Operating Manual

Optimod-PC

1101

Digital Audio Processor PCI Sound Card

Software Version 1.0

orban

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

Model Number:	**Description:**
1101	OPTIMOD-PC Digital Audio Processor on a PCI Sound Card. OPTIMOD-PC is a broadcast-quality audio processor offering gain-riding AGC, parametric equalization, multiband compressor, and look-ahead peak limiting.
1101/CBLXLR	Pre-wired cable option for 1101 I/O Interface, terminated in XLR connectors.
1101/CBLRCA	Pre-wired cable option for 1101 I/O Interface, terminated in RCA connectors.
1101/CBL	Pre-wired cable option for 1101 I/O Interface, unterminated.



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.



In accordance to the WEEE (waste electrical and electronic equipment) directive of the European Parliament, this product must not be discarded into the municipal waste stream in any of the Member States. This product may be sent back to your Orban dealer at end of life where it will be reused or recycled at no cost to you.

If this product is discarded into an approved municipal WEEE collection site or turned over to an approved WEEE recycler at end of life, your Orban dealer must be notified and supplied with model, serial number and the name and location of site/facility.

Please contact your Orban dealer for further assistance.

www.orban.com

PLEASE READ BEFORE PROCEEDING!

Manual

Please review the Manual, especially the installation section, before installing the unit in your computer.

Trial Period Precautions

If your unit has been provided on a trial basis:

You should observe the following precautions to avoid reconditioning charges in case you later wish to return the unit to your dealer.

(1) Note the packing technique and save all packing materials. It is not wise to ship in other than the factory carton. (Replacements cost $35.00).

(2) Avoid scratching the plating. Set the unit on soft, clean surfaces.

(4) Use care and proper tools in removing and tightening screws to avoid burring the heads.

Packing

When you pack the unit for shipping:

(1) Wrap the unit in its original plastic bag to avoid marring the unit.
(2) Seal the carton with tape.

If you are returning the unit permanently (for credit), be sure to enclose:

The Manual(s)
The Registration/Warranty Card

Your dealer may charge you for any missing items.

If you are returning a unit for repair, do not enclose any of the above items.

Further advice on proper packing and shipping is included in the Manual (see Table of Contents).

Trouble

If you have problems with installation or operation:

(1) Check everything you have done so far against the instructions in the Manual. The information contained therein is based on our years of experience with OPTIMOD and broadcast stations.

(2) Check the other sections of the Manual (consult the Table of Contents) and search the text to see if there might be some suggestions regarding your problem.

(3) After reading the section on Factory Assistance, you may call Orban Customer Service for advice during normal Arizona business hours. The number is +1 480.403.8300.

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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, subject 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.)

CAUTION

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 destroy one or more of the CMOS semiconductors employed in OPTIMOD-FM. 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 V, you may not notice damaging discharges.

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

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Table of Contents

PLEASE READ BEFORE PROCEEDING! ---- *0-3*
Table of Contents ---- *0-7*
Index ---- *0-12*

SECTION 1 INTRODUCTION ---- 1-1

ABOUT THIS MANUAL ---- 1-1
AUDIO PROCESSING FOR LEVEL CONTROL ---- 1-1
Audio Processing: Making Broadcasts/Netcasts Sound Professional ---- *1-1*
Figure 1-1: Unprocessed Audio ---- *1-2*
Figure 1-2: Same Audio Processed Through OPTIMOD-PC ---- *1-2*
Audio Processing for Netcasts ---- *1-3*
Measuring Studio and Transmission Levels ---- *1-3*
Figure 1-3: Absolute Peak Level, VU and PPM Reading ---- *1-3*
Controlling Program Levels in a Playout System before OPTIMOD-PC ---- *1-4*
THE OPTIMOD-PC DIGITAL AUDIO PROCESSOR ---- 1-5
General Features ---- *1-6*
Adaptability through Multiple Audio Processing Structures ---- *1-9*
PRESETS IN OPTIMOD-PC ---- 1-10
Factory Processing Presets ---- *1-10*
User Processing Presets ---- *1-11*
INPUT/OUTPUT CONFIGURATION ---- 1-12
Figure 1-4: OPTIMOD-PC Signal Flow and I/O ---- *1-13*
Digital AES3 Left/Right Input/Output ---- *1-13*
Analog Left/Right Input/Output ---- *1-14*
The Orban I/O Mixer ---- *1-14*
OVERVIEW OF AN OPTIMOD-PC INSTALLATION ---- 1-16
Figure 1-5: Typical I/O mixer ---- *1-16*
Simple Operation in One Host Computer ---- *1-18*
Security ---- *1-18*
Networking OPTIMOD-PC Cards ---- *1-20*
LOCATION OF OPTIMOD-PC FOR NETCASTING ---- 1-21
Genlocking OPTIMOD-PC Cards to a Reference Sample Frequency ---- *1-22*
STUDIO-TRANSMITTER LINK IN DIGITAL BROADCASTING ---- 1-22
Transmission from Studio to Transmitter ---- *1-23*
Digital links ---- *1-23*
Microwave STLs ---- *1-25*
Analog Telephone/Landline (PTT/Post Office Line) ---- *1-26*
LOCATION OF OPTIMOD-PC IN DIGITAL RADIO SERVICE ---- 1-26
At the Transmitter is Best ---- *1-26*
Where Access to the Transmitter is not Possible ---- *1-26*
OPTIMOD-PC at the Transmitter: Gain Control before the STL ---- *1-27*
USING LOSSY DATA REDUCTION IN THE AUDIO CHAIN BEFORE OPTIMOD-PC ---- 1-28
INTERFACING TO THE TRANSMITTER ---- 1-28
Sync Input ---- *1-28*
Sample Rate and Audio Bandwidth ---- *1-28*
Subframe Delay ---- *1-29*
SETTING OUTPUT/MODULATION LEVELS ---- 1-29
MONITORING ON LOUDSPEAKERS AND HEADPHONES ---- 1-30
STREAMING AND NETCASTING APPLICATIONS ---- 1-31

Using OPTIMOD-PC in Streaming Applications ---- *1-31*
Using OPTIMOD-PC to Prepare Audio Files for Download ---- *1-31*
Loudness ---- *1-32*
Choosing your Encoder ---- *1-32*
SHIPPING INSTRUCTIONS ---- 1-32
WARRANTY, USER FEEDBACK ---- 1-33
User Feedback ---- *1-33*
LIMITED WARRANTY ---- *1-33*
INTERNATIONAL WARRANTY ---- *1-34*
EXTENDED WARRANTY ---- *1-34*

---- SECTION 2 INSTALLATION ----2-1

INSTALLING OPTIMOD-PC IN WINDOWS® COMPUTERS ----2-1

1. Unpack and inspect. ---- *2-1*
2. Mount OPTIMOD-PC in a free PCI slot in your computer. ---- *2-2*
3. Install driver and software. ---- *2-2*
Figure 2-1: OPTIMOD-PC Network Scenarios ---- *2-3*
Figure 2-2: Wiring Diagram for the OPTIMOD-PC XLR Cable Assembly ---- *2-4*
Figure 2-3: Wiring Diagram for the OPTIMOD-PC RCA Cable Assembly ---- *2-4*
4. Plan your installation. ---- *2-4*
Figure 2-4: The Orban Control Application ---- *2-5*
5. Connect hardware inputs and outputs. (optional) ---- *2-5*
6. Set up passwords and card names for cards in your computer. (optional) ---- *2-6*
Figure 2-5: Card & Security Administration ---- *2-7*
8. Edit the local OPTIMOD-PC server's network accessibility, port numbers, and Service Security Password. (optional) ---- *2-10*
10. Add remote cards to your list of available cards. (optional) ---- *2-10*
11. Connect to a remote card. (optional) ---- *2-12*
12. Change passwords and card names over a network. (optional) ---- *2-12*
13. Delete a remote computer's profile. (optional) ---- *2-13*
15. Simple installations: Connecting to an OPTIMOD-PC card. ---- *2-14*
16. Connect inputs and outputs. (optional) ---- *2-14*

AUDIO INPUT AND OUTPUT CONNECTIONS ---- 2-15

Cable ---- *2-15*
Connectors ---- *2-15*
Analog Audio Input ---- *2-15*
Analog Audio Monitor Output ---- *2-16*

AES3 DIGITAL INPUT AND OUTPUT ---- 2-16

GROUNDING ---- 2-17

Power Ground ---- *2-18*
SETUP: THE OPTIMOD-PC CONTROL APPLICATION ---- 2-18
1. From the Tools menu, bring up the I/O Mixer. ---- *2-18*
2. Select the card you are setting up. ---- *2-19*
3. Configure global audio processing parameters. ---- *2-20*
Figure 2-6: Configuration Page in the I/O Mixer ---- *2-21*
4. Set digital output properties. (optional) ---- *2-22*

Figure 2-7: Processor Mixer Page in I/O Mixer ---------- 2-24

INPUT SETUP ---------- 2-24

About the Interaction between the OPTIMOD-PC Input Mixers and the Microsoft Windows Mixer ---------- 2-25

Figure 2-8: MS Mixer Output ---------- 2-25

Figure 2-9: MS Mixer Input ---------- 2-26

Input Setup Procedure ---------- 2-26

1. Adjust the Analog Input Reference Level control. ---------- 2-26

2. Adjust the Analog Output Reference Level control. ---------- 2-27

3. Select the Stereo/Mono input mode for the analog input. ---------- 2-28

4. Adjust the Processor mixer analog input fader. ---------- 2-28

5. Adjust the Analog L/R Input Balance Control. (optional) ---------- 2-30

6. Adjust the remaining input faders. (optional) ---------- 2-30

7. Set up the automatic backup feed function. (optional) ---------- 2-30

Figure 2-10: Output Levels Page in I/O Mixer ---------- 2-31

OUTPUT AND ROUTING SWITCHER SETUP ---------- 2-31

THE DIRECT MIXER ---------- 2-32

INTERFACING OPTIMOD-PC WITH WAVE DEVICES ---------- 2-33

Turning Off Windows Sounds ---------- 2-33

Applying Output from WAVE Applications to OPTIMOD-PC ---------- 2-33

Applying OPTIMOD-PC's Output to WAVE Devices ---------- 2-34

Enabling the Windows 2003 Server Audio Service ---------- 2-35

PROBLEMS AND POSSIBLE CAUSES ---------- 2-36

When I first turn on my computer, the sound seems wrong. ---------- 2-36

When I Launch the OPTIMOD-PC control application, the meters do not move and I cannot control my card. ---------- 2-36

