BENCHMARK MEDIA SYSTEMS, INC.

ALM-110 Instruction Manual

1.0 Introduction
The following will familiarize the installer with the System 1000 and the ALM-110.

1.1 System 1000
The ALM-110 is one of a series of high performance modules, a series known as the System 1000. The systems concepts utilized with the System 1000 provides for the highest flexibility, a flexibility that is unparalleled in the industry.

1.2 ALM-110 Introduction
Specifically the ALM-110 is a 10-channel loss of audio alarm module, with variable level threshold and variable delay time before alarm activation. Ten LEDs provide front panel indication of the status of each alarm channel. The module features a single buffered logic output per audio input, with ground being the 0 (audio present) state and +12 Volts being the 1 (loss of audio alarm) state. Additionally each module has an "ORed" output that will go high when any of the ten alarm signals goes high. The "ORed" logic section has an external input so that the "ORed" outputs of additional modules may be daisy-chained providing single indication with the loss of any from a virtually unlimited number of monitor channels.

2.0 Unpacking
Care has been taken in packing the ALM-110 system to assure it will withstand normal shipping conditions. Examine the equipment carefully, as it is unpacked. If the shipping carton appears to have been damaged and if there are signs of physical damage check the equipment and immediately notify the carrier and Benchmark Media Systems.

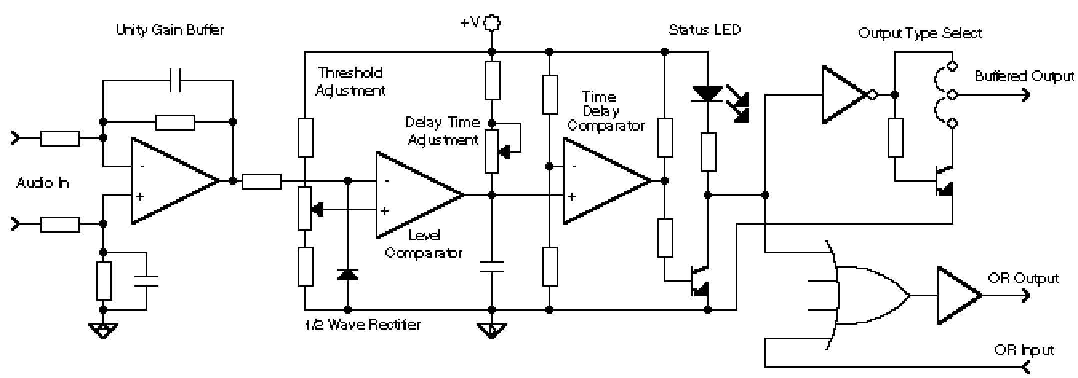

Fig 1.1 ALM-110 Block Diagram

3.0 Installation
The installation of the ALM-110 is a simple matter of placing the System 1000 module frames in their proper location, inserting the ALM-110 modules into their companion frames, making

the input and output connections and adjusting the level threshold and delay time at each channel for the conditions of use.

