

FSR

BMS 1032

BACKGROUND MUSIC SYSTEM

INSTALLATION and OPERATING MANUAL

PROPRIETARY INFORMATION

All information in this manual is proprietary to and the property of FSR inc.

This publication is protected by the Federal Copyright Law, with all rights reserved. No part of this document may be reproduced, transcribed, or transmitted, in any form or by any means, without prior explicit written permission from FSR inc.

43831

244 Bergen Boulevard, West Paterson, NJ 07424 Tel 973.785.4347 Fax 973.785.3318
E-Mail sales@fsrinc.com Web www.fsrinc.com

CONTENTS

Operators Safety Summary.....A-1

Introduction.....1-1

System Components.....2-1

Equipment Placement.....3-1

Cabling.....4-1

Grounding.....5-1

System Specifications.....6-1

Operation.....7-1

Overview.....7-1

Programming.....7-3

Audio Calibration.....7-6

OPERATORS SAFETY SUMMARY

The general safety information in this summary is for operating personnel.

Do Not Remove Covers or Panels

There are no user-serviceable parts within the unit. Removal of the top cover will expose dangerous voltages. To avoid personal injury, do not remove the top cover. Do not operate the unit without the cover installed.

Power Source

This product is intended to operate from a power source that will not apply more than 230 volts rms between the supply conductors or between both supply conductor and ground. A protective ground connection by way of grounding conductor in the power cord is essential for safe operation.

Grounding the Product

This product is grounded through the grounding conductor of the power cord. To avoid electrical shock, plug the power cord into a properly wired receptacle before connecting to the product input or output terminals. A protective-ground connection by way of the grounding conductor in the power cord is essential for safe operation.

Use the Proper Power Cord

Use only the power cord and connector specified for your product. Use only a power cord that is in good condition. Refer cord and connector changes to qualified service personnel.

Use the Proper Fuse

To avoid fire hazard, use only the fuse specified on the rear panel for this product and having identical type, voltage rating, and current rating characteristics. Refer fuse replacement to qualified service personnel.

Do Not Operate in Explosive Atmospheres

To avoid explosion, do not operate this product in an explosive atmosphere.

INTRODUCTION

This BACKGROUND MUSIC SYSTEM (BMS 1032) was developed to answer the need for a digital high quality stereo sound distribution along with reliable paging. This system works in conjunction with all commercial systems such as AEI, DMX, Muzak, etc. as well as any audio sources including CD's, radios etc.

Using this system, a customer can select among 10 stereo audio sources from an elegant wall plate located in each room. The system is designed for "sky boxes", luxury suites: small salons, professional offices (doctors, lawyers, commercial suites); cruise ships; and just about any space that requires a selection of multiple background music sources as well as paging.

All of this capability is installed with just a single Category (Cat) 5 cable run from the head end to each of the possible 32 rooms.

The system consists of the following equipment;

1. A rack or shelf mounted chassis 2 rack units high (3.5"). This chassis contains all the control circuitry and the main stereo audio input. It has mounting space for up to 8 stereo output modules, each module capable of supplying 4 rooms.
2. A number of output modules depending on the order requirement.
3. A stereo audio control panel (2 gang)
4. A power supply for the main chassis

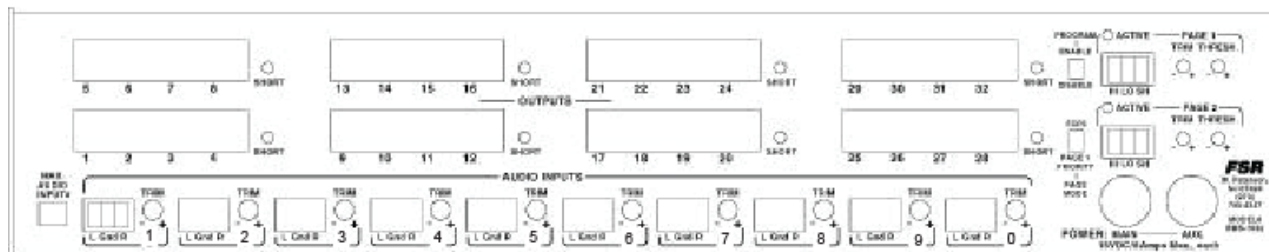
System features include:

1. Category 5 interconnect cabling.
2. A page override system functions at a user defined volume level independent of wall plate settings.
3. Digital transmission of stereo audio to all rooms (up to 32 rooms per system).
4. Two gang wall plate in each room, controls volume, channel selection, and page programming.
5. The wall plate outputs stereo line level audio to the contractor supplied powered speakers or local amp and speaker (8 ohms only) system in each room.
6. A local audio input (personal CD player or VCR) can also be connected in each room and selected from the wall plate. The wall plate can control volume of the local device and still allow paging through the speakers, even when the music is turned off.
7. Headphones can be connected to the wall plate. when headphones are connected, the other speakers are silenced. However, paging still will go through the speakers, and line output, as well as the headphones.
8. UL approved

SYSTEM COMPONENTS



Background Music System Front View



Background Music System Rear View



Background Music System Wall Plate

EQUIPMENT PLACEMENT

The main BMS unit should be mounted in the rack if the particular installation has one, otherwise place this BMS unit on a shelf or table. This unit must be accessible to the various program inputs, as well as the paging system.

