Preliminary Operating Manual

Digital FM Stereo Encoder

Model 8208

orban®

IMPORTANT NOTE: Refer to the unit's rear panel for your Model #.

Model #:	**Description:**
8208/U2S	8208 Stereo Encoder, set to 230V (for 180-260V operation), switchable to 50µs or 75µs.
8208/E2S	8208 Stereo Encoder, set to 230V (for 180-260V operation), switchable to 50µs or 75µs.

Options Available:

Model #:	Purpose:

CAUTION: TO REDUCE THE RISK OF ELECTRICAL SHOCK, DO NOT REMOVE COVER (OR BACK).
NO USER SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.

WARNING: TO REDUCE THE RISK OF FIRE OR ELECTRICAL SHOCK,
DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE.

This symbol, wherever it appears, alerts you to the presence of uninsulated dangerous voltage inside the enclosure — voltage that may be sufficient to constitute a risk of shock.

This symbol, wherever it appears, alerts you to important operating and maintenance instructions in the accompanying literature. Read the manual.

Operating Manual

Digital FM Stereo Encoder

Model 8208

orban®

WARNING

This equipment generates, uses, and can radiate radio-frequency energy. If it is not installed and used as directed by this manual, it may cause interference to radio communication. This equipment complies with the limits for a Class A computing device, as specified by FCC Rules, Part 15, Subpart J, which are designed to provide reasonable protection against such interference when this type of equipment is operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference. If it does, the user will be required to eliminate the interference at the user's expense.

WARNING

"This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications." "Le present appareil numerique n'emet pas de bruits radioelectriques depassant les limites applicables aux appareils numeriques (de las class A) prescrites dans le Reglement sur le brouillage radioelectrique edicte par le ministere des Communications du Canada."

IMPORTANT

Perform the installation under static control conditions. Simply walking across a rug can generate a static charge of 20,000 volts. This is the spark or shock you may have felt when touching a doorknob or some other conductive item. A much smaller static discharge is likely to completely destroy one or more of the CMOS semiconductors employed in OPTIMOD-FM or the software module. Static damage will not be covered under warranty.

There are many common sources of static. Most involve some type of friction between two dissimilar materials. Some examples are combing your hair, sliding across a seat cover or rolling a cart across the floor. Since the threshold of human perception for a static discharge is 3000 volts, many damaging discharges will not even be noticed.

Basic damage prevention consists of minimizing generation, discharging any accumulated static charge on your body or work station and preventing that discharge from being sent to or through an electronic component. A static grounding strap (grounded through a protective resistor) and a static safe workbench with a conductive surface should be used. This will prevent any buildup of damaging static.

This manual is part number xxxxx-xx-xx (Preliminary)
80 - KC - 5/95

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Section 1
Introduction

page contents

8208 Digital FM Stereo Encoder

More and more FM stations are thinking digital, from studio to transmitter. However, digital links typically handle left/right rather than composite. Orban's 8208 stand-alone Digital FM Stereo Encoder can extend your all-digital performance through to the stereo encoder. It's designed to perfectly complement Orban's OPTIMOD-FM 8200 in an all-digital transmission system.

All encoding is done entirely in the digital domain by a dedicated DSP chip, producing two analog composite outputs with outstanding specifications and long-term stability. The 8208 accepts either analog or AES/EBU digital inputs. The digital input automatically synchronizes to and de-jitters any standard incoming sampling rate. In addition, it responds to status bits in the AES/EBU data stream that may be used to turn de-emphasis on or off. This feature allows automatic switching of pre-emphasis and/or J.17 (NICAM) de-emphasis to accommodate different transmission schemes.

Features

- >70dB separation, 20Hz-15kHz.
- <–90dB noise and distortion (after de-emphasis, and referenced to 100% modulation output).
- Digitally-created composite signal, from either analog or AES/EBU digital input. The 8208 also accepts two analog SCA inputs, and sums them with analog composite output. The analog composite appears on two outputs, each with individual level control.
- Built-in sample rate converter that allows 8208 to accept any digital AES/EBU input sample rate between 32kHz and 48kHz.
- Recessed front panel controls for selecting Input type (Analog/Digital), Stereo/MonoL/MonoR mode, Pilot On/Off, and Crosstalk Tests.
- Front panel metering of Left and Right inputs plus Composite or Pilot outputs.
- Recessed front panel multi-turn screwdriver potentiometers for Analog Left, Analog Right, and Digital input levels, as well as for Pilot, Composite #1, and Composite #2 output levels.
- Recessed rear panel DIP switch for selecting pre-emphasis In/Out, pre-emphasis type (50µs/75µs), J.17 de-emphasis In/Out, and whether or not the stereo encoder's pre-emphasis and J.17 de-emphasis settings respond to status bits of the AES/EBU digital input.
- Remote (contact closure) interface using opto-isolation has pins to select between analog or digital input, turn pre-emphasis on or off, and to select among stereo, mono from left, or mono from right operational modes. Also on the remote connector is a digital pilot reference output clock for external subcarrier generators like RDS. This is a TTL level signal with 0 to +5V transition occurring at the pilot zero crossing.

Input/Output Configurations

The 8208 is designed to simultaneously accommodate:

- Analog left/right inputs or digital AES/EBU left/right input.
- Composite baseband outputs.
- SCA subcarrier inputs.
- Pilot Reference output.

Analog Left/Right Inputs

The left and right analog inputs are on XLR-type female connectors on the rear panel. Input impedance is greater than 100kΩ; balanced and symmetrical. Inputs can accommodate from 0 to +15dBu for 100% modulation. (0dBu = 0.775Vrms).

Level control of the analog inputs is via the screwdriver-adjustable Drive controls for left and right, located on the 8208's front panel.

The Left/Right meter on the 8208 shows left/right input levels as a 10-segment bar graph (5 to 110%).

Digital AES/EBU Left/Right Input

The digital input follows the professional AES/EBU standard. The left/right digital input is on one XLR-type female connector on the rear panel.

The input can accommodate from 0dB to –6dB below full scale for 100% modulation. Level control of the AES/EBU input is via the screwdriver-adjustable Drive control, located on the 8208's front panel.

The 8208 accepts any digital AES/EBU input sample rate between 32kHz and 48kHz by use of a built-in sample-rate converter.

The 8208 can be switched between digital and analog inputs by the front panel Input select switch or by remote interface. Both analog and digital outputs are active continuously.

