FONIX®
COLT™

MAINTENANCE MANUAL

February 20, 2013

Contents

Chapter 1
Overview

1.0 Power on procedure for the Colt Audiometer

The basic Colt audiometer consists of two parts, the tablet and the main Colt base unit. Both have to be powered and Blue Tooth wireless communication between the two has to be established before operation. The procedure to follow:

Step 1- Turn on the power to the base colt unit

To turn on the power, plug the Colt line cord into a suitable source of AC power (100 to 250 VAC, 50 to 60 Hz) and switch the power on by moving the rear panel mounted toggle to the "-" position.

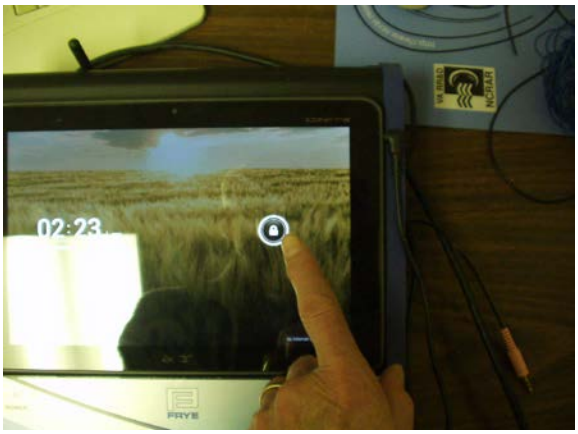
The Colt main unit panel has two LED's. The left one indicates that power has been applied. When first powered on, the right blue LED will flash, indicating that communication with the tablet has not yet been established.

If a monitor headphone is plugged into the rear panel monitor jack, a tone will be heard in the monitor after power is applied, indicating that the Colt hardware is operational and ready to be linked to the tablet.

Step 2- Turn on power to the Colt tablet.

Press the on switch button located on the side of the tablet and hold it down for several seconds.

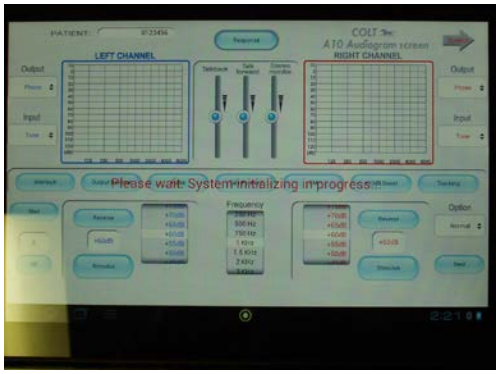
A vibration may be felt and the boot sequence will occur.
When the booth sequence ends, a picture of a lock will appear. Touch the lock and slide it to the right.



The home screen will then appear.

Step 3- Select the Colt icon from the home screen
Touch to select the Colt logo icon on the screen.

The pure tone Colt screen will appear. A message will be seen on the screen, indicating that blue tooth service is being actuated. The background color is a light tan.



When the startup sequence is complete, The background color on the tablet screen will turn a light shade of blue. The tone from the monitor headset will stop, indicating that communication and control has been established by the tablet. The blue LED on the Colt main unit will then indicate a steady glow.

Test the control by pressing the Stimulus button on either the right or left channel. A tone will be heard in the monitor headset for the channel touched.

The Colt audiometer is now operational.

1.1 A Description of the Colt audiometer system

Audiometers are basically calibrated pure tone generators which are used to test people for their ability to hear. The amplitudes of the tones used are adjusted to be near that which people with “normal hearing” can just barely hear when the attenuator is set to “0.” The Colt audiometer works in this way, too. It also allows the hearing professional to perform a variety of different tests, and may be compared in capability with the most complex of audiometers available today.

1.2. The Tablet Operator Interface

But then, how is it any different from any other audiometer? The differences and advantages of the Colt lie in its operator interface. Instead of being computer based, it is actually based on a multiple of computers. And one of these is devoted to handling the operator interface. Through a tablet based touch screen, it presents a virtual system of keyboard devices to allow rapid and intuitive adjustment of controls, while presenting an ongoing graph of the test results. The commands from the keyboard are passed to the Colt Base unit, where digital electronics act on the commands to produce the sounds and intensities called for.

1.3. Microphone channels

Multiple digital channels also amplify microphone pickup of voices for talk forward and talkback functions. A stereo monitor lets the operator know what sound is being presented to the tested person. These are all standard audiometer functions and are controlled with the tablet's virtual interface. But very few analog circuits are involved in the generation, amplification and switching of the audiometer signals. The complication is handled by the millions of digital transistors in a multiple number of integrated circuits under software control.

1.4. Digital Operation for Reliability

There are no screwdriver adjustments in a Colt audiometer. Gain settings of virtual amplifier stages are numbers embedded in a memory element. As are signal generators and pulse and

warble (FM) circuits.

Why go to all this trouble? Why can't we just stay simple and more understandable?

A good reason is the elimination of a multitude of moving parts. Adjustment controls like potentiometers wear out and/or become unstable. The Colt's calibration factors are stored in memory in the form of numbers that are stable and long lived. It is rare that the instrument goes out of calibration, because there are no moving parts. No switch noise.

1.5. Control Simplicity

The tablet works well in the audiometer environment, as it allows the instrument to only present those controls that apply to the task at hand. In the case of the pure tone test, the VU meter is not needed and is not there. Signal choices are limited to those that are needed in pure tone testing. Speech noise is not used.

In speech mode, the VU meter appears. The frequency dial disappears and is replaced by a calculator to allow the user to score correct percentages automatically. Sets of speech signals are selectable and played as desired. These are stored in a miniature SD chip. The talk forward microphone can now be used as a speech microphone, with the gain set by a separate and adjustable front panel control to suit the characteristics of the individual operator.

1.6. Audio Power

A high efficiency audio power amplifier is built into the system and allows relatively high levels of sound intensity for sound field testing. It must be used, however, with proper shielded cables that can carry both the drive and return signals on the tip and ring of the ¼ inch plug/jack system. If the power is insufficient for the intended purpose, an external amplifier can be used to drive the sound field.

1.7. Blue Tooth Connectivity allows Operator Freedom

Wireless Blue Tooth connectivity between the controlling tablet and the Colt base unit allow the operator greater flexibility in the placement of audiometric components. No longer is the audiologist tied to a fixed position close to the instrument with its keyboard or touch panel.

1.8. Portability and Data Storage

When used in the field, the instrument's small size and light weight make it easily transported; a series of tests can be saved into the tablet's memory and later downloaded to a computer at the office. Test data files are linked to the patient number. Privacy is thus maintained if something should happen to the Colt audiometer and associated tablet. A NOAH interface is available through the FONIX audiometer module in an external computer through USB to the Colt base unit.

1.9. RF Shielding

Extensive shielding makes the Colt audiometer capable of meeting the toughest international standards for RF emissions and susceptibility.

Chapter 2.
Specifications

2.1 General Characteristics

Size	11.3 x 11.5 x 4.2 inches (28.7 x 29.2 x 10.7 cm)
Weight	3.8 pounds (1.7 kg) (not including tablet)
Mains Voltage	100-240 VAC, 50 to 60 Hz
Mains input current rating	1A
Operating and storage environmental conditions	
Operating temperature/humidity	15 to 35 degrees Celsius, relative humidity from 5 to 90 percent (non-condensing).
Shipping/Storage temperature/humidity	-20 to 60 degrees Celsius , 5 to 90 percent relative humidity (non-condensing)

2.2 Pure Tone Signals

Frequency Range

Air conduction, sound field	125 – 12000 Hz
Bone conduction	250 – 6000 Hz
Frequency Accuracy	+/- 1%

Intensity Range (air conduction)

125 Hz	-10 to 70 dB SPL
250 Hz	-10 to 90 dB SPL
500 – 4000 Hz	-10 to 120 dB SPL
6000 Hz	-10 to 110 dB SPL
8000 Hz	-10 to 100 dB SPL
12000 Hz	-10 to 70 dB SPL

Intensity Range (Bone conduction)

250 Hz	-10 to 45 dB SPL
500 – 750 Hz	-10 to 60 dB SPL
1000 – 3000	-10 to 70 dB SPL
4000 Hz	-10 to 60 dB SPL
6000 Hz	-10 to 50 dB SPL

Intensity Range (Sound Field)

125 Hz	-10 to 50 dB SPL
250 Hz	-10 to 70 dB SPL
500 – 4000 Hz	-10 to 100 dB SPL
6000 Hz	-10 to 90 dB SPL
8000 Hz	-10 to 80 dB SPL
12000 Hz	-10 to 70 dB SPL

Attenuators

Range	-10 to 110 dB HL (120 dBHL with +10 dB boost activated
Step Sizes	5 (default), 2, or 1 dB

Signal Format

Warble	10% frequency Deviation at a modulation frequency of 5 Hz (+/- 5%)
Pulsed	2.5 Hz (+/- 0.5Hz) with 50% duty cycle (+/- 20%)
White noise	Flat (+/- 2 dB) to 8kHz
Speech Noise	Weighted Random Noise with spectrum density constant from 250 to 1000 Hz, falling at a rate of 12 dB/octave from 1 to 4 kHz +/- 5 dB
Narrow Band Noise	As defined in ANSI S3.6-2010

Channel Inputs

Tone	Pure, pulsed, warble, pulsed warble
Speech Microphone	With adjustable gain control
Noise	Speech, narrow band, or white
External	100K ohm input impedance.
Minimum signal	100 mV RMS
Maximum signal	3.5 Volts peak

VU Meters

Range	-20 to +3 dB VU
Accuracy	+/- 1 dB at 0 dB VU, +/- 2 dB at –10 dB and –20 dB VU

Channel Outputs

Speaker	10 Watts RMS typical into 8 ohms
Earphones	TDH39P- 100 ohm, or Eartone 3A, 50 ohms
Opposite channel routing available	
Bone vibrator	B71, 100 ohm

Sound Field Speaker

Frequency Response	+/- 7.5 dB, 750 to 4000 Hz
Output	> 90 dB SPL at 36 inches (1 meter) At 3 watts RMS input at 1000 Hz, 45 degree azimuth

Built in Speech Testing

Spondee, NU-6, and Maryland CNC word lists
Acceptable Noise Level (ANL) test

Regulatory

Designed, manufactured and tested to meet US, Canada, European and International regulations including	ISO 13485, IEC 60601-1 93/42/EEC IEC 60645-1 ANSI S3.6-2010

Chapter 3
Specification Test Procedure

3.1 Pure Tone Audiometric screen

3.1.1 Testing against a “normal” hearing threshold.

It is possible and in fact encouraged, that frequent tests be run by a normal hearing professional to be sure that the Colt audiometer is in calibration. However, while these checks are useful in finding major calibration problems, they are obviously not sufficient to insure that the Colt audiometer is in calibration.

3.1.2 A table of audiometric calibration values

See Table 5.1, which covers the values to be measured when testing pure tone amplitudes with TDH39 headphones, Eartone 3A insert earphones, and the B71 bone oscillator, working into NBS9A and HA2 couplers, and an Artificial mastoid, respectively. The table covers threshold (RETSPL or RETFL) values.

3.1.3 Reference to ANSI S3.6-2010 and IEC 60645-1

Reference to these documents are made in testing features not covered in this maintenance manual. Such features include pulse attributes of rise and fall times, duty factor and repetition rate, distortion, inter-channel cross talk and noise levels.

3.2 Speech Audiometric Screen

3.2.1 Check of Speech Sound Levels

When the sound level from an external input of 1000 Hz, or the calibration tone from the speech test signal reads 0 dB on the VU meter, the sound level at the patient’s position should read the level shown on the right or left attenuator + 19.5 dB SPL. Inputs from the microphone, from an the external source of sound or the internal recorded sound track may be tested for right and left channels, respectively.

Chapter 4
Circuit Description

4.1 Introduction

The Colt ™ audiometer is “a new breed of audiometer”™. That is apparent in its look and design, both inside and out. For instance, there is no circuit description for the wireless tablet that is used as the operator interface. It is treated as a single component. Colt circuits that can be placed in the category as “Repairable” are also relatively simple, since few are used.

The main components in a Colt system are the wireless tablet, the Colt base unit, and an optional personal computer. The tablet allows control and a view of the operation of the Colt system. The actual work is done by the Colt base unit, and test data may be collected by the personal computer. Communication of commands and data between tablet and Colt base unit is through a wireless Blue Tooth interface. Communication between the base unit and the personal computer is handled by a USB cable. No personal patient data other than the patient designation number is handled in the Colt audiometer system; such data is only held in the personal computer. This is done to avoid potential federal personal information regulations.

The Colt base unit is completely shielded. Connectors that communicate with the world outside of the Colt are fitted with protective circuits to prevent damage to the Colt and to prevent unwanted radiation emissions. It should be noted that the class D power amplifier used for speaker power should be connected to external speakers with cables that carry drive and drive return conductors encased in a braided shield. The ¼ inch stereo plug for this cable should carry the signal currents on the tip and ring of the plug, with the shell connected to the shield.

If a sound field option is purchased, the talkback microphone serves as a reference microphone for calibration of sound field intensities by an automatic program built into the Colt. The sensitivity and response parameters of the talkback microphone are stored in a chip located in this microphone and that gets read out (U6) when the Colt hardware module is turned on.

Power is handled by a high efficiency converter that can take inputs from 100 through 250 volts AC, 50 to 60 Hz. It provides DC power at + and - 15 volts and + 5 Volts to the main board via a short cable and connector. Multiple power regulators are used on the main board to control crosstalk and noise.

4.2 Block Diagram and Circuit Diagrams

A Block Diagram is shown in Figure 4.1. Individual circuit elements are noted in this diagram and are covered in more detail in the circuit diagrams listed on sheets 1 through 10. These pages are to be seen in Chapter 10.

