# whirlwind OPERATIONS MANUAL

# 5.1PA
## PRECISION ATTENUATOR



## INTRODUCTION

The Whirlwind 5.1PA system is an extremely accurate, sonically pure, six channel precision attenuator. The 5.1PA was designed to provide precise, repeatable, multichannel volume adjustments in the post production editing environment. The level of all channels track symmetrically in 0.5 dBV increments, allowing the user to vary the listening volume and perfectly maintain the surround image.

In addition to the single knob multichannel level control, the 5.1PA system offers a multitude of switching functions that allow the operator to mix seamlessly with different speaker combinations and compare different aspects of the surround mix in real time.

The 5.1PA has two sets of outputs and can be configured to control two separate sets of 5.1 speaker systems for comparison purposes, or configured for one 5.1 speaker arrangement and two pair of stereo speakers to accommodate both surround and stereo mixing.

## HOOKUP CABLES

Audio connections are made through 25 pin female Dsub connectors, wired to the Tascam® analog pinout. A variety of standard and custom DB25 cables are available from Whirlwind through your dealer. Part numbers for some common DB25 cables are:

| | |
|---|---|
| DBMD-010 | DB25 male to DB25 male, Tascam analog pinout, 10 feet, molded |
| DBMF-010 | DB25 male to fanout, 8 XLRF, Tascam analog pinout, 10 feet, molded |
| DBMM-010 | DB25 male to fanout, 8 XLRM, Tascam analog pinout, 10 feet, molded |
| DBMS-010 | DB25 male to fanout, 8 TRSM, Tascam analog pinout, 10 feet, molded |
| DB1-015 | DB25 male to DB25 male, Tascam analog pinout, 15 feet, Canare MR202-8AT |
| DBF1-F-025 | DB25 male to fanout, 8 XLRF gold, Tascam analog pinout, 25 feet, Canare MR202-8AT, Snakeskin |
| DBF1-M-015 | DB25 male to fanout, 8 XLRM gold, Tascam analog pinout, 15 feet, Canare MR202-8AT, Snakeskin |
| DBF1-S-015 | DB25 male to fanout, 8 TRSM gold, Tascam analog pinout, 15 feet, Canare MR202-8AT, Snakeskin |

## SYSTEM DESCRIPTION

The 5.1PA is a two piece system consisting of a single space rack mount main unit which contains all system input and output connections and a small portable controller unit that houses the level adjust knob, LED display and switches that operate input and output signal selection.

There are two sets of line level outputs on the 5.1PA main I/O unit. The A output is for connection to the 5.1 surround amplifiers or powered speakers. The B output can be used to control a second set of 5.1 speakers or configured to operate two pairs of stereo speakers providing multiple monitoring options. Output connections are balanced line level on 25 pin female Dsub connectors, wired to the Tascam® analog standard. Ground lift switches are provided on all outputs to eliminate ground loops, if necessary.

Balanced line level audio inputs for the six surround channels plus the separate stereo input are through another 25 pin female Dsub connector, also wired to the Tascam® analog standard. An alternate set of stereo inputs on the front of the rack mounted I/O box allows easy access for injection of an additional stereo signal. The front ¼" TRS inputs are electronically buffered and summed with the stereo signal from the DB25 input. Both signals are controlled by the Stereo input selector switch.

The portable controller is a tabletop, sloped enclosure with individual Speaker on/off switches, Speaker selector switches, and a precision level control with an LED display. Other switches include 5.1 and Stereo input selectors, Ref, Mute and Solo functions, and a 5.1 to Stereo down mix. The controller connects to the rack unit with a standard eight pin RJ45 cable.

## CONFIGURATION

The 5.1PA can be used as a dual output 5.1 controller or as a single 5.1 speaker system with two additional sets of stereo speakers for both surround and stereo mixing. The installer determines which configuration is desired and engages it with the B output configuration switch on the rear of the rack mount I/O unit.

In the dual 5.1 configuration, the A and B line level outputs are connected to two 5.1 surround speaker arrangements. The 5.1 output switch on the controller selects which of the two systems is active.