I can't connect to a given OPTIMOD-PC card from my network. ---------- 2-36

I get clicks when I source my WAVE material from a CD. ---------- 2-37

I get clicks when I source my WAVE material from my computer's hard drive. -------- 2-37

I get clicks in the 1101's WAVE output. ---------- 2-38

I am running Windows 2003 and I cannot get audio to pass through OPTIMOD-PC's WAVE inputs and outputs. ---------- 2-38

Meters on Optimod-PC Control Application freeze temporarily but audio continues to be processed normally. ---------- 2-38

RFI, hum, clicks, or buzzes ---------- 2-38

Poor peak level control ---------- 2-38

Audible distortion ---------- 2-38

Audible noise in processed audio ---------- 2-39

Shrill, harsh sound; excessive sibilance ---------- 2-40

Gain pumping when high frequency energy is present ---------- 2-40

System receiving OPTIMOD-PC's AES digital output will not lock ---------- 2-40

System will not pass line-up tones at full output level/100% modulation ---------- 2-40

General dissatisfaction with subjective sound quality ---------- 2-40

TECHNICAL SUPPORT ---------- 2-41

ADDING A CUSTOM LOGO ---------- 2-41

USING WINDOWS FIREWALL WITH OPTIMOD-PC ---------- 2-42

NAT (Network Address Translation) Firewalls ---------- 2-44

SECTION 3 OPERATION ---------- 3-1

Figure 3-1: The OPTIMOD-PC Control Application ---- *3-1*
THE OPTIMOD-PC CONTROL APPLICATION ---- 3-1
INTRODUCTION TO PROCESSING ---- 3-4
Some Audio Processing Concepts ---- *3-4*
Distortion in Processing ---- *3-4*
Loudness and Distortion ---- *3-4*
Speech/Music Detector ---- *3-5*
Processing for Low Bitrate Codecs ---- *3-5*
Optimod-PC in Radio-Oriented Applications: From Bach to Rock ---- *3-6*
Sound for Picture Applications: Controlling Dynamic Range ---- *3-7*
Protection Limiting ---- *3-7*
Studio AGC ---- *3-8*
ABOUT OPTIMOD-PC'S SIGNAL PROCESSING FEATURES ---- 3-8
Dual-Mono Architecture ---- *3-8*
Audio Processing Signal Flow ---- *3-9*
Figure 3-2: Simplified OPTIMOD-PC Digital Signal Processing Diagram ---- *3-9*
Two-Band Purist Processing ---- *3-12*
Input/output Delay ---- *3-12*
CUSTOMIZING OPTIMOD-PC'S SOUND ---- 3-13
Basic Control ---- *3-13*
Gain Reduction Metering ---- *3-15*
Fundamental Requirements: High-Quality Source Material and Accurate Monitoring ---- *3-15*
ABOUT THE PROCESSING STRUCTURES ---- 3-15
FACTORY PROGRAMMING PRESETS ---- 3-17
Protection and AGC Presets ---- *3-18*
Table 3-1: Protection and AGC Presets ---- *3-19*
Radio-Style Presets ---- *3-20*
Table 3-2: Radio-Style Presets ---- *3-21*
Sound for Picture Presets ---- *3-26*
Table 3-3: Factory Programming Presets (Video) ---- *3-26*
Table 3-4: Equalization Controls ---- *3-27*
EQUALIZER CONTROLS ---- 3-27
STEREO ENHANCER CONTROLS ---- 3-32
Table 3-5: Stereo Enhancer Controls ---- *3-32*
Table 3-6: AGC Controls ---- *3-33*
AGC CONTROLS ---- 3-33
DISTORTION CONTROL ---- 3-38
Figure 3-3: Bass Clipper Input/Output Transfer Curves as Bass Clip Shape Control is Varied from 0.0 (Hard) to 10.0 (Soft) ---- *3-39*
Table 3-7: Distortion Control Adjustments ---- *3-40*
THE TWO-BAND STRUCTURE ---- 3-40
Customizing the Settings ---- *3-41*
The Two-Band Structure's Full and Advanced Setup Controls ---- *3-41*
Table 3-8: Two-Band Controls ---- *3-42*
THE FIVE-BAND STRUCTURE ---- 3-45
Putting the Five-Band Structure on the Air ---- *3-45*
Table 3-9: Five-band Controls ---- *3-46*
Customizing the Settings ---- *3-46*
The Five-Band Structure's Full and Advanced Setup Controls ---- *3-46*
Table 3-10: Multiband Attack / Release Controls ---- *3-47*
Table 3-11: MB Band Mix Controls ---- *3-51*

If the Host Computer Restarts or Crashes… ----------3-53
Using OPTIMOD-PC for Production and Mastering ----------3-54
Creating Custom "Factory" Presets----------3-57
Table 3-12: Less-More Reference---------- *3-59*

----------SECTION 4 SOFTWARE SUMMARY
----------4-1

OPTIMOD-PC Software Summary---------- 4-1
Application Installation File ---------- *4-1*
Driver Files ---------- *4-2*
Driver ---------- *4-2*
Service ---------- *4-2*
Agent (Tray Icon) ---------- *4-2*
Control Application ---------- *4-3*
Registry ---------- *4-3*
Hardware I/O and PCI Expansion Chassis ---------- *4-3*
About the OPTIMOD-PC Driver and Service---------- 4-3

---------- SECTION 5 UNINSTALLATION
----------5-1

Uninstalling the OPTIMOD-PC Software ---------- 5-1

---------- SECTION 6 CONTROL API
----------6-1

OPTIMOD-PC System/Mixer Control API---------- 6-1
Table 6-1: Telnet/SSH Command List---------- *6-1*
Table 6-2: OPTIMOD-PC System Command and Status List---------- *6-4*
Using the API and the 1100 Control Application Simultaneously ---------- *6-4*
Using the API: Examples---------- *6-4*
Setting the Analog Output Level ---------- *6-4*
Muting the Wave Input---------- *6-5*
Toggling the Audio Inputs to Insert Replacement Commercials---------- *6-5*
Microsoft Windows Mixer Control API---------- 6-6
Table 6-3: Windows Driver Enumeration---------- *6-6*
Table 6-4: Windows Mixer Output Destination Names ---------- *6-7*
Table 6-5: Windows Mixer Input Destination Names---------- *6-7*
Table 6-6: Windows Mixer Peak Meter Data ---------- *6-7*
Administering the 1101 through Serial Ports---------- 6-7
Connecting via Serial Port Using a Terminal Program on a PC ---------- *6-8*
Administering the 1101 through Ethernet TCP/IP----------6-10
Connecting via TCP/IP Using a Terminal Program on a PC ----------*6-11*

A

aacPlus 1- · 3
aacPlus 3- · 6
active setup 2- · 19
Administering 1101 Through Terminal Program 6- · 7, 10
Adobe Reader 1- · 1
AES/EBU digital I/O 2- · 16, 23
AGC
  bass attack control 3- · 37
  bass coupling control 3- · 35
  bass release control 3- · 37
  bass threshold control 3- · 36
  control list 3- · 33
  crossover control 3- · 37
  defeating 3- · 34
  defeating 3- · 22
  drive control 3- · 34
  gate threshold control 3- · 35
  idle gain control 3- · 37
  master attack control 3- · 37
  master release control 3- · 34
  meter 3- · 1
  presets 3- · 18
  ratio control 3- · 36
  studio 3- · 8
  using 1101 as 3- · 19
AGC 3- · 11
AGC Matrix 3- · 38
agent 4- · 2
allpass crossover 3- · 37
analog
  I/O setup 2- · 24
analog I/O 1- · 14
analog input calibration 2- · 28
analog input reference 2- · 28
analog inputs 2- · 15
analog landline 1- · 26
analog monitor output 2- · 16
API
  commands 6- · 4
  conflicts with Control App 6- · 4
  examples 6- · 4
  Microsoft mixer 6- · 6
API 6- · 1
artifacts
  minimizing codec 3- · 5
Attack
  Multiband 3- · 52
attack 3- · 37
audio
  analog input 2- · 15
  analog output 2- · 16
  bandwidth 1- · 28
  connections 2- · 15
  digital I/O 2- · 16
automatic backup feed 2- · 30

B

B1/B2 crossover control 3- · 53
balance control 2- · 30
balanced
  inputs 2- · 16
  output transformer 2- · 16
band coupling 3- · 50
bandwidth 2- · 20
BASS CLIP control 3- · 38
bass threshold 3- · 36
brightness
  controlling excessive 3- · 5
Brilliance control 3- · 30
buzzes 2- · 38

C

cable
  shielding 2- · 15
cable 2- · 15
Classical music 3- · 21
clicks
  in WAVE output 2- · 38
clicks 2- · 38
clipper
  control list 3- · 38
clipper, bass 3- · 11
clipping 2- · 32

clipping 3- · 4
codec
  aacPlus 3- · 6
  HE-AAC 3- · 6
  processing for low bit rate 3- · 5
  Windows Media Audio 3- · 6
commercials
  replacing 6- · 5
common mode rejection 2- · 16, 17
compression 3- · 4
compressor gate 3- · 35
connect menu 3- · 3
connectors 2- · 15
consistency 1- · 4
control
  ST CHASSIS 2- · 20
control application · 1
control application 4- · 3
control pane 3- · 2
controls
  analog input reference 2- · 28
  BASS CLIP 3- · 38
  digital output rate 2- · 22
  dither 2- · 22
  DO RATE 2- · 22
  DO SYNC 2- · 22
  Final Limit 3- · 40
  input selector 2- · 26
  Less-More 3- · 13
  LO PASS 3- · 31
  MAX LPF 2- · 20
  preemphasis 2- · 23
  R CH BAL 2- · 30
  STAT BITS 2- · 23
  SYNC DELAY 2- · 21
  word length 2- · 22
crash
  host computer 3- · 53
crossover
  allpass 3- · 37
  linear phase 3- · 37
  modes 3- · 37
custom logo 2- · 41