All Cat 5 cables are run from this BMS unit to the individual wall plates located in the various rooms or locations.

The included wall mount power supply mounts in the rear of the rack (if the unit was rack mounted), or it should be located close to the shelf or table location.

The wall plates mount in a standard 2 gang electrical box (min. depth 3 inches) and are connected to the cable already pulled. Refer to the section on wall plates to determine proper hook-up.

CABLING

WALL PLATES

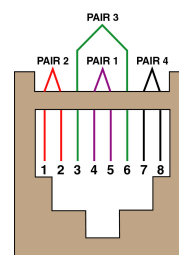
The wall plates are wired in a home run (star) configuration. One is installed in each room and is wired to the BMS. The wall plates mount in a standard 2 gang electrical box.

Use standard Cat-5 cable (four twisted pair 24 AWG solid, shielded). Use Belden 1584A or equivalent. The home run distance to any wall plate should not exceed 1000 feet. If 8 ohm speakers are going to be directly driven from the line out on the wall plate then the maximum cable distance should not exceed 500 feet.

Refer to the figure for the chassis terminal identification.

The Cat-5 connectors should be terminated to correspond with this figure.

Pair 1	White/Blue	(4) (Green)	Blue/White	(5) (Red)
Pair 2	White/Orange	(1) (Black)	Orange/White	(2) (Yellow)
Pair 3	White/Green	(3) (White)	Green/White	(6) (Blue)
Pair 4	White/Brown	(7) (Orange)	Brown/White	(8) (Brown)



All these Cat-5 cables are wired straight thru (pin 1 to pin 1 etc.).

The audio connections from these wall plates are detailed on the next page.

MAIN UNIT

There are two sets of audio inputs to the main unit, program audio (music sources) and line level mixer inputs that carry the paging audio source.

The program audio inputs are three terminal pluggable screw connectors. They accept stereo audio and are wired with H the high side and GND the shield of the cable for both left and right input connections. These are unbalanced inputs.

The mixer inputs (page audio) are balanced inputs and are wired with the Red wire to H, the Black wire to L, and the Shield to SH.

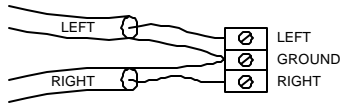
POWER SUPPLY (S)

Either one or two power supplies will be supplied with the system. Only one supply is required if the system will only use either the headphone outputs and/or the line level outputs. If the installation calls for a direct speaker hookup then the additional supply will be required if the rooms serviced exceed 16.

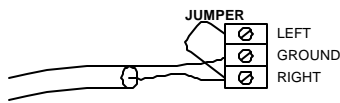
CHASSIS AUDIO CONNECTIONS

BACKGROUND AUDIO INPUTS

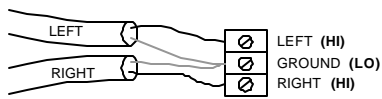
STEREO AUDIO INPUT - UNBALANCED CONNECTIONS



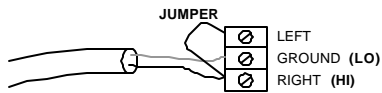
MONO AUDIO INPUT - UNBALANCED CONNECTIONS