The second configuration provides 5.1 surround connections on the A output and two sets of stereo outputs with an optional subwoofer on the B output DB25 connector. The first set of stereo speakers (ST A) utilizes the left and right front line level outputs and the second set (ST B) uses the left and right surround output drivers. Internal switching in the 5.1PA routes the same audio to either set of stereo speakers. A single independent subwoofer can be connected to the LFE output of the B DB25 connector. The subwoofer audio is either the LFE signal from the 5.1 input or a derived center mix of the left and right stereo signals. This configuration gives the user three listening options; the 5.1 system or either set of stereo speakers, selectable via the controller switches.

## OPERATION

The 5.1PA functions are manipulated through a convenient portable controller box. A large soft touch jog wheel associated with the easy to read four digit display allows the user to make precise, repeatable level adjustments to all outputs at once with a single knob. The 5.1PA is an attenuator only, with a range of 0 to –70 dB. There is no gain through the system except for a switchable +10 dB of gain on the LFE outputs. This switch is located on the front of the rack I/O unit.

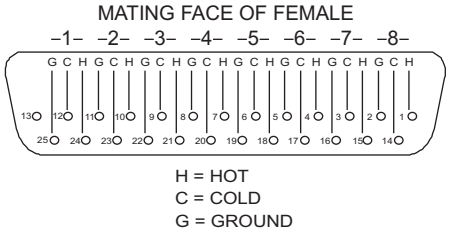
To the right of the level adjust knob are eight switches, six of which turn the individual speaker outputs on and off. The function of these switches is always associated with the set of speakers that is currently selected for listening. The ST A and ST B switches turn the two sets of stereo speakers on and off. These switches are active only when the 5.1PA is configured for 5.1/Stereo operation, indicated by the red LED between them.

To the left of the level adjust knob are six switches that manipulate the input audio signals and a seventh switch that selects the desired surround system for listening.
The **Stereo Input** switch applies the two channel stereo input signal to the left and right front outputs of the selected speaker system. When a stereo speaker selection is active, a mixed mono sum of the left and right signals available to the LFE output and the center 5.1 channel.
The **5.1 Input** switch sends the six surround audio input signals to their respective speaker outputs.
The **Stereo Downmix** switch creates a stereo combination of the surround inputs and routes them to the left and right front speakers.
The **Ref** switch allows the user to set a reference system attenuation level that can be recalled at any time. To set the reference level, press and hold the Ref switch and rotate the level adjust knob to the desired level of attenuation. The letter "r" is displayed while the level is being set and goes away when the Ref switch is released. The reference level is now set and is recalled by pushing the Ref switch.
The **Mute** switch turns all outputs off.
The **Solo** switch changes the function of the Speaker selection switches from individual on/off; to last switch pressed turns off the other speaker outputs. Pushing the Solo switch causes it to blink and prepares the Speaker selection switches for solo operation. Pushing any of the Speaker selection switches turns off all the other available speakers. The speaker that is on has the switch fully lit and the switches for the other speakers that can be soloed are blinking. Pressing the Solo switch again returns the Speaker selection function to individual on/off. Pressing and holding the Solo switch enables a signal Mono function. The Mono function combines the various audio signals and presents them to selected speakers. 5.1 surround signals are combined into mono by summing the downmix left and downmix right signals and routing the mono signal to the left, right and center front speakers. Stereo audio inputs are properly summed to mono and sent to the left and right front speakers.
It is possible to use both the 5.1 input and the Stereo input simultaneously. In this case the stereo left and right are routed to the front left and right speakers along with the front left and right signals of the 5.1 mix.

The table on page 5 outlines the various signal routing paths with different input switch combinations.