Composite Baseband Outputs

The stereo encoder has two unbalanced baseband outputs (Comp 1 and Comp 2) on two BNC connectors on the rear panel. Each output can be strapped for 0Ω or 75Ω source impedance (jumper-selectable), and can drive up to 5V peak-to-peak into 75Ω in parallel with up to 0.047μF (100ft/30m of RG-59/U cable) before any noticeable performance degradation occurs. With slightly decreased separation (still >50dB) these outputs can drive up to 8V peak-to-peak. (The 8208 is shipped from the factory with 0Ω source impedance.)

Level control of each output is via a separate screwdriver control accessible from the front panel.

A ground lift switch is available on the rear panel. This is useful to prevent ground loops between the 8208 and the transmitter.

The Composite meter on the 8208 shows composite output levels as a 10-segment bar graph (5% to 110%).

You ordinarily adjust the 8208's output level so that 100% corresponds to ±75kHz carrier deviation. Note that if you apply subcarriers (SCAs) to the rear panel subcarrier input, the meter will ordinarily read higher than 100%. For example, in the U.S.A., if two subcarriers are used, the meter will usually read peaks of 110%, corresponding to ±82.5kHz deviation.

Subcarriers

The 8208 has an unbalanced 10kΩ subcarrier (SCA) input with rear panel BNC connector to accept any subcarrier at or above 23kHz. The subcarrier will be mixed into each composite output, and its level will be affected by the composite level control for that output. The gain is scaled so that 0.8V peak-to-peak at the subcarrier input produces 10% subcarrier injection with reference to 100% deviation of the FM carrier.

A 19kHz TTL-level square wave is available on pin 24 of the remote interface, located on the rear panel of the unit. This provides a means for synchronizing an external subcarrier generator, like an RDS (Radio Data Systems) subcarrier, to the 19kHz pilot tone.

Ultrastable Pilot Option

The 8208's optional ultrastable pilot can be used as a reference for the station's carrier frequency to maintain the carrier frequency within 100Hz of the assigned channel frequency. With a 100MHz carrier, this requires a stability of 1 part per million (ppm).

Remote Control Interface

The Remote Control Interface is a set of seven optically-isolated inputs and one output on a DB-25 connector that can be activated by 5-12VDC or AC 50/60Hz signals.

The seven inputs allow you to select between various functions of the 8208:

- Analog/Digital Input.
- Pre-Emphasis On/Off.
- Operation Mode (Stereo, Mono From Left, or Mono From Right).

The one output on the Remote Control Interface is a Digital Pilot Reference Output Clock.

Location of 8208

Optimal Control of Peak Modulation Levels

The audio processing circuitry in most modern audio processors produces a signal that is pre-emphasized to either the 50μs or 75μs standard curve, is precisely and absolutely high frequency-controlled and peak-controlled to prevent over-modulation, and is filtered at 15kHz to prevent distortion caused by aliasing-related non-linear crosstalk in FM stereo systems.

If this signal is fed directly into the 8208, peak modulation levels on the air will be precisely controlled. But if the audio processor's signal is fed to the stereo encoder through any circuitry with frequency response errors and/or non-constant group delay, the peaks will be magnified. Peak modulation will increase, but average modulation will not. The modulation level must therefore be reduced to accommodate the larger peaks. Reduced average modulation level will result in reduced loudness, and a poorer signal-to-noise ratio at the receiver.

Frequency response errors and non-constant group delay are typically introduced by land line equalizers, transformers, and digital links that use lossy data compression.

There are three criteria for preservation of peak levels through the audio system:

1) The system group delay must be essentially constant throughout the frequency range containing significant energy (30-15,000Hz). If low-pass filters are present, this may require the use of delay equalization. The deviation from linear phase must not exceed ±10° from 30-15,000Hz.

2) The low-frequency −3dB point of the system must be placed at 0.15Hz or lower (this is not a misprint!). This is necessary to ensure less than 1% overshoot in a 50Hz square wave and essentially constant group delay to 30Hz.

3) Any pre-emphasis used in the audio transmission system prior to the transmitter or stereo encoder must be canceled by a precisely complementary de-emphasis: Every pole and zero in the pre-emphasis filter must be complemented by a zero and pole of identical complex frequency in the de-emphasis network (an all-pole de-emphasis network is not appropriate).

Low-pass filters (including anti-aliasing filters in digital links), high-pass filters, transformers, distribution amplifiers, and long transmission lines can all cause the above criteria to be violated, and must be tested and qualified.

The 8208 can be located at the studio or transmitter, depending on the requirements of your system. In the most common application, the 8208 will be located at the transmitter, receiving left and right processed, pre-emphasized digitized audio via digital, microwave, or land/post-line and directly driving the FM Exciter/Transmitter.

If the 8208 is located at the studio, its composite output will be passed to the transmitter through a composite microwave analog STL or through a composite digital STL like the QEI "Cat-Link."

Transmission from Studio to Transmitter

There are four types of studio-to-transmitter links (STLs) in common use in FM stereo service that can feed a transmitter-located 8208: digital, video STLs with PCM adapters, analog land line (telephone/post line), and dual microwave.

All these links carry the left and right channels. These links are normally fed the pre-emphasized, peak-controlled left and right outputs of an appropriate FM stereo audio processor like Orban's OPTIMOD-FM 8200.

Digital links

There are several types of digital links presently available. They pass the audio in left and right form, and may apply data-rate-reduction processing to the signal to reduce the number of bits per second required for transmission through the digital link. Such processing will almost certainly distort peak levels, and such links must therefore be carefully qualified before you use them to carry the peak-controlled output of your audio processor to the 8208 stereo encoder. For example, ISO/MPEG Layer 2 with dual-mono coding at 384 kb/S typically adds approximately 1dB of peak level. Lower rates rapidly increase the overshoot, with joint stereo encoding at 192kb/S adding as much as 4dB overshoot. No station wishing to maintain competitive loudness should use data rates of less than 384kb/S, and major-market stations requiring highest loudness should not use any data-rate-reduction processing at all because even 1dB loudness loss is quite audible.

Older-technology links may use straightforward PCM (pulse-code modulation) without data rate reduction. These can be completely transparent provided that they have AES/EBU digital I/O. If these older-technology links have only analog inputs and outputs, their input anti-aliasing filters and output reconstruction filters must be rigorously designed to achieve constant group delay over the frequency range that contains significant program energy. This is not particularly difficult to do with modern over-sampled converter technology.

Older-technology converters with analog inputs and outputs usually exhibit rapid changes in group delay around cut-off because their analog filters are ordinarily not group-delay equalized. Additionally, they may exhibit quantization distortion unless they have been correctly dithered. The installing engineer should be aware of all of these potential problems when designing a transmission system.

