The Dangerous Monitor Manual

Thank you for choosing products from the exciting line of ***Dangerous*** recording equipment. Many years of dependable and trouble free service can be expected from our gear. This has been made possible by careful design, construction, and top shelf component choices by recording industry veterans. The ***Dangerous*** team is committed to providing equipment that brings you the highest quality for your dollars.

This manual will assist you in the installation and use of the **Monitor**. There are also helpful hints for safety, grounding, and terminology that apply to all recording equipment. Please read the manual to familiarize yourself with the outstanding features of your purchase.

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Safety Review

Certain precautions should be taken when using electrical products. Please observe the safety hints by reading the manual, following the directions, and obtaining qualified help if necessary to adhere to the precautions.

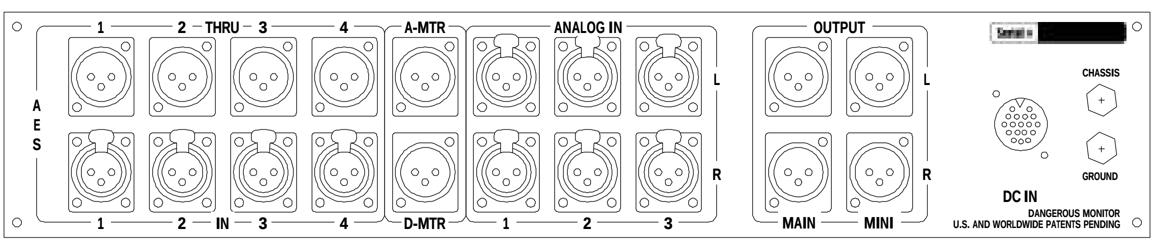
1. Use a properly grounded power supply with this product. Please do not defeat the ground pin on the mains plug. This connection protects the user in case of an internal fault by providing a low impedance path to ground. If a ground lift mains adapter is necessary to avoid hum problems, the system setup should be reviewed to locate the ground loop. The chapter on "Grounding examples" gives an explanation on obtaining quiet, safe system performance.
2. Avoid high temperature operation by providing air circulation space in equipment racks. The number one killer of electronic gear is HEAT. Placing Monitor in a hot rack with no ventilation will reduce the life span significantly depending on the operating temperature. This rule applies to the other equipment sharing the rack.
3. Avoid areas of high magnetic fields. The steel chassis of Monitor is designed to shield the circuits from EMI and RFI (magnetic and radio interference). When installing equipment in racks, it is advisable to put power amplifiers and other high powered equipment at least several rack spaces away, if not in a different rack, from microphone pre-amps and summing amplifiers. Separation of high level and low level equipment can pre-empt trouble caused by heat and EMI.
4. Care should be taken to avoid spills of liquids around electrical gear. If a spill occurs, please shut off the equipment. A qualified technician should investigate accidents to prevent further equipment damage or personnel hazards caused by spills.
5. Every attempt has been made by the designers to provide versatility in the setup and calibration of this product. As such, there ARE user serviceable parts inside (what a pleasant surprise). If one is uncomfortable with opening up gear and changing jumpers or making adjustments, please seek qualified help if necessary.

Overview

The **Monitor** is designed to be the cornerstone of a recording studio by providing a convenient method for listening to and metering the different stages of the recording process. Careful attention to detail has resulted in a unit of stunning ergonomic clarity and unprecedented performance in a compact enclosure. The user will discover that the ability to select between different analog and digital sources as implemented in **Monitor** allows accurate assessment of program material without quality differences in the signal paths clouding the user's judgment.

The built in digital to analog converter provides a solid basis for comparing digital sources directly without being subjected to the inevitable differences in calibration and sound quality between the converters in separate pieces of gear. Many times, the engineer can be fooled by differences in sound quality of "clones" (DAT from a CD) because the different brands of equipment don't sound the same even though the data on the carriers is the same. The topology of **Monitor** lets the engineer concentrate on the music and not the process.

Hooking up your Dangerous Monitor



DANGEROUS MONITOR REAR PANEL

The connectors on the back of **Monitor** are arranged into 5 groups. The first is the "AES IN and THRU" connectors. The user is to plug AES signals into the XLR female connectors. Up to four devices are selectable for routing to the built in D/A converter and digital meter feed. The XLR male connectors provide an uninterrupted through. The front panel switch group named "digital" will select which input feeds the D/A and the digital meter send.