STEREO AUDIO INPUT - BALANCED CONNECTIONS

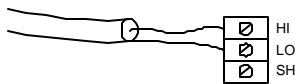


MONO AUDIO INPUT - BALANCED CONNECTIONS

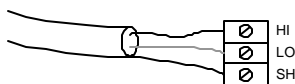


PAGE AUDIO INPUTS

UNBALANCED CONNECTIONS

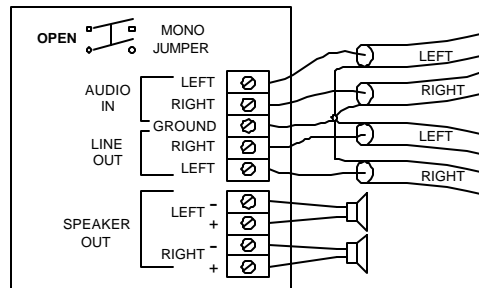


BALANCED CONNECTIONS

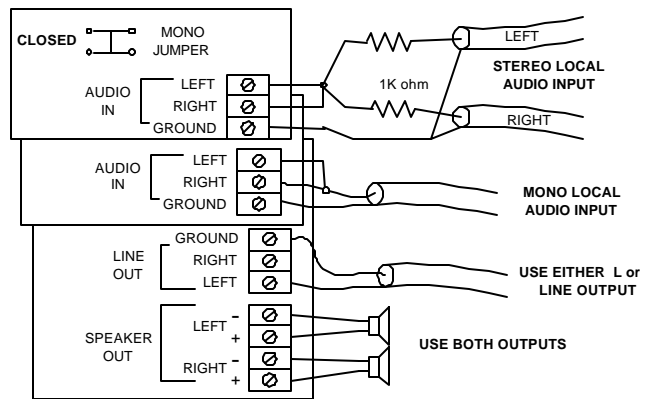


WALLPLATE AUDIO CONNECTIONS

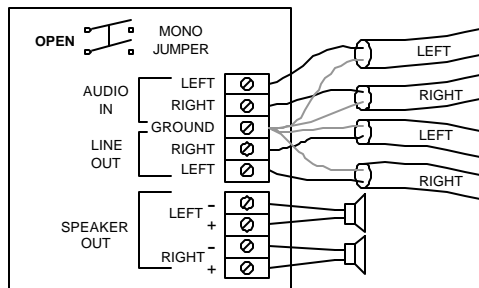
STEREO AUDIO OUTPUT - UNBALANCED CONNECTIONS



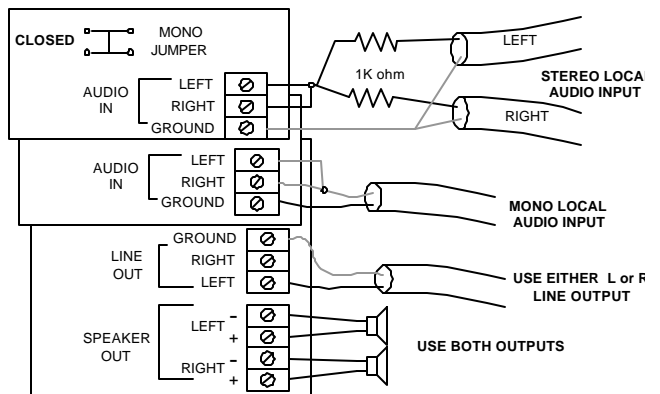
MONO AUDIO OUTPUT - UNBALANCED CONNECTIONS



STEREO AUDIO OUTPUT - BALANCED CONNECTIONS



MONO AUDIO OUTPUT - BALANCED CONNECTIONS



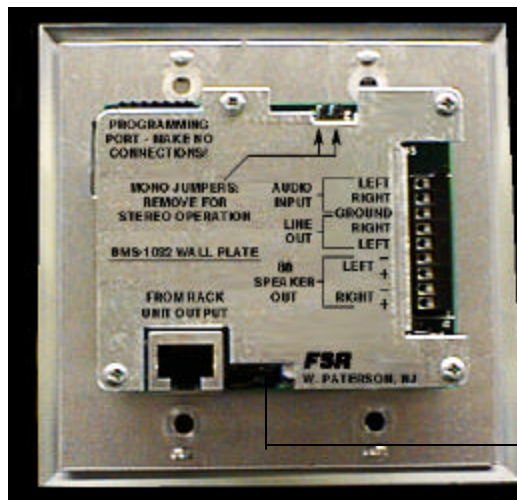
GROUNDING

It is strongly recommended in any rack setup to ensure appropriate power application as well as superior power surge protection, the FSR Power Conditioning and Sequencing (SPC) System be utilized.

The BMS System, along with the associated program inputs, is an audio system of some complexity and requires a proper grounding procedure be followed.

WALL PLATE GROUNDING CONSIDERATIONS

In order to prevent damage to the BMS system from ESD (Electro-Static Discharge), it is incumbent upon the installer to carefully consider the grounding of the system. Since the BMS is a digital/audio hybrid, proper ground is essential to maintaining audio quality while preventing damage to the electronic circuitry.



Rear of BMS Wall plate

GROUND JUMPER

The BMS wall plates should be grounded to prevent damage due to ESD events. The best way to guard against ESD damage in any system is to return the charge to ground by the shortest path possible. A direct connection between the wall plate and conduit ground is the most desirable method.

The BMS wall plates are provided with a ground jumper to allow the installer to connect or disconnect the metal of the wall plate from the DC ground of the wall plate electronics. If the electrical mounting boxes are already grounded, this jumper should be disconnected to prevent a ground loop. In systems that do not have grounded electrical boxes, the ESD ground path is through the shield and/or power ground pair conductors of the recommended cable to the chassis of BMS rack unit.