Note that most modern audio processors (in particular, Orban's 8200) have virtually no power in their output spectrum above 16kHz. Therefore the input anti-alias filters in older-technology converters can be bypassed; the audio processor protects against aliasing. Note, however, that the link receiver's output reconstruction filters cannot be bypassed; these must have constant group delay.

NICAM is a sort of hybrid between PCM and data-rate-reduced systems, It uses a block-companded floating point representation of the signal with J.17 pre-emphasis. If equipped with the optional advanced digital I/O card (8200D/SRC), the Orban 8200 can supply an AES/EBU output that has been pre-emphasized to J.17. (The NICAM encoder must take this PCM data stream and convert it to the NICAM representation.)

The 8208 has the ability to apply J.17 de-emphasis to its AES/EBU digital input, and can thus accept the pre-emphasized output of a NICAM receiver, provided that the receiver has

decoded the NICAM signal and converted it to PCM in AES/EBU form. (See Chapter 2 for a complete discussion of the 8208s extensive pre-emphasis switching capabilities.)

Video microwave STLs with PCM adapters:

The video STLs in use typically operate above 20GHz, with consumer PCM adapters (from Sony or dbx, for example) to encode left and right audio into a video-like signal. The quality of signal received at the transmitter through this type of STL is high. However, the high carrier frequencies make these links subject to rain fading. Other potential problems include very sharp high-frequency cut-off, rapid changes in group delay around cut-off, and quantization distortion. These problems can only be alleviated by use of digital I/O. To the best of our knowledge, of these various units only the Sony PCM-601 has a suitable digital I/O, which is S/P-DIF. (The 8208's AES/EBU input will often lock to a S/P-DIF signal without difficulty, although we cannot guarantee this for all cases.)

The Sony and dbx encoders are no longer manufactured, but may be found on the used market.

Analog land line (PTT/post office line):

Analog land line quality is extremely variable. Even the best land lines will have slight frequency response irregularities and non-constant group delay, which will cause overshoots at their outputs. This will increase the peak-to-average ratio and will thus reduce the effectiveness of any peak limiting performed prior to their inputs. In competitive environments these lines are never suitable because of this overshoot. (see Optimal Control of Peak Modulation Levels on page 1-6).

Dual microwave STLs:

Dual microwave STLs can provide satisfactory results if carefully designed. Otherwise they can introduce non-constant group delay in the audio spectrum, distorting peak levels.

Some left/right microwave links may be modified to meet the specification for frequency response and phase linearity stated in Optimal Control of Peak Modulation Levels on page 1-6. Many such links have been designed to be easily configured at the factory for composite operation, where the entire FM stereo baseband is passed, including the pilot tone and stereo subchannel. The requirements for maintaining stereo separation in composite operation are similar to the requirements for high waveform fidelity with low overshoot. Therefore, most links have the potential for excellent waveform fidelity if they are configured for composite operation (even if a composite FM stereo signal is not actually being applied to the link).

If the STL microwave uses pre-emphasis, its input pre-emphasis network will probably introduce overshoots that will increase peak modulation without any increases in average modulation. We strongly recommend that you defeat the microwave STL's transmitter pre-emphasis and receiver de-emphasis. Perform pre-emphasis in the audio processing system driving the link (like the Orban 8200). This reduces potential overshoot.

Line-Up Facilities

Left/Right Input Level

The Left/Right meter on the 8208 shows left/right input levels as a 10-segment bar graph (5% to 110%), absolute instantaneous peak-indicating.

Composite Output Level

Composite modulation is indicated in percent modulation, absolute instantaneous peak indicating. You ordinarily adjust the 8208's output attenuators to make 100% on the meter correspond to ±75kHz carrier deviation. Note that if subcarriers (SCAs) are applied to the 8208's subcarrier input, the meter will ordinarily read higher than 100%. For example, in the U.S.A., if two subcarriers are used, the meter will usually read peaks of 110%, corresponding to ±82.5kHz deviation.

Pilot Injection Metering

You can switch the lower meter to read pilot injection in percent modulation. Most government authorities require pilot injection to be between 8% and 10%. 9% is the value customarily used.

Section 2
Installation

page contents

CAUTION

The installation and servicing instructions in this manual are for use by qualified personnel only. To avoid electric shock, do not perform any servicing other than that contained in the Operating Instructions unless you are qualified to do so. Refer all servicing to qualified service personnel.

Installation of 8208

Allow about 2 hours for installation.

Installation consists of: (1) unpacking and inspecting the 8208, (2) optional resetting of jumpers for composite output impedance, (3) checking the line voltage setting, fuses and power cord, (4) setting the ground lift switch, (5) mounting the 8208 in a rack, (6) connecting inputs, outputs and power, (7) and optional connecting of remote control leads.

1. Unpack and inspect.

If you note obvious physical damage, contact the carrier immediately to make a damage claim. Packed with the 8208 are:

1	Operating Manual (includes Registration Card)
1	Line Cord
2	Fuses (F1 = ½A or 250mA)
4	Rack-mounting screws, 10-32 x ½ — with washers, #10
1	BNC Cable — 24″ (60.96cm)
1	Orban green screwdriver (Xcelite R3323)

A☐ *Save all packing materials*! If you should ever have to ship the 8208 (e.g., for servicing), it is best to ship it in the original carton with its packing materials because both the carton and packing material have been carefully designed to protect the unit.

B☐ **Complete the Registration Card and return it to Orban.** (please)

The Registration Card enables us to inform you of new applications, performance improvements, and service aids that may be developed, and it helps us respond promptly to claims under warranty without our having to request a copy of your bill of sale or other proof of purchase. Please fill in the Registration Card and send it to us today.

We do not sell our customer's names to anyone.

2. Set stereo encoder composite output impedance.

[Skip this step if your installation does not need 75Ω source impedance.]

The stereo encoder is shipped from the factory with 0Ω source impedance. This is correct for virtually all installations. However, the 8208 stereo encoder can be changed to 75Ω source impedance if desired.

Figure 2-1: Composite Output Impedance Jumpers
Jumpers JA and JB

The frequencies in the stereo baseband are low by comparison to RF or video, and the characteristic impedance of coaxial cable is not 75Ω at lower frequencies, so the transmission system will have more accurate amplitude and phase response (and thus, better stereo separation) if the cable is driven by a very low source impedance (0Ω) and is terminated with greater than 1kΩ at the exciter.