D

default port 2- · 43
delay 3- · 12
delta release control 3- · 52
digital I/O
  sync 2- · 22
digital I/O 1- · 13
digital I/O 2- · 16
digital links 1- · 23
digital media
  preprocessing for 1- · 1
digital output
  not locking 2- · 40
Direct Mixer 2- · 32
distortion
  in WAVE output 2- · 38
distortion 2- · 38
distortion control 3- · 38
dither 2- · 22
DJ Bass control 3- · 30
downward expander 3- · 49
driver
  files 4- · 2
  upgrading 4- · 2
driver 4- · 2, 3
driver enumeration 6- · 6
DSP block diagram 3- · 9
dual-mono 3- · 8
ducking 2- · 40

E

edit menu 3- · 3
enabling analog input 2- · 26
equalizer
  bass shelf 3- · 28
  control list 3- · 27
  parametric 3- · 28
equalizer 3- · 11
Ethernet
  and terminal program 6- · 10
  crossover cable 6- · 12
Eureka 147 1- · 5

F

factory presets
  creating custom 3- · 57
  radio 3- · 20
  tv 3- · 26
factory presets 1- · 10
features 1- · 6
file
  setup 4- · 1
file menu 3- · 3

Final Limit control 3- · 40
Firewall
NAT 2- · 44
Firewall 2 · 42
five-band
band coupling controls 3- · 50
delta release control 3- · 52
downward expander thresold control 3- · 49
full modify control list 3- · 46
limiter attack control 3- · 52
multiband drive control 3- · 46
multiband gate threshold control 3- · 48
mutiband release control 3- · 48
output mix controls 3- · 51
five-band 3- · 45

G

gain pumping 2- · 40
gate
threshold control 3- · 48
gate 3- · 35
Gate indicators 3- · 2
Genlocking 1- · 22, 28
global processing parameters
configuring 2- · 20
grounding
ground loop 2- · 17
grounding 2- · 17, 18

H

Hard Clip Shape 3- · 39
hardware I/O 4- · 3
harshness 2- · 40
HD Radio
processing for 3- · 5
HE-AAC 3- · 6
headphones 1- · 30
headroom
in codecs 1- · 24, 30
relationship to EQ 1- · 30
headroom 2- · 32, 39
HF enhancer 3- · 11
High Frequency Enhancer 3- · 31
high frequency limiter 3- · 50
high-pass filter
30 Hz 3- · 10
Highpass Filter 3- · 31
hum 2- · 38

I

idle gain 3- · 37
input
analog 2- · 15
balanced 2- · 16
reference level 2- · 28
unbalanced 2- · 16
inspection 2- · 1
installation
networked 1- · 20
overview 1- · 16
simple 1- · 18
simple 2- · 14
Instrumental format 3- · 23
internal sample clock 2- · 22

J

Jazz format 3- · 23

L

latency 3- · 12
Less-More 3- · 33
Less-More control 3- · 13
levels
measuring 1- · 3
limiter
attack 3- · 52
look-ahead 3- · 19
limiter meter 3- · 2
limiting
look-ahead 3- · 4
limiting 3- · 4, 7
linear-phase crossover 3- · 37
line-up level 1- · 4
line-up tones at 100% modulation
not passing 2- · 40
Lo Pass control 3- · 31
Location
streaming 1- · 21
location 1- · 26
logo
customizing 2- · 41
look-ahead limiter 3- · 19

look-ahead limiting 3- · 4
lossy data reduction 1- · 28
loudness · 4
Loudness
  increase expected 1- · 32
loudness 1- · 2
loudness 3- · 4
Loudness Controller
  and 5-Band · 45
Loudness Controller 5- · 45

M

mastering applications 3- · 54
mastering presets 3- · 54
Matrix
  AGC 3- · 38
Max Delta GR
  AGC 3- · 38
MaxDeltaGR control 3- · 52
meter
  gain reduction 3- · 15
meters
  AGC 3- · 1
  limiter 3- · 2
Mixer
  built into PC 2- · 25
  configuration page in IO 2- · 21
  processor 2- · 18, 24
modulation
  switching 1- · 29
monitoring
  analog 2- · 16
monitoring 1- · 30
mounting unit 2- · 2
MP3 1- · 32
MPEG4 HE-AAC 1- · 3
Multiband
  Gain reduction meters 3- · 2
multiband drive 3- · 46
multiple cards 1- · 5
music/speech detector 3- · 5

N

netcasting
  processing for 1- · 1
netcasting applications
  encoder 1- · 32
netcasting applications 1- · 31
Network
  Can't Connect 2- · 36
Networking 1- · 20
News format 3- · 24
NICAM 1- · 24
noise 2- · 39
non-streaming applications 1- · 31
normalization 1- · 4

O

Opticodec-PC 1- · 3
Opticodec-PC 3- · 6
Optimod-PC
  general description 1- · 5
Optimod-TV 8382 3- · 20
output
  analog 2- · 16
  balanced 2- · 16
  not locking 2- · 40
output mix controls 3- · 51

P

packing list 2- · 1
parametric equalizer 3- · 11
password
  setting · 6
Password
  changing 2- · 12
PCI expansion chassis 1- · 5
PCI expansion chassis 4- · 3
pdf 1- · 1
peak clipping 1- · 3
peak limiter 3- · 19
peak modulation
  cannot control 2- · 38
peak normalization 1- · 4
phase rotation 3- · 20
phase rotator 3- · 10
Phase Rotator 3- · 32
phase-linear
  two-band purist processing 3- · 12
Plink 6- · 2
port
  default 2- · 43
power
  ground 2- · 18

PPM 1- · 3
PreCode 3- · 5
preemphasis 2- · 23
preparing files for download 1- · 31
preprocessing 1 - · 1
presets
"modified" 1- · 12
backing up user 1- · 12
compatibility with V1 1- · 11
copying user 1- · 11
country 3- · 22
creating "factory" 3- · 57
creating user 1- · 12
crisp 3- · 22
dance 3- · 22
default folder 1- · 11
deleting user 1- · 12
edge 3- · 22
factory 1- · 10
factory programming 3- · 17
five-band 3- · 16
folk 3- · 22
gold 3- · 22
oldies 3- · 22
radio 3- · 20
smooth jazz 3- · 25
techno 3- · 22
two-band 3- · 17
user presets 1- · 11
video 3- · 26
WMA music 3- · 25
WMA news-talk 3- · 25
Presets
Gregg 3- · 23
Impact 3- · 23
Instrumental 3- · 23
Jazz 3- · 23
Loud 3- · 23
News-Talk 3- · 24
Rock 3- · 24
Sports 3- · 24
Urban 3- · 25
processing
AGC 3- · 11
distortion in 3- · 4
equalization 3- · 11
intelligent clipping 3- · 12
introduction to 3- · 4
multiband compression 3- · 11
music/speech 3- · 5
radio-style 3 · 6
signal flow 3- · 8
structures 3- · 15
two-band purist 30 · 12
video oriented 3- · 7
Processing
Stereo enhancement 3- · 10
processing structures
two-band 3- · 26
protection limiter 3- · 19
protection limiting 3- · 7
PuTTY 6- · 2

R

ratio
AGC 3- · 36
control 3- · 11
record volume control
nonfunctional 2- · 26
reference level
analog 2- · 26
reference level 1- · 4
registry 4- · 3
remote card
connecting to 2- · 12
remote Card
adding 2- · 10
remote computer's profile
delete 2- · 13
remote control
via API 6- · 1
reset
host computer 3- · 53
restart
host computer 3- · 53
RFI 2- · 18, 38
Rock format 3- · 24
Routing Switcher 2- · 31
Rumble Filter 3- · 31

S

sample rate 1- · 28
sample rate 2- · 22
sample rate 3- · 10
Security 1- · 18
serial port
configuring 2 · 8
Serial Port #2 6- · 7, 10
Server
editing properties 2- · 10
service 4- · 2, 3

setup file 2- · 19
shelving equalizer
  bass, slope of 3- · 11
shipping
  container 2- · 1
  damage 2- · 1
shrillness 2- · 40
signal flow 3- · 9
smooth jazz 3- · 25
software summary 4- · 1
sound card mode 2- · 27
sound customization 3- · 13
Sound Quality
  Dissatisfaction with 2- · 40
  Startup 2- · 36
source material 3- · 15
SPDIF 2- · 23
speech/music detector 3- · 5
Sports format 3- · 24
SSH
  command list 6- · 1
SSH 6- · 1
ST CHASSIS mode 2- · 20
status bits 2- · 23
Stereo enhancement 3- · 10
Stereo enhancer
  Controls 3- · 32
Stereo Enhancer
  Amount 3- · 32
  Depth 3- · 33
  Diffusion 3- · 33
  In/Out 3- · 32
  Ratio Limit 3- · 33
  Style 3- · 33
stereo/mono input mode 2- · 28
STL protection 3- · 8
STL systems 1- · 23, 25, 27
Streaming
  location of card 1- · 21
streaming media 1- · 31
studio AGC
  preset 3- · 19
studio AGC 3- · 8
subframe delay 1- · 29
sync delay 2- · 21
Sync input 1- · 28