The 2nd connector group is the "meter feeds" group. These jacks allow the selected analog and digital sources to be sent to meters and/or phase scopes to allow visual aid to the monitoring process. A breakout cable is provided for the “A-MTR” feed. The pinout of this connector is in the “Specifications” chapter of this manual and there is a circuit example for those who wish to set up a pair of VU meters in the “Metering Circuits” chapter. The “D-MTR” feed sends the selected digital input to a digital meter or phase scope.

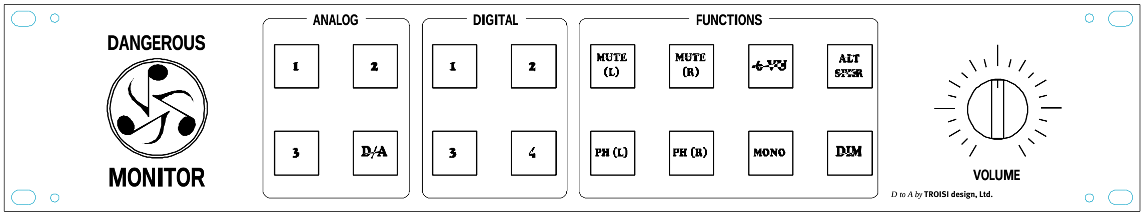
The 3rd group of connectors is the “analog inputs” group. There are three stereo inputs selectable by the switch group marked “analog” on the front panel. Note that the fourth switch selects the D/A converter that is built into the **Monitor**.

Next are the amplifier feeds. There is a “MAIN” and “MINI (alternate)” set of feeds to drive power amplifiers. These feeds are balanced and low impedance sends capable of driving long distance cables. It is easy to drive unbalanced amplifiers or cue systems with the appropriate adapters but best noise and crosstalk performance will be obtained by using amplifiers with professional, balanced inputs.

The “AC IN” jack is where the power supply cable goes. It is best to make sure that the power supply is turned off before connecting this cable as hot plugging can result in burned contacts. And lastly, banana jacks are provided for easy means to accommodate different system grounding schemes. The chassis and audio grounds are strapped together at the factory. This arrangement works for most cases but the jacks are provided for special situations needing a different grounding scheme. If hum or buzz problems are encountered, please consult the chapter on “Grounding” for hints to clear up the situation.

The 25 way ‘D’ connector is provided for options and expansion capabilities.