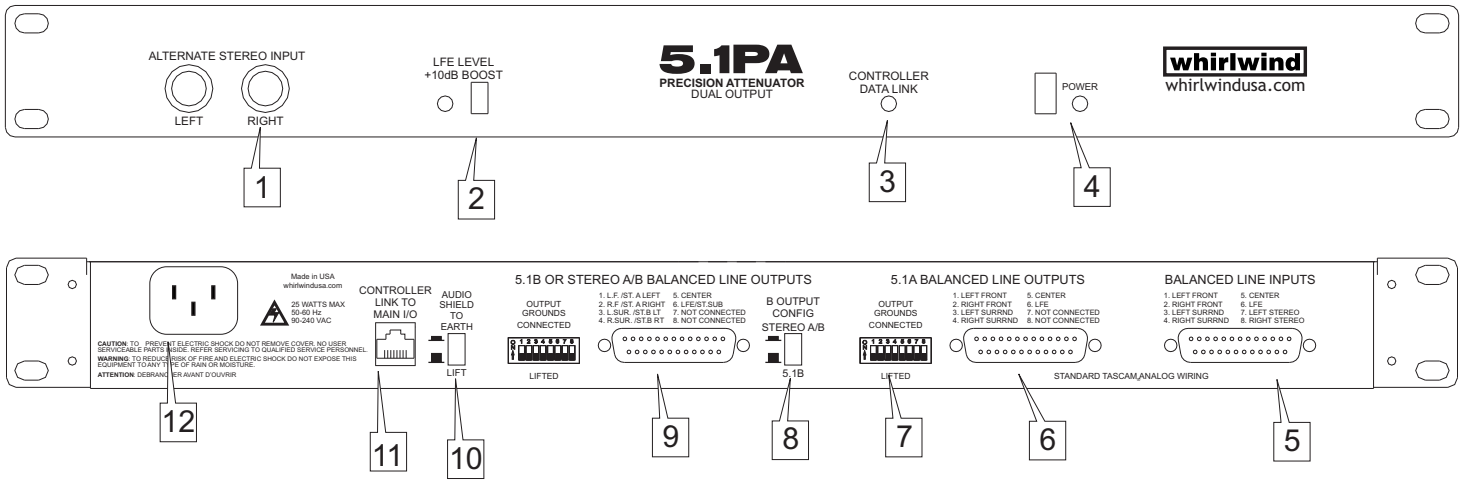
## DB25 PINOUT AND CHANNEL ASSIGNMENT

| CH# | INPUT AUDIO |
|---|---|
| 1 | Left (front) |
| 2 | Right (front) |
| 3 | Left Surround |
| 4 | Right Surround |
| 5 | Center |
| 6 | LFE |
| 7 | Left - Stereo |
| 8 | Right - Stereo |




Channels 7 and 8 stereo inputs are summed with the Alternate Stereo input connectors on the front panel of the rack I/O unit.

Output DB25 connections for 5.1 are the same as the inputs except channels 7 and 8 are unused. Stereo outputs connections use channels 1-4 on the B output DB25 connector: CH 1-2=ST A, CH 3-4=ST B.




## CONTROLS AND CONNECTIONS

**1. Alternate Stereo** Input balanced line level ¼" TRS jacks allow insertion of external stereo sources into the stereo inputs. These inputs are electronically balanced and summed with the stereo signal from the rear DB25 input.

**2. LFE Level Boost** switch adds 10 dB of gain to the signal applied to the LFE outputs. The LED illuminates when the boost is active for visual confirmation.

**3. Controller Data Link** LED indicates operational data communication between the main I/O unit and the controller.

**4. Power** switch connects AC to the transformer primary and the LED indicates that the unit has power. Both sides of the AC line are switched and a mains fuse is located on the circuit board inside the unit. At system power up, the speaker outputs are set to –35dB to prevent high turn on levels.

**5. Input** DB25 female connector accepts balanced line level audio for the six surround channels plus left and right stereo. The pinout follows the Tascam® analog standard and channel assignment can be found on the preceding chart.

**6. 5.1A Output** DB25 female connector delivers 6 channels of balanced line level audio to the 5.1 surround amplifiers or powered speakers. The pinout follows the Tascam® analog standard and channel assignment can be found on the preceding chart.

**7.Output Ground** switches are provided for both the A and B outputs to connect the shield from each output to the common audio ground bus. The dip switches are numbered 1-8 and correspond with the same numbered output channel. In the down (off) position the shield of each output is lifted.