MAIN UNIT

The Main Unit is connected to ground either through the rack or the plug-in power supply that is supplied with the unit.

TECHNICAL SPECIFICATIONS

MAIN UNIT

Music Audio Inputs:

Input Type: Stereo Unbalanced

Input Impedance: 10k ohm

Nominal Input Level: 0dBV/0.775 VRMS

Max Input Level Before Clipping: +12dBV/2.9 VRMS (with trim control set to unity)

Input Trim Control Range: -20 to +6dB

Crosstalk: -95dB

Max Number of Inputs: 1-10 user selectable via rear panel rotary selector plus 1 local input at wall plate,.

D/A converter performance:

Resolution: 18 bits

Sample rate: 44.1k samples/second (CD quality)

Dynamic range: 94 dB

Conversion Method: 128x oversampling delta-sigma modulator with digital anti-alias filtering

Audio Transmission Method:

AES-3 digital encoding

Page Audio Inputs:

Input Type: Mono Balanced

Input Impedance: 20k ohm

Nominal Input Level: 0dBV/0.775 VRMS

Max Input Level Before Clipping: +12dBV/2.9 VRMS (with trim control set to unity)

Input Trim Control Range: -20 to +14dB

Crosstalk: -85dB

Page Detection Threshold: -25 to -5 dBV (this is the level required to trigger a page with trim set to unity)

Page Detection Delay: 50 milliseconds max

Page Hold Time: 2 seconds (internally adjustable from 0.1 to 8 seconds)

Number of Page Inputs: 2, may be enabled in any combination by programming each wall plate.

WALL PLATES

Volume control range: -40 to 0 dB

Local Audio Input

Local Input: Stereo Unbalanced

Local Input Gain: 10dB fixed

Nominal Local Input Level: -10dBV/0.25VRMS

Max Local Input Level: +2dBV/1.0VRMS

Audio Output

Line output: Stereo Unbalanced

Gain: Unity with respect to rack audio inputs, when rack trim control is set to unity and wall plate volume is set to max.

Distortion: 0.065% @ 1 VRMS, 1kHz, 1 k load wall plate volume max. (typical)

Speaker Output:

Power: 0.75 watts/channel RMS 2.5 watts/channel music power.

Speaker Impedance: 8 ohm recommended

Distortion: 0.3% @ 0.75 watts into 8 ohms 20Hz-20kHz.

Mono Jumper:

When installed, sums left & right rack audio, and feeds it to both left & right outputs. Local inputs remain stereo- bridge them separately for mono operation.

Headphone Output:

1/8" jack provided for connection to 16-32 ohm headphones. Headphones are automatically sensed, and disable line and speaker outputs when plugged in. Page audio unconditionally overrides this feature re-enabling all outputs for the duration of the page.

Mechanical:

Main Unit

Size: 19 inches wide, 3.5inches high (2 RU), 12 inches deep

Mounting: Standard rack mounting

Wall Plates

Size: 6 1/4 inches wide by 4 1/2 inches high, approximately 2.5 inches deep

Mounting: fits standard 2 gang electrical wall box with four screws

Switches: membrane

Connector: RJ 45

Cable: 4 pair 24 awg solid Cat-5 shielded cable, Belden 1584A or equivalent.

Power Supply (supplied with system)

Size/Mounting: Wall mount

Input power: auto ranging 100 - 120 Vac / 200 - 240 Vac at 3.2 Amps

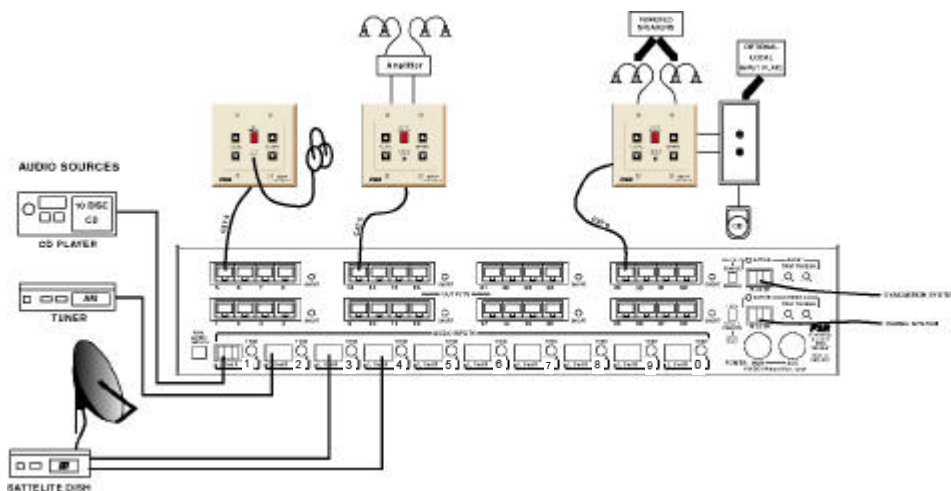
Interconnect: 8 foot cable supplied, 5 conductor stranded