Usage examples



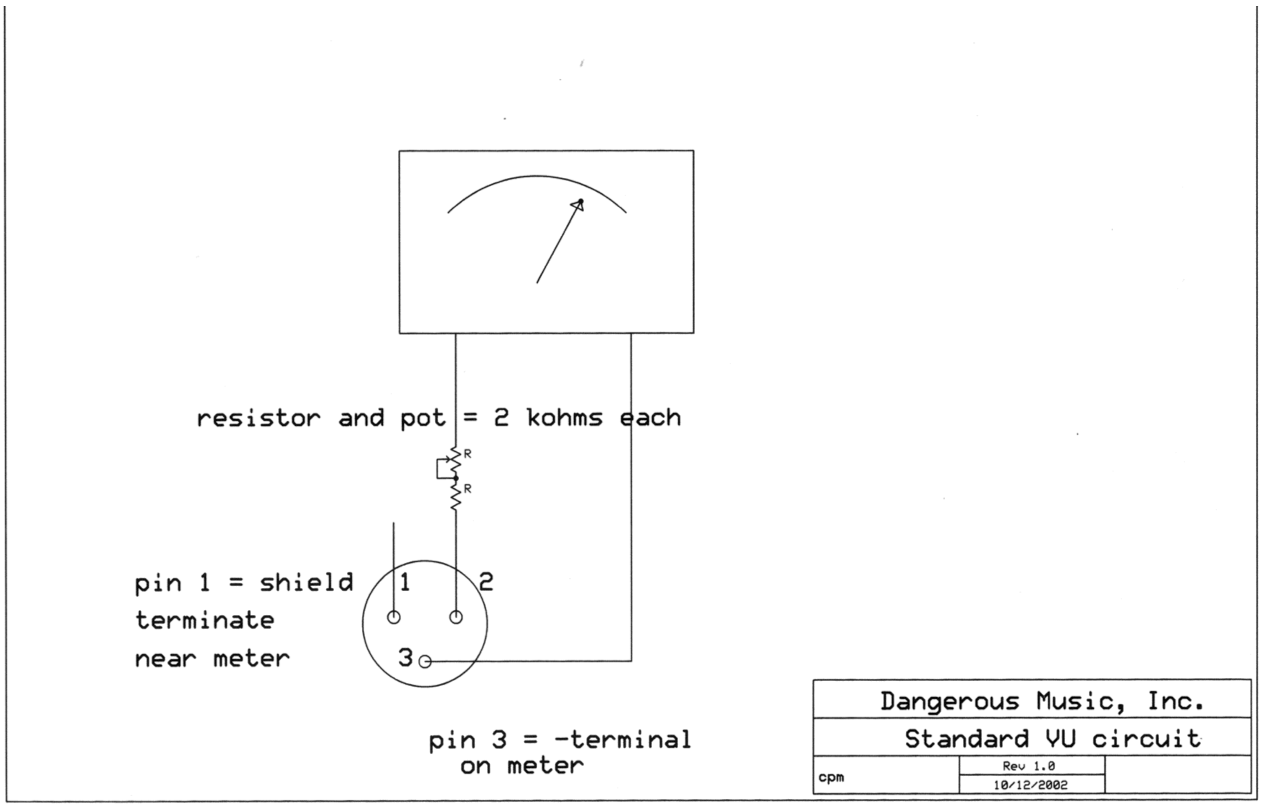
DANGEROUS MONITOR FRONT PANEL

The “Analog” switches select from four sources to be listened to. The selected source is sent to the “Functions” group and the “A-MTR” feed on the back panel. The fourth analog selection is a built in D/A converter which is fed by the selected “Digital” switch.

The “Functions” group allows channel phase reversal, mutes, mono, volume dim, alternate speaker selection, and a VU meter offset (to keep from thrashing the meter movements when listening to high level program material). The “Volume” control is a 21 position stepped attenuator. It was decided in the design process to use an attenuator for its accuracy and repeatability. It was also found that attenuators provide for consistent sound quality at all volume levels whereas pots tend to change the sound depending on the setting. Pots also require DC blocking to reduce scratching noises on adjustment. The use of an attenuator avoids these issues but has its limitations. The gain of most power amps today is very high so most of the attenuator range is set for about 30dB of loss. Since it is desirable to occasionally listen to the noise floor, which requires unity gain at the volume control, the last step is a big one. In other words, **BE CAREFUL** of the highest step. It is 9dB over the previous one.

Meter wiring

The “A-MTR” feed is designed to drive a standard VU meter circuit. The diagram that follows is a schematic of a standard VU meter circuit. The **Monitor**’s D/A is calibrated so that a digital sine wave of 1kHz frequency at -14dBfs will provide a +4dBu output of the “A-MTR” jacks to calibrate the meter. Set the adjustment pot for a deflection of 0VU indicated on the meter. This sine wave signal can be obtained from a DAW or a test CD. The chapter on “Voltage, dB, Bits” provides some background of these terms for those unfamiliar with them.



The resistor is a 2k ohm value, 1/4 watt. The potentiometer is a 2k unit for adjusting meter sensitivity.

The “D-MTR” connector is a standard AES digital output and goes directly to a digital meter or phase scope.

Internal Jumpers

Monitor is shipped from the factory with its internal jumpers set to interface with balanced equipment. There are rare cases that certain gear might buzz with the factory presets. If this happens, the following chapter has information that can help the user achieve quiet performance.

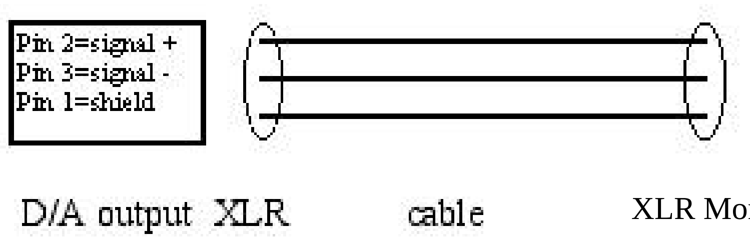
Ground header jumpers are included on the main circuit board to facilitate proper system grounding with **Monitor**. Shut off the power when removing the screws and top to avoid damage to the board by falling metal objects (been there, done that). Depending on the internal wiring, a buzz can occur when using unbalanced sources that may be cleared up by moving the header jumper marked “input shield lifts” on the circuit board, so that the jump is connected. Headers on the “AES inputs” can ground the digital cable shields if necessary. To figure out which piece of equipment is causing trouble, disconnect any installed cables one at a time to determine where the problem is. Changing the position of the jumper associated with the problem input will likely clear up the problem. If not, the following chapter discusses system grounding in more detail to help troubleshoot interesting studio problems. These techniques have been learned through years of experience (mostly bad ones), and have never failed to please.