T

Talk format 3- · 24
TCI/IP 6- · 11
Telnet
  command list 6- · 1
Telnet 6- · 1, 13
terminal server 6- · 1
Threshold
  Bass Delta 3- · 38
  Master Delta 3- · 38
  Multiband Compression 3- · 48
toolbar 3- · 3
tools menu 3- · 3
Transmitter
  interfacing to 1- · 28
tray icon 4- · 2
tv presets 3- · 26
two-band
  bass attack control 3- · 45
  bass coupling control 3- · 44
  bass threshold control 3- · 45
  clipping control 3- · 44
  crossover control 3- · 45
  drive control 3- · 41
  full modify controls 3- · 41
  gate control 3- · 43
  high frequency limiting control 3- · 44
  master attack control 3- · 45
  master compression threshold 3- · 44
  release control 3- · 42
two-band processing structure 3- · 26
two-band structure 3- · 40

U

unbalanced
  inputs 2- · 16
uninstall 4- · 1
Uninstalling Software 5- · 1
unpacking 2- · 1
upgrade from earlier version 2- · 4
Urban format 3- · 25
user presets
  creating 3- · 14
user presets 1- · 11

V

video presets 3- · 26
view menu 3- · 3
VU meter 1- · 3

W

warranty 1- · 33
Warranty 1- · 33
WAVE Devices
  fed from Optimod-PC 2- · 34
Window Release 3- · 36
Window Size 3- · 36
Windows
  Server 2003 2- · 35
Windows firewall 2- · 42
Windows Media Codec 3- · 6
Windows mixer
  input destination names 6- · 7
  output destination names 6- · 7
WIndows mixer
  peak meter data 6- · 7
Wiring Harness
  wiring diagram 2- · 4
word length 2- · 22

X

XLR connectors 2- · 15

Section 1
Introduction

About this Manual

The Adobe pdf form of this manual contains numerous hyperlinks and bookmarks. A reference to a numbered step or a page number (except in the Index) is a live hyperlink; click on it to go immediately to that reference.

This manual has a table of contents and index. To search for a specific word or phrase, you can also use the Adobe Acrobat Reader's text search function.

Audio Processing for Level Control

Audio Processing: Making Broadcasts/Netcasts Sound Professional

Professional radio broadcasters would never consider going on the air without audio signal processing. They consider it a vital aspect of their program content. This carefully crafted content is what holds listeners and keeps them coming back. Since 1975, Optimod algorithms have dominated the world market for professional radio and television audio processing and have been improved continuously since then. OPTIMOD-PC puts this technology inside your computer.

For optimum sound, loudness, and peak control, you should digitally preprocess an Internet audio signal to condition it prior to encoding. The appropriate preprocessing has much in common with the preprocessing required for DAB, HD Radio™, CD mastering, or digital satellite.

OPTIMOD-PC audio processing is appropriate for all of these and for any other digital transmission media and channels. OPTIMOD-PC's three on-board Motorola DSP56367 DSP chips provide a loud, consistent sound to the consumer by performing automatic gain control (AGC), equalization, multiband gain control, and peak-level control.

There are many gain/peak control devices and software available to perform dynamics processing. Many of these tools are designed for recording studio applications as effects compressors/limiters for individual microphone or instrument tracks. These devices' controls need to be tuned carefully for the specific material being processed—they are not "set and forget" processors. Moreover, most do not process mixed program material without introducing objectionable audible artifacts, particularly when called upon to gain-ride input material having widely varying levels.

A broadcast audio processor should ideally be "seen, but not heard." Optimod processing algorithms simultaneously control audio gain and peaks, artistically, musically,

and naturally, to give the illusion that processing is not taking place. Moreover, Optimod algorithms intelligently adapt themselves to the input program material. Once OPTIMOD-PC is tuned for the sound texture required for the broadcast or netcast format (which is made easy by OPTIMOD-PC's many format-specific presets), it will provide excellent consistency regardless of the level or texture of the original program material. OPTIMOD-PC's automatic gain control and equalization achieve a consistent sound, while accurate peak control maximizes loudness. Booming bass is tightened; weak, thin bass is brought up; highs are always present and consistent in level.

Without Optimod-PC processing, audio can sound dull, thin, or inconsistent in any combination. Optimod-PC's multiband processing automatically levels and re-equalizes its input to the "major-market" standards expected by the mass audience. Broadcasters have known for decades that this polished, produced sound attracts and holds listeners.

You can expect a considerable increase in loudness from Optimod-PC processing by comparison to unprocessed audio (except for audio from recently mastered CDs, which are often overprocessed in mastering). Broadcasters generally believe that loudness relative to other stations attracts an audience that perceives the station as

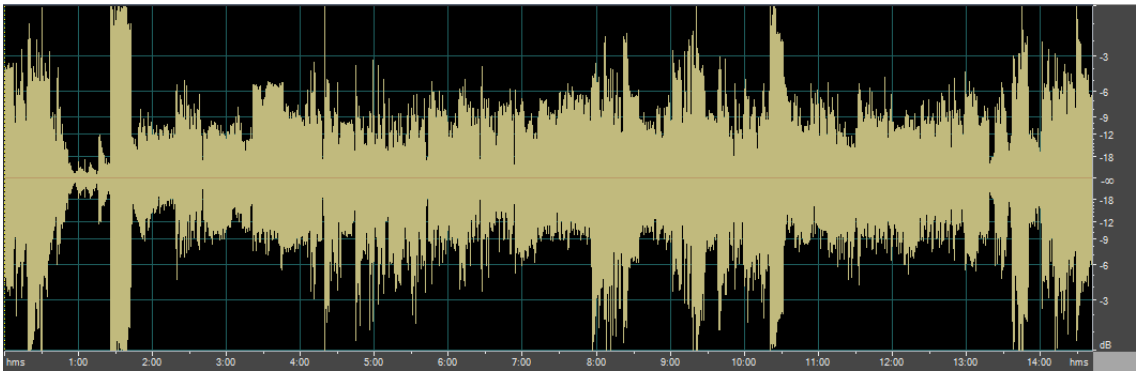


Figure 1-1: Unprocessed Audio

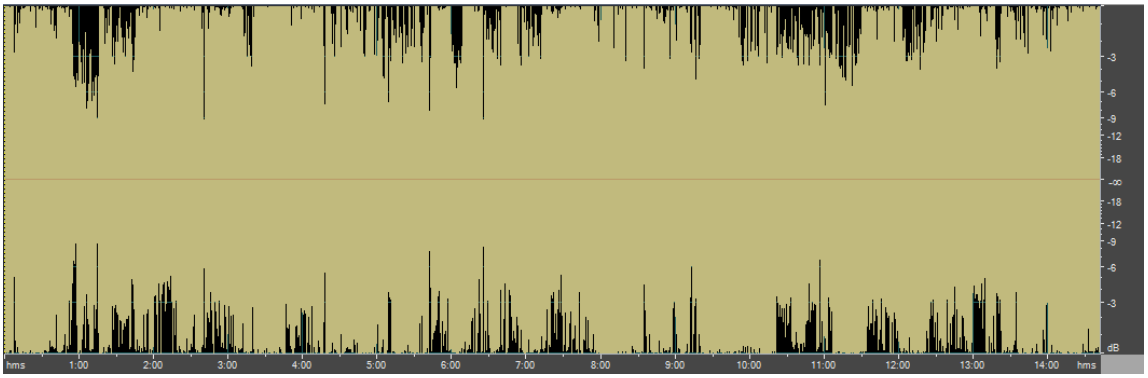


Figure 1-2: Same Audio Processed Through OPTIMOD-PC

being more powerful than its competition. We expect that the same subliminal psychology will hold in netcasting too.

Figure 1-1 shows a 15-minute snapshot of program audio as it emerged from the on-air mixer of a major Los Angeles radio station. Source material included music, speech, and commercials. Notice the large inconsistency in peak and average level between one program source and the next. Figure 1-2 shows the same material after being processed through OPTIMOD-PC, using the GREGG preset. Notice that program levels are now consistent from source to source

Audio Processing for Netcasts

Professional-grade netcasting requires audio processing similar to FM broadcast (although there are some important differences in the peak limiting because of the different characteristics of the pre-emphasized FM channel and the perceptually coded netcasting channel). Your listeners deserve to get the best quality and consistency you can provide. Good audio processing is one important thing that separates the amateur from the professional.

Conventional AM, FM, or TV audio processors that employ pre-emphasis/de-emphasis and/or clipping peak limiters do not work well with perceptual audio coders such as Orban's Opticodec-PC® MPEG4 AAC/aacPlusV2 streaming encoder. The pre-emphasis/de-emphasis limiting in these processors unnecessarily limits high frequency headroom. Further, their clipping limiters create high frequency components—distortion—that the perceptual audio coders would otherwise not encode. None of these devices has the full set of audio and control features found in Optimod-PC.

Peak clipping sounds bad even in uncompressed digital channels because these channels do not rely on pre-emphasis/de-emphasis to reduce audible distortion. Instead of peak clipping, OPTIMOD-PC uses look-ahead limiting to protect the following channel from peak overload.

Measuring Studio and Transmission Levels

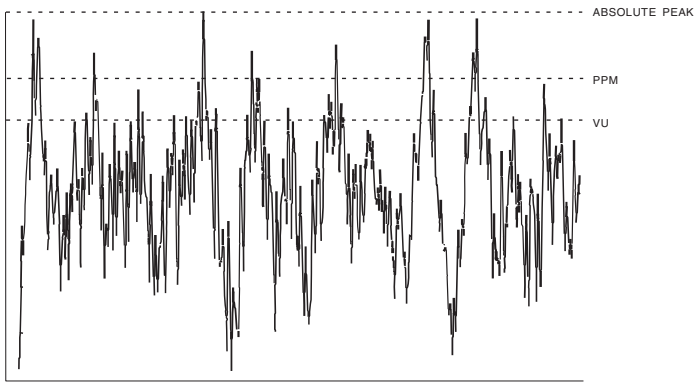


Figure 1-3: Absolute Peak Level, VU and PPM Reading

Studio equipment (like mixers) and transmission equipment (like codecs) typically use different methods of metering to display audio levels. The VU meter is an aver-

age-responding meter (measuring the approximate RMS level) with a 300ms rise time and decay time; the VU indication usually under-indicates the true peak level by 8 to 14 dB. The Peak Program Meter (PPM) indicates a level between RMS and the actual peak. The PPM has an attack time of 10ms, slow enough to cause the meter to ignore narrow peaks and under-indicate the true peak level by 5 dB or more. The absolute peak-sensing meter (the type most common in codecs) shows the true peak level. It has an instantaneous attack time, and a release time slow enough to allow the engineer to read the peak level easily. All of OPTIMOD-PC's level meters are absolute peak sensing.