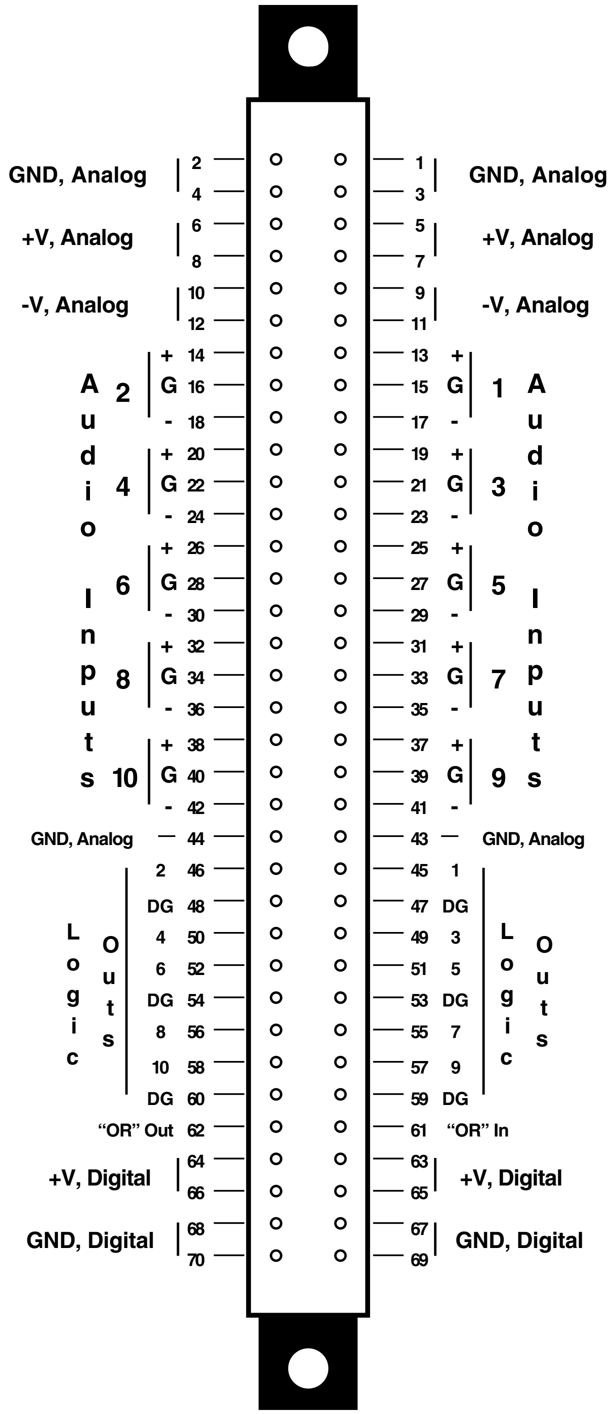

Fig 3.1 Card Edge Connector

3.1 Input Connections

Audio input is made via the card edge connector at the pins labeled inputs 1 through 10 on the connector nomenclature. Please note that there are ten balanced inputs on the module, and that they are spaced vertically. The various interconnection points are shown in figure 3.1, the ALM-110 Card Edge Connector (as seen from the rear of the card frame).

3.2 Output Connections

Both the individual logic outputs and the "ORed" output are taken from output positions as labeled. Since the outputs are fast rising logic level signals, care should be exercised in the routing of logic cabling near high quality audio inputs. Belden 9000 Series low capacitance shielded data cable is recommended to route these logic signals.

3.3 Connector Assembly

Either AMPMODUE or preferably the Molex™ SL (because of their physical size) series pins and housings should be used for all connections to the pins of the card edge connector. The Molex™ pins and housings are available from Benchmark Media for these interconnections. Wire wrap is an alternative and while it is not flexible in terms of changing the system while in operation, wire wrap has shown itself to be an extremely reliable form of connection.

When used with the System 1000 the SL connectors are generally made up as either two or three pin configurations. Larger connector assemblies may be made, but since the female pins are not zero insertion force type, you may find it difficult to attach the completed connector assembly to the card edge connector posts. On the other hand, if a condition exists that would allow a three pin connector assembly to be inadvertently pulled off the card edge connector, then the added retention strength of a large assembly may be preferred. Large assemblies, however, have the disadvantage of not allowing additional wiring to the module position while the module is in use, whereas three pin assemblies may be added at any time.

The three pin audio signal connectors also have the advantage of being able to be physically inverted, effecting a polarity reversal of the signal. This is easily accomplished since we have purposefully placed the ground (shield) of the cable as the center pin of the assembly for this very purpose.

The following are part numbers for the recommended Molex connector parts.

2 pin housing	50-57-9002
3 pin housing	50-57-9003
Individual pins	16-02-0102
Crimp tool	11-01-0118

Follow the directions that came with the crimp tool you purchased for the specifics of the connector pins to be used.

Crimp tools are now available for rent, please check with the sales department for rates.

3.4 Additional Installation Points

The following points should be considered in the installation and operation of the ALM-110.

1. Unused channels must be tied to an audio source when using the "ORed" outputs.

2. The inputs are standard differential amplifier circuits, therefore when connecting them to unbalanced outputs, the unused input leg must be tied to ground to ensure normal gain and thus proper calibration. We suggest using the "forward referencing" technique outlined in the Benchmark Media application note A Clean Audio Installation Guide.

3. Always use a well thought out grounding scheme with the System 1000. The techniques found in "A Clean Audio Installation Guide" should to be applied for best results.