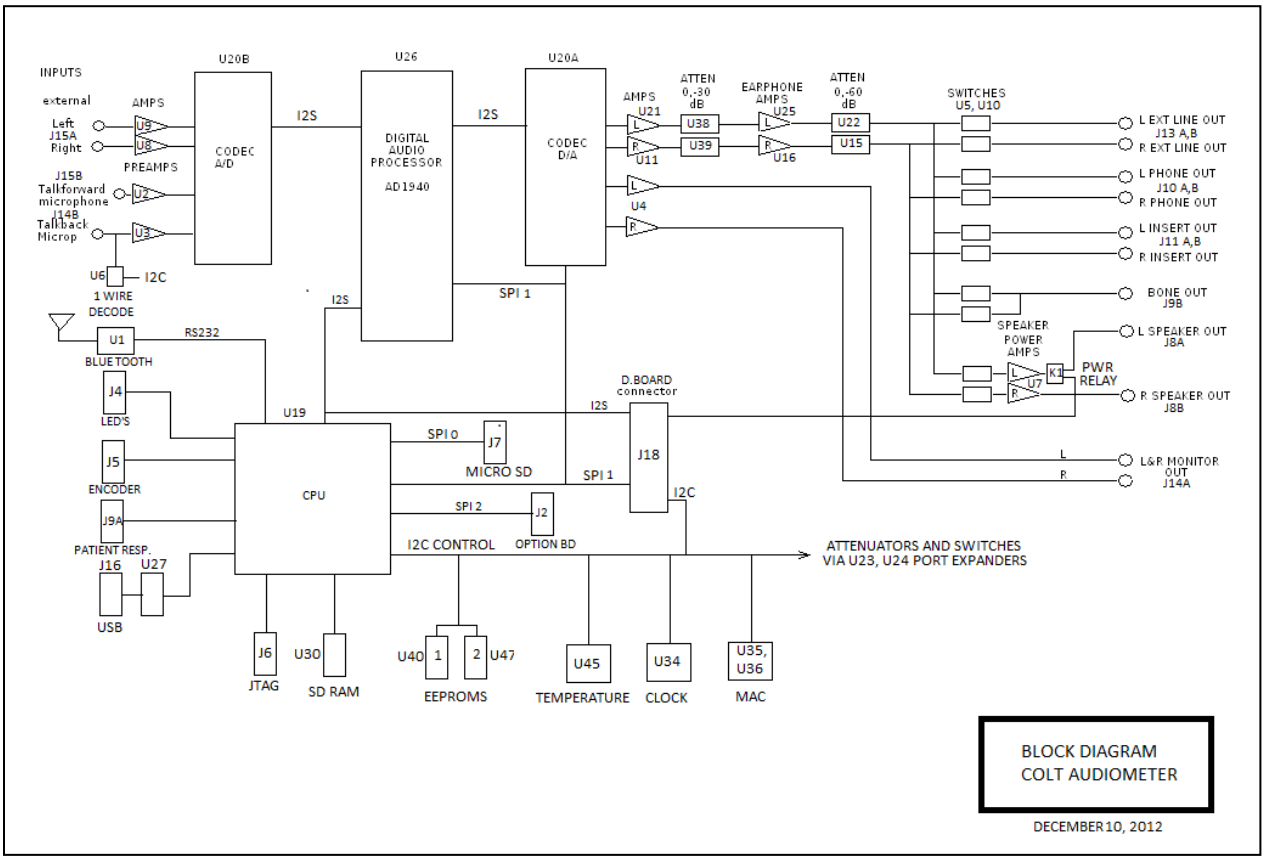


Figure 4.1

4.2.1 Circuit diagram sheets

Sheets 1 – 3.

CPU associated circuits.

Sheet 4

A/D, digital signal processing and D/A circuit elements

Sheet 5

Amplifiers for the analog signals from the D/A circuit, 30 dB attenuators, and earphone amplifiers. The power supplies for the amplifiers are also listed here.

Sheet 6

analog 60 dB attenuators,

External outputs for lower level transducers, which include drives for external amplifiers, headphones, insert earphones, bone vibrator, and circuits for driving the speaker power amplifiers.

Sheet 7

Analog input amplifiers, including
external line inputs,
talkforward microphone and
talkback microphone with its chip decoder

Sheet 8

Monitor output amplifiers, the daughter board connector and the patient response switch jack.

Sheet 9

Speaker power amplifiers

Sheet 10

Power supply circuits

4.3. CPU and associated circuits

Most of the Colt's audiometric signal functions are handled by the digital signal processor (U26) as controlled by the Concerto CPU (U19), which has internal RAM and flash memory elements. External EEPROM and random access memory (U40, U47 and U30) also can be used by the CPU.

Additional facilities of Colt cabinet temperature, date and time and other system data are available in circuits U45, U34 and the combination of U35 and U36 and are accessed by the CPU.

Communication with the Tablet is through the Blue Tooth transceiver package U1 with its antenna (J12). Communication with the PC is through the USB J16 and its decoder chip U27.

Cabinet LED's are powered through J4.

J5 is reserved for a possible upgrade.

The JTAG port J6 is used for program debugging.

Additional large sound files can be located in the microSD part through the socket J7.

An additional system upgrade is possible by use of the “daughterboard” connector J18.

The same is also true for the option board connector J2.

Control over analog signal attenuator switches are handled by U23, 16 bit port expander. U24 port expander sends LED signals and speaker power amplifier controls.

The USB interface is controlled by U27.

Serial buses

Four serial buses handle different types of signals to Colt circuits.

SPI

This is a control and communication bus to allow the CPU to tell circuits what to do and to retrieve information from them.

I2S

Digital form of audio signals are handled on various components with this bus. 48Khz sample rate, 64 bit words for both left and right signals per port.

I2C

A control bus. Moderate speed control over devices.

RS232

Handles the Blue tooth communication

4.4. DSP Circuits

The principal audio processor is the AD1940 (U26). **All** signal information is handled in **digital** format in this part. It receives signals from the A/D part of the U20 CODEC, the CPU, and can also receive signals from the daughter board through connector J18. It sends signals to the D/A part of the U20 CODEC as well as to the CPU. Pure tones and different types of noise are generated in U26.It also is programmed to provide signal switching and amplitude modifications. This part contains a power regulator for operation at 2.5 volts DC.

4.5. Analog input signals

The AD1939 CODEC receives analog signals from four different channels or sources.

Right and Left line inputs

These come through amplifiers U9 and U8, which attenuate line level inputs before generating differential analog drives to the A/D channel inputs of the CODEC U20.

Microphone Amplifiers

Analog signals from the speech or talkover microphone are amplified by U2.

Signals from the talkback microphone are amplified by U3. The talkback microphone also is made with a memory chip that contains its gain and response characteristics. These allow the microphone to be used to calibrate the sound field by using an automatic program.

Both microphone amplifiers deliver differential drive to the CODEC U20.

Analog Output amplifiers

Differential outputs from the CODEC are amplified by left and right channel amplifiers formed with U21 and U11, respectively. U25 and U16 form switchable amplifier and attenuators for left and right channels with gains of 0 and -30 dB. These amplifiers have superior gain and noise characteristics. They have enough power to drive the lower level transducer elements used by the Colt.

Summary of DSP inputs and outputs

8 inputs

left and right external line
talkback microphone
talk forward microphone
Two CPU channels
two Daughterboard channels

6 outputs

right and left audiometer channels
left and right monitor channels
two CPU channels

Analog output channels

As also mentioned above, left (U25) and right (U16) channel ear phone amplifiers are used to develop enough power to drive the output transducers directly or though attenuators as described below.

Left (U22) and right (U15) channel, passive, switchable 0 and 60 dB gain attenuators are used to drive sets of switches to directly channel signal drive to one of several sets of transducers or to the output speaker power amplifiers. These switches are controlled through port expanders U23 and U24 by the CPU through the I2C bus.

The drives to the lower level transducers are all passive, not amplified any further.

4.6. Speaker Power Output amplifiers

The speaker power amplifiers (U7) are switched in when needed. A difference is that the input to the power amplifier is loaded with a low impedance resistive attenuator to reduce the signal level to that which is compatible with the amplifier input needs. The attenuator also provides a load to approximate that which is provided when the other output transducers are selected. The power amplifier is switched to an “OFF” condition when it is not needed.

Note:

All output connectors to audiological devices use ¼ inch stereo type jacks. The tip and the ring are used to deliver the power to the device. The body is used for the outer shield, if used. The power amplifier requires a cable made with a grounded shielded jacket over a differential pair speaker drive.

4.7. Monitor Amplifier

The monitor amplifier (U4) delivers left and right channel signals to tip and ring of the 3.5 mm output connector (J14A). This amplifier takes the differential signals from the left and right channels of the CODEC to drive the headset. All attenuation of signals going to the monitor headset is controlled within the AD1940 (U26).

4.8. Power Regulators

A number of power regulators are used in the Colt to provide isolation between channels and to reduce noise. Separate regulators are used for both + 12V and – 12V supplies used for the right and left channels. Two additional regulators are used for the + 8V and – 8V input supplies. Two more 3.3V regulators is used for the digital and analog supplies. The AD1940 (U26) has its own 2.5 volt regulator.

4.9. Power Supply

A high efficiency power inverter is used to convert line level AC power to + 15V and – 15V and + 5V for use in the Colt circuits and is connected to the Colt main board through J3. A fuse is used to prevent accidental thermal problems that could be caused by a fault in the high current 5 Volt circuit. Several sets of diodes (D44, D45, D46, D47) are used between supplies to prevent circuit component damage in the case of accidental circuit shorts.

Chapter 5
Calibration

5.0 General

The calibration of the Colt audiometer requires the use of a personal computer operating under a Microsoft Windows operating system, XP pro or later. A special program called ColtCal.exe is used to allow adjustment of the internal random access and flash memory elements inside the Colt. The computer is connected to the USB port of the Colt audiometer and controls the audiometer frequency and amplitude through this connection. The acoustic sound from the TDH 39 headphone or ER3A insert earphone is picked up by a standard NBS9A, or 2CC coupler, respectively, and from the bone oscillator by an artificial mastoid. Sound from the speakers is calibrated in the pure tone audiometer program. Sound from these transducers and couplers must be measured by a laboratory grade sound level meter. This calibration procedure should only be undertaken by a skilled and properly equipped special instrument technician.

5.1 Loading the ColtCal Program

The ColtCal program must be loaded along with the set of *.RETSPL files that define the calibration parameters for each transducer into the same folder in your computer.

5.2 Running and Operation of the ColtCal Program

It is not necessary to activate the Blue Tooth communication link between the Colt base unit and the tablet for the calibration procedure. Later, after the calibration is complete, it is a good idea to activate the operator interface tablet and verify the calibration settings as well as attenuator accuracies and frequency responses.

The USB cable must be in place and line power applied to the Colt base unit.

After starting the ColtCal program, click on the Connect button that will appear in the upper left hand corner of the entry screen. This action will cause the computer to make the connection to the Colt base unit.

5.2.1 Calibration Tables

A table (Figure 5.1) will be displayed that lists values for all transducers and associated frequencies for pure tone and narrow band noise frequencies tested. These values are the nominal dB amounts of correction that are added to the drive to achieve the desired levels for each frequency. This table includes left and right TDH39 earphones, ER3A insert earphones, B71 bone vibrator and speaker outputs for pure tone and narrow band noise. A table of actual dB SPL outputs are shown in Table 5.1 for each frequency and device. Speech outputs add 20 dB to the SPL value at 1 kHz.