Figure 1-3 shows the relative difference between the absolute peak level and the indications of a VU meter and a PPM for a few seconds of music program.

The studio engineer is primarily concerned with calibrating the equipment to provide the required input level for proper operation of each device, and so that all devices operate with the same input and output levels. This facilitates patching devices in and out without recalibration and ensures that no part of the program chain will clip the audio.

For line-up, the studio engineer uses a calibration tone at a studio standard level, commonly called line-up level, reference level, or operating level. Metering at the studio is by a VU meter or PPM. As discussed above, the VU or PPM indication under-indicates the true peak level. So the studio standardizes on a maximum program indication on the meter that is lower than the clipping level, so those peaks that the meter does not indicate will not be clipped. Line-up level is usually at this same maximum meter indication.

In facilities that use VU meters, this level is usually at 0 VU, which corresponds to the studio standard level, typically +4 dBu. For facilities using +4 dBu standard level, instantaneous peaks can reach +18 dBu or higher (particularly if the operator overdrives the mixer). OPTIMOD-PC's analog input clips at an instantaneous peak level of +20 dBu, which provides 16 dB of headroom above a +4 dBu line-up level.

In facilities that use the BBC-standard PPM, maximum program level is usually PPM4 for music and PPM6 for speech. Line-up level is usually PPM4, which corresponds to +4 dBu. Instantaneous peaks will reach +17 dBu or more on voice. In facilities that use PPMs that indicate level directly in dBu, maximum program and line-up level is often +6 dBu. Instantaneous peaks will reach +11 dBu or more.

Controlling Program Levels in a Playout System before OPTIMOD-PC

To optimize the consistency of a broadcast or netcast, preprocessing each program element via OPTIMOD-PC before it is stored on a playout system is not as effective as processing the playout system's output in real time using OPTIMOD-PC. The latter technique maximizes the smoothness of transition between program elements and makes voice from announcers or presenters merge smoothly into the program flow, even if the announcer is talking over music.

You can help OPTIMOD-PC operate at its best by setting the level of each program element when you load it into the playout system. Many audio editing programs permit a sound file to be "peak-normalized," which amplifies or attenuates the level of the file to force the highest instantaneous peak to reach 0 dBfs. This is a very

poor way to set the levels of different audio files on a playout system. Absolute peak levels have nothing to do with loudness, so peak-normalized files are likely to have widely varying loudness levels depending on the typical peak-to-average ratio of the audio in the file. Because of over-use of peak limiting in today's CD mastering (which has the unfortunate side-effect of sucking the life and punch out of music), the average level of a CD produced in the '80s can be as much as 15 dB lower than the average level of a CD produced today. When a playout system segues two such disparate peak-normalized files, this can cause audible loudness inconsistencies in your broadcast/netcast while OPTIMOD-PC's AGC section corrects the loudness. OPTIMOD-PC's AGC section uses window-gating technology to minimize the audibility of such gain riding. Even so, 15 dB of level correction can take several seconds and is determined by OPTIMOD-PC's AGC release time setting.

It is far better to normalize levels in a playout system by making the *average* levels of all elements identical, which means that they would all peak at the same level when observed with a VU meter. This allows OPTIMOD-PC's AGC to work as unobtrusively as possible. Moreover, if your system includes locally originated speech material, using a microphone processor (like the dbx 286A) will help smooth the transition between live and recorded program segments.

The OPTIMOD-PC Digital Audio Processor

OPTIMOD-PC is a PCI card that fits in an IBM-compatible PC and processes one stereo audio stream or two mono audio streams. It is equally suitable for netcasts and digital radio or television broadcasting. With its supplied WAVE drivers, it looks like a standard sound card to your native applications, like the Orban's Opticodec-PC® MPEG4 AAC/aacPlusV2 streaming encoder. However, unlike a sound card, OPTIMOD-PC packs hundreds of MIPS of built-in DSP processing power, allowing it to apply broadcast-quality audio processing to your netcast or digital broadcast without loading down your computer's CPU with DSP tasks.

OPTIMOD-PC is useful for users with multiple streams because you can load one computer (which may be connected to a PCI expansion chassis) with as many OPTIMOD-PC cards as you have free PCI slots, each card handling one stereo program. Each card has two AES3 or SPDIF digital inputs and one high-quality analog input, all of which can be mixed—built-in sample rate converters allow digital sources to be asynchronous. The card also offers an AES3 output and an analog monitor output. Therefore, you can route audio through the computer's PCI bus or entirely independently of the computer—the choice is yours, and will depend on your application. For example, DAB multiplexes can use multiple OPTIMOD-PC cards to save cost and space by comparison to stand-alone processors. (The multiplexes would use OPTIMOD-PC's AES3 inputs and outputs, and could exploit OPTIMOD-PC's ability to genlock its output sample rate to the sample rate applied to either AES3 input.) OPTIMOD-PC (including the I/O mixer) is also fully remote controllable over a network.

The rest of Chapter 1 explains how OPTIMOD-PC fits into the DAB and DTV broadcast facilities, and how it can be used for netcasting. Chapter 2 explains how to in-

stall it. Chapter 3 tells how to operate OPTIMOD-PC and tune it to get the sound you want.

OPTIMOD-PC was designed to deliver a high quality sound while simultaneously increasing the average level on the channel substantially beyond that achievable by "recording studio"-style compressors and limiters. Because such processing can exaggerate flaws in the source material, it is very important that the **source audio be as clean as possible.**

For best results, **feed OPTIMOD-PC unprocessed audio.** No other audio processing is necessary or desirable.

In digital radio applications, if you wish to place level protection prior to your studio/transmitter link (STL), use an Orban studio AGC like the Orban 8200ST. The 8200ST can be adjusted so that it substitutes for the broadband AGC circuitry in OPTIMOD-PC, which is then defeated. Other types of AGC systems may adversely affect the audio.

General Features

- Orban **Optimod-FM® 8500HD-class digital audio processing** on a PCI sound card—pre-processes audio for consistency and loudness before it is transmitted or recorded.

- **Applications** include netcasting, HD Radio® (both primary and secondary digital channels), DAB and other dedicated digital radio services, FMExtra™ and other digital subcarriers, mastering, audio production, and many others.

- Orban's **PreCode™** technology manipulates several aspects of the audio to minimize artifacts caused by low bitrate codecs, ensuring consistent loudness and texture from one source to the next. PreCode includes special audio band detection algorithms that are energy and spectrum aware. This can improve codec performance on some codecs by reducing audio processing induced codec artifacts, even with program material that has been preprocessed by other processing than Optimod.

- While **primarily oriented toward "flat" media**, Optimod-PC can also provide **preemphasis limiting** for the two standard preemphasis curves of 50μs and 75μs. This allows it to protect preemphasized satellite uplinks and similar channels where protection limiting or light processing is required.

  Because its processing topology is most effective with "flat media," Optimod-PC cannot provide extreme loudness for preemphasized radio channels. Use one of Orban's Optimod-FM processors for this application. For analog television with FM aural carrier(s), use Optimod-TV 8382.

- Two-Band **automatic gain control** with window gating and selectable L/R or sum/difference processing compensates for widely varying input levels.

- Shelving **bass equalizer** and three-band **parametric equalizer** let you color the audio to your exact requirements.

- **Low-IM look-ahead limiter** effectively limits peaks while ensuring that low-bit-rate codecs operate optimally without overload.

- Optimod-PC's **dual-mono** architecture allows entirely separate mono programs to be processed in 5-band mode, facilitating dual-language operation.

  In this mode, both processing channels operate using the same processing parameters (like release time); you cannot adjust the two channels to provide different processing textures. See *Dual-Mono Architecture* on page 3-8.

- **Two AES3 or SPDIF digital inputs** with high-quality sample rate conversion allow two asynchronous digital sources to be mixed: Ideal for network operations using local commercial/announcement insertion.

- The **second digital input** also accepts AES3 house sync, synchronizing the AES3 output sample rate to the sample rate of the sync input.

- Digital inputs **accept any sample rate** from 32 to 96 kHz without manual configuration.

- **Balanced analog input** with 24-bit A/D converter is always active, mixing with the two digital inputs.

- **Wave input** from any PC audio application (like a playout system) that can emit audio. Audio from the Wave input can be mixed and switched with OPTIMOD-PC's hardware inputs.

- **Wave output** to any PC audio application that can record or encode.

- Supplied **WAVE drivers** allow OPTIMOD-PC's processed output to pass through the PCI bus to the CPU, driving standard PC applications, like Microsoft or Real streaming encoders. The driver (with the aid of concurrently running third-party software) also allows OPTIMOD-PC to receive audio over IP from the host computer's network connection. Drivers are available for **32 and 64-bit Windows XP** as well as **32 and 64-bit Windows Vista**.

- **Full PCI bus-mastering** with optimization.

- **I/O Mixer application** permits versatile routing and switching of processed and unprocessed audio from and to OPTIMOD-PC's inputs and outputs, and to and from the host computer's WAVE audio.

- **Terminal Control API** for network or localhost control and automation of all I/O Mixer functions and Preset switching.

- **MS Windows Mixer API** support in parallel to the existing Orban Mixer allows standard Microsoft Windows audio applications to control Optimod PC's inputs and outputs.

- **MS Windows Metering API** so Windows applications using this API will display audio levels. (Many broadcast playout systems use this.)

- **Serial port protocol** allows Optimod-PC to be controlled either by ASCII serial commands or by a serial-to–contact-closure device such as a Broadcast Tools SRC-16.

- Balanced **analog monitor output** with 24-bit D/A converter.