4. It is desirable to label the channel functions at the LEDs on the inside of the front panel. We suggest printing the channel titles either with typewriter or laser printer. Cut the page segment to fit the inside of the front panel. Next coat the top surface (information side) of the printout with a rubber cement used by paste-up artists, known as One Coat. This product is available at commercial art supply stores. A slightly thin coating is preferable to a thick coat. Allow the cement to dry for approximately 10 to 15 minutes. Carefully position the legend in its proper location and firmly press into place. It is helpful to remove the plastic front panel and place it on a firm surface, then using a hard rubber roller apply pressure to the legend to create as uniform an adhesion as possible.

4.0 Specifications

Board Size:	100 x 220 mm EuroCard - 70 Pin Edge Card connector.
Input Threshold:	-20 to +8 dBu (adjustable).
Input Impedance:	100 kΩ balanced.
Time Delay:	10-45 Seconds (adjustable), longer times available on special order.
Outputs:	10 buffered CMOS logic or open collector outputs (1 per channel); 1 "OR" function logic output.

Alarm: 0V (GND) = safe state; +12V = alarm state.

Alarm Indicators: 10 Red LEDs, one for each channel.

5.0 Operation

This section provides a description of the operation of the ALM-110

5.1 General Operation

The operation of the ALM-110 is quite intuitive. However the following items may not be immediately apparent.

There are five groups of components that each make up two channels of alarm. With the module oriented such that the LEDs are to the Left and the card edge connector is to the right, the groups are staggered such that channels 1 and 2 are at the top left of the module, channels 3 and 4 are toward the card edge connector and "half a group" lower. Channels 5 and 6 are again "half a group" lower and in line vertically with channels 1 and 2, etc. The potentiometers below are shown at their center positions.

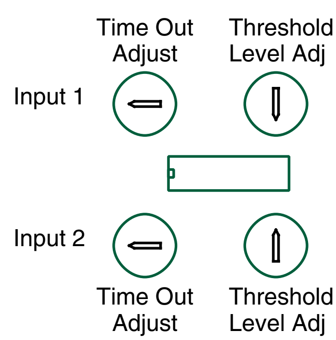

Fig 5.1 Adjustment Potentiometer Locations

5.2 Setting Levels Thresholds

The setting of the input threshold should be performed with the use of program material and an audio level meter. Feed the standard program material to the input of the ALM-110 channel under adjustment at the desired threshold level as determined by the audio level meter. For instance, if the desired threshold were say 0 dBu, (the factory default setting), -4 VU as read on a standard volume indicator, then this would be the signal level to be fed to the channel under adjustment.

With the aid of an EX-01 extender card, adjust the level threshold potentiometer to its full clockwise position and observe that the associated red LED turns on after approximately 6-7 seconds. Next, slowly adjust that potentiometer in the opposite direction just until the LED extinguishes. This is now the correct setting for the level threshold adjustment. If you must do this adjustment using continuous tone as a signal, allowance must be made for the 8 dB peak to average ratio that exists between peak and average levels in program material. The detector in this circuit is a peak type whereas the VU meter is a quasi-average measuring device. It is necessary therefore to feed a tone to the system that is 8 dB higher in level than program material.

If you will not be changing this threshold, it may be advisable to seal the adjustment with an anti-tamper product called torque seal. This is available from Organic Products in Irving TX. This day glow orange material shows any tampering that has taken place with the adjustments. Red nail polish is a more permanent substitute. It is also much less desirable, as it usually runs inside the potentiometer preventing re-adjustment at a later date.

5.3 Setting Alarm Delay Time.

Apply an adequate level to the channel under adjustment in order to exceed the level detection threshold. This will extinguish the LED. Remove the input signal and start a timer to determine the time out of the circuit. Adjust the time delay potentiometer until the desired time delay is achieved. This may take 3 or 4 iterations to achieve.

5.4 Logic Scanning

Scanning the individual logic outputs and feeding that status information to a PC can provide a fast way of locating a fault in an audio chain. A program written for the purpose would then display the status of each individual channel or when a channels alarm came on the monitor could flash a warning and the identity of the faulty channel.

5.5 "ORed" Output

The ORed output is a logic output that will be true (1) with the loss of audio for any of the 10 channels on the module. This circuit is included to allow the creation of simple alarm systems that will sound a bell, light lights, etc., when any one of the signals that were being monitored lost their audio. The "ORed" output of one module may be "looped through" and added as a source to the "OR" circuit of another module in a daisy chain fashion. Hence, the final "ORed" output of the last module in the chain will be monitoring all of the previous modules. There is no limit to the number of channels that can be monitored, with one alarm for all, using this method.