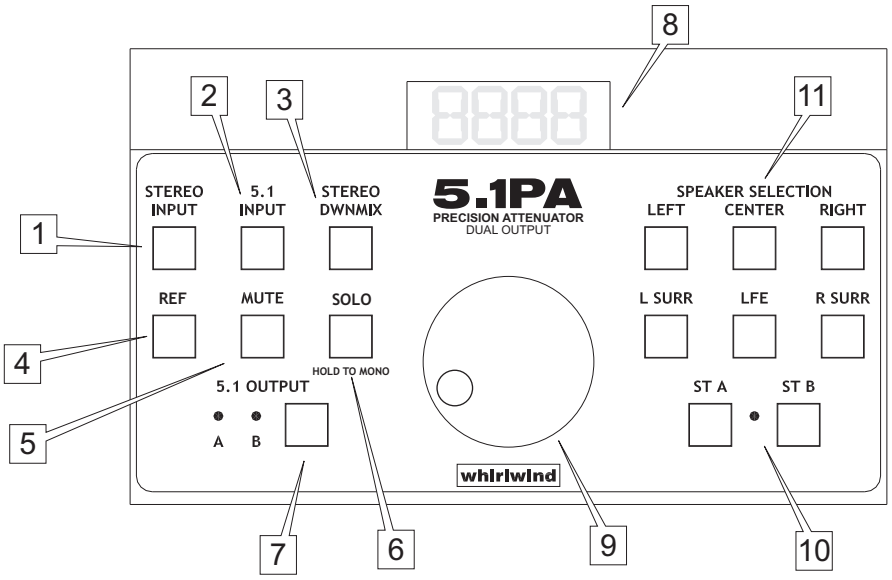
**8. B Output Configuration** switch determines which audio signals are delivered to the balanced output drivers. In the out position a second 5.1 speaker system can be connected. The in position feeds the stereo signals to the outputs for connection of two sets of stereo speakers.

**9. B Output** DB25 female connector is dual function depending on the position of the configuration switch. The B output can be used to feed a second set of 5.1 speakers or configured to operate two pair of stereo speakers and a subwoofer. The pinout follows the Tascam® analog standard and channel assignment can be found on the preceding chart.

**10. Audio Shield to Earth** switch separates the earth ground of the power cord (which is always connected to the chassis) from the audio ground. When in high Radio Frequency Interference situations, it is suggested to keep audio ground connected to chassis ground.

**11. Controller Link** RJ45 connector sends power and communications to the controller unit. The yellow LED indicates that power is being supplied to the controller and the green indicates data communication with the controller.

**12. Power IEC** inlet connects to incoming AC power with a voltage range of 90- 240 VAC at 50 or 60 Hz.




## CONTROLLER FUNCTIONS

**1. Stereo Input** switch turns the stereo input signal on and off. These signals are sent to the left and right stereo outputs and also to the left and right front speakers of the 5.1 systems.

**2. 5.1 Input** switch turns the six surround input signals on and off and directs them to the proper outputs.

**3. Stereo Downmix** switch combines the front, center and surround signals in the proper proportions and sends them to the left and right front 5.1 outputs. The LFE signal is unaffected. See the signal combinations chart.

**4. Ref** switch allows instant recall of a reference system attenuation level. Press and hold the Ref switch and rotate the level adjust knob to set the desired level of attenuation. The reference level is stored when the Ref switch is released and is retained through power cycling.

**5. Mute** switch turns all active outputs on and off. The display will flash as long as mute is engaged.

**6. Solo/Mono** converts the Speaker selection switches from individual on/off; to last switch pressed turns off the other speaker outputs. The Solo switch blinks when activated and sets the Speaker selection switches for solo operation. Pushing any of the Speaker selection switches turns off all the other available speakers. The speaker that is on has the switch fully lit and the switches for the other speakers that can be soloed are blinking. Pressing and holding the Solo switch enables the Mono function that combines the left and right stereo inputs and the downmix surround inputs into mono and routes them to various speakers depending on the current operation of the 5.1PA. Refer to the signal combination chart for complete mono signal routing information.

**7. 5.1 Output** switch selects between 5.1 speakers systems when the 5.1PA is configured for dual 5.1operation. In 5.1/Stereo mode the switch turns the 5.1 A outputs on and turns off the stereo outputs.

**8. Display** indicates the amount of attenuation being applied to the 5.1 surround signals. The display will flash when the Mute switch is active and the leftmost digit will show an “r” when the reference level is being set. On power up, the display will briefly shown the current software version and if communication with the main I/O unit is lost a 'C.err” message will be displayed. Turn on level of the system is –35dB.

**9. Level Adjust** knob is a rotary encoder that changes the amount of attenuation in 0.5 dBV increments from –70 dB to 0 dB. The four digit display shows the attenuation in real time for accurate adjustment repeatability.

**10. ST A** and **ST B** switches select between the stereo outputs when the 5.1PA is configured for stereo speaker operation. In dual 5.1 mode these two switches are inactive.

**11. Speaker Selection** switches turn the individual outputs on and off. The Left and Right switches control the left and right front surround speakers and also the left and right stereo speakers when those are selected for monitoring. The LFE switch controls the 5.1 sub and also a stereo subwoofer, if connected.