Grounding Examples

To achieve maximum performance from the **Monitor**, cables need to be wired correctly. Store-bought cables can work just fine. Custom cable sets can be ordered from Redco Audio if necessary. Below are diagrams of frequently encountered wiring scenarios to help explain some of the possibilities. We’ll start with professional, balanced, +4dBu systems encountered in most studio situations and then cover some contingencies that happen when interfacing -10dBu, semi-pro, unbalanced equipment. The balanced world (XLR- type connectors) is the easiest to deal with because the audio signals and shield are treated separately down the cable.

Properly wired systems that use balanced interfaces can achieve impressive signal to noise ratios with the least amount of bother. Unbalanced equipment (RCA and two wire 1/4” type connectors) can be made to perform very well but sometimes requires more effort because the signal reference (low side, or ground) and the cable shield (and usually, the chassis) of such equipment is shared. This sharing can cause hum or buzzing problems for several different reasons that can usually be remedied with some logical thinking and judicious jumper placement.

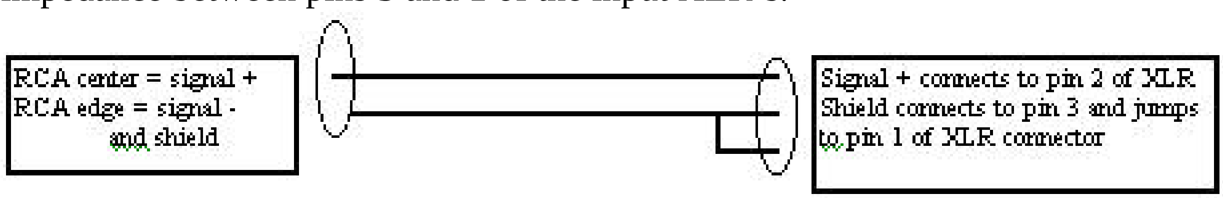
The **Monitor** inputs are designed to make the unbalanced interface easy to pull off properly if some simple rules are followed, but first, let’s explore the balanced input interface.



XLR Monitor input

Standard XLR cables are used to plug sources into the Monitor inputs. Shields should not be lifted as this is done at the appropriate place inside the Monitor to keep the input cable shield from conducting ground current. This is the beauty of the balanced connection. The signal pins carry the signal across them (transverse mode) and noise that gets through the shield is picked up equally by both signal conductors (if they are a twisted pair). This “common mode” noise is canceled by the differential action (subtraction) of the instrumentation amplifier in the first stage of the Monitor. Since the shield is not connected at both ends, current does not flow down the shield wire and no ground loop results from this interface. Audio goes through, noise is canceled, and grounds stay inside their respective pieces of gear. Beauty exists.

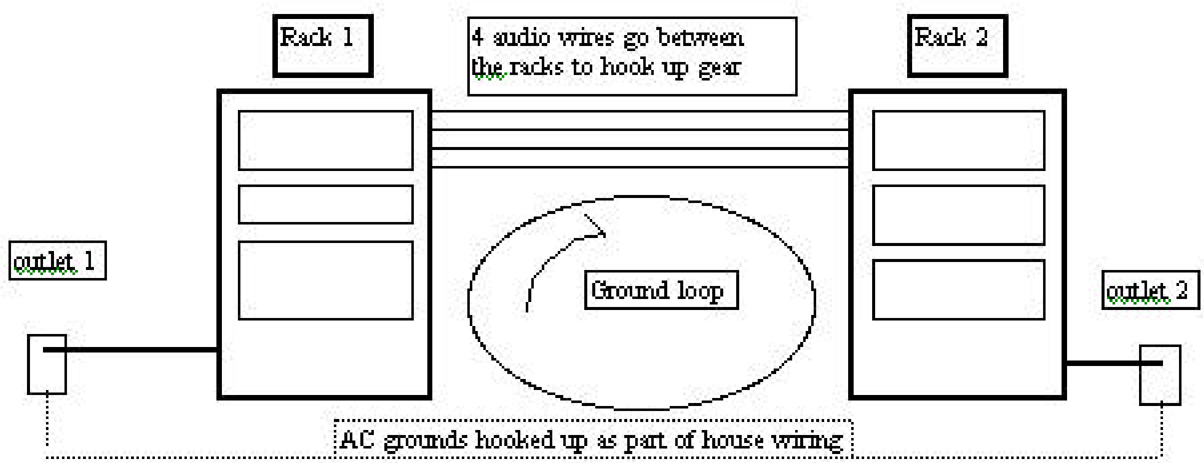
An unbalanced source driving Monitor presents no problem due to the differential action of the input stage. This interface doesn’t have common mode noise canceling but ground loop currents are limited by the high impedance between pins 3 and 1 of the input XLR’s.