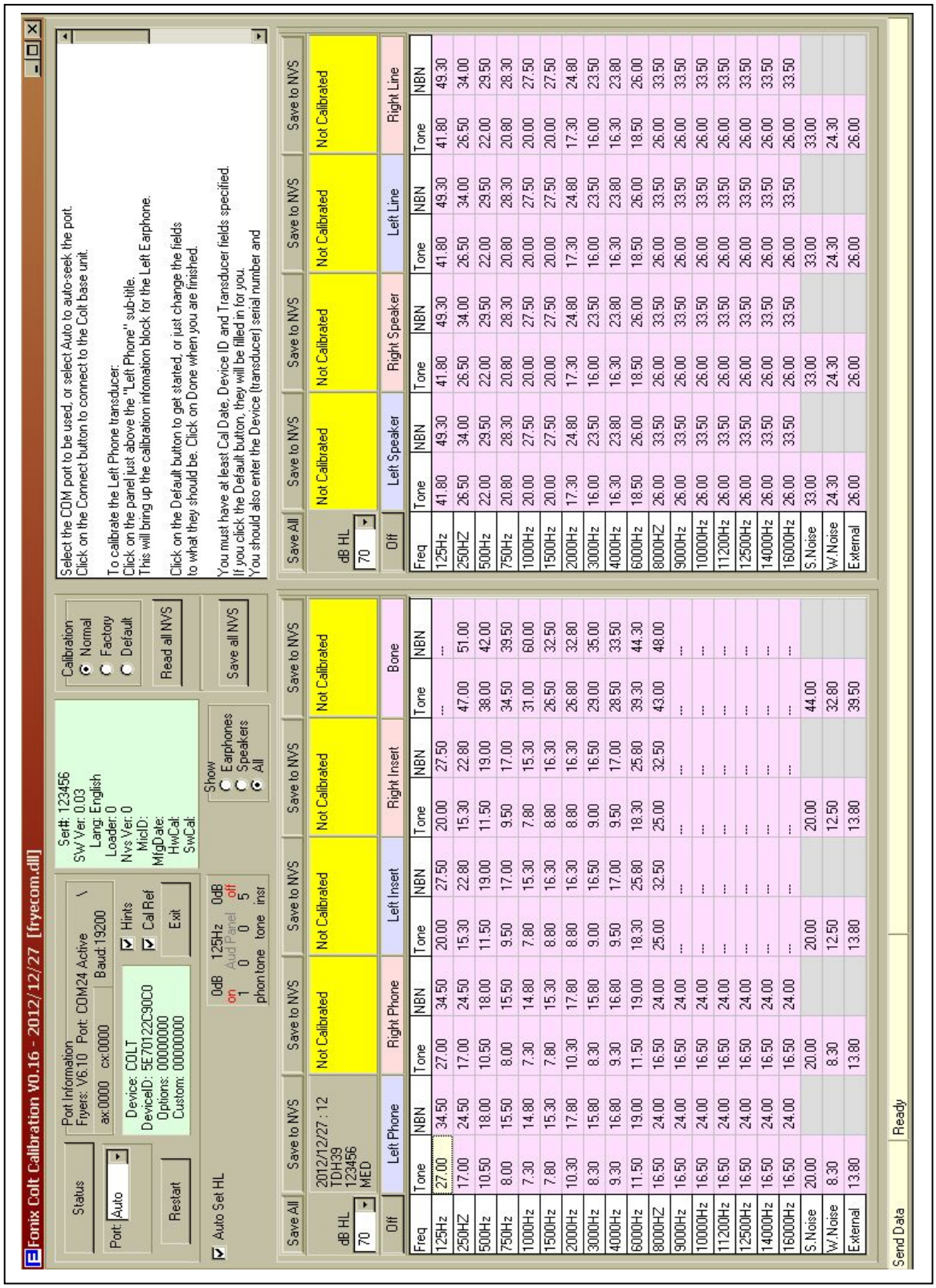

Fonix Colt Calibration V0.16 - 2012/12/27 [fryecom.dll]
Status
Port: Auto
Restart
Port Information
Fryers: V6.10 Port: COM24 Active
ax:0000 cx:0000 Baud:19200
Device: COLT
DeviceID: 5E70122C90C0
Options: 00000000
Custom: 00000000
Hints
Cal Ref
Exit
Set#: 123456
Sw Ver: 0.03
Lang: English
Loader: 0
Nvs Ver: 0
MicID:
MfgDate:
HwCal:
SwCal:
Calibration
Normal
Factory
Default
Read all NVS
Save all NVS
Auto Set HL
0dB 125Hz 0dB
on Aud Panel off
1 0 0 5
phon tone tone instr
Show
Earphones
Speakers
All
Select the COM port to be used, or select Auto to auto-seek the port.
Click on the Connect button to connect to the Colt base unit.
To calibrate the Left Phone transducer:
Click on the panel just above the "Left Phone" sub-title.
This will bring up the calibration infomation block for the Left Earphone.
Click on the Default button to get started, or just change the fields
to what they should be. Click on Done when you are finished.
You must have at least Cal Date, Device ID and Transducer fields specified.
If you click the Default button, they will be filled in for you.
You should also enter the Device (transducer) serial number and
Save All
Save to NVS
dB HL
70
2012/12/27 : 12
TDH39
123456
MED
Not Calibrated
Off
Left Phone
Right Phone
Left Insert
Right Insert
Bone
Left Speaker
Right Speaker
Left Line
Right Line
Freq Tone NBN
125Hz 27.00 34.50 20.00 34.50 20.00 27.50 20.00 27.50 ... ... 41.80 49.30 41.80 49.30 41.80 49.30
250HZ 17.00 24.50 15.30 24.50 15.30 22.80 15.30 22.80 47.00 51.00 26.50 34.00 26.50 34.00 26.50 34.00
500Hz 10.50 18.00 11.50 18.00 11.50 19.00 11.50 19.00 38.00 42.00 22.00 29.50 22.00 29.50 22.00 29.50
750Hz 8.00 15.50 9.50 15.50 9.50 17.00 9.50 17.00 34.50 39.50 20.80 28.30 20.80 28.30 20.80 28.30
1000Hz 7.30 14.80 7.80 14.80 7.80 15.30 7.80 15.30 31.00 60.00 20.00 27.50 20.00 27.50 20.00 27.50
1500Hz 7.80 15.30 8.80 15.30 8.80 16.30 8.80 16.30 26.50 32.50 20.00 27.50 20.00 27.50 20.00 27.50
2000Hz 10.30 17.80 8.80 17.80 8.80 16.30 8.80 16.30 26.80 32.80 17.30 24.80 17.30 24.80 17.30 24.80
3000Hz 8.30 15.80 9.00 15.80 9.00 16.50 9.00 16.50 29.00 35.00 16.00 23.50 16.00 23.50 16.00 23.50
4000Hz 9.30 16.80 9.50 16.80 9.50 17.00 9.50 17.00 28.50 33.50 16.30 23.80 16.30 23.80 16.30 23.80
6000Hz 11.50 19.00 18.30 19.00 18.30 25.80 18.30 25.80 39.30 44.30 18.50 26.00 18.50 26.00 18.50 26.00
8000HZ 16.50 24.00 25.00 24.00 25.00 32.50 25.00 32.50 43.00 48.00 26.00 33.50 26.00 33.50 26.00 33.50
9000Hz 16.50 24.00 ... 24.00 ... ... 26.00 33.50 26.00 33.50 26.00 33.50
10000Hz 16.50 24.00 ... 24.00 ... ... 26.00 33.50 26.00 33.50 26.00 33.50
11200Hz 16.50 24.00 ... 24.00 ... ... 26.00 33.50 26.00 33.50 26.00 33.50
12500Hz 16.50 24.00 ... 24.00 ... ... 26.00 33.50 26.00 33.50 26.00 33.50
14000Hz 16.50 24.00 ... 24.00 ... ... 26.00 33.50 26.00 33.50 26.00 33.50
16000Hz 16.50 24.00 ... 24.00 ... ... 26.00 33.50 26.00 33.50 26.00 33.50
S.Noise 20.00 20.00 20.00 20.00 44.00 33.00 33.00 33.00
W.Noise 8.30 12.50 12.50 32.80 24.30 24.30 24.30
External 13.80 13.80 13.80 13.80 39.50 26.00 26.00 26.00
Send Data
Ready

Figure 5.1

The values in the table will have a pink background. When the transducer has been calibrated, the values will change to a white background.

5.2.2 Transducer Initial Data entry

To get started, work on the left TDH39 earphone. Click on the panel above the “Left Phone” sub-title. The calibration info edit panel will be displayed for that transducer.

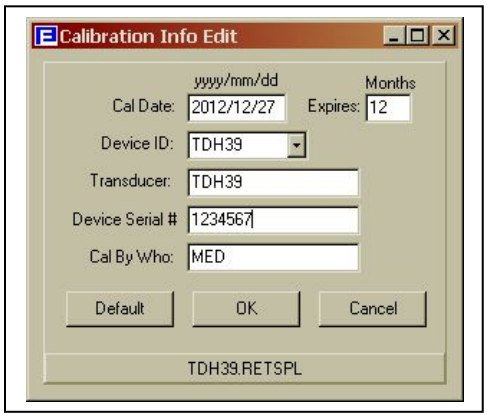


Figure 5.2

Click on the “Default” button to get started, or manually fill in the fields of the entry data list. Minimum data to be entered are:

- Calibration Date
- Transducer type
- Transducer serial number
- Name of Calibration Technician

Type OK when done. The data entered will appear in the box above the column.

5.2.3 Calibration Point by Point

As a single point is chosen, as for example, 125 Hz, pure tone, for the left channel TDH39 earphone, a small dialog box is presented and that transducer is actuated at 125 Hz and at a drive that should develop 115 dB SPL that is equivalent to a 70 dB HL level.

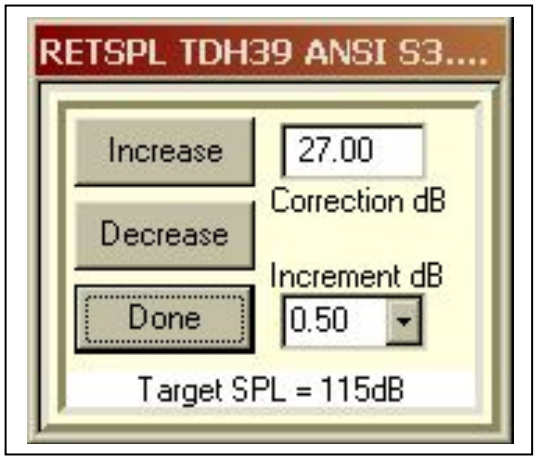


Figure 5.3

If the target SPL level is not seen by the acoustic meter system, then the operator increases or decreases the level of drive by clicking the appropriate buttons to make an adjustment to achieve the required level. The level can also be adjusted by the insertion of a number into the provided window to make different jumps in amplitude. When the desired sound level has been achieved, **click on the Done box** to set the value into the Colt random access memory. The process is continued by each time going through this process for each frequency in the list for the left channel TDH39 until all frequencies have been adjusted. The settings **will not have been stored as yet** in permanent flash memory. That is accomplished by clicking the **SAVE TO NVS** box, located at the top of the table. Pure tone signal levels for the Colt are now calibrated for that left TDH39 earphone.

Repeat the procedure outlined above for both pure tones and narrow band noise for all of the transducers that will be used in the Colt audiometer system.

Adjustment of internal gain controls for sound field speech calibration is also done by the use with a 1000 Hz tone at a level of 69.5 dB SPL. When calibrated, a person speaking into the speech microphone which is also used for talk forward, and the front panel is set to bring peaks to an indicated level of 0 VU, the signal level set by the right and left channel attenuators will be presented to the person under test.

Note:
The frequencies above 8000 Hz do not include 12000Hz, but 11,200 and 12500. Frequencies higher than 12500 can be left to default for the TDH39 earphones since those frequencies will not be used for audiometric testing. These frequencies are used for high frequency audiometry with a different type of earphone. The test frequency of 12000Hz is determined by a process of interpolation by the Colt processor.

Table 5.1
Pure tone RETSPL's (and RETFL's for B71)

Frequency (Hz)	TDH39	ER3A	B71
125	45.0	26.0	
250	25.5	14.0	67.0
500	11.5	5.5	58.0
750	8.0	2.0	42.5
1000	7.0	0.0	51.0
1500	6.5	2.0	36.5
2000	9.0	3.0	31.0
3000	10.0	3.5	30.0
4000	9.5	5.5	35.5
6000	15.5	2.0	51.0
8000	13.0	0.0	50.0
12000	17.5		
speech	19.5	12.5	55.0

Chapter 6
Service, Repair and Software Upgrades

6.0 General Notes

The construction of the Colt audiometer is unique in that the operator interface is formed by a tablet with a touch screen rather than a traditional keyboard and monitor. The circuits in the tablet are not serviceable except by personnel expert in the repair of that type of tablet. Therefore no tablet service or repair notes are given in this manual. The Colt base unit, on the other hand, is more traditionally constructed with a chassis and circuit board with rear panel audio output and power line connectors.

The Colt base unit contains one major circuit board. The circuit components on this board, with some exceptions, are reached by the removal of the bottom panel. One that may need to be replaced from time to time is the 1.6 ampere rated fuse that limits the current drawn by the high current digital components on the board. See section 6.1.2, Main board Fuse Replacement, for the steps needed to reach and remove this fuse.

If it is necessary to replace the main fuse, please refer to section 6.1 below.

Main power and front panel LED cable connectors and a few other components are located on the top side of the board. An accessory board, listed as the “daughter board,” may also be plugged into a connector on the top of the main board. If it is necessary to reach these parts, then the entire working Colt circuit subassembly can be separated for service by removing it from the outer shell. See section 6.2 for the needed steps.

Note:

Setting the power switch to the off position or disconnecting the power cord isolates the Colt audiometer circuits from the mains power voltage.

6.1 Fuse Replacement

If a fuse is blown for some reason, replace it with a like kind and voltage rating.

6.1.1 Line Fuse Replacement

To change the line fuse, first unplug the line cord from the power entry module. Then using a small screwdriver, pry the top of the power entry module off at the notch near the line cord socket.

Replace the defective fuse(s) located in the holder and replace the cover.

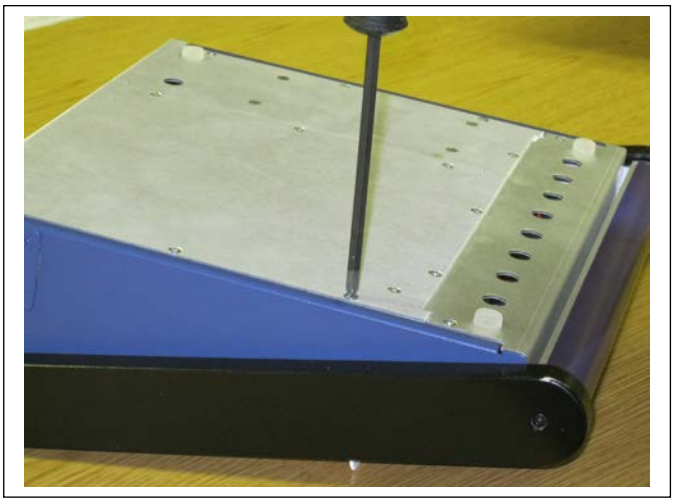
Fuse: (T1AH) 1A, 250V Type T, IEC 60127-2 sheet 5 (Time Lag Type, Ceramic, 5mm x 20mm).

(See Section 8 - Rear Panel Safety Markings.)

6.1.2 Main Board Fuse Replacement

Turn off power to the Colt and remove the line cord. Remove the bottom panel. (see figures 6a, and 6b). Use a #1 Phillips screwdriver. Save the screws.

Replace the defective fuse located in holder F1: 1.6A, 250V, Fast-acting, 5x20mm fuse (F1.6AL), IEC 60127-2 Sheet 2. . (See Figure 6c).



Figures 6a and 6b
Bottom panel removal

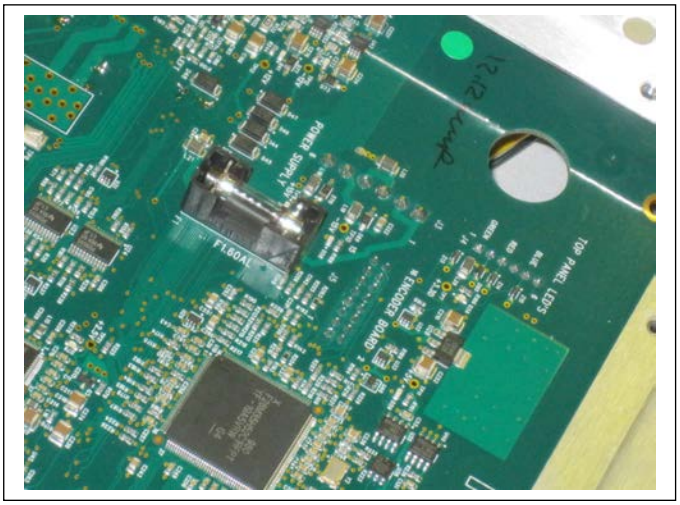


Figure 6c
Internal fuse location

When fuse replacement has been accomplished, replace the bottom panel, using the removed retaining hardware.

6.2. Colt Circuit Assembly Removal and Separation

Turn off power to the Colt and remove the line cord. Referring to Figures 6d, remove the 3 screws in the bottom side on the upper panel and the 2 screws close to the bend. Use a #1 Phillips screwdriver.

Figure 6d
Wrap around screw removal

Figure 6e
Bottom plate removal

Then, referring to Figure 6e, remove the 9 screws around the edge of the bottom panel. Slide the assembly clear of the surrounding metal enclosure. The LED cables can be unplugged at this time. See Figure 6f and 6g.

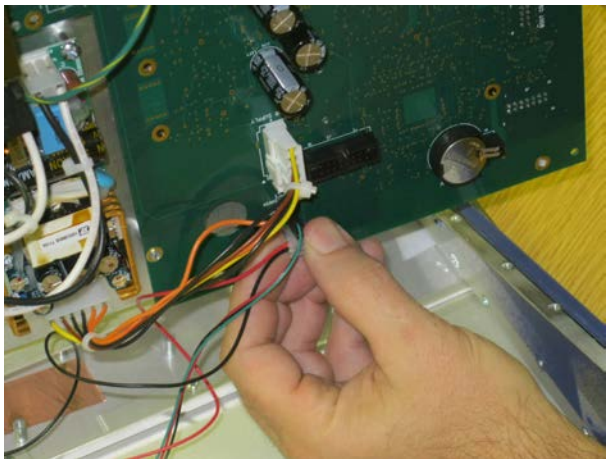


Figure 6f
Unplugging Cables

Figure 6g
Removed electronics

6.3. Colt Circuit Reassembly

To reassemble the Colt, first plug in the power and LED cables. The power cable can only be plugged in one way and only to its mating, latching connector. The 6 pin LED connector (J4) has one pin missing and mates with the two LED cables. The first cable has three wires, green, black and red. The second cable has two wires, red and black. Plug in the three wire cable so that the colors match the labels on the J4 connector: Green to green and red to red. The center wire is black. Plug in the two wire cable so that the red wire is closest to the label marked “blue.”

Slide the assembly into place, taking care that all the cables are not pinched on assembly. The unit has a snug fit. Restore the 9 screws to the bottom outside edge, the 3 screws to the bottom round portion and the 2 screws near the back panel bend. When restoring the screws, place all screws with a loose fit until all have been placed. Then go around again and tighten all 14 screws.

