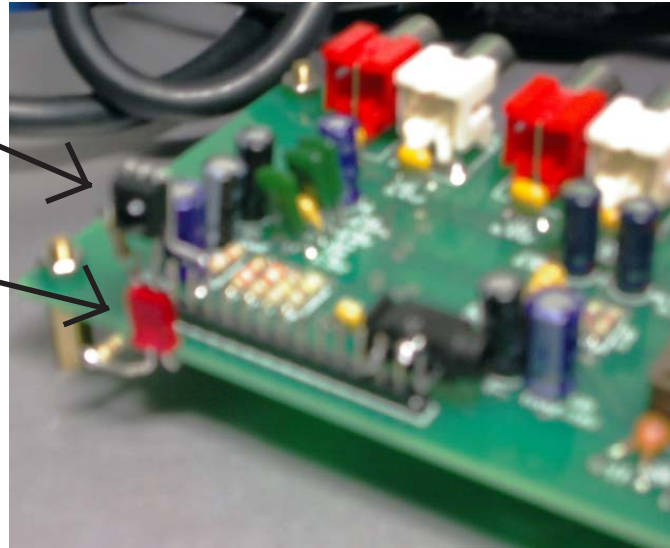


FIGURE 37 : HOW TO CONNECT THE INFRARED RECEIVER and the STANDBY LED

CHAPTER 7

Extra _____

Extra _____

Extra _____

This Chapter is more or less a way of the author to explain some of his failure, his intentions, real experienced preventive measures, invitations, asking support, flood the 8051 knowledge, etc.

Danger of ESD on the DATC Kit

One of the aim of Heart Systems is to provide an **easy, affordable, fast and fun [EAF²]** ways of Learning the 8051 Microcontroller's - hardware and firmware applications in *Digital Audio Tone Control* - unfortunately, I am having a problem to implement this idea because there is "**no fun**" in building the current **DATC Kit** if a hobbyists encountered "a dead or busted TDA7442D" IC. There are about 10 persons tried to build the un-assembled DATC Kit and only 2 persons made it successfully. The other eight (8) trialist have encountered the same symptoms of a defective TDA7442D. Later, after failure analysis of the IC, I found it out that, the failure might caused by **ESD** and/or improper soldering.

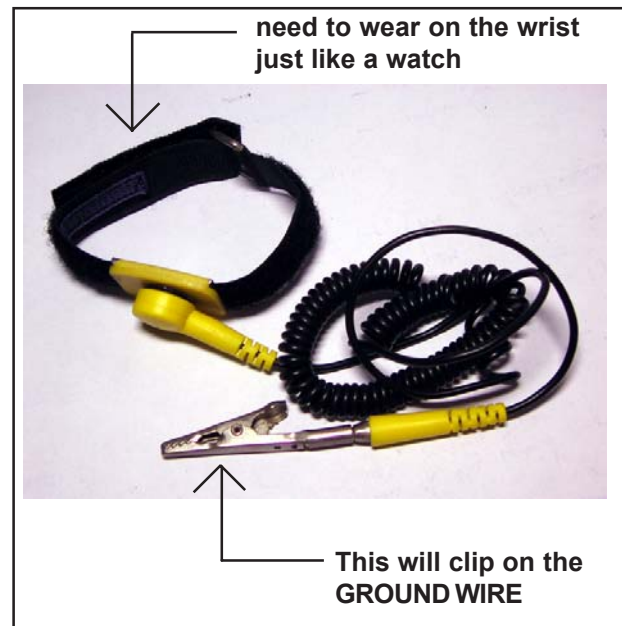
The first failure simulation I do is to touch the IC without a Ground Strap - that is January time and ESD build up in human body is so easy because the temperature is cold. A ground strap is used by a person and wear on his wrist to discharge the ESD voltage that is developed in the **human body**. The voltage developed may reach as high as 5KV depending on the environment materials (with carpet, curtain, etc.), the type of clothes wear by the person and the environment temperature and humidity. The ESD voltage developed on the Human Body may eventually "bleed off" on the IC pins if you will going to touch it which internally causes damage. *Some Electronic Magazine discusses of the danger of ESD - one way to prevent ESD damage it to touch a Ground first before you will touch CMOS device IC. The reason to touch the "ground" first is to discharge the ESD toward GND not to the CMOS device.* After touching the TDA7442D without the ground-strap and simply soldered it on the DATC Main board, it is not working.