OPERATION

OVERVIEW

The purpose of the BMS is to distribute very high quality audio from various sources as well as controlling the source selection and volume from each plate located in the rooms. Another feature of the BMS is the paging function which qualifies the BMS as Life/Safety compliant.

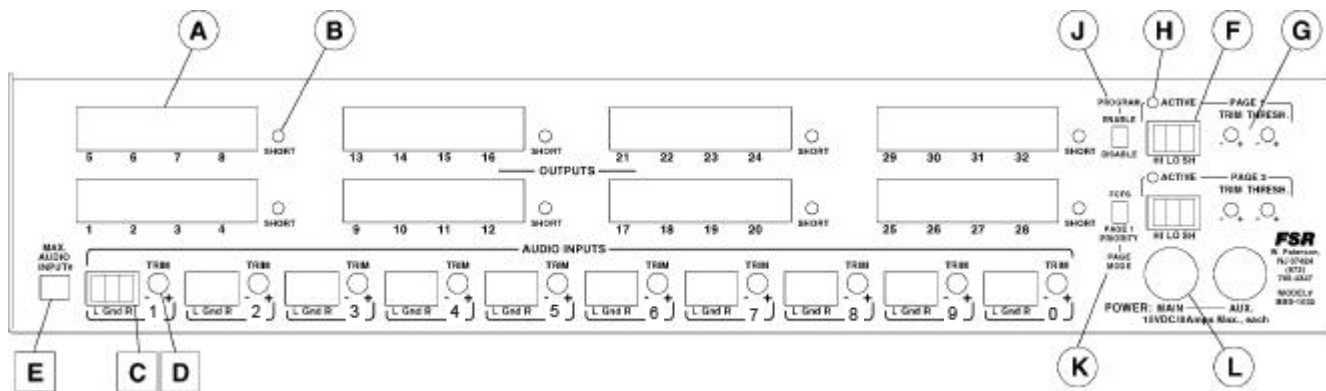
A hookup diagram of the system follows;



Main Unit

The front panel of the BMS only contains a power on LED, which illuminates when the main power supply is on.

The rear panel of the BMS contains all inputs and outputs as well as level adjusts for incoming audio and page signals and other items explained below;



A. These openings house the output modules. The BMS is shipped with the appropriate number of output

modules installed (if 18 rooms were required then there would be 5 output modules installed).

The output connectors are RJ45 and their pin outs are fully described in the Section on Cabling. There are two jumpers to configure, upper or lower tier on each module. These are already configured before shipment and need no further adjustment.

B. This is a red LED and it will illuminate whenever there is a power short in any of the four output cables connected to that output module. Please refer to the cabling section for proper wiring of the CAT-5 connectors.

C. This is one of ten input connectors for the incoming audio. It is a screw terminal pluggable connector, speeding installation and ensuring a durable trouble free termination of the audio cable. Please refer to the cabling section for proper wiring of the audio connectors.

D. This is trim control to adjust the level of the incoming audio.

E. Max Audio Input is a digital switch that establishes how many audio sources can be selected from the wall plate. If only 5 audio sources are available, then this switch would be set to 4 and the wall plate indicator would only go as high as 4 before it returned to 0.

F. Page audio input (one of two). It is a screw terminal pluggable connector and it is designed to accept a balanced line level input source, typically from a microphone preamplifier, mixer or telephone system.

G. There are two adjustments on each of the two page inputs. The trim adjust control is used to establish the typical operating level (see Setup Section). The threshold control is set so that any signal on the incoming line will automatically activate the page circuitry. This feature eliminates the need for a push to talk switch on the microphone or near the microphone.

H. A red LED will illuminate any time the associated page circuit is activated. This is basically an installation aid.

J. This toggle switch enables or disables the ability to program the wall plates. Typically after a system is installed and checked out this switch would be placed in the disabled position.

K. This toggle switch selects the type of page mode of operation that is desired.

FCFS (first come first served) automatically puts the first microphone to activate the page circuitry in charge. The second microphone will not interrupt it.

Page One Priority will let the page one microphone take over at any time it is activated.