6.4 Upgrading the Colt audiometer

On occasion, it is desirable to upgrade the digital instructions that control the Colt audiometer user interface tablet as well as those for the Colt base unit. When this operation is needed, the instructions listed below in section 6.4.4 should be followed. Frye will supply specific version instructions needed.

The tablet can be used to determine the four program versions presently installed. When the Colt APP is running, touch the

symbol at the lower left hand side of the screen. Then touch “About Colt.” A window will appear that contains the four program versions. When an upgrade is done, these versions can be compared against the ones to be installed.

6.4.1 Four different sets of upgrade files

The instructions cover two different areas:

- Two separate Colt tablet instruction set upgrades. (One for the application, another for the communication control instruction set.)
- Two separate Colt main unit instruction set upgrades. (One for the Base firmware, another for the DSP firmware.)

These four different instruction sets for the tablet and base unit all have individual version numbers.

6.4.2 Minimum needed operations per upgrade

It may not be necessary to upgrade all sets of instructions. In some cases, only one or possibly two may need to be upgraded. But if an upgrade is done on one set and the instructions state that two sets need to be upgraded, then operations on the two stated sets have to be completed in order for the Colt system to operate properly.

6.4.3 Upgrade sources

Both **Tablet** applications are upgraded through the use of a file supplied by Frye and a USB interface to the tablet. The file can be supplied by access to the Frye website, www.frye.com.

Both **Colt main unit** instruction sets are supplied through the Frye web site, www.frye.com or through a CD that may be supplied by Frye.

An external Windows XP or newer computer with USB interface is also needed for both tablet and main unit upgrades.

6.4.4 Colt tablet upgrade procedure

The process consists of receiving an upgrade file from Frye Electronics, loading it to the external windows based computer, and then transferring it via a USB link to the tablet memory in either the external SD card location, or in the tablet internal memory. The upgrade is then run and installed to the tablet APP system, replacing the Colt APP that is already installed. .

a. From Frye, download the tablet install file(s) (*.apk) to the personal windows computer. This can be from a CD or from the Frye Website, www.frye.com.

b. Connect the USB cable between the tablet and the computer.

c. From the computer, locate the tablet file directories and load the Colt upgrade file to a convenient location on the tablet. (Download?)

d. Now, from the tablet, locate the file using the tablet's file system (For the ACER tablet it is under the ASTRO APP. For the Samsung, it is under "MY FILES.")

e. Find and run the file by touching it. It will replace the present APP.

f. If needed, repeat for the communication AidlFippService.apk.

6.4.6 Main Colt Unit Upgrade Procedure

6.4.6.1 Preliminary Computer Operations

Two tasks have to be done to prepare the computer to be able to perform the main Colt unit upgrade.

Task one- Load and install the program C2Prog. It is a free program and can be found on Codeskin.com. It is also supplied along with the upgrade Colt file(s). Run the install file. It is not necessary to install this program again when doing future upgrades.

Task two- Determine the USB communication port, and then when C2Prog is run, the port can be entered into the program following the instructions listed below.

a. Turn off the power to the Main Colt unit with the rear panel power switch.
b. Turn over the Main Colt unit and locate the Upgrade switch on the bottom panel. Slide the switch to the "upgrade" position. Place the Colt unit back in an upright position.
c. Insert the USB cable into the matching connectors on the Colt main unit and the computer, respectively.
d. Switch power **on** to the Colt main unit.
e. Find which com port the computer has assigned to the Colt

When the Colt main unit is connected to the computer through the USB cable, the computer automatically assigns a new com port to the job. The port number has to be determined so that it can be entered into the C2Prog when it is activated. This is done with a Windows utility.

From Windows 7 and 8, click on Start and select "devices and printers." Find the com port number that the computer has assigned to the Colt USB connection.

For Windows XP, click on **Start**, select **Control Panel**, then **System**, then **hardware**, and then **Device Manager**. From the hardware profiles listed, click on **ports (com and LPT)** and look for the port number associated with the Colt connection. Enter that into the C2Prog to set up communication.

f. Start the C2Prog program. Type the Com port into the box at the lower left corner of the screen, being careful to use uppercase letters for “COM” just before the port number. Then follow instructions given by the program; the upgrade will take place automatically. There is a possibility that an error will occur during the load process, causing it to fail. If this happens, then turn off the Colt unit, close the C2Prog and start over again.

g. If two upgrade program files are supplied by Frye, then repeat the procedure to install the second upgrade program. If the first load was successful, but the second program does not load correctly, you only have to repeat the process to load the second program.

h. When the load processes are complete, turn off the power to the Colt main unit with its power switch. Turn the unit back over and switch the programming switch back to “Normal.”

The Colt system has been successfully upgraded and is now ready to run again. Follow the start up procedure listed in section 1.0 of this manual.

Please note:

Sometimes both tablet and Colt main unit programming have to be upgraded at the same time in order for proper operation to be achieved.

Chapter 7
MAINTENANCE

7.1 Power
For your safety, disconnect the Colt from main power while cleaning.

7.2 Cleaning
Wipe the Colt with a slightly moist cloth. Use plain water or water with mild dishwashing detergent. Wipe away any detergent with a moist cloth, then dry the Colt.

Never allow fluid to enter:

- The Colt Enclosure
- The Colt switched power entry module.
- The Colt switching power supply.
- The Colt electrical connectors.
- The Colt front panel keyboard.

The microphones should be wiped with a dry cloth. Excess moisture may damage the microphone.

7.3 Solvents
Solvents and abrasives may cause permanent damage to surfaces on the Colt.

Chapter 8
Safety Information

8.0 Rear Panel Layout

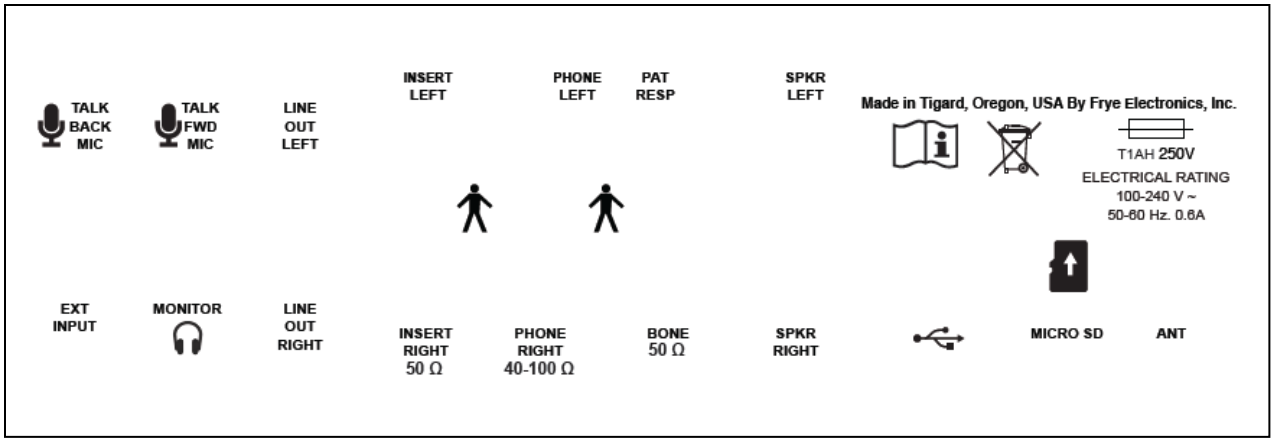
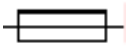


Figure 8.0

8.1 Rear Panel Safety Markings

Symbol	Meaning

(A)  **"For continued protection against fire and electrical shock, replace only with same type and rating fuse."**

The fuse specifications indicated on the Colt Rear Panel are as follows:

Marking: T1AH
Type: Time lag
Ampere Rating: 1 A
Voltage Rating: 250 V
Size: 5mm x 20mm

Fuses must conform to IEC 60127-2 sheet 5

(B) **100-240 V~** The "~" means AC, alternating current.

(C)  Read the accompanying documents

(D  Type B applied part.

(E)  CE signifies compliance with the European union's Medical Devices Directive.

8.2 Safety Classification for IEC 60601-1

Type of protection against electric shock:	Class 1
Degree of protection against electric shock:	Type B
Protection against harmful ingress of water:	IPX0
Mode of operation:	Continuous

The Colt audiometer does not require sterilization or disinfection.

Warning: This equipment is not suitable for use in the presence of a flammable anaesthetic mixture with air or with oxygen or nitrous oxide.

Warning: To avoid the risk of electric shock, this equipment must only be connected to a supply mains with protective earth.

Warning: Do not touch the contacts of connectors and the patient simultaneously.

Warning: Do not modify this equipment without authorization of the manufacturer.

8.3 Connection of peripheral equipment to the Colt

All electrical equipment attached to the Colt, such as audio equipment, computer equipment, etc., must, at a minimum, meet one of the following conditions:

1. The equipment complies with IEC 60601-1
2. The equipment complies with relevant IEC and ISO safety standards and is supplied from a medical grade isolation transformer.
3. The equipment complies with relevant IEC and ISO safety standards and is kept at least 1.5 meters from the patient.

The allowable leakage currents of IEC 60601-1 must not be exceeded. 60601-1 should be consulted when assembling such a system.

8.4 Disposal of the Colt and accessories

The Colt and its accessories contain lead. At the end of its useful life, please recycle or dispose of the Colt according to local regulations.

Chapter 9
Electromagnetic Compatibility

9.1 The Colt complies with IEC 60601-1-2.

The Colt generates and uses radio frequency energy. In some cases the Colt could cause interference to radio or television reception. You can determine if the Colt is the source of such interference by turning the unit off and on.

If you are experiencing interference caused by the Colt, you may be able to correct it by one or more of the following measures:

1. Relocate or reorient the receiving antenna.
2. Increase the distance between the Colt and the receiver.
3. Connect the Colt to a different outlet than the receiver.

In some cases radio transmitting devices, such as cellular telephones, may cause interference to the Colt. In this case try increasing the distance between the transmitter and the Colt.

Warning: The use of accessories, transducers and cables other than those listed in the tables below may result in increased emissions or decreased immunity of the Colt.

9.2 Cables with which the Colt complies with IEC 60601-1-2

Cable	Length (m)	Shield
Talk back mic.	1.8 m	Y
External input	1m	Y
Talk forward mic.	2 m	N
Left external output	1.8 m	N
Right external output	1.8 m	N
Monitor headphones	2 m	N
Left insert	2 m	N
Right insert	2 m	N
Left earphone	1.8 m	N
Right earphone	1.8 m	N
Patient response	1.8 m	N
Bone vibrator	1.8 m	N
Left speaker	3 m	Y
Right speaker	3 m	Y
USB	1.8 m	Y

9.3 Accessories with which the Colt complies with IEC 60601-1-2

Peripheral	Manufacturer	Model
Talk back microphone	Frye Electronics, Inc.	M828
Boom Mic. Headset	Cyber Acoustics	AC-202B
Left insert earphone	EAR Tone	3A
Right insert earphone	EAR Tone	3A
Left earphone	Telephonics	TDH-39P
Right earphone	Telephonics	TDH-39P
Patient response switch	Frye Electronics, Inc.	076-1700-02
Bone Vibrator	Radioear	B71
Left speaker	Frye Electronics, Inc.	034-2261-01
Right speaker	Frye Electronics, Inc.	034-2261-01

Warning: The Colt should not be used adjacent to or stacked with other equipment.

9.4 Guidance and manufacturer's declaration – electromagnetic emissions

The Colt is intended for use in the electromagnetic environment specified below. The customer or the user of the Colt should assure that it is used in such an environment.		
Emissions test	**Compliance**	**Electromagnetic environment – guidance**
RF emissions CISPR 11	Group 1	The Colt uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions CISPR 11	Class A	The Colt is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonic emissions IEC 61000-3-2	Class A	
Voltage fluctuations/ flicker emissions IEC 61000-3-3	Complies	

The Colt is intended for use in the electromagnetic environment specified below. The customer below. The customer or the user of the Colt should assure that it is used in such an such an environment.

The Colt is intended for use in the electromagnetic environment specified below. The customer or the user of the Colt should assure that it is used in such an environment.			
Immunity test	**IEC 60601 test level**	**Compliance level**	**Electromagnetic environment—guidance**
Electrostatic discharge (ESD) IEC 61000-4-2	+/- 6 kV contact +/- 8 kV air	+/- 6 kV contact +/- 8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst IEC 61000-4-4	+/- 2 kV for power supply lines +/- 1 kV for input/output lines	+/- 2 kV for power supply lines +/- 1kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	+/- 1 kV differential mode +/- 2 kV common mode	+/- 1 kV differential mode +/- 2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply input lines IEC 61000-4-11	<5% U_t (>95% dip in U_t) for 0.5 cycle 40% U_t (60% dip in U_t) for 5 cycles 70% U_t (30% dip in U_t) for 25 cycles <5% U_t (>95% dip in U_t) for 5 sec	<5% U_t (>95% dip in U_t) for 0.5 cycle 40% U_t (60% dip in U_t) for 5 cycles 70% U_t (30% dip in U_t) for 25 cycles <5% U_t (>95% dip in U_t) for 5 sec	Mains power quality should be that of a typical commercial or hospital environment. If the user requires continued operation during power mains interruptions, it is recommended that the Colt be powered from an uninterruptible power supply.
Power frequency (50/60 Hz) Magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic fields should be at levels characteristic of a

The Colt is intended for use in the electromagnetic environment specified below. The customer or the user of the Colt should assure that it is used in such an environment.			
Immunity test	**IEC 60601 test level**	**Compliance level**	**Electromagnetic environment —guidance**
Conducted RF IEC 61000-4-6 Radiated RF IEC 61000-4-3	3 Vrms 150 kHz to 80 MHz 3 V/m 80 MHz to 2.5 GHz	3 Vrms 3 V/m	Portable and mobile RF communications equipment should be used no closer to any part of the Colt, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance $d = 1.2\sqrt{P}$ $d = 1.2\sqrt{P}$ 80 MHz to 800 MHz $d = 2.3\sqrt{P}$ 800 MHz to 2.5 GHz Where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m). Field strengths from fixed RF transmitters as determined by an electromagnetic site survey,[a] should be less than the compliance level in each frequency range.[b] Interference may occur in the vicinity of equipment marked with the following symbol:

Note 1 At 80 MHz and 800 MHz, the higher frequency range applies.

Note 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

[a] Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the Colt is used exceeds the applicable RF compliance level above, the Colt should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the Colt.

[b] Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m

9.5 Recommended separation distances between portable and mobile RF communications equipment and the Colt

The Colt is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the Colt can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the Colt as recommended below, according to the maximum output power of the communications equipment.