However, a few broadcast organizations require that FM composite be transmitted in impedance-matched coaxial cable with 75Ω source and load impedances.

To change the source impedance of one or both of the composite outputs:

Make sure that power is off before removing the cover.

To change the source impedance of composite output #1 (the upper BNC connector on the 8208's rear panel), move jumper JA to the "75Ω" position. To change the source impedance of composite output #2 (the lower BNC connector on the 8208's rear panel), move jumper JB to the "75Ω" position. Then replace the cover and close the chassis.

8208 Rear Panel

Fuse: Values can be changed to support 115V or 230V operation. Fuse F1 must be 3AG Slow-Blow, ½-amp for 115V, or ¼-amp (250mA) "T" type for 230V.

Power Cord is detachable and is terminated in a "U-ground" plug (USA standard), or CEE7/7 plug (Continental Europe), as appropriate to your 8208's Model #.

Remote Control Interface is provided to connect the 8208 to your existing transmitter remote control. The 8208 remote control accepts a DB-25 connector and supports seven inputs and one output (Digital Pilot Reference Output Clock).

Seven remote inputs are defined as follows:

Remote 1 = analog input
Remote 2 = digital input
Remote 3 = stereo
Remote 4 = mono from left
Remote 5 = mono from right
Remote 6 = pre-emphasis off
Remote 7 = pre-emphasis on

A valid remote signal is a momentary transition from no-current to current flowing through the particular remote signal pins. Current must flow for at least 50mS for the signal to be interpreted as valid. It is acceptable to apply current continuously to an input, DC or AC. Do not exceed 12 volts unless you use an external current-limiting resistor that limits current to 10mA.

Analog Inputs are provided to support left and right audio signals through XLR-type connectors.

Digital AES/EBU Input is provided to support two-channel AES/EBU-standard digital audio signals through an XLR-type connector.

Two SCA Inputs are provided for stations that use additional subcarriers (SCAs). Each SCA input uses a BNC connector.

Two Composite Baseband Outputs are provided, each with independent Output level control. Each output uses a BNC connector.

Pilot Reference Output is provided on remote control interface DB-25 connector.

Voltage Selector can be set to 115V (for 95-130V operation) or 230V (for 180-260V operation).

Rear Panel DIP Switch

Pre-Emphasis and J.17 Response to AES Status Bits: In AUTO, when the input source is DIGITAL, the pre-emphasis applied to a valid AES/EBU digital audio input follows the status bits of this input, as found is the AES/EBU bitstream. If the AES status bits indicate that the digital audio input is not pre-emphasized, then 50µs or 75µs pre-emphasis is applied according to the setting of the 50/75 DIP switch. If the AES status bits indicate that the digital audio input is J.17 pre-emphasized (which would be likely if it were being received from a NICAM STL), then J.17 de-emphasis is applied to this input. If a valid AES/EBU digital audio signal is not present at the input, the 8208 will process the analog inputs. The pre-emphasis and de-emphasis status is then determined as if AES STAT is LOCAL.

Byte 0 bits 2-4	AES/EBU definition	8208 interpretation	Comments
000	not indicated	not emphasized	8208 applies FM pre-emph
001	undefined	undefined	8208 doesn't alter emphasis
010	undefined	undefined	8208 doesn't alter emphasis
011	undefined	undefined	8208 doesn't alter emphasis
100	no emphasis	not emphasized	8208 applies FM pre-emph
101	undefined	J.17+FM pre-e	8208 applies J.17 de-emph
110	50/15 uSec	FM pre-e	8208 doesn't alter emphasis
111	J.17	J.17	8208 applies J.17 de-emph + FM pre-emph

When AES STAT is LOCAL, the three DIP switches (PRE-EMPH IN/OUT, 50/75, and J.17 IN/OUT) and the remote interface controls (PRE-EMPH IN and PRE-EMPH OUT) determine the pre-emphasis and de-emphasis applied by the 8208. If DIP switch PRE-EMPH IN/OUT and the signals received from remote interface controls PRE-EMPH IN and PRE-EMPH OUT do not agree: (1) the 8208 will follow DIP switch PRE-EMPH IN/OUT if it changed more recently than last valid remote control action on PRE-EMPH IN or PRE-EMPH OUT; (2) the 8208 will follow remote control action on PRE-EMPH IN or PRE-EMPH OUT if a remote signal is received on either of these remote inputs more recently than a change to DIP switch PRE-EMPH IN/OUT.

Pre-Emph In/Out: Determines whether 50 or 75µs pre-emphasis (as set by the 50/75 switch) is applied to the incoming audio. This function is independent of the J.17 switch, and is overridden by AES status bits when AES STAT is AUTO, input is DIGITAL, and a valid AES/EBU digital audio signal is present at the digital input.

50/75 Switch: The 50/75 switch determines the type of pre-emphasis to apply, 50µs or 75µs, to the input audio. Whether or not any pre-emphasis is applied to the input audio is determined by state of Input select (Analog/Digital), AES STAT DIP switch, PRE-EMPH IN/OUT DIP switch, and remote signals PRE-EMPH IN or PRE-EMPH OUT. See description of AES STAT DIP switch.

J.17 De-Emph: Determines if J.17 de-emphasis is applied to the incoming audio. This function is independent of the 50 or 75µs pre-emphasis.

Front Panel vs. Rear Panel Remote Controls and DIP Switch Settings

1) Front panel and remote interface are treated as equals, neither having priority over the other. 8208 will respond to the most recent front panel or remote operation. Since front panel switches are momentary and since response to remote signals is defined to be momentary, they should never be conflict. It is possible for a continuous remote signal to be in an 'incorrect' position. Since the 8208 will respond to the most recent front panel or remote operation, this should not pose a problem unless you are using AC to excite the remote. In this case, each cycle of the AC waveform will retrigger the remote.

2) Rear panel DIP switches and remote interface are treated as equals, neither having priority over the other. 8208 will respond to the most recent rear panel switch setting or remote operation. This relationship is the same as described in #1 except that the DIP switches are not momentary switches. This means that a remote action can lead to the DIP switch being in the 'incorrect' position. Since the 8208 will respond to the most recent DIP switch or remote operation, this should not pose a problem.

3) The Emphasis Control Dip switch that selects between AUTO and DIP is a special case. When it is placed in the AUTO position, the 8208 will set up emphasis based upon AES emphasis status bits and the 8208 will ignore the two DIP switches PRE-EMPH IN/OUT and J.17 IN/OUT, and will also ignore Remote 6 and Remote 7 for pre-emphasis off/on.