The second failure analysis I did is by using a non-controlled 30 Watt soldering Iron (same as the soldering Iron used by the users). The IC failed just after the first soldering (I am already wear my ground strap). I tried another board and used my temperature controlled soldering Iron --- it works. I tried to solder once and increased the temperature, it works still. I used the 30 watts soldering Iron and re-soldered it and now comes the failure.

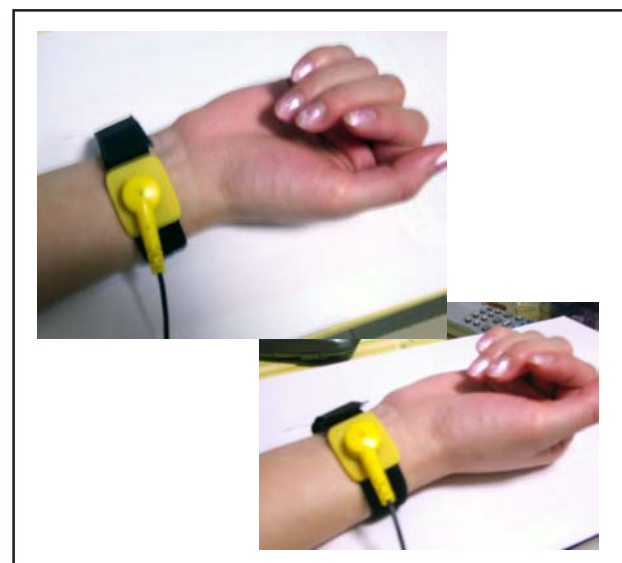
I am thinking of two (2) things, maybe it caused by grounding problem on the soldering Iron or the "heat" exceeds the IC specifications. Unfortunately, I did not find any special consideration regarding the SMT (Surface Mount Technology) reflow in the data sheets of the IC.

Note:

It is not my intention to degrade the TDA7442D or other IC. What I am telling here is a real life experienced that - - if anyone observed the pre-cautions and use the right materials and tools, Failure is unlikely to happen.



■ FIGURE 38 : ESD GROUND STRAP



■ FIGURE 39 : HOW TO WEAR ESD GROUND STRAP



If you asked me why I did not see this problem in the prototyping stage (so I should have prevented it) -- it's because I am using a temperature and well grounded soldering iron and it is my rule of thumb to use a Ground-strap whenever I work with IC in my bench. January is the coldest time in my place (China) and ESD build up in the human body is easy.

Why used of SMT Device?

The main purpose and reason why I choose and voted the SMD rather than the PDIP package is that, Digital Audio IC trend is towards SMD. I would like to introduce to my fellow electronics hobbyists the usage of SMD to familiarized, practice and grasp of this SMD Technology which is now the trend in IC for Digital Audio applications. Unfortunately, I found it out in the middle that the TDA7442D SMT package requires more attention and requires the use of grounds-strap and a controlled soldering iron.

I pretty know that **ground-strap** and **temperature controlled soldering iron** is not a common "gear" of an electronic hobbyists (as I was once an electronic project builder hobbyists with limited tools). Of course, this is not the *FUN* I am mentioning in Project building and Learning. But I need to live with it because this is the characteristics of Semiconductor devices (not only this IC, other SMD device perform the same susceptibility to ESD and soldering specially RF IC).

Basically, there are two type of SMD device I used in this project :

1. TDA7442D - Audio Processor
2. TDA1308 - Low Power Amplifier

But I did not encountered problem on the SMD TDA1308 low power amplifier.

Again the main purpose of introducing the SMD device here is for my fellow hobbyists to grasp the SMD technology in which if he want to build a better Tone Control or AV amplifier and use a more powerful processor than the one I used here (perhaps from YAMAHA, Mitsubishi, ATMEL etc.) which normally comes in SMD package like the Quad Pack, PLCC, etc. then, he have some experience to handle the IC and avoids failure.