Rated maximum output power of transmitter W	**Separation distance according to frequency of transmitter** (m)		
	150 kHz to 80 MHz $d = 1.2\sqrt{P}$	**80 MHz to 800 MHz** $d = 1.2\sqrt{P}$	**800 MHz to 2.5 GHz** $d = 2.3\sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23

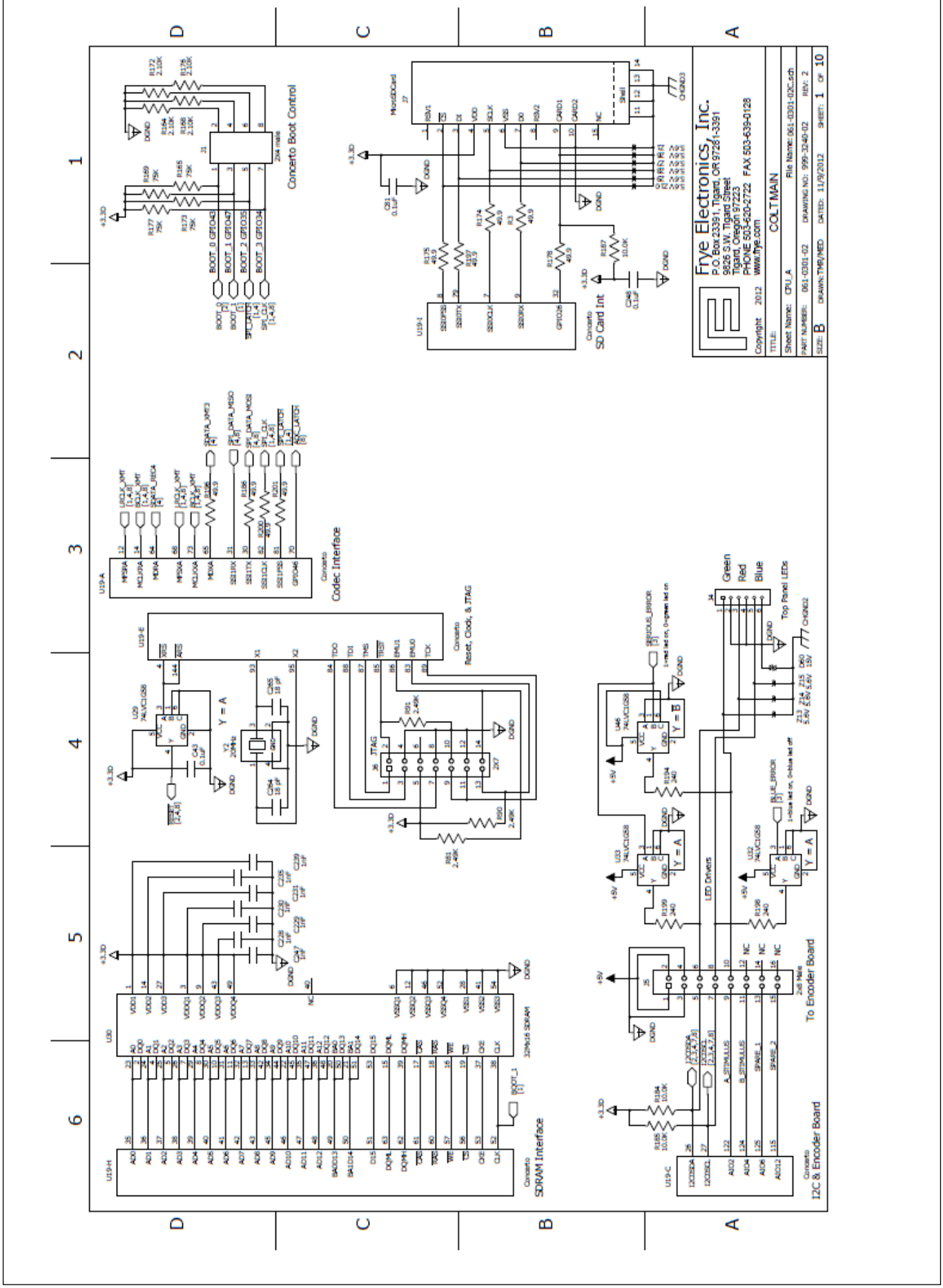
For transmitters rated at a maximum output power not listed above, the recommended distance d in metres (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

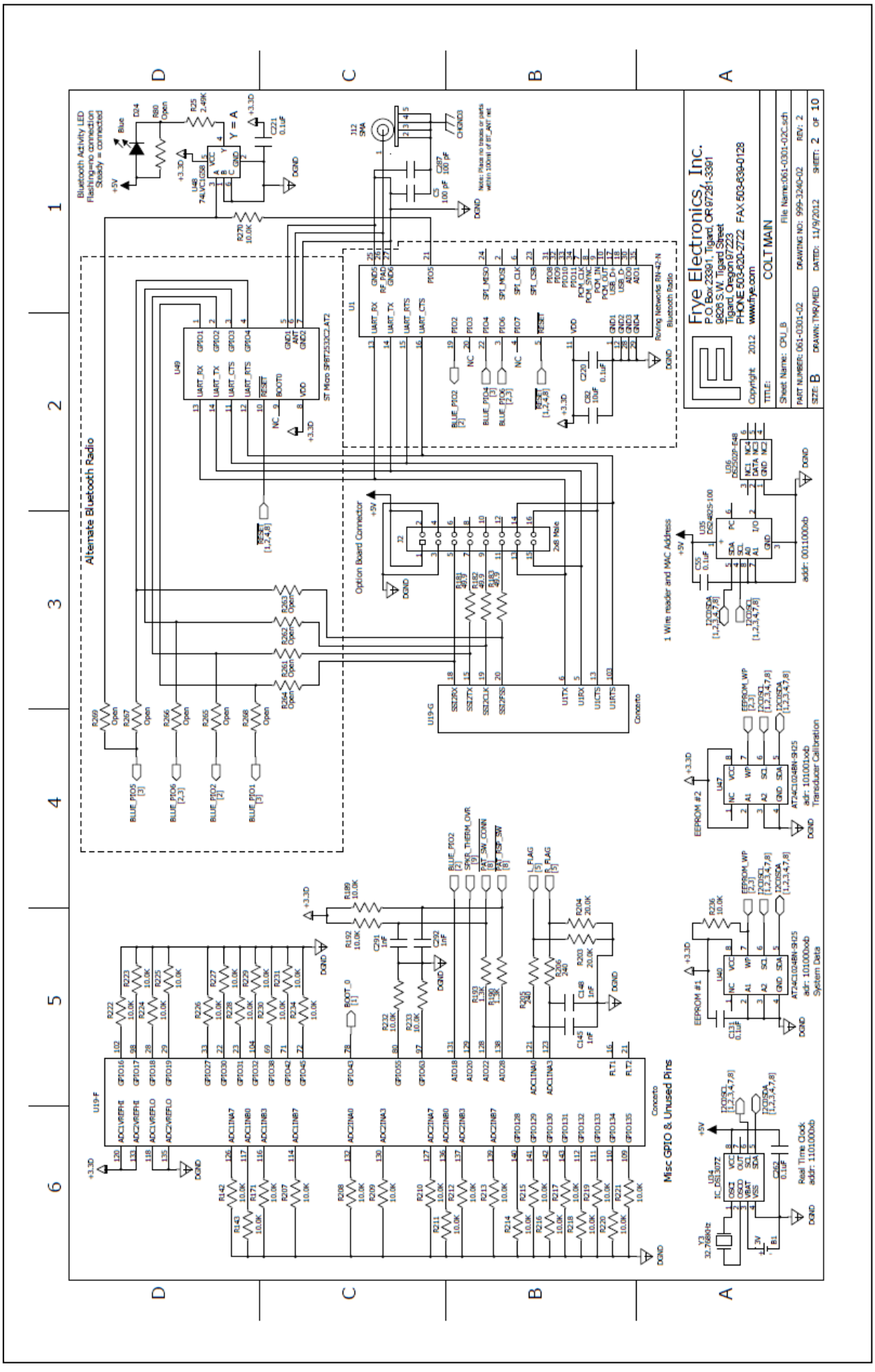
NOTE 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

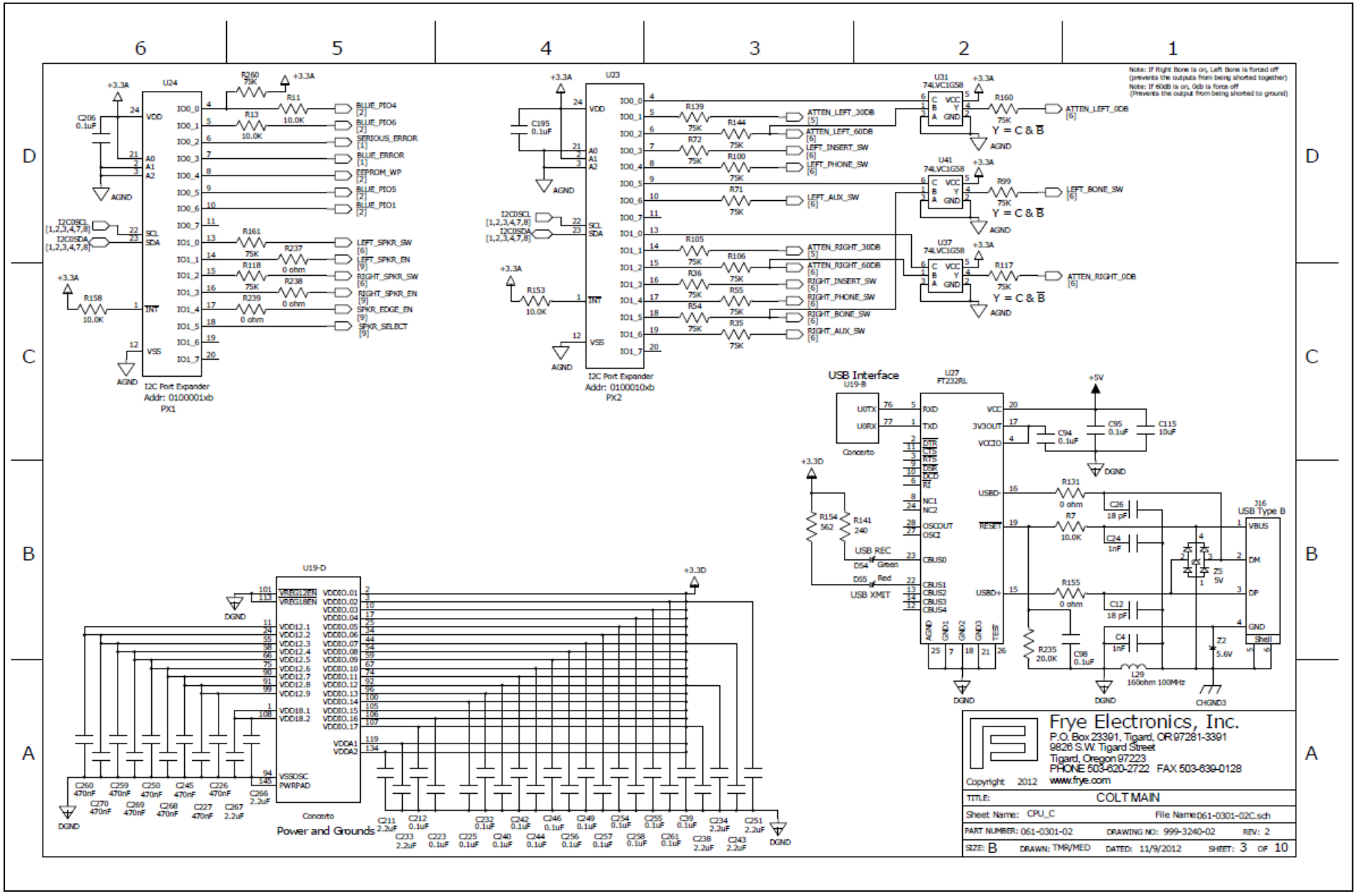
NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

Chapter 10: Schematic Drawings

Page	Circuit Board Description	Part Number	Drawing #
32	Colt Main, CPU_A	061-0301-XX	999-301-02C.sch
33	Colt Main, CPU_B	061-0301-XX	999-301-02C.sch
34	Colt Main, CPU_C	061-0301-XX	999-301-02C.sch
35	Colt Main, CODECS	061-0301-XX	999-301-02C.sch
36	Colt Main, OUTPUT_AMPS	061-0301-XX	999-301-02C.sch
37	Colt Main, EXT_OUTPUTS	061-0301-XX	999-301-02C.sch
38	Colt Main, EXT_INPUTS	061-0301-XX	999-301-02C.sch
39	Colt Main, MONITOR	061-0301-XX	999-301-02C.sch
40	Colt Main, SPEAKER	061-0301-XX	999-301-02C.sch
41	Colt Main, POWER	061-0301-XX	999-301-02C.sch
42	Colt Power Distribution	061-3269-00.sch	999-3269-00
43	Colt Talkback Microphone	colttalkbackmic.sch	999-3263-00
44	LED Cables, Colt	3270-00.sch	999-3270-00
45	COLT DIP Switch Board		999-3273-00


Concerto Boot Control
Codec Interface
Concerto Reset, Clock, & JTAG
SDRAM Interface
I2C & Encoder Board
SD Card Int
LED Drivers
Top Panel LEDs
To Enoder Board
Frye Electronics, Inc.
P.O. Box 23391, Tigard, OR 97281-3391
9826 S.W. Tigard Street
Tigard, Oregon 97223
PHONE 503-620-2722 FAX 503-639-0128
www.frye.com
Copyright 2012
TITLE: COLTMAIN
Sheet Name: CPU_A
File Name: 061-0301-02C.sch
PART NUMBER: 061-0301-02
DRAWING NO: 999-3240-02
REV: 2
SIZE: B
DRAWN: TMR/MED
DATED: 11/9/2012
SHEET: 1 OF 10


Alternate Bluetooth Radio
Option Board Connector
Misc GPIO & Unused Pins
Frye Electronics, Inc.
P.O.Box 23391, Tigard,OR 97281-3391
9826 S.W. Tigard Street
Tigard, Oregon 97223
PHONE 503-620-2722 FAX 503-639-0128
www.frye.com
Copyright 2012
TITLE: COLT MAIN
Sheet Name: CPU_B
File Name:061-0301-02C.sch
PART NUMBER: 061-0301-02
DRAWING NO: 999-3240-02
REV: 2
SIZE: B
DRAWN: TMR/MED
DATED: 11/9/2012
SHEET: 2 OF 10