4) If line power is removed from the 8208 and then restored, it will turn on with the same status that it had when power was removed. Note that if a continuous DC voltage is applied to a remote control terminal, the logic will interpret this as an edge transition on 8208 power-up, so that remote function will be activated.

3. Check the line voltage, fuse and power cord.

A☐ *DO NOT connect power to the unit yet!*

B☐ Check the VOLTAGE SELECTOR. This is on the rear panel.

The 8208 is shipped configured for either 95-130V or 190-260V, 50Hz or 60Hz operation, as indicated on the rear panel. Refer to the unit's rear panel for your Model # and the inside of the front cover of this manual for your Model #'s line voltage setting. To change the operating voltage, set the VOLTAGE SELECTOR to 115V (for 95-130V) or 230V (for 190-260V) as appropriate.

C☐ Check the value of the fuse and change the fuse if the value is incorrect.

For safety, fuse F1 must be Slow-Blow, ½-amp for 115V, or ¼-amp (250mA) "T" type for 230V.

D☐ Check power cord.

AC power passes through an IEC-standard mains connector and an RF filter designed to meet the standards of all international safety authorities.

The power cord is terminated in a "U-ground" plug (USA standard), or CEE7/7 plug (Continental Europe), as appropriate to your 8208's Model #. The green/yellow wire is connected directly to the 8208 chassis.

If you need to change the plug to meet your country's standard and you are qualified to do so, see Figure 2-8. Otherwise, purchase a new mains cord with the correct line plug attached.

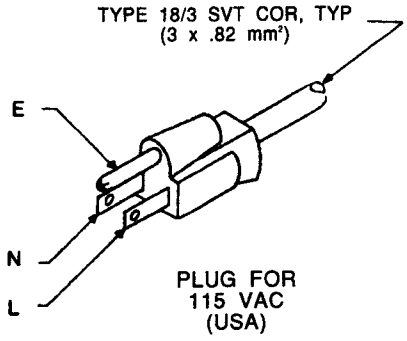
4. Set GROUND LIFT switch.

The GROUND LIFT switch is located on the rear panel.

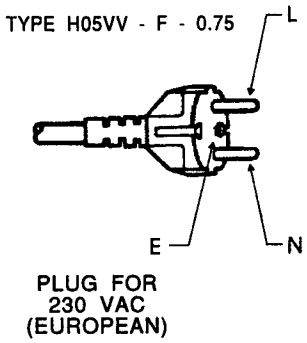
The GROUND LIFT switch is shipped from the factory set to CONNECT (to connect the 8208's circuit ground to its chassis ground). This is appropriate if you are driving the 8208's composite output into an *balanced* exciter input. If you are driving the 8208's composite output into an *unbalanced* exciter input, set the GROUND LIFT switch to LIFT.

This will break a ground loop that could otherwise occur.

Unbalanced exciter inputs can cause hum and noise because it is difficult to control the system grounding. If hum or noise appears that cannot be cured by resetting the GROUND LIFT switch, we suggest that you install the optional Orban CIT25 Composite Isolation Transformer at the exciter's input to balance it. If you use the CIT25, set the 8208's GROUND LIFT switch to CONNECT.



CONDUCTOR		WIRE COLOR	
		NORMAL	ALT
L	LINE	BROWN	BLACK
N	NEUTRAL	BLUE	WHITE
E	EARTH GND	GREEN-YELLOW	GREEN



CONDUCTOR		WIRE COLOR
L	LINE	BROWN
N	NEUTRAL	BLUE
E	EARTH GND	GREEN-YELLOW

Figure 2-2: AC Line Cord Wire Standard

5. Mount the 8208 in a rack.

The 8208 requires four standard rack units (7 inches/17.6 cm).

There should be a good ground connection between the rack and the 8208 chassis — check this with an ohmmeter to verify that the resistance is less than 0.5Ω.

Mounting the unit over large heat-producing devices (such as a vacuum-tube power amplifier) may shorten component life and is not recommended. Ambient temperature should not exceed 113°F/45°C when equipment is powered.

Equipment life will be extended if the unit is mounted away from sources of vibration, such as large blowers.

The shorter the baseband cable run from OPTIMOD-FM to exciter, the less likely that ground loops or other noise problems will occur in the installation. If you require a long cable run, it is usually best to mount the RF exciter close to OPTIMOD-FM, and to make the long cable carry the RF output from the exciter to the transmitter's RF power amplifiers.

6. Connect remote control. (optional)

The 8208 has extensive remote control provisions, which are described on previous pages.

Optically-isolated remote control connections are terminated in a type DB-25 female connector located on the rear panel. It is wired according to Fig. 2-3. To select the desired function, apply a 5-12V AC or DC pulse between the appropriate REMOTE terminals. The (–) terminals can be connected together and then connected to ground at pin 17 to create a REMOTE COMMON. A current-limited +12VDC source is available on pin 25.

> In a high-RF environment, remote control wires should be short and should be run through foil-shielded cable, with the shield connected to CHASSIS GROUND at both ends. This will prevent RF from entering the chassis through the remote control leads.

Figure 2-3: Wiring the 25-pin Optically-isolated Remote Control Connector

7. Connect inputs and outputs.

See the hook-up and grounding information on the following pages.

Audio Input and Output Connections

Cable

We recommend using **two-conductor foil-shielded cable** (such as Belden 8451 or equivalent), because signal current flows through the two conductors only. The shield does not carry signal, and is used only for shielding.

Connectors

- **Input and output connectors** are XLR-type connectors.

  In the XLR-type connectors, pin 1 is CHASSIS GROUND, while pin 2 and pin 3 are a balanced, floating pair. This wiring scheme is compatible with *any* studio wiring standard: If one pin is considered LOW, the other pin is automatically HIGH.

Analog Audio Input

- The sensitivity of the 8208 can be adjusted so that **Input level** between 0dBu and +15dBu will produce 100% modulation. (See step 1-C on page 2-7 for a full discussion).

  (0dBu = 0.775Vrms. For this application, the dBm @600Ω scale on voltmeters can be read as if it were calibrated in dBu.)

- The **electronically-balanced input** uses a full instrumentation amplifier topology for best common mode rejection, and is compatible with most professional and semi-professional audio equipment, balanced or unbalanced, having a source impedance of 600Ω or less. The input is EMI suppressed.

- Input connections are the same whether the driving source is balanced or unbalanced.