The Challenge & Solution

To me -- the problem in project building mentioned above forced me to find a solution on the project building process. Of course the clear solution is to use a proper tools, like :

1. Temperature controlled Soldering Iron
2. Ground-strap and good grounding connection
3. Pin-set or IC holder (perhaps).

For hobbyists who would like challenges, adventure and learn from experienced, the current DATC using the SMD device is a good chance to test on how well do you know and how well your handling of SMD components.

Basically, the TDA7442D is an SMD (Surface Mount Device) and by theory should be process using SMT machines. In my experienced, SMD can be soldered manually using a soldering iron (just need some practice) or by using a hot-air blower. When doing this - we normally do it in a controlled environment. Controlled environment means that the humidity and temperature are maintained, a clean table with anti-static mat, use of ESD ground-strap, use of an IC handler, etc.

In reality, I still encountered some defect on the Processors. *Sometimes, it is a good reason to my boss to simple say --- damage by **ESD**... period!*



Your Support - is a support to me & support to him

The author is a "one man band" operation (*myhobby*). The author has plan to release more Educational Trainer kits on the following field:

1. Radio Frequencies (RF) in the applications of Wireless Communications specially cordless telephony,
2. Wire Communications specially on Telephony, Digital Answering Machines,
3. Audio and Video..... and
4. Security and Controlling

Your purchase of :

8051 MicroController Educational Trainer kits	: my8051 Vol 1 - STARTER MCU-EB8051 Trainer Kit
8051 MicroController Project / Trainer	: Hobbyists Cental Office Simulator [Hob-COS]
8051 MicroController Project	: Digital Audio Tone Control [DATC]
8051 MicroController Project / Trainer	: Hob-COS Trainer Board [HCTB]
8051 MicroController Project / Trainer	: Night Eyes Security Systems ver. 2 [NE2ss]

will give Heart System's enough budget to develop more Educational Trainer Kits and Projects and to ensure its operations to continue over the next years, for support for the next generation. The author encourage you to avail the original **Technical User's Guide** rather than photocopying it and to avail our **Specially packed Trainer Kits / Board**. Please check the availability from Heart Systems or write email to me.

These **Trainer Kits** were specially packed and designed for you - - that is affordable by technicians, students, engineers and electronic hobbyists. It is basically cheap even with the high tax which I can claim as the cheapest in the world (I wish to be exempted from the tax). These **Trainer kits** were conceived while working in the real world of R&D which the author would like to disseminate at the early stage of taking up electronic course in the school or university.

Your support to the author and Heart Systems to spread the 8051 knowledge in the entire Philippines will ensure having more MCU hobbyists, firmware and software developers which he believes to be good to the electronic profession and to the industry.

Your support to the software tools, like the Acebus 8051 IDE , Pinnacle52, BASCOM 8051 or your preferred IDE software in developing your application's firmware, by registering or obtaining the registered version which will ensure them to continue their operations and support to you.

Teamwork & Cooperations

At present - I am a "one man band operation" which I used to called it as - *myhobby*.

I wish to have friends who are expertise and can handle the RF design, multi-layer PCB design with SMT components, software, firmware and hardware design. I would like to have a friends, a students, a technicians, engineers, professors, scientist, a team, or someone whom I can share and dicussed my idea and put that idea into a physical working matter. At least a Filipino

Thank you for your understanding. Heart Systems will strive hard to seek for support from individual, group, schools, institutions, friends and government agencies to support Heart Systems activities.

friend who can tell me "hey! your spelling is wrong". Perhaps, if we sit down infront of that "icy SMB", we can find ourselves to agree in one project. ----- Welcome my friends. If you are new, let Heart Systems teach you.



Why 8051 MCU & why ATMEL AT89x5x?

Basically, there are a dozens of 8051 derivative MCU you can use other than the ATMEL AT89 series. For me, I used to love the ATMEL AT89C51. But now a days, I am more in-love with the AT89S51 because of its ISP features.

Talking about ATMEL 8051 Architecture - I am currently using the AT89C51 4K bytes Flash Programmable MCU. But now ATMEL is suggesting to use the AT89S51 4K bytes **In-System Programming**. The difference between the two MCU is that :

AT89C51 is a Conventional Flash Microcontroller. If you are using this Microcontroller, you are required to use a Conventional Flash Programmer like the Top 851 Light Programmer or the JDT2008 Universal Programmer. Please see the detail programming on the AT89C51 data sheet.