5.6 Monitoring a Critical Chain

In applications where the loss of a chain could cost significant amounts of money or even possibly is life threatening, it is advisable to monitor the output of every piece of equipment in that chain. The ALM-110, with its high density is well suited for that job. For instance, in the broadcast environment, the audio chain that comprises the "On Air" audio, is the most costly in terms of loss. Dedicating a module or two to monitoring the output of every device in such a chain will allow the instant isolation of a problem circuit. The LED indicators give visual indication as to where in the chain the audio stopped. Equipment can then be bypassed or substituted at the patch bay, almost instantly. Even further, redundant chains can be configured, and the logic output can be used to actuate automatic switching between systems, or even to the individual equipment level. With the cost of "make goods" and loss of good will, time is of the essence.

Once again one or two modules may be coupled through the "ORed" output circuit to provide a simple alarm system to monitor the chain.

5.7 Input or Output Monitoring

The degree of sophistication in the monitoring is limited only to budget and wiring constraints. For instance it is possible to monitor the input and the output of each piece of equipment, thus proving the wire path in between the various pieces of equipment as well.

6.0 ALM-110 Alarm Circuit Description

The following is a generally complete description of the circuitry comprising the ALM-110 preamplifier.

6.1 General

Except for logic circuitry that is common, each of the 10 channels are identical and the circuit description will apply equally to each channel.

6.2 Input Stage

The input stage of the ALM-110 is a standard differential amplifier, that operates at unity gain and has a differential input impedance of 100 kΩ. No common mode trims are provided, in that the minimum signal level of concern is ≈-20 dBu, and even at worse case, common mode rejection is 28 dB. Capacitive feedback compensation is added to give the alarm a cutoff frequency of 21.3 kHz.

6.3 Rectifier

A half wave rectifier follows that is simply a small signal diode, being feed from the 10 kΩ source impedance. This clips the negative going signal at -0.7 volt and prevents destructive negative voltages from being placed on the inverting input of the comparator.

6.4 Level Threshold Comparator

One quarter of a quad level comparator is used to detect the input level of the rectified audio. A voltage divider string places a pre-determined DC voltage on the non-inverting input of the comparator. When the half wave rectified audio's peak voltage exceeds that of the voltage divider string, the comparator trips and turns on the open collector output transistor at the output pin. When in the ON state, the comparator discharges any charge in the time-out capacitor, thus resetting the time delay to zero. With normal audio this happens on a regularly occurring basis. I.e., audio stops for a brief moment, and the RC network starts its charging cycle. The instant audio reappears, it causes the first comparator to discharge the 10 µF capacitor, forcing the time-out to start over.

6.5 Delay Comparator

The second comparator in the string, in essence, is waiting for the voltage on the capacitor to reach the threshold set by it's associated voltage divider string. When that happens, audio has been absent from the channel for the time that it takes to reach the threshold voltage. The threshold voltage chosen for this comparator is very close to 63% of the power supply voltage that powers the circuit. Significantly, this is equal to the voltage that an RC network will reach in one time constant after the application of a step function. The purpose of choosing this value is to facilitate the calculation of the time out range for this network, where one time constant TC = R•C. For instance, with the choice of a 1 Meg Ω resistor and a 10 µF capacitor, TC = 10 seconds, with the voltage on the capacitor reaching 63% of its final value in that amount of time, precisely the trip voltage of the comparator. If a time out of 47 seconds were needed, this then could be easily accomplished by the choice of a 4.7 MΩ resistor and a 10 µF capacitor, or a 10 MΩ resistor and a 4.7 µF capacitor.

6.6 Indicator LED

Once time out has occurred, a method of indicating such is necessary. With the ALM-110 two methods are in use. First, a red LED at the front edge of the module turns on to indicate the alarm status of the channel. Secondly, a logic level voltage is sent to the rear of the module for detection by external circuitry.

The LED is driven by a transistor driver, an inverter, allowing the comparator's open collector output to "turn off", that is "go high" for a loss of audio indication.

6.7 OR Circuit

Each of the comparator outputs feeds two CMOS devices. One is a buffer for individual output indication, the second is an "OR" circuit. The "OR" circuit gives a true (+12 volts) output when any of the inputs is in that same (alarm) state. The output of the buffer is fed to a buffer stage providing a high current output

6.8 Buffer Outputs

As the comparator output goes high, it drives the buffer output to a high state. The buffer, is not an open collector type. It has an active pull-up transistor, and must be interfaced accordingly. It is also a high current type and is capable of driving standard TTL loads.