6
5
4
3
2
1
D
C
B
A
U24
I2C Port Expander
Addr: 0100001xb
PX1
U23
I2C Port Expander
Addr: 0100010xb
PX2
U31
74LVC1G58
U41
74LVC1G58
U37
74LVC1G58
Y = C & B
Note: If Right Bone is on, Left Bone is forced off (prevents the outputs from being shorted together)
Note: If 60db is on, 0db is forced off (Prevents the output from being shorted to ground)
USB Interface
U19-B
Concerto
U27
FT232RL
J16
USB Type B
USB REC
USB XMIT
U19-D
Power and Grounds
Frye Electronics, Inc.
P.O. Box 23391, Tigard, OR 97281-3391
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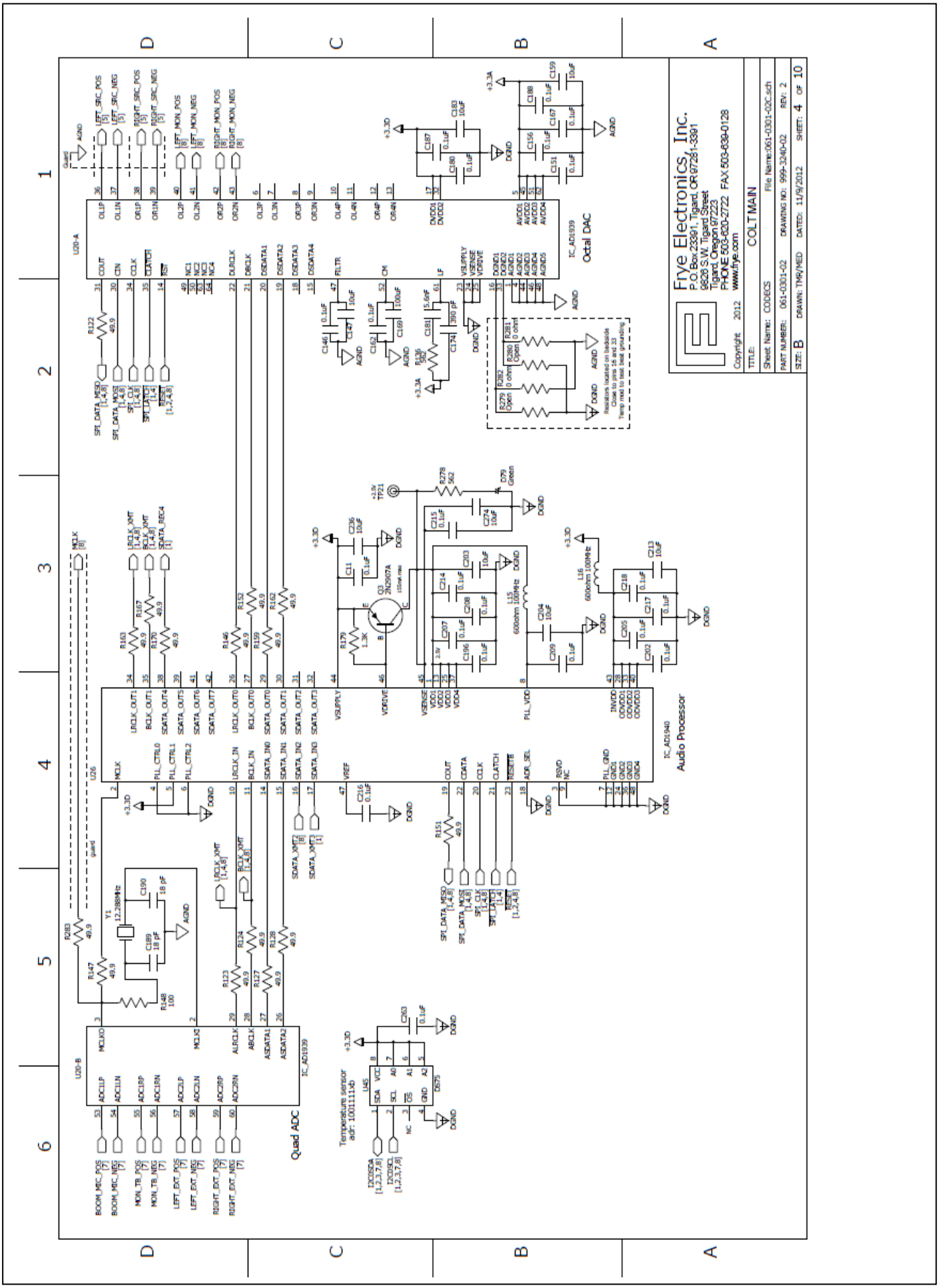
Copyright 2012
TITLE: COLT MAIN
Sheet Name: CPU_C
File Name 061-0301-02C.sch
PART NUMBER: 061-0301-02
DRAWING NO: 999-3240-02
REV: 2
SIZE: B
DRAWN: TMR/MED
DATED: 11/9/2012
SHEET: 3 OF 10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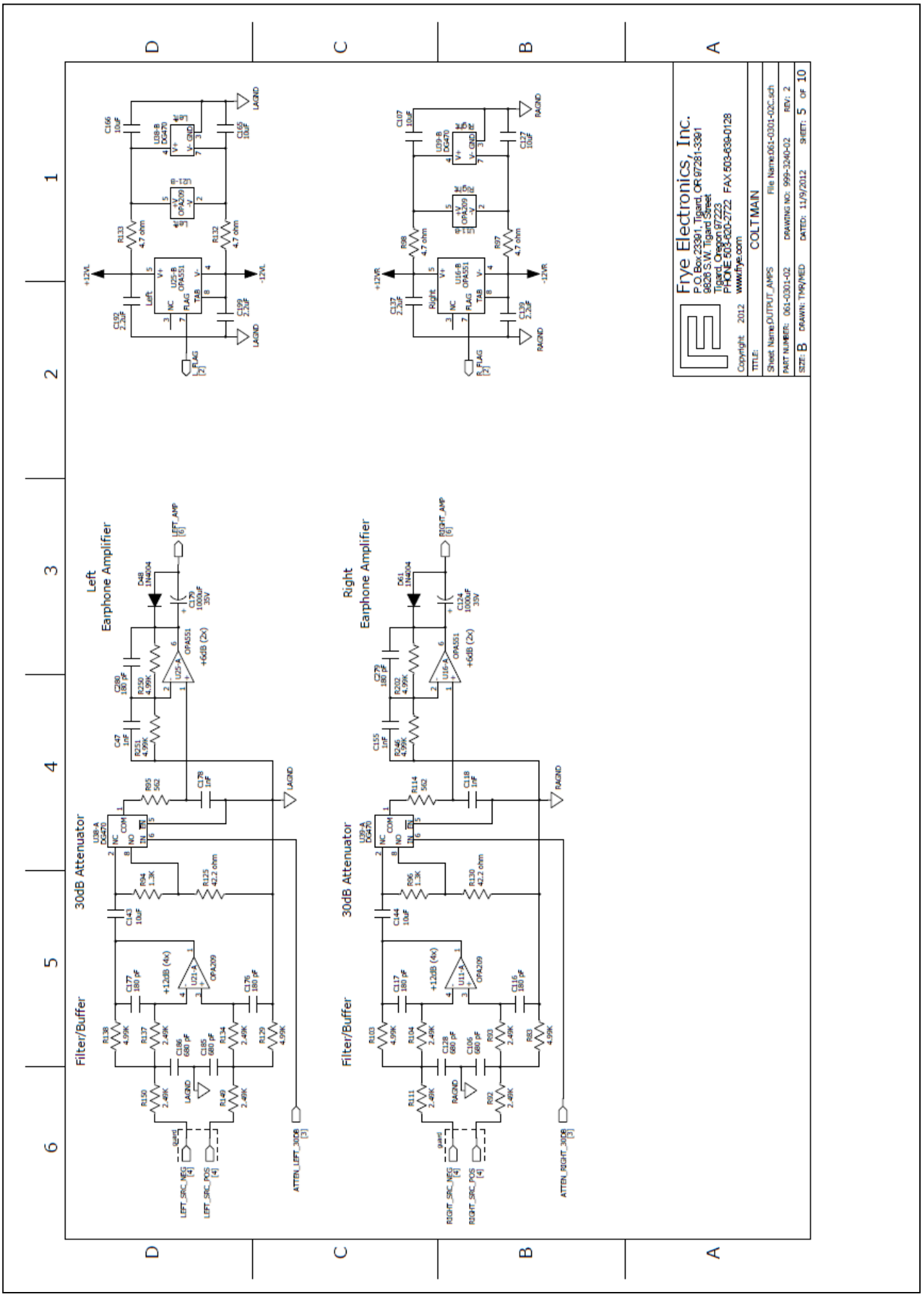
TITLE: COLTMAIN
Sheet Name: CODECS
File Name: 061-0301-02C.sch
PART NUMBER: 061-0301-02
DRAWING NO: 999-3240-02
REV: 2
SIZE: B
DRAWN: TMK/MED
DATED: 11/9/2012
SHEET: 4 OF 10
Quad ADC
IC_AD1939
Audio Processor
IC_AD1940
Octal DAC
IC_AD1939
Temperature sensor
adr: 1001111x0
Resistors located on backside
Close to pins 16 and 33
Temp mod to test best grounding


Left
Earphone Amplifier
Filter/Buffer
30dB Attenuator
Right
Earphone Amplifier
Filter/Buffer
30dB Attenuator
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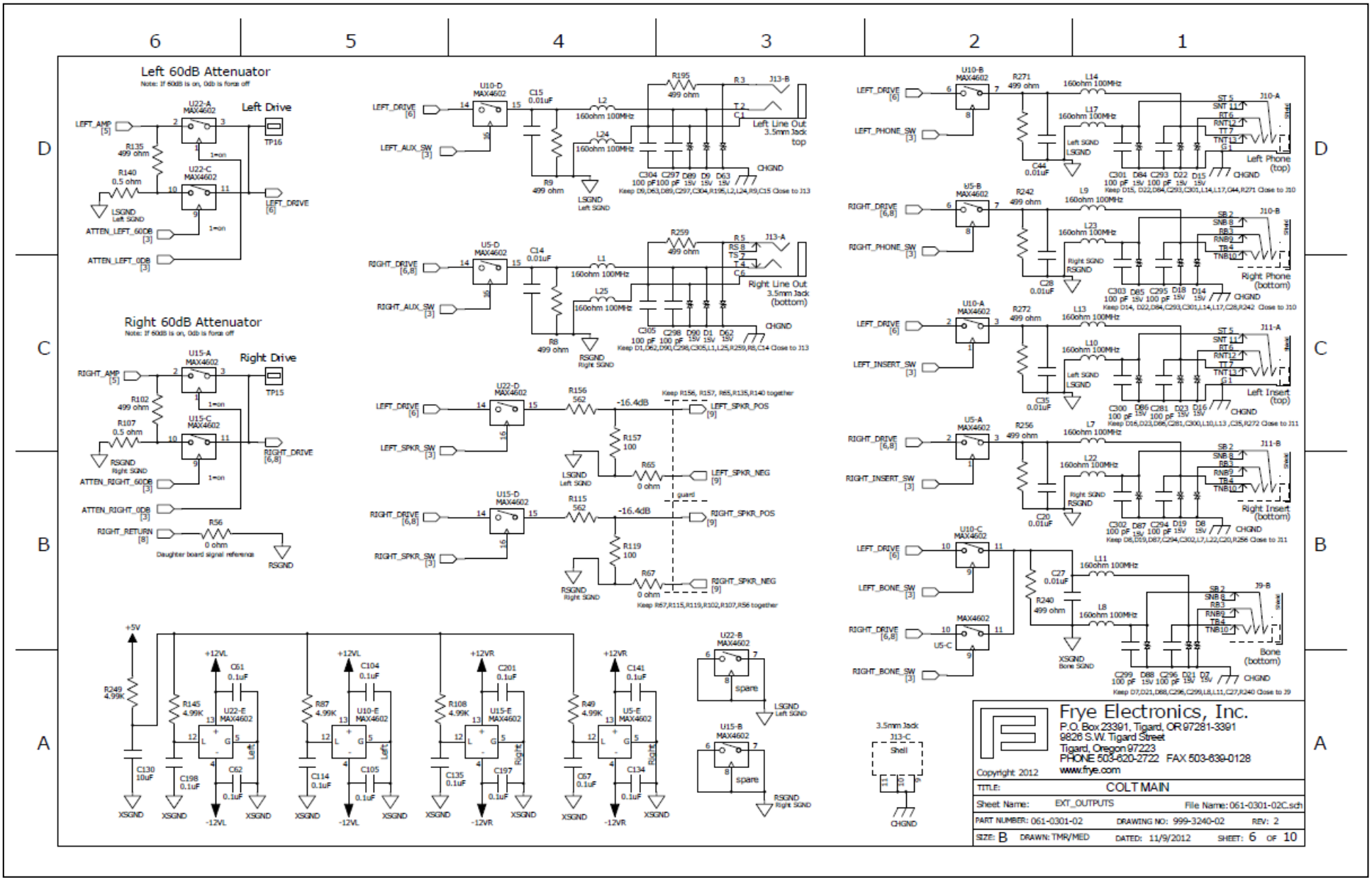
TITLE: COLTMAIN
Sheet Name: OUTPUT_AMPS
File Name: 061-0301-02C.sch
PART NUMBER: 061-0301-02
DRAWING NO: 999-3240-02
REV: 2
SIZE: B
DRAWN: TMR/MED
DATED: 11/9/2012
SHEET: 5 OF 10