AT89S51 is In-System Programmable. This means that, you can program this MCU in the board without the need to pull it out from the ZIF socket (or pull it our from the board). In this case, you need to use ISP programmer so that you can program the MCU in the target board. Visit www.atmel.com.

The Top 851 Light Programmer and the JDT2008 Universal Programmer cannot program the MCU on the target board, but there is an option to program this MCU but you need to take it out the MCU from the Target Board and program on the Programmer slot. After programming, you need to return the MCU in the Target Board. Please see the detail programming of AT89S51 on the data sheet.

If you would like to know more other 8051 derivative MCUs, please visit <http://www.8052.com> - click CHIPS. Semiconductor Companies who manufacture the 8051 derivative are :

- Analog Devices
- ATMEL
- Sygnal Integrated Products
- Cypress Semiconductor
- Dallas
- Integrated Silicon Solution, Inc.
- Philips
- Standard MicroSystem Corporation
- TDK Semiconductor
- Texas Instrument
- Triscend, and
- Windbond
- STC

You see! With Intel 8051 core, you have a lot of choices.

No worry where to find the MCU -- it's flooded in most electronic stores and **definitely you can find it with us**. Do you need it? Please contact Heart Systems.



myIntelligent AV Receiver

Before I bought a sofa in my sala, a bed in my room and a washing machine, I bought first a mid-class Intelligent AV Receivers -- the **Computer Audio Video** better known as **CAV**. Refrigerator is an exemption because I need a place to cool the San Miguel beer (SMB) and the famous Chinese brand - Tsing Tao beer.

CAV belong to high-end Technology from Europe and believe to be a superior performance in this arena. You may visit <http://www.cav-audio.com> for more information and see the latest breed of AV receivers. If you compare my CAV receivers (in 2011), this model is almost obsolete on the "looks" as the advance in AV is so fast. But I am still satisfied with its capability on decoding AC-3, DTS and PCM.

Well, I could say this is the result of my dream for 10 years. It may not be my design (huh!) but I did satisfied my long cravenness to have one ----- a real Hi-Fi.

Well, I am working hard for my **AVlight** - visit www.avlight.com.

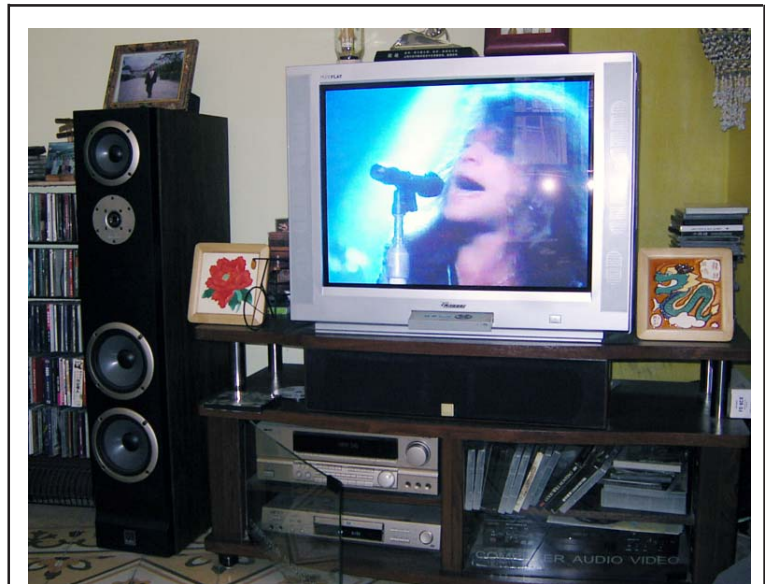


FIGURE 40 : my CAV Photo Gallery



myIntelligent T600 AV Receiver

Another high performance AV receiver - the T600 AVlight.

The T600 is produce by AVlights (www.avlight.com). It is a product of hardwork , keep focus on my dream and partnership. It is costly, it is 50% more expensive than the CAV I.