**12. RJ45** connection (not shown) uses a standard, straight through wired, eight conductor RJ45 cable as the control cable connection to the rack mount main I/O unit.

## SIGNAL ROUTING COMBINATIONS TABLE

| Input Sources abbreviation key | | |
|---|---|---|
| ***5.1 Inputs*** | ***Stereo Inputs*** | ***Down Mix*** |
| **FL** (Front Left) | **STL** (Stereo Left) | **DML** (DownMix Left) = Mix of FL + 0.708*(SL + CC) |
| **FR** (Front Right) | **STR** (Stereo Right) | **DMR** (DownMix Right) = Mix of FR + 0.708*(SR + CC) |
| **SL** (Surround Left) | **DC** (Derived Center) = Mono Mix of STL + STR (This term is used to avoid confusion in the table.) | **MONO** (DML+DMR) = Mix of DML+DMR |
| **SR** (Surround Right) | | |
| **CC** (Center Channel) | | |
| **LFE** (Low Freq) | | |

### 5.1 Output signal paths

(Mono mode = **OFF**)

| ***Outputs -->*** | **FL** | **FR** | **SL** | **SR** | **CC** | **LFE** |
|---|---|---|---|---|---|---|
| Selected Input | | | | | | |
| **5.1** | FL | FR | SL | SR | CC | LFE |
| **DownMix** | DML | DMR | - | - | {MONO} | {LFE} |
| **Stereo** | STL | STR | - | - | {DC} | {DC} |
| **5.1 + Stereo** | FL+STL | FR+STR | SL | SR | CC | LFE |
| **DownMix+Stereo** | DML+STL | DMR+STR | - | - | {MONO} | {LFE} |

(Mono mode = **ON**)

| ***Outputs -->*** | **FL** | **FR** | **SL** | **SR** | **CC** | **LFE** |
|---|---|---|---|---|---|---|
| Selected Input | | | | | | |
| **5.1** | MONO | MONO | - | - | MONO | LFE |
| **DownMix** | MONO | MONO | - | - | {MONO} | {LFE} |
| **Stereo** | DC | DC | - | - | {DC} | {DC} |
| **5.1 + Stereo** | MONO+DC | MONO+DC | - | - | MONO | LFE |
| **DownMix+Stereo** | MONO+DC | MONO+DC | - | - | {MONO} | {LFE} |

### Stereo A or B Output paths

(Mono mode = **OFF**)

| ***Outputs -->*** | **LEFT** | **RIGHT** | **LFE** |
|---|---|---|---|
| Selected Input | | | |
| **5.1** | FL | FR | {LFE} |
| **DownMix** | DML | DMR | {LFE} |
| **Stereo** | STL | STR | {DC} |
| **5.1 + Stereo** | FL+STL | FR+STR | {LFE} |
| **DownMix+Stereo** | DML+STL | DMR+STR | {LFE} |