7.0 Trouble Shooting and Repair

The ALM-110 was designed and manufactured to the strictest commercial standards. As such the probability of failure is very small. However should you experience difficulty the following procedures should be employed.

7.1 Troubleshooting Techniques

Armed with the knowledge of the circuit descriptions given above, standard trouble shooting techniques should be used to determine first the general area of malfunction, and then more specifically the actual offending components. A review of the most basic of these techniques follows.

1. It is best to trouble shoot a module at a workbench using current limited lab power supplies. Set the current limiting of the power supplies to 150 mA for the analog supplies and 100 mA for the logic supply. This will protect the module and still allow the location of failures to be made.
2. Since most failures are catastrophic in nature rather than a gradual degradation of performance, make a close visual inspection of the module for any discoloration of components and possible shorts on the PC board itself. Discoloration would indicate excessive heat, most likely from a component failure. Remove any component that has obviously failed, i.e. carbonized resistors or IC packages that are cracked.

3. If fuses are blown, replace them and power up the module. If there are short circuits on the module the current limiting of the power supplies will prevent any further failures, and the current limiting of the power supplies will show the presence of a short. Allow the module to operate in this condition.

4. Look for any components that are operating too hot to the physical touch. This will show where the shorts are when there is no physical symptoms. Typically one can just keep their hand on a surface at 130° F.

With one exception, that of the discontinued PS-101, all of the components of the System 1000 are meant to operate at temperatures lower than this.

5. Remove any components, i.e. transistors or integrated circuits that are experiencing overheating. Most often at this point the power supplies will come out of current limiting, and the module will function in part. If further problems exist after the power supplies come out of current limiting, they can most often be found by performing voltage checks through the circuitry.

7.2 Circuit Board De-Soldering

Printed circuit boards are <u>very</u> easy to damage by excessive heat. Unless you have developed the specialized skills necessary to remove and replace components, we suggest that you leave the task to someone skilled in these techniques.

When servicing printed circuit boards we strongly recommend the use of a vacuum de-soldering station, such as the Pace MBT-100.

The proper technique with these stations is to apply the tip to the area to be de-soldered and wait for the solder to thoroughly melt. You can be sure of a thorough melt by observing the top side of the board. <u>When</u> the solder there has become liquid, apply the vacuum while moving the hollow tip with the component lead in a circular motion. By rotating the lead, with the tip against the board, but <u>without</u> applying pressure to the pad, you are able to most thoroughly remove solder in the plated-through hole. In turn the component will often drop out of the board when you are finished.

If the solder is not thoroughly removed from the plated-through hole, attempting to remove the component will bring with it plating from inside the hole. This may destroy the usefulness of the board. If you find that your attempt to completely remove the solder from the hole and pads has failed, do not attempt to re-heat the area with the de-soldering tool, as this will <u>overheat</u> the pad, and not the area that is in need. As a result the board is usually damaged. Rather, re-solder the joint, and then go back and apply the proper technique, by allowing the solder in the joint to thoroughly melt <u>before</u> applying vacuum. This technique uses new solder as an efficient heat conductor to the total area, eliminating hot spots.

7.3 Circuit Board Re-Soldering

NASA has developed an effective technique that ensures highly reliable solder joints. It involves first heating the component lead, since it usually has the higher mass, by applying a small amount of solder to the tip of the soldering iron at almost the same time as you apply the iron to the component lead. This will allow some flux to make it to the component lead. The iron should be approximately 1/8" above the board. When the lead has come up to temperature so that it melts the solder when placed against it and has good wetting, slide the soldering iron down the lead and heat the printed circuit board pad while applying a controlled amount of solder to the joint. All of this should take no more than a couple of seconds. If the component that is to be installed has leads that are oxidized, it will be necessary to clean them. This may be done with either a Scotch Bright® abrasive pad or fine bristle fiberglass brush, among other methods.

This completes the ALM-110 Instruction Manual   Ed. 7/13/2000

BENCHMARK MEDIA SYSTEMS, INC.
5925 Court Street Road, Syracuse, NY 13206-1707
(315) 437-6300, FAX (315) 437-8119