Rear Speakers



Home Theater <Dreams Come True>

It is true that human (like me) are endless sartisfaction, perhaps I am really crazy about Audio and Home Theater Systems. After having the T600, we (with my ex-partner who by that time we are a team player) worked on to have the ultimate Home Theater Systems with:

- (1) Cinema Projector
- (2) Blue Ray Home Theater
- (3) Comfortable Cinema Sit



Let me present to you my Home Theater as shown on the right.

Back to diy

And also true that, when you got what you like, soon or later, you will get board of it (perhaps, this is only true for me). I started then to find a solution for a diy 5.1 Home Theater. The search is easy this time -- I find Cirrus Logic Solution of 5.1 Channel Decoder and the next days is burning the oil.

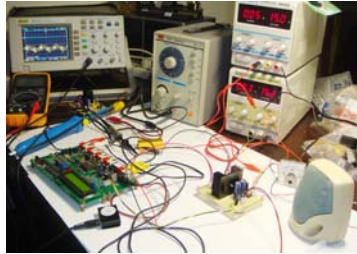


- **Project** -
- **Trainer Kits** -
- **DATC** -

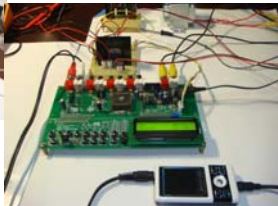
Gallery



DATC 2004



Testing the DATC with a Low Power Amplifier - working in my bench

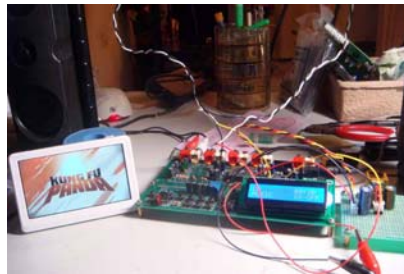


Integrate the DATC into a Low Power Amplifier, Satellite Receiver and Video display - demonstration to fellow audio & Satellite Hobbyists.

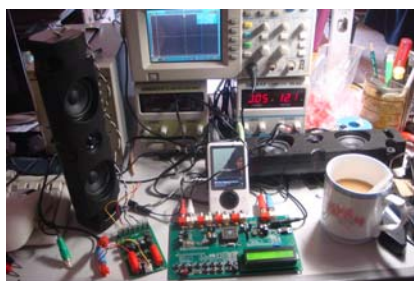
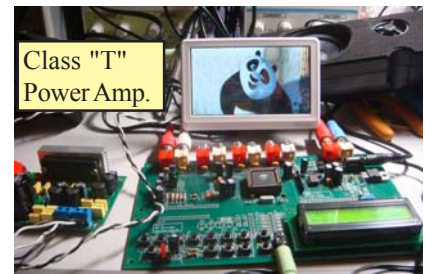
Reviving DATC 2011



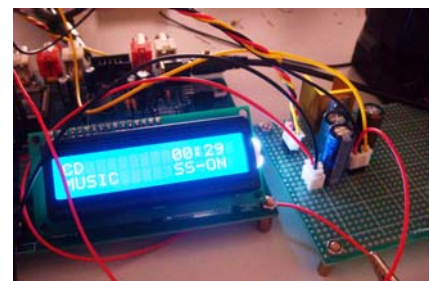
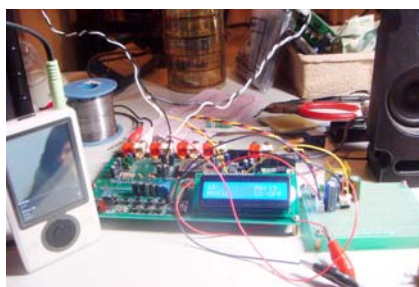
Reviving DATC - start to work on the new PCB



Testing with Movie - trying to improved the surround sound effect - hmmm even the Panda looks laughing at me, like telling me, "if you really like a real surround sound, go for blu ray", I guess Kungfu Panda is right.