- **Precisely controls peak levels** to prevent overmodulation or codec overload. The peak limiter can be set up to control "flat" transmission channels or channels preemphasized at 50μs or 75μs.

- Internal processing occurs at **48 kHz** sample rate and **20 kHz** audio bandwidth.

- **Two AES3 digital outputs** at 32, 44.1, 48, 88.2, or 96 kHz sample rate. In v1.0 software, these emit identical signals.

- OPTIMOD-PC **controls the audio bandwidth** as necessary to accommodate the transmitted sample frequency, obviating the need for extra, overshooting anti-aliasing filters in downstream equipment. OPTIMOD-PC's high frequency bandwidth can be switched instantly (typically in 1 kHz increments) between 10.0 kHz and 20 kHz. 20 kHz is used for highest-quality systems. 15 kHz meets the requirements of the iBiquity® HD-AM system that use 44.1 kHz system input sample frequency. (15 kHz codec bandwidth may also help low bitrate lossy codecs sound better than they do when fed full 20 kHz bandwidth audio.) 10 kHz bandwidth meets the requirements of auxiliary DAB transmissions using a 24 kHz sample frequency.

- Three **Motorola DSPs** do all the audio processing—there is no extra DSP load on your computer's CPU.

- Full **coprocessing** (independent of the CPU) means that audio will ordinarily continue to pass through the card from its hardware inputs to its hardware outputs even if the host computer crashes. (Of course, WAVE inputs and outputs will stop working because these are dependent on operating system services.)

- OPTIMOD-PC ships with over **twenty standard presets**, which correspond to different programming formats. These presets have already been tested and field-proven in major-market radio netcasting, digital radio, and direct satellite

broadcasting applications (both radio and television) worldwide. There are also special-purpose presets for studio AGC, pure peak limiting, and low bitrate encoding applications.

- An easy-to-use **graphic control application** runs on your PC and can act as a client to control any number of OPTIMOD-PC cards, either locally or in other PCs on your network via TCP/IP addressing. Other Orban software offers a server function, allowing other computers on your network to address cards located in your PC. (This server software is installed automatically as part of the OPTIMOD-PC installation process and runs as a Windows service.)

- The Control application allows you complete flexibility to create **your own custom presets**, to save as many as you want to your local hard drive, and to recall them at will.

Adaptability through Multiple Audio Processing Structures

- A **processing structure** is a program that operates as a complete audio processing system. Only one processing structure can be active at a time. Just as there are many possible ways of configuring a processing system using analog components (such as equalizers, compressors, limiters, and clippers), there are many possible processing structures achievable by OPTIMOD-PC. OPTIMOD-PC realizes its processing structures as a series of high-speed mathematical computations made by Digital Signal Processing (DSP) chips.

- OPTIMOD-PC features two processing structures: **Five-Band** (or Multiband) for a consistent, "processed" sound, free from undesirable side effects and **Two-Band** for a tastefully controlled sound that preserves the frequency balance of the original program material.

- The Two-Band structure can also be tuned to operate as a **Protection Limiter**, providing up to 25dB of safety limiting with minimal side effects.

- OPTIMOD-PC **can increase the density and loudness** of the program material by multiband compression and look-ahead limiting, improving the consistency of the station's sound and increasing loudness and definition remarkably, without producing unpleasant side effects.

- OPTIMOD-PC **rides gain** over an adjustable range of up to 25dB, compressing dynamic range and compensating for operator gain-riding errors and for gain inconsistencies in automated systems.

- OPTIMOD-PC's processing structures are all **phase-linear** to maximize audible transparency.

- OPTIMOD-PC can be changed from one processing structure to another with a **smooth cross-fade**.
- Two-Band **automatic gain control** with window gating and selectable L/R or sum/difference processing compensates for widely varying input levels.
- Shelving **bass equalizer** and three-band **parametric equalizer** let you color the audio to your exact requirements.
- **Low-IM look-ahead limiter** effectively limits peaks while ensuring that low-bit-rate codecs operate optimally without overload.
- A pure peak limiting preset is available. It allows the 1101 to perform **very high quality peak limiting in mastering applications**.
- OPTIMOD-PC can be used as a **studio AGC** (including peak limiting) to protect a studio-to-transmitter link (STL), optimally using the STL's native dynamic range.

Presets in OPTIMOD-PC

There are two kinds of presets in OPTIMOD-PC: Factory Processing Presets and User Presets.

Factory Processing Presets

There are over 20 Factory Processing Presets. These are our recommended settings for various program formats or types. The description indicates the processing structure and the type of processing. Each Factory Processing Preset on the Open Preset list is really a library of 20 separate presets, selected by using the LESS-MORE control to adjust OPTIMOD-PC for less or more processing.

> Factory Processing Presets are stored as text files on the hard drive of the same computer that houses the OPTIMOD-PC card. After an OPTIMOD PC card is installed in your PC, a Presets folder containing all the factory and user Preset files is created on your hard drive.
>
> Each set of preset files consists on one "master" file and several "less/more" files. Master files contain the preset data that is first loaded when you activate a factory preset. Less/more files contain the preset data that is called up when you edit a factory preset via the Control application's one-knob "less/more" editing procedure. If there is no less/more file for the less-more setting you choose, OPTIMOD-PC will automatically generate the data by interpolating between the contents of the two nearest less/more files.
>
> The suffix of the master Factory preset files is ORBF11. Within the preset folder on your hard drive, there is a corresponding less/more folder

named after the master factory preset file. The Less/More files are located in these folders. The file names of the less/more files are [preset name] LMxxx.ORBF11, where "xxx" is three numbers, like "080" (which corresponds to a LESS/MORE value of 8.0). All of these files have been given the "read-only" attribute to make them inconvenient to erase, even at the operating system level. You cannot erase or overwrite them from the OPTIMOD-PC Control application. If you erase or modify a factory or less/more file from an external file manager like Windows Explorer (a very unwise thing to do), you will have to reinstall the Optimod-PC software to regenerate the file unless you have a backup copy of the file elsewhere.

The normal location for factory presets is `c:\Program Files\Orban\OPTIMOD-PC2\presets`. Each factory preset has an associated folder containing all of the less/more files for that preset. The less/more folders are located immediately below the `presets` folder; each less/more folder bears the name of its associated preset.

There is only one copy of the factory presets per computer, regardless of the number of OPTIMOD-PC cards installed in that computer.

You can create custom "factory" presets that have full LESS-MORE functionality. See *Creating Custom "Factory" Presets* on page 3-57.

User Processing Presets

You can change the settings of a Factory Processing Preset, but if you want to preserve your changes, you must then store those settings as a User Preset, which you are free to name as you wish. User presets can also be created by editing existing user presets and saving the results under a new name.

The suffix of User Presets is `ORB11USER`. The Factory preset remains unchanged.

Optimod-PC 1101 v1.0 is compatible with presets created by Optimod-PC 1100 v2.0 or later. Because of the major structural changes in the DSP processing between Optimod-PC 1100 version 1.x and version 2.x, user presets created under version 1.x *cannot be loaded into Optimod-PC 1100 with version 2+ software and cannot be loaded into the 1101*. Because of the improvements between 1100 v1.0 and v2.0, it is often worthwhile to create new user presets for the 1100 and 1101.

The suffix of 1100 version 1.x user presets is `ORBU`.

You can store as many User Presets as the OPTIMOD-PC card's host computer hard drive and operating system can accommodate. User Presets are shown on the "Open Preset" list by the name that you gave them when you saved them.

You can name them as you wish, limited only by the file naming limits in your operating system.

Do not use a suffix; `.ORB11USER` will be added automatically.

The default folder containing User Presets for a given OPTIMOD-PC card is `c:\Program Files\Orban\OPTIMOD-PC2\[card serial number]\presets`. A user preset that you create while working with a given card is available only for that

card. To make the preset available to a second card, copy the preset file to the appropriate presets folder located under the second card's serial number.

If you want to back up a user preset, use the standard Windows file copy mechanism to copy it from its current folder into a backup folder you have made.

If you want to delete a user preset, use Windows to delete the preset's associated `*.ORB11USER` file.

User Presets cannot be created from scratch. Start by recalling a Factory preset. You can then immediately store this in a new User Preset (with "Save As" from the FILE menu), give it whatever name you wish, make changes to the settings as desired, and then save it again. Alternatively, you can recall a Factory preset, make the changes first, and then store this as a User Preset. Either way, the Factory preset remains for you to return to if you wish.

You can also modify an existing User Preset.

> When you modify an existing preset, whether Factory or User, the OPTIMOD-PC server software will automatically generate a temporary User Preset whose name consists of "Modified" appended to the front of the existing preset name. If you do not save your modifications, this temporary preset will remain on the server's hard drive until you further modify any preset. Then the temporary preset will be overwritten.

Input/Output Configuration

OPTIMOD-PC simultaneously accommodates:

- Two digital AES3 left/right outputs.
- Two digital AES3 left/right inputs, either of which can be used as a sync input to synchronize the output sample rate emitted from the AES3 output to the sample rate present at the sync input.

  > The output sample rate can also be synchronized to OPTIMOD-PC's internal clock.)

- One set of analog left/right inputs and outputs.

  > The AES3 inputs and outputs and the analog input and output appear on a female DB-25 connector on the rear of the card (see Figure 2-2 on page 2-4). Orban offers three variations of an "umbilical" cable that plugs into the connector—one variation is terminated with XLR connectors, one is terminated with RCA phono plugs, and one is unterminated.

- Inputs and outputs passing through the computer's PCI bus, using operating system multimedia sound drivers, such as Microsoft Windows DirectSound WDM WAVE drivers.

These inputs and outputs are controlled by the OPTIMOD-PC Mixer application, which can be launched from the Tools menu on the OPTIMOD-PC control application, and can also be remotely accessed.

Digital AES3 Left/Right Input/Output

The digital inputs and outputs follow the professional AES3 hardware standard regarding impedances and levels, although their data streams can also be configured to follow the consumer SPDIF standard.