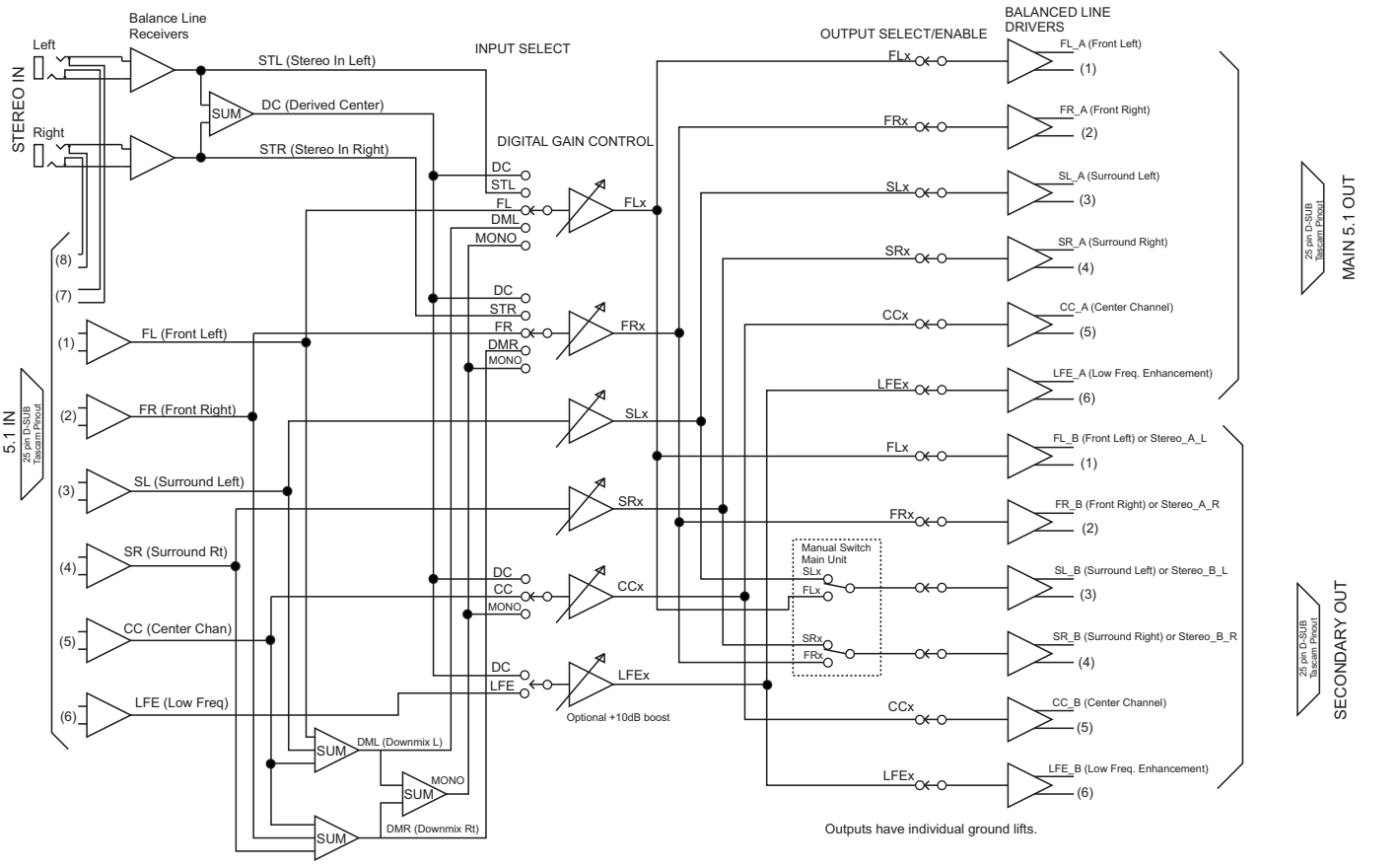
(Mono mode = **ON**)

| ***Outputs -->*** | **LEFT** | **RIGHT** | **LFE** |
|---|---|---|---|
| Selected Input | | | |
| **5.1** | MONO | MONO | {LFE} |
| **DownMix** | MONO | MONO | {LFE} |
| **Stereo** | DC | DC | {DC} |
| **5.1 + Stereo** | MONO+DC | MONO+DC | {LFE} |
| **DownMix+Stereo** | MONO+DC | MONO+DC | {LFE} |

Note: A switch on the main unit determines Speaker Mode, either dual 5.1 outputs, or one 5.1 output and two stereo outputs.

{}means it defaults to off, but, this signal may be turned on.

## 5.1PA Block Diagram




## CIRCUIT DESCRIPTION

The design of the 5.1 PA provides precision level control such that channel gains are matched very closely to prevent image shifts when changing monitor levels. Since the 5.1PA is intended to be used in critical post production mixing, the goal was to achieve “straight wire with attenuation” performance. Noise, distortion and switching artifacts are kept extremely low by careful attention to circuit design, component choices and signal routing.

**Signal Flow**

The 5.1PA signal path begins with the balanced line inputs and proceeds to the input select section. The selected input signal then passes through the digital gain controls for attenuation and through the output select/enable circuitry to the balanced output drivers. Switching functions are performed electronically with proprietary circuitry under microprocessor control.

Six surround channels and stereo auxiliary input signals are connected to the 5.1PA via a 25 pin Dsub connector. The alternate stereo ¼” TRS inputs on the front of the rack mounted I/O unit are electronically buffered and summed with the stereo signal from the DB25 input.

Balanced line input circuits use high quality, low noise, low distortion amplifiers and reject common mode signals while preserving the balanced audio signal.

Downmix, mono, and derived center signals are created from summing signals after the balanced input circuits.

Input source selection switching is performed by a proprietary Whirlwind FET switching circuit.