- Connect the red (or white) wire to the pin on the XLR-type connector (#2 or #3) that is considered HIGH by the standards of your organization. Connect the black wire to the pin on the XLR-type connector (#3 or #2) that is considered LOW by the standards of your organization.

- In **low RF fields** (like a studio site), do not connect the cable shield at the 8208 input — it should be connected at the source end only. In **high RF fields** (like a transmitter site), also connect the shield to pin 1 of the male XLR-type connector at the 8208 input.

- If the output of the driving unit is unbalanced and does not have separate CHASSIS GROUND and (–) (or LO) output terminals, connect both the shield and the black wire to the common (–) or ground terminal of the driving unit.

Composite Output and Subcarrier Input

- There are two independent composite baseband outputs (containing the encoded stereo signal, the stereo pilot tone, and any subcarrier that may have been applied to the subcarrier input).

  Each output has an independent OUTPUT LEVEL control and can be strapped for 0Ω or 75Ω source impedance. Each output can drive up to 5V peak-to-peak into 75Ω in parallel with up to 0.047μF in cable and input capacitance before any noticeable performance degradation occurs. The output is capable of up to 8V p-p drive with slight separation loss; separation will still exceed 50dB.

- Connect the 8208's composite output to the exciter input with up to 100 feet (30.5m) of RG-58/U or RG-59/U coaxial cable terminated with BNC connectors.

  Longer runs of coax may increase problems with noise, hum, and RF pickup at the exciter. In general, the least troublesome installations place the 8208 close to the exciter and limit the length of the composite cable to less than 6 feet (1.8m).

  We do not recommend that the exciter input be terminated by 50Ω or 75Ω unless this is unavoidable. Because the frequencies in the stereo baseband are low by comparison to RF or video, and because the characteristic impedance of coaxial cable is not constant at very low frequencies, the transmission system tends to have more accurate amplitude and phase response (and thus, better stereo separation) if the coax is driven by a very low impedance source and is terminated with greater than 1kΩ at the exciter end. This also eases thermal stresses on the output amplifier in the stereo encoder, and can thus increase equipment life.

  If the Orban CIT25 Composite Isolation Transformer is used, the exciter *must* present a 1kΩ or greater load to the transformer for proper transformer operation.

  Designed to be installed adjacent to each exciter, the CIT25 Composite Isolation Transformer provides ground loop isolation between the OPTI-MOD-FM composite output and the exciter's input, and presents OPTI-MOD-FM with a balanced floating load.

- The **subcarrier input** is provided for convenience in summing subcarriers into the baseband prior to its presentation to the FM RF exciter.

  The subcarrier input will accept any subcarrier (or combination of subcarriers) above 23kHz. Below 20kHz, its sensitivity rolls off at 6dB/octave to suppress hum that might otherwise be introduced into the subcarrier input, which is unbalanced.

- Connect the subcarrier generator to the 8208's subcarrier input with coaxial cable terminated with BNC connectors. Any 50Ω or 75Ω coaxial cable will do as long as it can accommodate BNC connectors.

  The subcarrier input is 600Ω impedance and unbalanced. The gain is scaled so that 0.8V peak-to-peak at the subcarrier input produces 10% subcarrier injection with reference to 100% deviation of the FM carrier.

AES/EBU Digital Input and Output

Per the AES/EBU standard, each digital input carries both the left and right stereo channels.

The front-panel DIGITAL input attenuator adjusts the sensitivity of both channels. Its range is –6dB to 0dB to produce 100% modulation, where 0dB = the full-scale digital word. This range should be sufficient to accommodate any digital audio processor or STL. For example, the nominal digital output level of the Orban Optimod-FM 8200 is –2.75dB for 100% modulation.

Grounding

Very often, grounding is approached in a "hit or miss" manner. But with care it is possible to wire an audio studio so that it provides maximum protection from power faults and is free from ground loops (which induce hum and can cause oscillation).

In an ideal system:

- All units in the system should have *balanced inputs*. In a modern system with low output impedances and high input impedances, a balanced input will provide common-mode rejection and prevent ground loops — regardless of whether it is driven from a balanced or unbalanced source.

  The 8208 has balanced inputs. Its optional subcarrier input is unbalanced, but its frequency response is rolled-off at low frequencies to reject hum.

- All equipment *circuit grounds* must be connected to each other; all equipment *chassis grounds* must be connected together.

- In a low RF field, *cable shields* should be connected at one end only — preferably the source (output) end.

- In a high RF field, *audio cable shields* should be connected to a solid earth ground at both ends to achieve best shielding against RFI.

- Whenever coaxial cable is used, shields are automatically grounded at both ends through the terminating BNC connectors.

Grounding (continued)

Power Ground

- Ground the 8208 chassis through the third wire in the power cord. Proper grounding techniques *never* leave equipment chassis unconnected to power/earth ground. *A proper power ground is essential to safe operation.* Lifting a chassis from power ground creates a potential safety hazard.

Circuit Ground

To maintain the same potential in all equipment, the circuit (audio) grounds must be connected together:

- Circuit and chassis ground should always be connected by setting the 8208's GROUND LIFT switch to CONNECT, *except* when the 8208's composite output is driving an **unbalanced exciter input.** This is an unbalanced-to-unbalanced connection, so the ground loop that would otherwise occur must be broken by setting the 8208's GROUND LIFT switch to LIFT.

  Alternately, you can balance and float the exciter input with the Orban CIT25 Composite Isolation Transformer — (see page 1-13).

- *In high RF fields*, the system is usually grounded through the equipment rack in which the 8208 is mounted. The rack should be connected to a solid earth ground by a wide copper strap — wire is completely ineffective at VHF because of the wire's self-inductance.

Detailed Exciter Interface Instructions

Most exciters have straightforward wideband inputs, and no special considerations are involved. This section provides instructions on interfacing the 8208 to certain older exciters requiring special wideband interfaces.

Collins 310Z-1(B)

Prior to installing the required Continental Electronics 785-1 Wideband Interface Card, this exciter must be modified using a kit of parts and instructions provided by Continental. Once this modification has been performed, proceed as in the case of the Continental 510R-1 (immediately below).

Continental 510R-1 (Collins 310Z-2)

- Obtain a 785E-1 Interface Card directly from Continental Electronics.
- Remove the 53kHz phase-linear baseband filter (FL-1), Continental Part # 673-1162-020. The filter is located on the opposite side of the chassis under the protective grill in the rear of the exciter. To access this filter, first remove the entire rear grill of the exciter. Next, the circuit board that covers the screws that secure the filter in its socket must be removed. The filter is plugged into an octal socket and can be readily unplugged once its hold-down screws are removed.