These two scenarios cover the receiving side of the Monitor. The driving side uses the same principles but optimum system performance usually requires the use of the dreaded voltmeter plus possibly a soldering gun. Don’t worry, read on. Let’s look at the scenario where a Monitor drives the balanced input of a power amplifier.

Equipment manufacturers are required by CE standards to connect pin 1 of an input XLR to chassis ground at the connector in order to get the coveted sticker that lets them sell gear in Europe. This can cause ground loops if the shield wire is allowed to hook both ends of the cable up. The problem stems

from the fact that two grounds in a system are never at the same potential. They can be close if the two pieces of gear in question are in the same rack or a heavy gage wire is used to bolt both the chassis together.
Some people in desperation resort to using AC plug “ground lifts” to defeat the safety grounds (the third pin on an AC cord) in a random fashion until the system quiets down. This in our view is an unacceptable method of curing ground loop buzzes or hums. The diagram illustrates the problem and a solution follows.

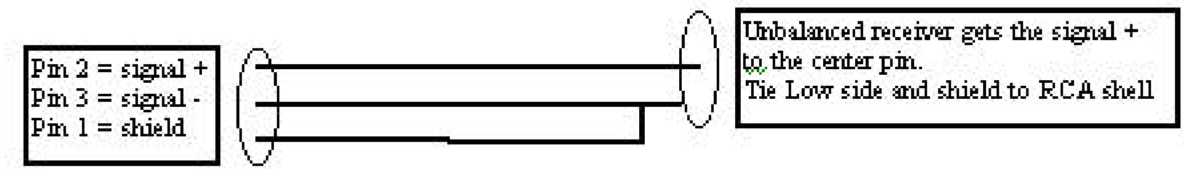


If the audio cables between the racks connect the grounds together via the shield pins, and the racks are at even slightly different potentials (on different circuits, one draws heavy juice with amplifiers, long distance from each other, etc.) the shield of the audio cable will try to equalize the potential difference between the two racks. Juice will flow down the shield of the audio cable and broadcast hum into the signal wires the shield was supposed to protect. This situation manifests itself as the all too familiar buzz of a ground loop. The intensity depends on many variables but can go from unnoticeable to raging. The simple way to avoid this problem is take the voltmeter and switch it to measure continuity (the unit beeps when the leads are touched together).

Pull the AC plug, disconnect the cables from the back of the amplifier and put one of the leads into pin 1 of the input XLR connector. Touch the other lead to the AC ground pin or a convenient chassis screw and see if the VOM beeps. If it does, then pin 1 is grounded and the shield of the interconnecting cable should be unsoldered and taped (so as not to inadvertently short to the shell of the XLR) at the male connector. If the hum clears up, then the problem was ground loop noise between Monitor and the power amp.

Some equipment manufacturers provide a header inside the gear to lift the pin 1 connection. In this case the VOM in the above test would not beep and the audio cable can be left alone. This test can be performed on most balanced line level interfaces to clear up ground loops without applying AC ground lift adapters (which are generally unsafe to use unless the gear in question is grounded by some other method). If you are unfamiliar with VOM and soldering techniques, this whole procedure can be avoided and the system just hooked up to hope for the best. In small installations where there are no great distances for signals to travel or everything is in the same rack, resulting ground currents cause hum below the desired noise floor.

Driving an unbalanced input of a power amp is done by using balanced cable at the Monitor end and tying pin 1&3 together at the amplifier end and applying that connection to the shell of the RCA connector as in the following diagram.



If noise is encountered using an unbalanced connection, the following steps will clear up the problem. It may be necessary to bolt the amplifier in the same rack as the Monitor to obtain optimum performance. Please leave breathing room for hot or magnetically noisy gear (power amps can be both). Not being able to run long lines is the potential downside of unbalanced equipment, but this method can be effective. Isolating the amp from the rack would be the next step. Using an AC ground lift adapter and letting the offending amplifier get its ground down the signal line would be the last resort although this technique can still work OK. Be sure to unplug the power cords while changing the grounding schemes as to not complete a circuit with your body parts and by all means seek help of an experienced friend if you are not familiar or uncomfortable with trouble shooting.