These circuits, developed specifically for this product, allow virtually no artifacts when switching audio signals. They are able to work with high peak to peak signals, adding no noise or distortion, yet also allow “gentle” switching. They switch slowly, so pops and clicks are eliminated compared to relays or off the shelf FET switching circuits. The source selectors also allow mixing of signals, which handles the case of both Stereo and 5.1 inputs selected at the same time.

After the input selection circuitry, all 6 channels of audio are passed through precision digitally controlled audio attenuators. These circuits employ precision resistor networks that are responsible for the high accuracy of the attenuators. In addition, zero cross detection helps reduce any artifacts of gain changing to below audible levels.

A second level of audio switching follows the attenuators to route signals to the proper outputs. This employs the same high performance switching circuits used for source selection.

Finally, the signals are balanced and buffered by the output balanced line drivers. These are also very low noise and low distortion amplifiers with excellent drive characteristics. The 12 output drivers are also equipped with gain trimmers. This allows Whirlwind technicians to calibrate each output at the factory to guarantee excellent level matching on all 12 outputs.

Control is done by microprocessors in the main I/O unit and the controller. Communication between the processors and power to the controller is done using RJ-45 connections and a single 8 wire CAT-5 cable. The interface uses balanced RS-485 circuits ensuring a low noise, reliable interface. Most of the processing is done in the controller.

Power is provided by a switching supply in the main I/O unit that accepts line voltages of 90 to 240 VAC at 50 or 60 Hz. This provides an efficient, universal supply for the system.

## SPECIFICATIONS

| | |
|---|---|
| Frequency Response | 20 to 20 kHz, +0/-0.1 dB |
| Total Harmonic Distortion +noise | 1 KHz, +10 dBV, <0.002%, 20 to 20 KHz<br>+18 dBV <0.007% |
| Phase Shift | < +/- 12 degrees<br>20-20 KHz |
| Reference Level Resolution | .5 dB steps |
| Range of level pot | 0 to –70 dB |
| Gain tracking between channels | 0.1 dB typical, 0.2 dB max |
| Zipper Noise | < -90 dBV |
| Common Mode Rejection of Input | > 60 dB at 60 Hz. |
| Maximum Input level | +18 dBV |
| Input Impedance | 20 k ohms |
| Maximum output level | +18 dBV |
| Output Impedance | 200 ohms |
| Dynamic Range | 110 dB (active channel) |
| Noise at unity gain | -92.7 dBV |
| Isolation between input channels | >100 dB at 1 kHz. |
| Turn off/on impulse noise | < -60 dBV |
| Power consumption | 23 Watts Maximum |
| Power requirements | 85 - 264 VAC, 23W 50/60 Hz |
| Internal Mains fuse | 0.5 amp fast blow |
| AC dropout voltage | 85 VAC |
| Emissions of RFI | Compliant with FCC Part 15 Class B |
| Size 5.1PAR | 19”w x 1/75”h x 8.5”d  6.8 lbs. |
| Size 5.1 PAC | 6.5”w x 2.3”h x 4.5”d  1.8 lbs. |
| Shipping Weight - 5.1PA | 13 lbs. |
| Ship Wt.- 5.1PA with Dsub | 18 lbs. |