  Despite the inconvenience, it is IMPERATIVE that this filter be removed as it shunts the baseband input to the FM modulator and its continued presence would seriously degrade separation.
- Replace the hardware and grill.
- Install the 785E-1 Interface Card in its designated slot in the card cage.
- Be certain that the Interface Card is not being overloaded by the 8208. This can happen easily if the B/B LEVEL control on the modulator card of the Continental exciter is set excessively low and the OPTIMOD-FM output level is increased to make up the gain. The problem may not be immediately noticeable under test conditions, but will seriously degrade the normal operation of the system.

  To avoid this condition, do not change the adjustment of the B/B LEVEL control from the setting appropriate for use with the Continental stereo generator. If there is any reason to suspect that this control has been misadjusted, it is worthwhile to check the input sensitivity. The B/B LEVEL control is correctly adjusted when a sinewave of 1.24Vrms (3.5Vp-p) applied to the Continental Wideband Input produces 100% modulation at any frequency.

Detailed Exciter Interface Instructions (continued)

RCA BTE-15

- If your exciter is not equipped with an RCA "Monaural Audio Module" (RCA P/N MI-561072), then order Orban Accessory RCA-1 (Orban P/N 05004-000) directly from Orban.
- Install 8208 directly above the exciter, allowing at least 1¾" (1 rack unit) of air space between the units. You may want to switch the 8208's LINE VOLTAGE selector to "230V" so that it can be operated from the same 230 volt circuit that ordinarily powers the exciter. If you do this, be sure to change the fuses.
- Using the BNC/BNC cable provided with your 8208, connect the 8208 COMPOSITE output to the WIDEBAND BNC connector (J108) on the right rear apron of the exciter mainframe. The WIDEBAND input is the second BNC connector from the top. Be careful not to connect to the TELEMETRY input.
- Remove the RCA BTS-1B stereo generator from the BTE-15 mainframe. If the RCA "Monaural Audio Module" is available, install it in place of the RCA stereo generator. S201, which is located on the Monaural Audio Module circuit board, must be in the EXTERNAL position.

  If the "Monaural Audio Module" is not available, install the "RCA Jumper Plug" (RCA-1) in the jack vacated by the RCA stereo generator.
- If any of the following conditions are noted after installing 8208, your BTE-15 probably has a defective varactor diode:

  The peak modulation level, as indicated on your modulation monitor peak flasher, seems to vary several percent with transmitter room temperature.

  Modulation is asymmetric.

  8208 cannot supply enough level to modulate the exciter to 100%.

  Any of these conditions should make you suspect RCA modulated oscillator diodes CR2 and/or CR3. Replacement of these diodes and realignment of the modulator is critical, and should probably be left to personnel experienced in servicing this exciter.

Detailed Exciter Interface Instructions (continued)

Gates (Harris) TE-1 and TE-3

- If you do not have a Gates (Harris) Wideband Interface Kit (P/N 994 6672 001), order the Orban ATE-3F Interface Kit (P/N 04014-000-00) directly from Orban.
- Both the Gates (Harris) and Orban interface kits contain complete instructions for installation. Bear in mind that the Gates (Harris) interface provides a balanced input. This means that the 8208 circuit and chassis grounds will ordinarily be connected. The Orban interface provides an unbalanced input, and the 8208 circuit and chassis grounds will ordinarily be connected. See page 2-20.

8. Power up the 8208.

A☐ Plug in the 8208's power cord.

You should see several LEDs light on the front panel. Which LEDs light depends on the status of the 8208 prior to power-down.

9. Physical installation is complete.

A☐ Continue with the explanation of the 8208 Controls and Meters, and then SYSTEM SETUP (initialization) on page 2-39.

System Setup

Allow about 1 hour for system setup.]

1. Set pre-emphasis to your specification.

[SEE EARLIER LENGTHY DISCUSSION OF PRE-EMPHASIS AND REMOTE CONTROL, on page x-x.]

2. Adjust analog left/right input level.

A☐ Apply to the analog inputs processed audio with peaks hitting 100% modulation, or apply a line-up tone at 100% modulation.

B☐ Choose ANALOG IN from the front panel and adjust the left and right ANALOG INPUT ATTENUATORs to make the respective left and right LED meters read 100% on peaks. (These meters are true peak-reading.)

3. Adjust digital input level.

A☐ Apply to the digital AES/EBU input processed audio with peaks hitting 100% modulation, or apply a line-up tone at 100% modulation.

B☐ Set the METER to COMPOSITE.

C☐ Turn off any subcarriers you have connected to the 8208's rear-panel subcarrier input.

D☐ Choose DIGITAL IN from the front panel and adjust the DIGITAL INPUT ATTENUATOR to make the composite LED meter read 100% on peaks.

> This control adjusts the left and right channels simultaneously. If there is an channel imbalance in the system prior to the 8208, the left and right meters will indicate it. There is no channel balance control available on the 8208; you must correct channel balance at the source.

E☐ PILOT LEVEL (optional)

> This control adjusts the injection of the 8208's 19kHz stereo pilot tone. Most countries require this injection to be from 8% to 10% modulation. As shipped from the factory, this level has been adjusted for 9% injection and usually requires no change.
>
> If you wish to adjust pilot injection to a different level, switch the METER to PILOT, and adjust the pilot level with the screwdriver-adjustable PILOT control on the front panel.

F☐ Set the METER to COMPOSITE.

G☐ Adjust the 8208's COMPOSITE OUT level control(s) for 100% TOTAL MODULATION of your FM exciter, as indicated on a modulation monitor, or modulation indicator on your exciter.

If using a composite STL, adjust the 8208's COMPOSITE OUT level control(s) for 100% TOTAL MODULATION of your composite STL transmitter, as indicated on the STL's modulation indicator. Then adjust your STL's receiver output level control and/or FM exciter composite input level control for 100% TOTAL MODULATION of your FM exciter, as indicated on a modulation monitor, or modulation indicator on your exciter.

H☐ STEREO/MONO

[MONO L], [MONO R], or [STEREO]

This controls sets the 8208 for mono or stereo operation.

MONO L (MONO FROM LEFT) switches the 8208's stereo encoder off, using the left input as the program source.

MONO R (MONO FROM RIGHT) switches the 8208's stereo encoder off, using the right input as the program source.

STEREO switches the 8208's stereo encoder on.

Note that you can also use the rear-panel remote control terminals to switch this function.