In most practical situations, AES3 and SPDIF are interchangeable and can be interoperated with each other without difficulty; you usually do not have to concern yourself with which standard you are using. Generally, if the equipment to which you are connecting has pin jacks, set OPTIMOD-PC to use the SPDIF standard. If the equipment has XLR-type connectors

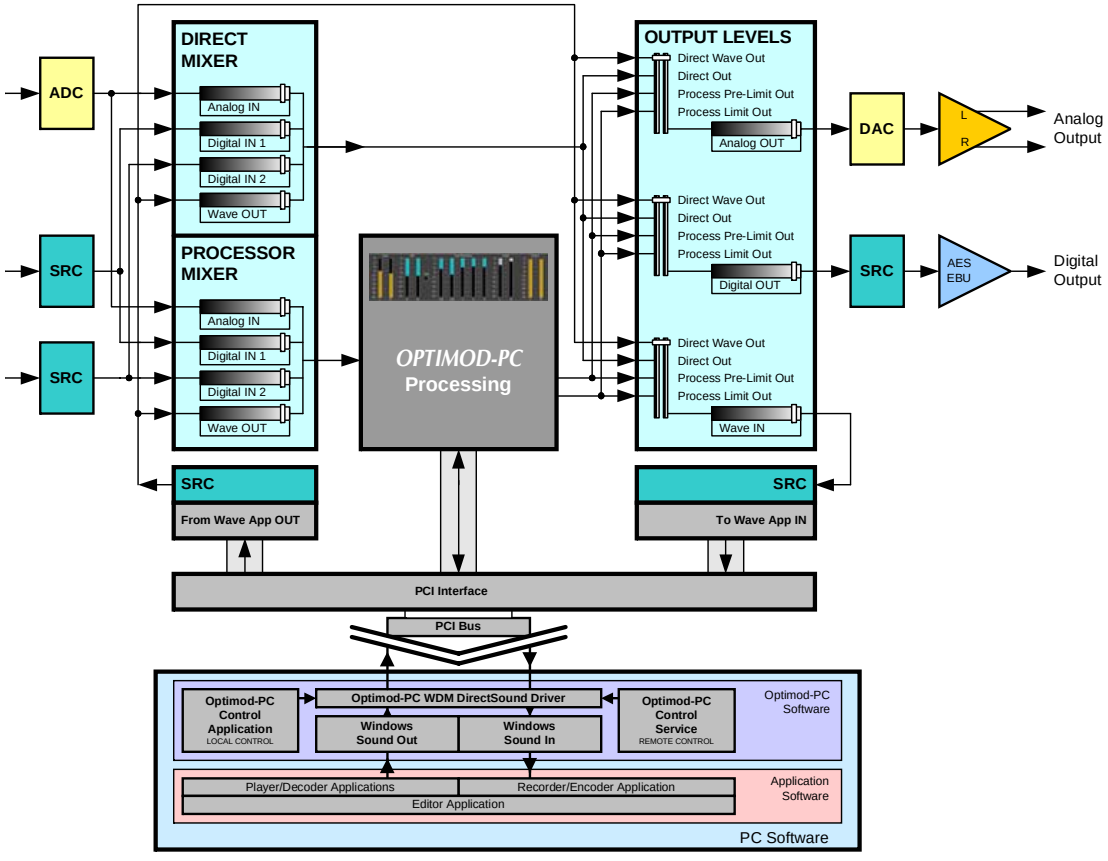


Figure 1-4: OPTIMOD-PC Signal Flow and I/O

or BNC connectors, set OPTIMOD-PC to use the AES3 standard.

OPTIMOD-PC incorporates an output sample rate converter that allows operation at 32, 44.1, 48, 88.1, or 96 kHz sample frequency. The inputs have sample rate converters that allow the input to accept any sample rate between 20 kHz and 96 kHz.

> To ensure best control of peak modulation, operate the output at 48 kHz. This guarantees that the output samples are synchronous with the peak-controlled samples produced by the processing.

If you have ordered the optional 1101/CBLXLR XLR-terminated cable assembly, then the left/right digital inputs appear on two XLR-type female connectors on this cable. The left/right digital output is on one XLR-type male connector on the cable. If a given digital input is not being used to receive a digital audio input, it is available to genlock OPTIMOD-PC's output sample frequency to house sync, if required.

OPTIMOD-PC simultaneously accommodates WAVE, digital, and analog inputs and outputs. You can mix all inputs into one signal that is applied to the processing. The digital inputs can be asynchronous because both are applied to sample rate converters that lock them to OPTIMOD-PC's internal 48 kHz sample frequency.

Level control of all inputs and outputs is via the OPTIMOD-PC Mixer application, including remote access.

Analog Left/Right Input/Output

The left and right analog inputs are on XLR-type female connectors on the umbilical cable. Input impedance is greater than 10kΩ; balanced and floating. Inputs can accommodate up to +20dBu (0dBu = 0.775Vrms).

The left and right analog outputs are on XLR-type male connectors on the umbilical cable. Output impedance is 50Ω, balanced and floating.

The outputs are intended for monitoring. They can drive 600Ω or higher impedances. However, they are AC-coupled with a –3dB frequency of approximately 1 Hz, which is higher than the 0.15 Hz recommended by Orban to avoid low-frequency overshoots ("bounce") caused by phase shifts. Therefore, when you are using the audio processing for peak control, such control will be noticeably poorer at the analog outputs than at the AES3 or WAVE outputs, both of which exhibit very tight peak control. Consequently, you should always use OPTIMOD-PC's AES3 or WAVE outputs to drive your transmission chain.

For a more detailed diagram of the "Processor" block, see *Figure 3-2: Simplified OPTIMOD-PC Digital Signal Processing Diagram* on page 3-9.

The Orban I/O Mixer

The I/O Mixer mixes and routes audio to and from the OPTIMOD-PC card. (See *Figure 1-4: OPTIMOD-PC Signal Flow and I/O* on page 1-13, and *Figure 1-5: Typi-*

cal I/O mixer on page 1-16.) You can open the Optimod PC Mixer from the Tools menu in the Orban Control application.

Within the Optimod PC Mixer, there are two mixers, each of which receives the same four inputs:

- The stereo analog input on the DB-25 connector
- Digital 1 Input(AES3) on the DB-25 connector
- Digital 2 Input (AES3) on the DB-25 connector
- The WAVE Out from the computer operating system's internal mixing and routing

The first "Processor Mixer" sends its output to the audio processing DSP on the OPTIMOD-PC card.

The second "Direct Mixer" sends its output directly to the output routing switcher.

There are three outputs, each of which can receive the following four possible sources:

- The *Direct WAVE bitstream* received from the computer.
- The *Direct Mixer's* output.
- The *processor without limiting*: The output of the OPTIMOD-PC audio processing that follows all processing except final peak limiting.
- The *processor with limiting*: The output of the OPTIMOD-PC audio processing that follows all processing, including peak limiting.

> Not all outputs have to receive the same source; any source can feed any output.
>
> Source (3) can provide low-delay monitoring into live talent headphones because it has much lower throughput delay than source (4).

The output signal routing switcher determines which of the above four signals feeds:

- the OPTIMOD-PC card's *stereo analog output*
- the OPTIMOD-PC card's *AES3 digital output*, and
- the *WAVE In* going to the PC.

Overview of an OPTIMOD-PC Installation

An OPTIMOD-PC card installs in a PCI slot in an IBM-compatible host computer. The computer's PCI bus must be Plug & Play PCI Version 2.2 compliant, 32-bit, 33MHz, with a transfer rate up to 132MBytes/sec. OPTIMOD-PC will operate in a 3.3V or 5V PCI slot, and with bus extenders.

Almost all recently manufactured PCs meet these PCI bus specifications.

OPTIMOD-PC is supported on Windows XP (SP2 or higher) and on Vista (SP1 or higher) computers. It will usually work on Windows 2000 computers (SP4 or higher) but Orban Customer Service does not support this platform. No other operating systems (such as Linux or Mac OS) will work.

OPTIMOD-PC's driver is multi-client but will only support multiclient operation in a Windows XP environment. Windows 2000, while compatible with OPTIMOD-PC's driver, only supports single-client operation.

Users who need to stream to multiple encoders from a single OPTIMOD-PC must use Windows XP.

More than one OPTIMOD-PC card can be installed in a given host computer. The number of cards is limited only by the number of available PCI slots, which may reside in a PCI expansion chassis.

Conceptually, there are two options for operating OPTIMOD-PC: *simple* and *net-*

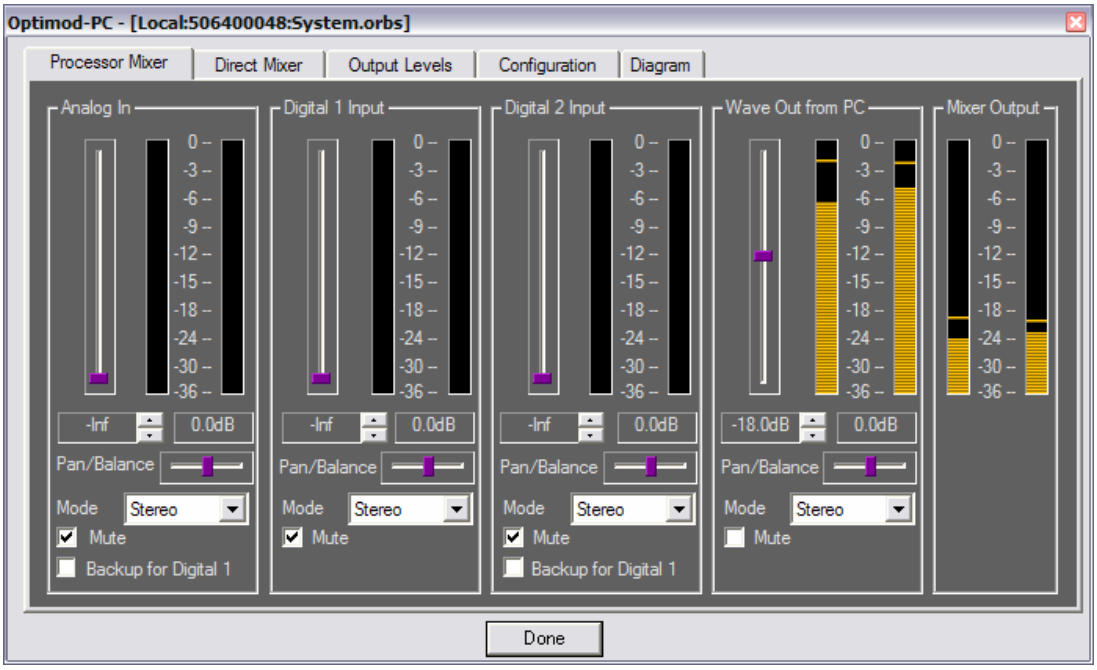


Figure 1-5: Typical I/O mixer

work (see *Figure 2-1: OPTIMOD-PC Network Scenarios* on page 2-3).