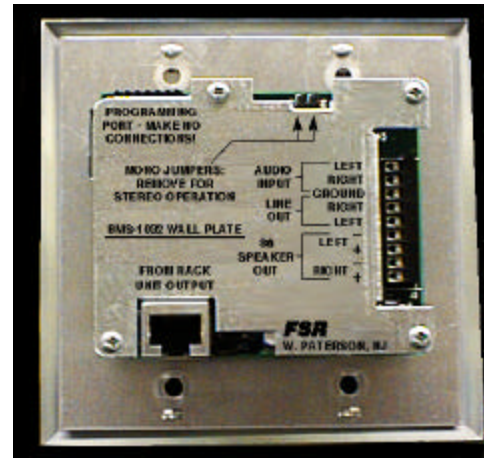
L. These two DIN type connectors are used to power the unit. One wall mount transformer will power a minimum of 16 rooms (all rooms using the speaker outputs in each room) or 32 rooms if only headphones and/or line level outputs are used (see section on cabling for more information).

Wall plate

These ergonomically designed wall plates mount in a standard two gang electrical box and operate the Background Music System.



Wall plate Front View



Wall plate Rear View

On the upper right of the wall plate rear is a jumper to select either mono or stereo operation for that wall plate.

The terminal strip on the far right provides connections for (top to bottom) a local audio source, such as a portable CD player. Next is the stereo line out terminals and last is the output to drive speakers without the use of an independent amplifier. Power is limited in this application but it certainly would be very appropriate to use this connection for a small office or waiting room.

The plug on the upper left is only used by the factory for initial programming. Do not connect anything to these pins.

The lower left is the RJ 45 connector that accepts the Cat-5 cable from the Main Unit.

The jumper next to this Cat-5 connector is a grounding option and is discussed in the section on Cabling.

PROGRAMMING

All programming for the BMS is done on the wall plate.

The FSR BMS Wall plates allow for user programming of the following four functions .

1 - PAGE enable/disable for PAGE ONE.

2 - PAGE enable/disable for PAGE TWO.

3 - PAGE VOLUME ON A SCALE FROM 0 TO 9.The PAGE VOLUME applies to the audio volume for both PAGES.

4 - LOCAL AUDIO SOURCE enable/disable.

There is a separate menu available for each when the wall plate is placed in the PROGRAMMING MODE. Once programming is complete the program enable switch on the rear of the rack unit should be set to "DISABLE".

ENTERING PROGRAMMING MODE AT WALL PLATE.

The simultaneous pressing of the VOLUME DOWN and the CHANNEL DOWN keys at the wall plate will cause the wall plate to enter the PROGRAMMING MODE, **if it is ENABLED at the RACK Unit**. If the wall plate is DISABLED the character "d" will be displayed for about one-third second, or as long as the user holds down the two programming keys.

ACCESSING THE PROGRAMMING MENUS.

When the PROGRAMMING MODE is entered initially it will immediately display Programming Menu 1 as; P 1 value where Value = 1 or 0. and 1 = enabled 0 = disabled. The characters "P 1" flash sequentially and the value is displayed for 2 seconds. This continues until one of five events occurs:

- 1 - the user hits the VOLUME UP key which toggles the value from 1 to 0 or 0 to 1,
- 2 - the wall plate "times-out" and exits programming mode after two minutes if no keys are pressed,
- 3 - the Wall plate enters the PAGING MODE,
- 4 - the user hits a menu scroll key(CHANNEL UP or CHANNEL DOWN,)
- 5 - the user hits the VOLUME DOWN and CHANNEL DOWN keys simultaneously to exit PROGRAMMING MODE.

MENU SCROLLING KEYS:

The CHANNEL UP KEY will cause Menu 2 for PAGE 2 to display as; P 2 value where Value = 1 or 0. The flashing sequence and duration of the display for PAGE 2 is the same as PAGE 1.

The scrolling sequence for the CHANNEL UP key is :

P1 (PAGE 1), P2 (PAGE 2), U (PAGE VOLUME), L (LOCAL).

The CHANNEL DOWN key operates to move in the reverse scrolling order, so that if Menu 4, LOCAL is displayed a CHANNEL DOWN key will cause Menu 3, PAGE VOLUME to be displayed.

DISPLAYING THE PROGRAMMABLE PARAMETERS.

The user may display all programmable parameters by using the scrolling keys, CHANNEL UP and CHANNEL DOWN to step through the menus without making any changes.

CHANGING THE PROGRAMMABLE PARAMETERS.

MENU 1, P1 (PAGE 1) when this menu is displayed the VOLUME UP key will toggle P1 from ENABLE = 1 TO DISABLE = 0 OR VISA-VERSA.

MENU 2, P2 (PAGE 2) this menu operates the same as MENU 1.