Left 60dB Attenuator
Note: If 60dB is on, 0db is force off
Left Drive
Right 60dB Attenuator
Note: If 60dB is on, 0db is force off
Right Drive
Left Line Out 3.5mm Jack top
Right Line Out 3.5mm Jack (bottom)
Left Phone (top)
Right Phone (bottom)
Left Insert (top)
Right Insert (bottom)
Bone (bottom)
Daughter board signal reference
Keep R156, R157, R65,R135,R140 together
Keep R67,R115,R119,R102,R107,R56 together
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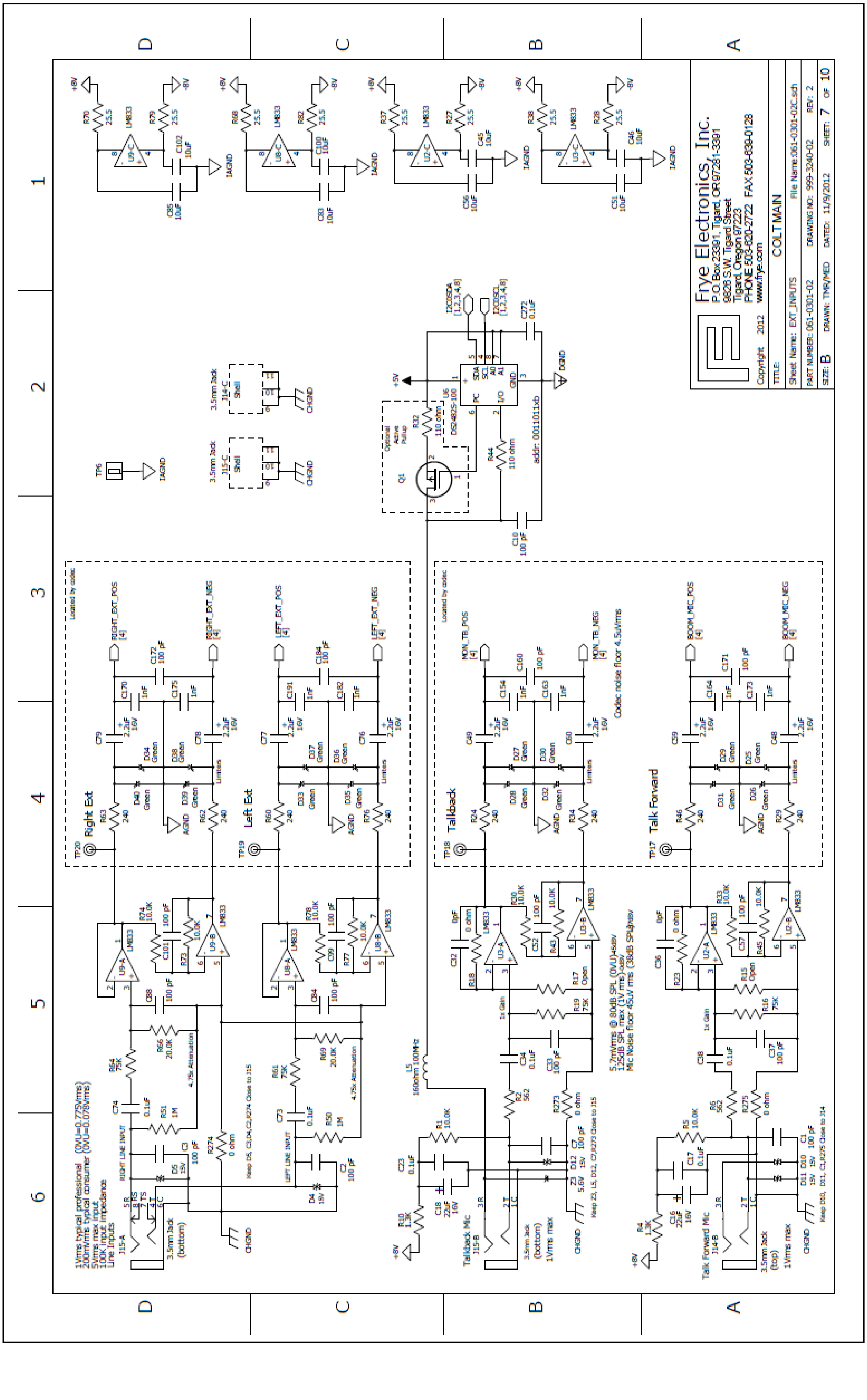
Copyright 2012
TITLE: COLT MAIN
Sheet Name: EXT_OUTPUTS
File Name: 061-0301-02C.sch
PART NUMBER: 061-0301-02
DRAWING NO: 999-3240-02
REV: 2
SIZE: B
DRAWN: TMR/MED
DATED: 11/9/2012
SHEET: 6 OF 10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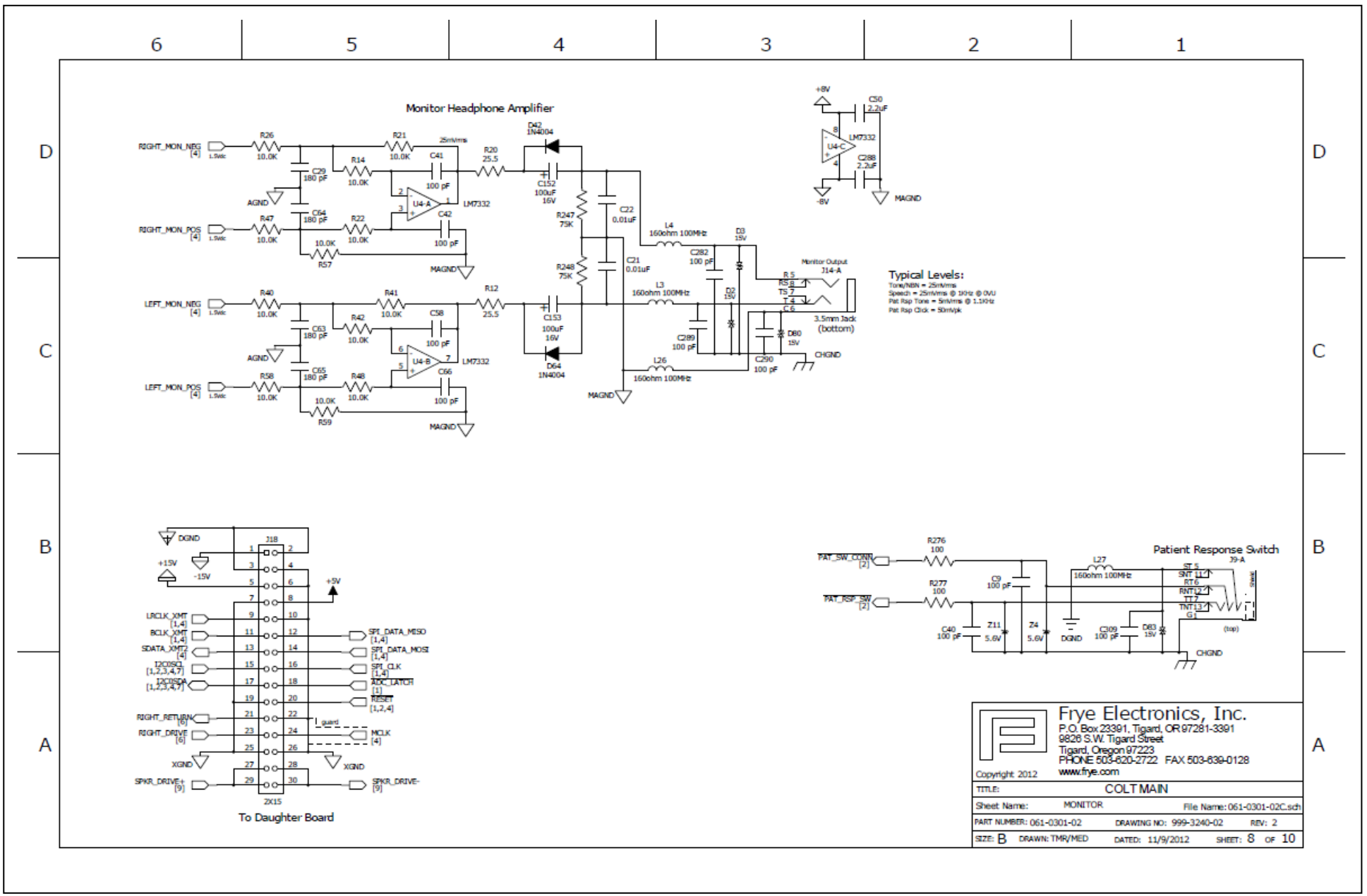
TITLE: COLT MAIN
Sheet Name: EXT_INPUTS
File Name: 061-0301-02C.sch
PART NUMBER: 061-0301-02
DRAWING NO: 999-3240-02
REV: 2
SIZE: B
DRAWN: TMR/MED
DATED: 11/9/2012
SHEET: 7 OF 10
Right Ext
Left Ext
Talkback
Talk Forward
Located by codec
RIGHT_EXT_POS
RIGHT_EXT_NEG
LEFT_EXT_POS
LEFT_EXT_NEG
MON_TB_POS
MON_TB_NEG
BOOM_MIC_POS
BOOM_MIC_NEG
Codec noise floor 4.5uVrms
1Vrms typical professional (0VU=0.775Vrms)
200mVrms typical consumer (0VU=0.0789Vrms)
5Vrms max input
100K input impedance
Line Inputs
3.5mm Jack (bottom)
3.5mm Jack (top)
Talkback Mic
Talk Forward Mic
1Vrms max
5.7mVrms @ 80dB SPL (0VU)-4dBV
125dB SPL max (1V rms)-0dBV
Mic Noise floor 45uV rms (38dB SPL)-87dBV
addr: 0011011xb
DS2482S-100
Optional Active Pullup
I2C0SDA
I2C0SCL
CHGND
IAGND
AGND
DGND


Monitor Headphone Amplifier
RIGHT_MON_NEG
RIGHT_MON_POS
LEFT_MON_NEG
LEFT_MON_POS
U4-A
U4-B
U4-C
LM7332
AGND
MAGND
CHGND
+8V
-8V
Monitor Output
J14-A
3.5mm Jack
(bottom)
Typical Levels:
Tone/NBN = 25mVrms
Speech = 25mVrms @ 1KHz @ 0VU
Pat Rsp Tone = 5mVrms @ 1.1KHz
Pat Rsp Click = 50mVpk
DGND
+15V
-15V
+5V
J18
2X15
To Daughter Board
SPI_DATA_MISO
SPI_DATA_MOSI
SPI_CLK
ADC_LATCH
RESET
MCLK
RIGHT_RETURN
RIGHT_DRIVE
XGND
SPKR_DRIVE+
SPKR_DRIVE-
Patient Response Switch
PAT_SW_CONN
PAT_RSP_SW
J9-A
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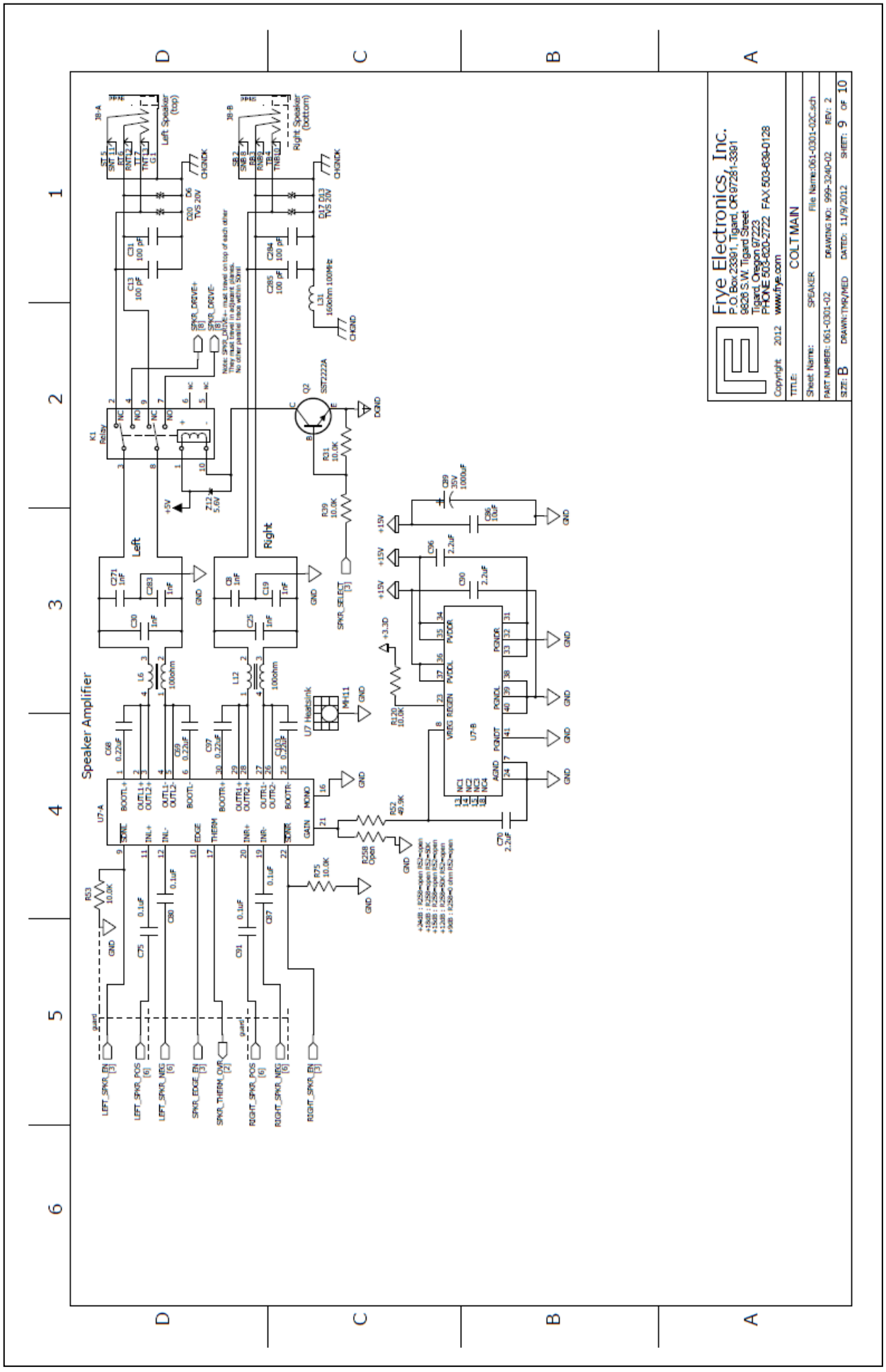
TITLE: COLT MAIN
Sheet Name: MONITOR
File Name: 061-0301-02C.sch
PART NUMBER: 061-0301-02
DRAWING NO: 999-3240-02
REV: 2
SIZE: B
DRAWN: TMR/MED
DATED: 11/9/2012
SHEET: 8 OF 10