Try the Zune Player - music and video playback



just a try..... with a low power amplifier with mute and standby control



2004 DATC Model



still, looking for 2011 DATC Model

Heart Systems Intel 8051 core MCU Trainer Kits

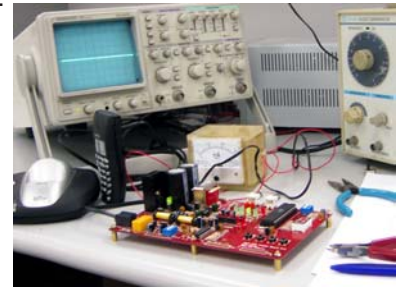
- Zero Programming Background → STARTER MCU-EB8051-"2" using Assembly Language
NE2ss - using BASIC Language
- Already have Knowledge in Programming Intel 8051 core → DATC - using BASIC Language
Hob-COS - using Assembly Language

 <p>STARTER MCU-EB8051-"2" Trainer Kit</p>	<p>Learning to program the Intel 8051 core Micro Controller and the AT89S51 MCU :</p> <p>This Trainer Kit is specially designed for beginners who have no experienced in Microcontroller (MCU) Programming. It teaches you how the basic of Microcontroller, CPU Architecture, Memory, Input/Output.</p> <p>Programming in Assembly and its simple applications. This Trainer Kit comes with Hardwares, CD ROMs, Programmers, and User's Manual. All source code in Assembly.</p>
 <p>Digital Audio Tone Control (DATC) Trainer Kit</p>	<p>Learning To Program Digital Tone Control and Its Applications :</p> <p>This Trainer Kit is specially designed for the user's of Intel 8051 core MCU who want to develop program for music applications specially for Tone Control. The MCU used is the AT89S52 with Intel 8051 core and the processor for Music is the SGS Thomson TDA7442. T</p> <p>The DATC, Digital Audio Tone Control. With sample source code in Basic and C language.</p>
	<p>Study Wire Communications with Hob-COS :</p> <p>The Hobbyist Central Office Simulator (Hob-COS) is a Trainer Kit / Project conceived to study Wire Communications like Telephony, Caller ID, Answering Machines. This Trainer Kit acts like a Central office providing basic signalling, thus, a telephone can be tested and studied. With Sample source code in Assembly and Basic Language.</p>
 <p>standard sensor to interface to the NE2ss</p>	<p>Security Systems (Open System Design)</p> <p>The Night Eyes Security Systems V2(NE2ss) is shareware and courseware Open System designed for the 8051 core users and hobbyists. All Documents are Shareware, Source Code, Schematics and Project Management.</p>

THEways of learning

- Affordable
- Easy
- Fast &
- Fun

Powered by :
HEART SYSTEMS-IdigTEAM



**Hob - COS Trainer Board
HCTB**

**Integrated Development Environment (IDE)
ACEBUS 8051 IDE**
www.acebus.com

**Hobbyists Central Office
Simulator (Hob-COS)**

----- Prototype version -----

The Heart Systems Hobbyists Central Office Simulator is a gadget use for Wire Telecom Trainer Kit Series (corded phone, answering machines, cordless phone, etc).

Since Learning and experimenting with Wire Communications requires signalling from PSTN which difficult to do because of the unforeseen harmful effect to yourself and to the PSTN network.

The Hob-COS is introduced to overcome this obstacle. It provide the basic signalling as the Central Office can offer, thus operating, learning experimenting of Wire Communications Trainer Board (or product) is made easy.

The Hob-COS is also a Trainer Board. It is one of the project on Microcontroller of my other Trainer Kit Series - *my8051 Vol 1, the Intel 8051 core and the Atmel AT89C51 Microcontroller.*

It is a basic and simple project in programming the 8051 Microcontroller. This will teach the reader how to design the hardware and the dedicated control firmware.

The Hob-COS can detect DTMF signalling, provide Dial Tone, Busy Tone, Transmit Voice Test indicator and Ringing Signal.

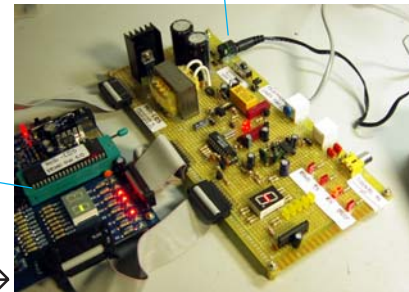
The firmware can be modified and improved to meet the requirements if use in Telephony Manufacturing Environment and technician test station.

System Test



Digital feature
Speakerphone

Switching and
Telephone Line Interface
Board



MCU-EB8051
Trainer Board

Prototype →



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