MENU 3, U (PAGE VOLUME) value can be changed by using VOLUME UP KEY to increase the value, or VOLUME DOWN KEY to decrease the value,

MENU 4, L (LOCAL) uses the VOLUME UP key to toggle between 1 = ENABLE and 0 = DISABLE.

EXITING THE PROGRAMMING MODE:

The PROGRAMMING MODE is exited by simultaneously pressing the VOLUME DOWN and the CHANNEL DOWN keys.

Upon exiting the programming mode, all menu settings are stored in a non volatile memory at the rack unit. Wall plate settings are stored individually for each room in the system. The factory default settings for all wall plates is P-1-1, P-2-1, U-5, L-0 (page 1 and 2 enables, page volume 5, local audio input disabled). If these settings need to be altered, it needs to be done on a room to room basis. Since the settings are stored in the rack unit, a single wall plate can be used to program the entire system by successively plugging it into each rooms' output jack. If a defective wall plate is replaced, no programming is required.

NOTE: The RACK UNIT does not update the programming information for a particular wall plate until the user exits PROGRAMMING MODE.

Once programming for all rooms is complete, it is recommended to set the program mode switch on the rear of the rack unit to "DISABLE".

WALL PLATE AND PAGING:

If a PAGE occurs while a user is in PROGRAMMING MODE at a wall plate, the wall plate displays a "P" and the keyboard is locked. When the PAGE is over the wall plate reverts to PROGRAMMING MODE at the menu displayed when the page occurred.

AUDIO CALIBRATION

Proper calibration of the BMS system is essential for best performance. The goal of the input trim calibration is to set the input gain stage to the maximum level before clipping, and to equalize the volume between all channels. It is at this point that the system delivers the best signal to noise ratio.

All of the source equipment, including any page sources, should be connected to the system before you proceed. To begin you will need a BMS wall plate, a set of headphones, a cat 5 cable to connect the wall plate to the rack unit, typical test media to be used with the audio source equipment (tapes, CD's, etc.), and a small screwdriver.

Start by setting all the trim pots to the middle of their range. Set the "Max Audio Input #" switch on the left rear of the rack unit to match the number of the highest input channel connected. For example, if the highest audio input used is 4, set the switch to 4. Connect the wall plate to the system using the cat 5 cable, and plug the headphones in. With all of the sources playing, and the wall plate volume set to a comfortable level, scan the inputs on the wall plate to find the loudest source. With the loudest source selected, increase the corresponding trim control to the maximum level before you hear distortion. Reduce the gain slightly. Make sure to listen to peaks in the program material for any distortion in order to set the level properly. If you anticipate louder media being used in the future, you may want to decrease the gain somewhat to allow for this.

Now scan the channels again to find the quietest source. Increase the trim control on this channel to match the perceived level of the previously adjusted channel. If the trim pot can't be set loud enough to achieve this, simply set it to maximum, and reduce the gain on the previously adjusted channel to match.

Continue in this manner with all remaining audio channels, until they are all adjusted to the same perceived level. The calibration of the Program Audio Inputs is now complete.

The next step is to calibrate the page audio levels in the system. Start by connecting the actual page audio source to Page Input 1. With a nominal page signal present, set the Page 1 trim control to be equal to the music channels. Compare the page level to the music level by turning the page source on and off. If you don't hear any paging, either the wall plate is not setup to allow paging (see wall plate setup instructions to enable), or the Page 1 threshold is set too high (turn threshold pot counterclockwise until the Page 1 Active LED lights.) Once you have set the Page 1 trim level, you can set the Page 1 threshold level.

The page threshold pot sets the trip level of the automatic page detection circuitry. If it is set too low, it will false trigger and interrupt the program audio. If it is set too high, the page will not be detected properly and may cut out during softer portions of a page. Once a page is triggered, it will remain active until page audio stops for at least 2 seconds. The page hold time pots located inside the rack unit control this time. Consult the factory if you need to alter this setting.

To set the page threshold level, make sure the page source is connected but inactive. Slowly turn the Page 1 threshold pot CCW until the Page 1 Active LED lights (if the LED does not light, don't worry, you just have a good low noise floor.) Note this position. Turn the threshold pot fully CW. Now with the page audio source active, slowly turn the pot CCW until the LED lights again. Note this position. Set the pot at the mid point

between these two extremes.

Repeat the trim and threshold setting procedures for Page 2.

The only other settings on the rack unit are the Page Mode and Program Enable switches. Set these switches to the desired modes as described elsewhere in the manual.

Detail of BMS 1032 Paging functions and troubleshooting

There are two Page inputs on the BMS-1032 rack that accept a balanced line level input from a mixer or telephone system. They are both 3 pin plug-able phoenix connectors located on the back of the BMS rack. The input impedance is 20k ohm. The input level should be 0dBV/ 0.775 VRMS. It is NOT a direct microphone input.