### UNPACKING

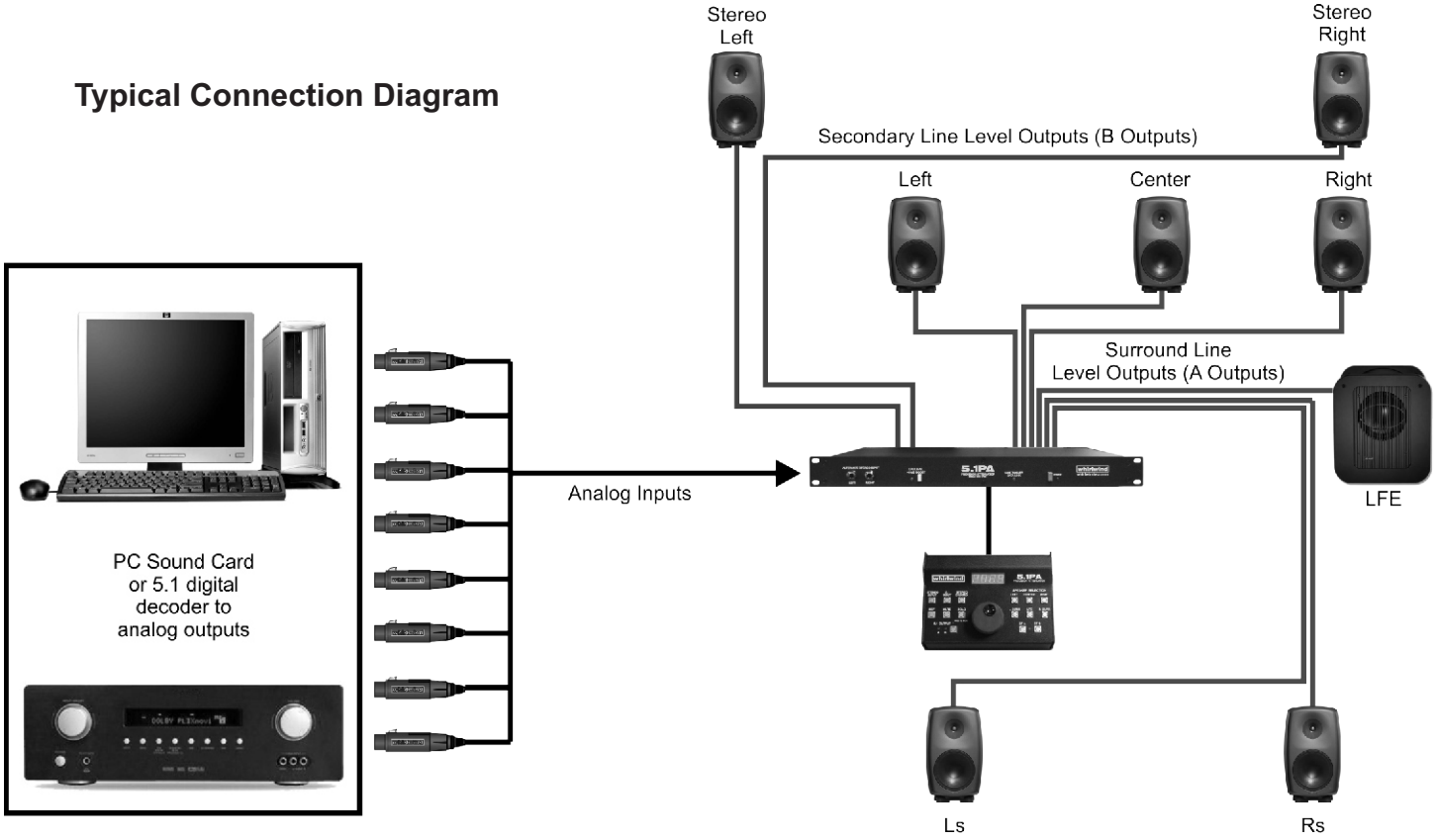
Whirlwind has made every effort to ensure that your equipment is received in the same perfect condition it was when it left the factory. Please inspect your product for any signs of damage during shipping and report them to your dealer so that a claim can be made to the shipper. We recommend that you save your packing material for use in the unlikely event that you need to return your equipment for service.

## Additional Resources for 5.1 Surround Mixing and System Setup

Creating 5.1 surround sound mixes is somewhat more involved than mixing for stereo. Available on the whirlwind website,: *http://whirlwindusa.com/support/downloads/downloads* are materials by noted audio educator, Mike Sokol. These materials can be helpful in preparing for 5.1 surround and setting up the mixing environment. His paper entitled “Zen and the Art of Surround” is a good resource that describes methods of equipment setup and the basics of surround mix creation.

There are also several audio files provided which can be downloaded and used to assist in the setup and testing of the 5.1 surround monitoring speaker system. Instructions for burning the sample audio files to CD are also located there.

## Typical Connection Diagram




**WARRANTY**
This product is guaranteed to be free from defects in materials and workmanship to the original purchaser for a period of 2 years from the date of purchase. Should service be required, return the unit postage prepaid along with the original sales receipt to:

Whirlwind
Attention - Repair
99 Ling Road
Rochester, New York 14612

The warranty on this product shall not apply to defects or damage resulting from abuse, abnormal use or from repairs or modifications performed by anyone other than Whirlwind. If it is determined a manufacturing defect has occurred, Whirlwind will repair or replace the unit at our option and pay the postage back to you.

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