I ☐ INPUT-ANALOG or DIGITAL

This sets the analog inputs or the AES/EBU digital input as the audio source. If no digital source is present, the 8208 will automatically use the analog input as its source. Note that you can also use the rear-panel remote control terminals to switch this function.

Section 3
Operation

page contents

Caution

The installation and servicing instructions in this manual are for use by qualified personnel only. To avoid electric shock do not perform any servicing other than that contained in the Operating Instructions unless you are qualified to do so. Refer all servicing to qualified service personnel.

8208 Controls and Meters

Screwdriver-Adjustable Controls

Orban supplies a special green-handled flat-blade screwdriver (Xcelite R3323) to adjust the stereo encoder controls. Note that the Orban tweaker tool supplied with the analog OPTIMODs cannot be used with the 8200.

LEFT: Determines the sensitivity of the encoder to signals appearing at the left analog input. When LEFT is advanced fully counter-clockwise, +15 dBu produces 100% modulation at 100Hz. When LEFT advanced fully clockwise, 0 dBu produces 100% modulation at 100Hz

RIGHT: Determines the sensitivity of the encoder to signals appearing at the right analog input. When RIGHT is advanced fully counter-clockwise, +15 dBu produces 100% modulation at 100Hz. When RIGHT advanced fully clockwise, 0 dBu produces 100% modulation at 100Hz

DIGITAL: Determines the sensitivity of the encoder to digital signals appearing at the AES/EBU input. When DIGITAL is advanced fully clockwise, digital input at 6dB below full scale produces 100% modulation at 100Hz. When DIGITAL is advanced fully counter-clockwise, digital input at full scale produces 100% modulation at 100Hz.

PILOT LEVEL control adjusts the level of the 19kHz stereo pilot tone. You can measure the injection of the pilot tone, in percent modulation, by switching the METER switch to PILOT. Its range is 7% to 11% injection.

COMPOSITE LEVEL 1 control sets the output level of Composite Output 1. Range is 0.4 to 8V p-p.

COMPOSITE LEVEL 2 control sets the output level of Composite Output 2. Range is 0.4 to 8V p-p.

Front Panel Buttons and Indicators

INPUT: Determines whether the analog or AES/EBU inputs drive the stereo encoder. If, when set to Digital, no legal digital signal is present at the digital input, the function defaults to ANALOG, the ANALOG lamp is lit, and the DIGITAL lamp is blinking. Upon receiving a valid digital input, the input switches to digital immediately, the digital lamp is lit, and the analog lamp is unlit.

STEREO/MONO: This determines whether the main operating mode of the stereo encoder is stereo or mono:

Stereo: The encoder produces the standard stereo baseband. Pre-emphasis is applied according to the state of the EMPHASIS logic. The state of the CROSSTALK TEST switch determines whether the stereo main channel and subchannel are produced according to their standard definitions, or if special test modes are present. (See the discussion of the CROSSTALK TEST switch, below, for a definition of these test

modes.). The state of the PILOT switch determines whether the stereo pilot tone is present. When entering STEREO MODE from MONO L or MONO R MODES, the state of PILOT is set to that used in the most recent occasion of STEREO MODE.

Mono L: The encoder produces a monophonic signal from the left audio input. Pre-emphasis is applied according to the state of the EMPHASIS logic. The stereo pilot tone is not present, regardless of the state of the PILOT ON/OFF switch. Both the PILOT ON and PILOT OFF LED's are not lit. The stereo subchannel is not present. (Operationally, this function requires the 8208 to increase the gain of the left channel to the output by 6.84dB mode by comparison to its gain in STEREO so that a signal of given level at the input produces the same peak level at the 8208's composite output in MONO mode as it does in STEREO mode, assuming 9% Pilot Injection.)

Mono R: Same as MONO L, but accepts audio from the right input.

PILOT: Determines whether the pilot tone is present when the operating mode is STEREO, and regardless of the setting of the CROSSTALK TEST switch. In MONO L or MONO R modes the button is locked out and both associated LED's are OFF. The PILOT is linked with STEREO MODE so that returning from MONO L, or, MONO R to STEREO MODE restores the PILOT to the state it was in when last in STEREO MODE.

CROSSTALK TEST: Determines if the stereo encoder operates normally, or if it produces special test functions. Whenever one of the two crosstalk tests is selected (Main>Sub or Sub>Main) the system first saves the current operational state for STEREO/MONO and PILOT. This operational state is restored when OPERATE is selected.

Operate: Stereo encoder operates normally

Main>Sub: Produces a pure main-channel signal from the left channel audio. Operating this function forces the encoder into STEREO mode if it is not already in that mode, and any local and remote STEREO/MONO switching is locked out. The stereo subchannel is turned off. Pre-emphasis is applied according to the state of the EMPHASIS logic. Pilot status is determined by the PILOT switch. The left channel input at 100% modulation level produces 91% modulation at the composite output with the pilot OFF, and 100% modulation at the composite output with the pilot ON (when pilot level set for 9% injection). This implies increasing the gain of the left channel to the composite output by 6.02dB by comparison to normal STEREO OPERATE mode.

Sub>Main: Produces a pure stereo subchannel channel signal from the left channel audio. Operating this function forces the encoder into STEREO mode if it is not already in that mode, and any local and remote STEREO/MONO switching is locked out. The main channel is turned off, and only the output of the subchannel modulator is applied to the composite output. Pre-emphasis is applied according to the state of the EMPHASIS logic. Pilot status is determined by the PILOT switch. The left channel input at 100% modulation level produces 91% modulation at the composite output with the pilot OFF, and 100% modulation at the composite output with the pilot ON (when pilot level set for 9% injection). This implies increasing the gain of the left channel to the subchannel modulator by 6.02dB by comparison to normal STEREO OPERATE mode.

METER: This determines whether the bottom meter displays the composite level in percent modulation, or if it displays the pilot injection, in percent modulation. When PILOT is displayed, the display is dark unless the 8208 is in STEREO mode and the PILOT is ON.

EMPHASIS: The functions of the four EMPHASIS lamps should be self-evident after the material below in "rear panel" is understood. In all cases, the EMPHASIS lamps show an actual status of the 8208: Whether it is applying 50μs or 75μs pre-emphasis to the input audio, whether it is applying J.17 de-emphasis to the audio, and whether this pre-emphasis is determined by DIP switches on the rear panel or by status bits received in the AES bitstream. The AES DETERMINES PRE-EMPH AND J.17 lamp should only be ON when the rear-panel AES STAT is set to AUTO and a valid AES signal is present at the digital input.