Speaker Amplifier
Left
Right
Left Speaker (top)
Right Speaker (bottom)
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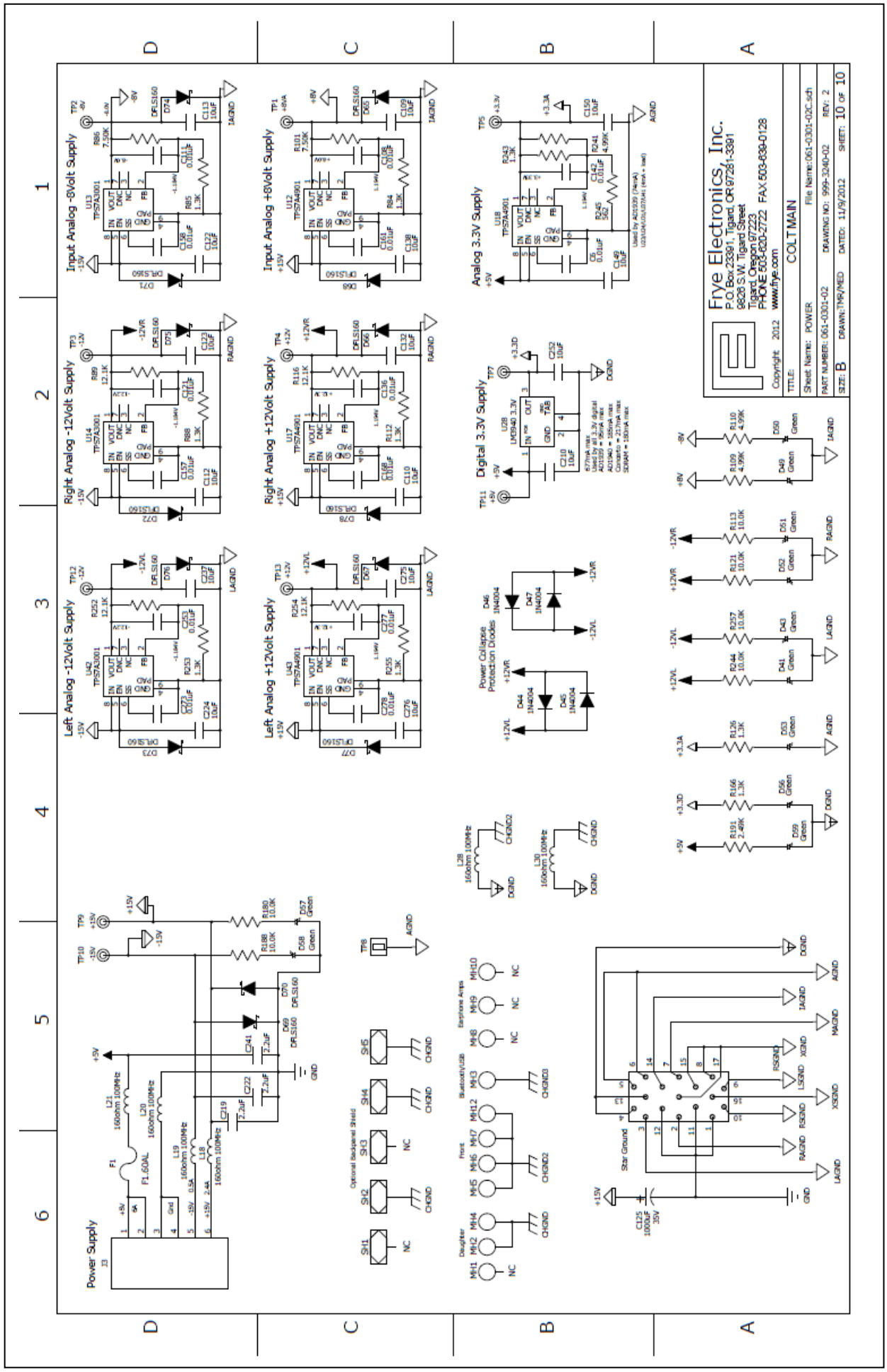
TITLE: COLT MAIN
Sheet Name: SPEAKER
File Name: 061-0301-02C.sch
PART NUMBER: 061-0301-02
DRAWING NO: 999-3240-02
REV: 2
SIZE: B
DRAWN: TMR/MED
DATED: 11/9/2012
SHEET: 9 OF 10


Input Analog -8Volt Supply
Input Analog +8Volt Supply
Analog 3.3V Supply
Right Analog -12Volt Supply
Right Analog +12Volt Supply
Digital 3.3V Supply
Left Analog -12Volt Supply
Left Analog +12Volt Supply
Power Collapse Protection Diodes
Power Supply
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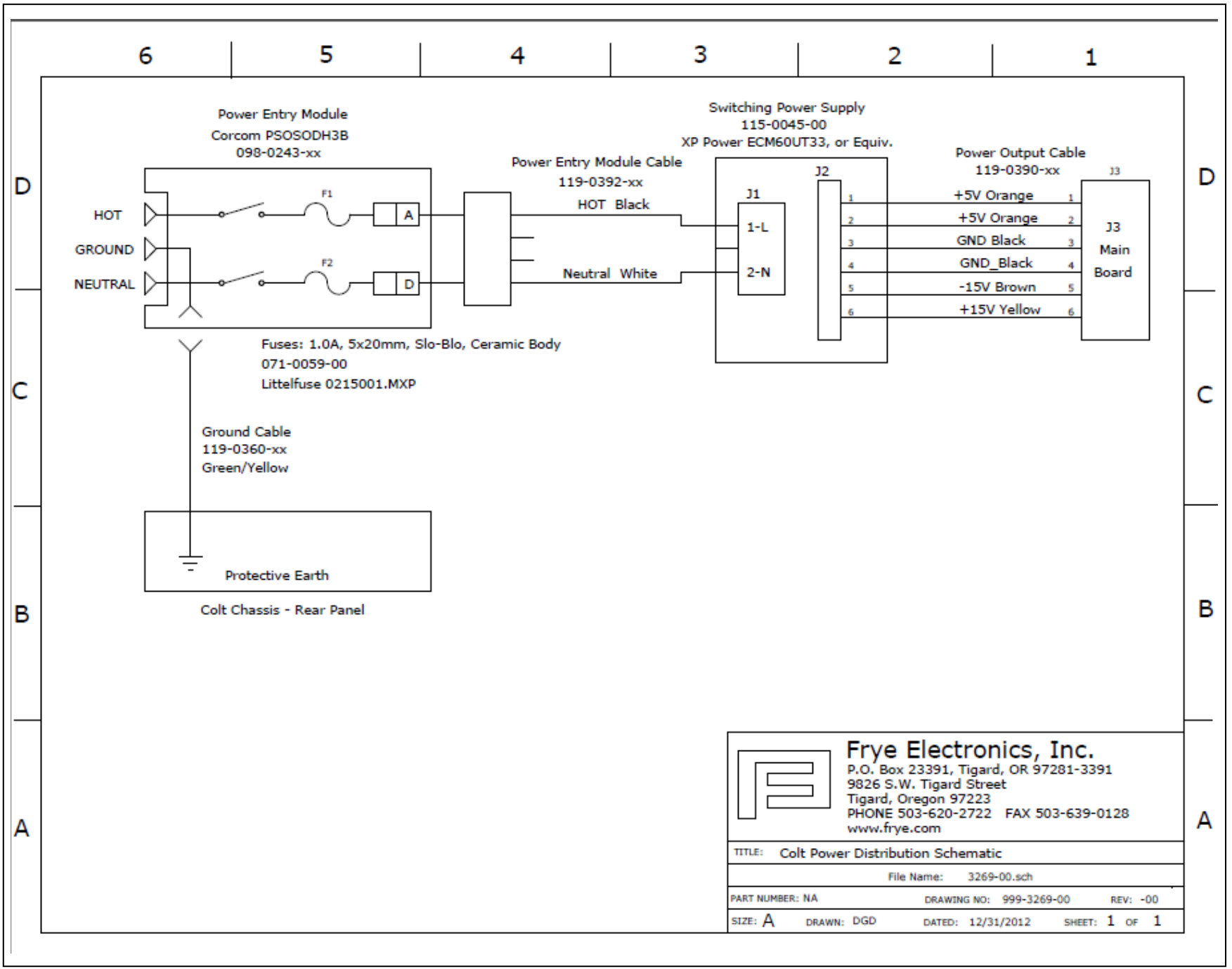
Copyright: 2012
TITLE: COLT MAIN
Sheet Name: POWER
File Name: 061-0301-02C.sch
PART NUMBER: 061-0301-02
DRAWING NO: 999-3240-02
REV: 2
SIZE: B
DRAWN: TMR/MED
DATED: 11/9/2012
SHEET: 10 OF 10


6
5
4
3
2
1
D
C
B
A
Power Entry Module
Corcom PSOSODH3B
098-0243-xx
HOT
GROUND
NEUTRAL
F1
F2
A
D
Fuses: 1.0A, 5x20mm, Slo-Blo, Ceramic Body
071-0059-00
Littelfuse 0215001.MXP
Ground Cable
119-0360-xx
Green/Yellow
Protective Earth
Colt Chassis - Rear Panel
Power Entry Module Cable
119-0392-xx
HOT Black
Neutral White
Switching Power Supply
115-0045-00
XP Power ECM60UT33, or Equiv.
J1
1-L
2-N
J2
Power Output Cable
119-0390-xx
J3
+5V Orange
+5V Orange
GND Black
GND_Black
-15V Brown
+15V Yellow
J3
Main
Board
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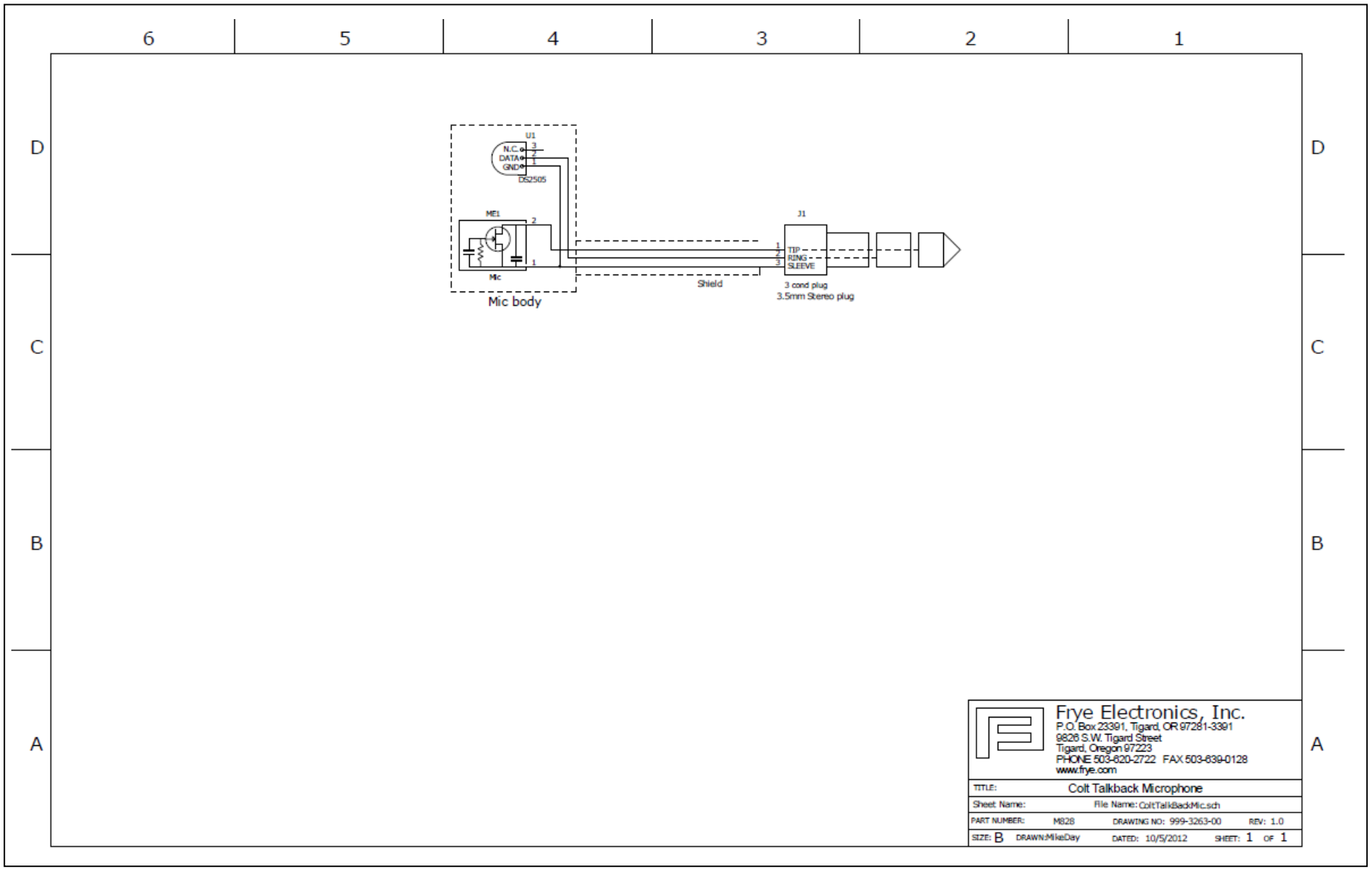
TITLE: Colt Power Distribution Schematic
File Name: 3269-00.sch
PART NUMBER: NA
DRAWING NO: 999-3269-00
REV: -00
SIZE: A
DRAWN: DGD
DATED: 12/31/2012
SHEET: 1 OF 1


6
5
4
3
2
1
D
C
B
A
U1
N.C.
DATA
GND
DS2505
ME1
Mic
Mic body
J1
TIP
RING
SLEEVE
Shield
3 cond plug
3.5mm Stereo plug
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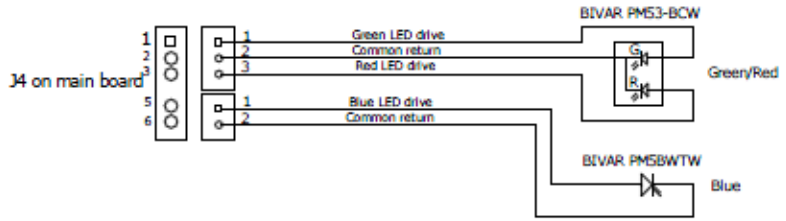
TITLE: Colt Talkback Microphone
Sheet Name:
File Name: ColtTalkBackMic.sch
PART NUMBER: M828
DRAWING NO: 999-3263-00
REV: 1.0
SIZE: B
DRAWN: MikeDay
DATED: 10/5/2012
SHEET: 1 OF 1



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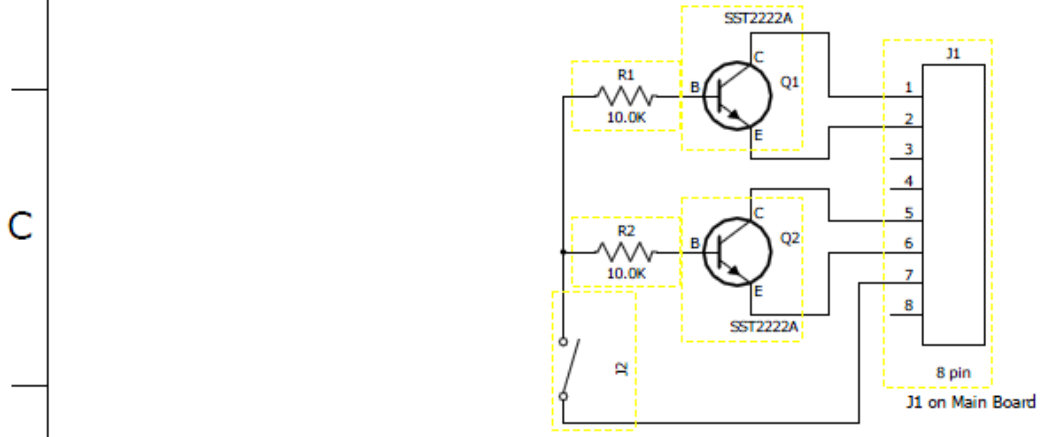
TITLE:	LED Cables, Colt		
Sheet Name:	LED_CABLES	File Name:	ColtLedCables.sch
PART NUMBER:	N/A	DRAWING NO:	999-3270-00 REV: 1.0
SIZE: A	DRAWN: MED/DGD	DATED:	12/20/2012 SHEET: 1 OF 1



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TITLE:	COLT DIP Switch Board		
Sheet Name: COLT_PANEL		File Name: DIPSwitchBoard-00.sch	
PART NUMBER:PART NUMBER:>	DRAWING NO999-3273-00		REV: 0
SIZE: A	DRAWN: TMR	DATED: 1/1/2013	SHEET: 1 OF 1