There is a paging mode switch located to the left of the Page 2 input connector. It is labeled "FCFS" or "Page 1 Priority".

FCFS- (first come first serve) enables the first audio input to lockout the other for the duration of the page.

Page 1 Priority- makes the "Page 1" input connector always override the "Page 2" input connector when a page on input 2 is present. Even if there is an active page on input 2, it will be muted during a "Page 1" input page giving Page 1 priority in this mode.

"Active" page led's- give visual indication of active page input. They are an aid to paging setup and troubleshooting. The indicators operate independantly of the wallplate settings and each other

Trim controls- Sets the paging levels and allows setting the paging equal to the music level

Treshold controls- sets the trip level of the automatic page detection circuitry.

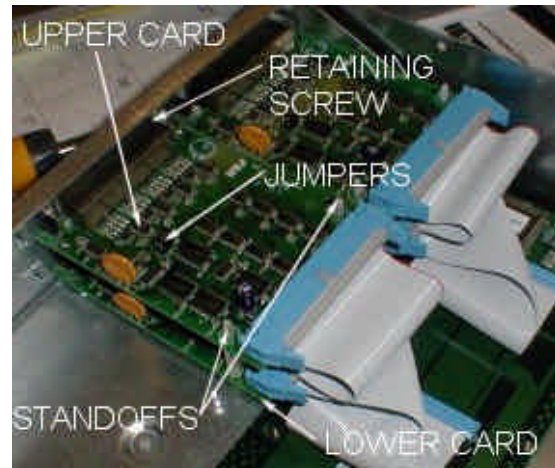
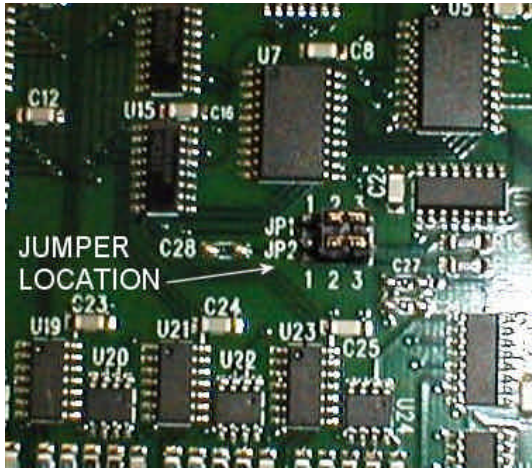
Individual room paging is enabled and disabled at each wallplate by programming.

Individual room paging volume is set by programming the individual wallplate.

All wallplate functions including programming are locked out during a page. A "P" will be displayed on the wallplates for the duration of the page.

FSR BMS-1032 BACKGROUND MUSIC SYSTEM

EXPANSION CARD INSTALLATION

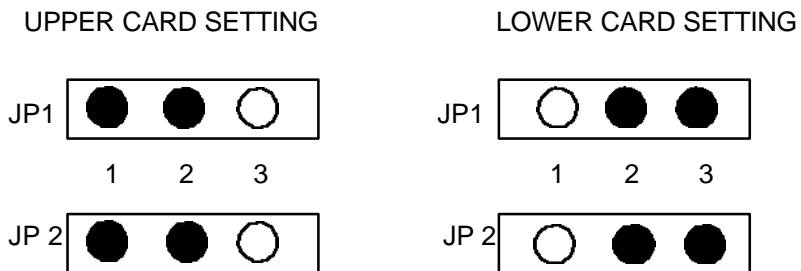


Remove the 10 top cover screws and top cover on the BMS-1032 controller to access the main chassis.

Remove the next blank cover plate in the numerical sequence by removing the two 6-32 cover plate screws.

There are two jumpers on each expansion card that identify whether it is an upper or lower board with respect to its position on the chassis.

Set jumper pins as indicated below:



Install plastic standoffs (supplied) if needed to mount the expansion board into the chassis. Install the expansion board by inserting the RJ45 jack array into the open slot and snapping the rear of the card onto the two standoffs. Replace one of the two cover plate screws in the left threaded hole to secure the new expansion board.

The ribbon cables are already installed on the BMS-1032 chassis.

The connector in the middle of the ribbon cable connects a lower card. The connector at the end of the ribbon cable connects to an upper card. Open the “ears” at the rear of the board and attach the appropriate ribbon cable to the board. Close the ears to lock the cable in place.

Repeat this procedure for each additional expansion card.

Install a “test” BMS-1032 wallplate into each of the new outputs to test the new card(s).

Replace the 10 top cover screws and top cover on the BMS-1032 controller to complete the installation.