Some power amps with unbalanced inputs have two pronged power cords and electrically isolating them from the rack and providing ground down the audio cable is a situation that has worked well and is really functionally equivalent to the last resort mentioned above. Use the VOM set to continuity mode to check isolation from the rack (with all the cables unplugged from the amp while testing).

Volts, Decibels, Bits (16), and Bits (24)

The voltage list is for a sine wave AC measured root mean squared (the way a volt meter would). The numbers are rounded off so a direct comparison to a calculation could be slightly different. Professional levels in a studio are referenced to 1.228VACRMS. This is the voltage out of a console when a VU meter says “0dB”. The dB scale is a logarithmic scale that is easier to deal with in a working world of audio than a voltage scale because loudness in hearing also follows a log scale. 6dB is twice the voltage. 10dB is roughly twice the loudness. 20dB is 10 times the voltage. The 16 bits column represents the number of bits on a CD or the number of bits that it takes to represent the voltage at a given level. The 24 bit column represents how a theoretical 24 bit converter would represent the given voltage. I don’t know of any microphone preamp, console, or A/D converter that can deliver 144dB of dynamic range but perhaps it is good to represent the noise floor with several bits. It is certainly not a bad idea to process digital audio information with at least a 24 bit system if number manipulation (DSP) is taking place.

Volts	dBu	(16)Bits	(24)
6.20	+18	16	24
3.10	+12	15	23
1.55	+6	14	22
1.228	**+4**	**13+**	**21+**
0.775	0dBu	13	21
0.3875	-6	12	20
0.245	**-10**	**11+**	**19+**
0.1938	-12	11	19
0.0969	-18	10	18
0.04844	-24	9	17
0.02422	-30	8	16
0.01211	-36	7	15
0.00605	-42	6	14
0.00303	-48	5	13
0.00151	-54	4	12
0.000757	-60	3	11
0.000378	-66	2	10
0.000189	-72	1	9
0.000095	-78	dither	8
0.000047	-84		7
0.000024	-90		6
0.000012	-96		5
0.000006	-102		4
0.000003	-108		3
0.0000014	-114		2
0.0000007	-120		1
	-126	dither	

In a digital system that uses binary counting (PCM being popular) every bit doubles the number of the possible voltages that can be present at the output of a D/A converter. A 16 bit number represents 65536 different possible voltages in a PCM converter assuming no DC offset and a noise floor at the least significant bit. The smallest step is roughly 94uV. Stack 65536 90uV steps on top of one another and you get the 6.2 volt maximum. The step size for a 24 bit word under these same conditions is about .7uV, a small step indeed. The point of this exercise is to illuminate the relationship between voltage, dB's, and bits in a PCM system.

Dangerous Monitor Specifications

Measurements taken at +4 dBu nominal level

Frequency Response	1 Hz- 100 kHz within 0.2dB
Total Harmonic Distortion	0.003% in audio band
Intermodulation Distortion	0.002% IMD60 4:1
Crosstalk @ 1 kHz	-113 dB
Crosstalk @ 10 kHz	-102 dB
Noise Floor	-91 dBu total energy in audio band
Maximum level	+26 dBu
Nominal operating level	+4 dBu
Input impedance	25k ohms balanced
Output impedance	50 ohms balanced (600 ohm drive capable)
Power consumption	40 watts
Warranty	2 years parts and labor. Subject to Inspection. Does not include shipping Damage, abusive operation, or modifications/attempted repair by unauthorized personnel.

Please fill out the registration card within two weeks of purchase to help us keep our paperwork straight. Any information included on the card is treated as personal and will not be used in any mailings or disclosed to third parties.

The warranty is activated if the card is filled out and mailed to:

Dangerous Music, Inc.
154 East 2nd street #4
New York, NY 10009
www.dangerousmusic.com

In case of suspected trouble with a DM Inc. unit, check the operation manual to see if the problem is addressed by internal jumper settings or usage suggestions. If not, please write or email the factory at the above address for service information. It is recommended to save the original shipping box for moving, service or storage. The warranty applies to the original purchaser.

Model # ______________________________

Serial # ______________________________

Inspected ______________________________