- *Simple* operation will only control OPTIMOD-PC cards that are installed in the same PC that is running the Orban application.
- *Network* operation allows you to control one or more OPTIMOD-PC cards over a network, regardless of whether the OPTIMOD-PC card is located in the controlling computer.

Both modes of operation require you to run a *server* application in the background on any remote computer housing OPTIMOD-PC cards. However, you do not need to run the server if you are running the Control Application in a computer that has no OPTIMOD-PC cards installed.

> In this case, the Control Application would be dedicated to controlling OPTIMOD-PC cards located in other computers on the network.

The server is installed automatically when you install the OPTIMOD-PC software and is configured to run as a "Windows Service." The server application is an intermediary that enables the Orban Control Application to remotely communicate with the OPTIMOD-PC card(s) installed in a given host computer. One instance of the server application handles communications for all of the OPTIMOD-PC cards in a given host computer. When the host computer is booted, the OPTIMOD-PC driver initializes the DSP on the card, initializes the I/O settings, and sets the processor settings to a default value. After that, the OPTIMOD-PC server finishes starting up and then resets the processing parameters and I/O settings to their previous power-down values. The service completes this task just before the Windows Log-On screen appears.

The Control Application connects (through the server) to only one card at a time, allowing you to recall, edit and save presets, set input/output mix levels, and do other housekeeping tasks for that card.

> Note that the Control Application does not use the server to interface with a card installed on the same computer that is running the Control Application.

"Simple" operation occurs when the Service's remote server is disabled. For "network" operation, you may use the Optimod Control Application to set passwords at a given OPTIMOD-PC card's host computer to protect it from unauthorized access from the network. You also need to make your local cards visible to the network by selecting "Allow Network to Access Local Cards" in the "Card and Security Administration" screen, which is accessible from the Tools drop down menu box. The setup instructions in Section 2 of this manual provide detailed instructions on how to do this.

In a Simple or Network environment, the number of OPTIMOD-PC cards that one host can accommodate depends only on the number of free PCI slots available and on the speed of the host's CPU. (PCI expansion chassis are supported.) OPTIMOD-PC cards share IRQs, so availability of IRQs will not usually be a problem.

Although OPTIMOD-PC contains on-board DSP, the host's CPU must still perform some "housekeeping" chores. It must run Orban's server software, and, more significantly, it must do sample rate conversion if OPTIMOD-PC is used as a WAVE device and the source or destination sample rates are different from 48 kHz. On the other hand, if only OPTIMOD-PC's analog input and/or AES3 digital I/O are used for input

and output, then OPTIMOD-PC's built-in hardware sample rate converters do all necessary conversion and no extra load is placed on the host CPU for sample rate conversion.

Simple Operation in One Host Computer

When only one card is installed in a local machine, the OPTIMOD-PC control application running on said local machine will automatically connect to that card if you start the application by clicking its "agent" icon, located in the far right side of the Windows taskbar in the Windows system tray. (This icon looks like a loudspeaker colored violet.) If more than one card is installed (or if you start the application any other way than by clicking on the agent icon), the Control application will initialize without connecting to a card and you must connect the application to the card you wish to control.

When you first install OPTIMOD-PC on a computer, all cards are hidden from the network by default. Consequently, "simple" operation is always the default in a new installation. Simple operation makes sense in applications like a production studio, where you are using the OPTIMOD-PC processing to master files for subsequent broadcast, streaming, or dissemination on other media like CD or DVD.

Security

OPTIMOD-PC is designed for networking. Because most PCs are now networked, the cards must be protected from unauthorized access when networking is activated. Two levels of security achieve this:

- Each card has a User password that allows an authorized user to "connect" to the card via the OPTIMOD-PC Control Application. When this occurs, the user can work with the audio processing functions in the card, can change and edit presets, and can do other tasks similar to those that one would do on a standalone audio processor. Additionally, each card has a Terminal Password (operating at the User security level) that allows you to connect to a card via the OPTIMOD-PC TCP/IP terminal server to allow external control of the OPTIMOD-PC cards from either a Telnet/SSH client or a custom third party application. See *Optimod-PC System/Mixer Control API* on page 6-1.
- Each card has an Administrator password that allows an administrator to change the name of the card, allow network access, change the Administrator password, and change the User password from anywhere on the network.

  Only an administrator can assign and change user passwords. If the user has checked "remember password" on the dialog box requesting password entry, only the administrator can "uncheck" the "remember password" function for that card.

  Unless networking is activated, cards located in a given machine are visible only to the Orban Control application running locally on that machine. They are invisible to other machines on the network. Not running in "network" mode therefore provides considerable security.

- By creating a "Network Accept List," you can specify which computers are permitted to connect to a given OPTIMOD-PC. This provides a layer of security that complements password protection. See step 7 on page 2-7.

Each OPTIMOD-PC has a unique serial number burned into its on-card ROM. It is also written on a label on the card's mounting flange so it can be seen from outside the host computer. *The serial number is the fundamental means by which the Orban software identifies the card*. When you first install your card(s), the card's serial number appears next to the profile name in the Connect drop-down box and at the top left hand corner in the application when you are connected to that card.

The Optimod-PC serial number is appended to the Windows audio device name, making it easier to keep track of multiple cards and their connections and allowing reliable software security for the individual Opticodec-PC encoder software that uses Optimod-PC as a hardware dongle.

The Orban software allows you to give a card an easily remembered name (e.g., "KORB") so the software does not have to address the card by its serial number. This name is an alias that is local to the computer from which you named the card; the same card could be known by a different name on each computer in the network.

If you give your card an alias name, this name will appear (instead of the serial number) next to the profile name in the Connect drop-down box and at the top left hand corner in the application when you are connected to that card.

> Only the card's serial number is unique. The serial number is always available on "Card and Security Administration" screen, which is accessible from the Tools drop-down menu box.
>
> Only an administrator can rename a card (profile), and that name will remain only on the machine from which it was assigned that name.

For Orban's Control application to access cards on other machines, those machines must have Orban server software running (with "Allow Network to Access Local Cards" checked in TOOLS/CARD & SECURITY ADMIN.) and the Control application must always know these remote cards' passwords to access them. These passwords are initially assigned by the administrator at the machine in which the remote cards are installed. If you plan network operation, it is very important to assign both a User and an Administrator password to each card in that machine to prevent the cards from being hacked.

> The dual password system is useful in protecting a networked installation from being damaged by disgruntled employees or hackers who might get access to a User password and server IP address. A malicious user might set incorrect presets and audio levels, activate test tones, mute the audio, or delete user presets. (This is another reason, other than potential hard drive failure, why it is wise to back up user presets.)
>
> However, a malicious user cannot take exclusive control of a card by changing its name or password. Only an administrator can do that. Meanwhile, the administrator can change User passwords and rename cards from a central location. It is wise to do this each time a person with

> a User password leaves the employ of the entity doing the streaming or broadcasting—it's like "changing the locks."

No networked card outside the local machine is viewable inside Orban's software until you "add" it to the list of viewable cards by going into Connect>Add and then supplying the IP address and the card's User password (if a password was assigned to that card). This allows one host computer to accommodate multiple OPTIMOD-PC cards, each processing competitor's streams, while allowing a given competitor to view only its own card(s) from the Control application.

Networking OPTIMOD-PC Cards

Orban's OPTIMOD-PC control application can control OPTIMOD-PC cards installed anywhere on a TCP/IP network, including the Internet. A complex system (such as one that a major broadcast group, or large server farm/ISP might operate) could have dozens of clients and servers networked together. Each host computer has a TCP/IP address and port assigned to it and runs an instance of the Orban server application.

The Orban Control application can automatically find all cards within a given host computer anywhere on the network if the Control application knows the IP address of the host computer. However, the Control application will leave the cards hidden from the application's user until the user "adds" the cards by supplying their User passwords and IP addresses.

To connect to a card, you must first add the host computer/server to your control application via CONNECT>ADD PROFILE/CARDS (step 10 on page 2-10). Here, you provide the host computer's IP address and port number. Once a profile/card is added, you can connect to it by double-clicking on the card in the CONNECT drop-down list.

Each local copy of the Orban Control application allows you to name a server (e.g., "Boston") so you do not have to remember its IP address and port number each time you connect the Control application to it.

> The server names are stored locally on each computer; each local copy of the Orban Control application can create a different profile name for a given server. A server's real "name" is always its IP address and port.

You can see a drop-down list of all cards that have been added previously, regardless of whether you are logged onto the host computer housing those cards. Once you have logged onto the host computer, you can connect to any card on this list if it is "available" (that is, if it is still installed in the host computer; removing a card from its host computer will not automatically remove its name from a client computer). If you have not previously connected to a given card and specified "remember password," you must supply your User password before you can connect.

> Once you have specified "remember password," the password dialog box will not appear again and the "remember password" status can only be canceled by an administrator. "Remember password" can compromise security, so you should use this feature with discretion.

Only one client can be logged into a given card at one time; the card will return "in use" if another client attempts to log into the same card. However, more than one client can be logged onto a given host computer at once, provided that each client is logged onto a different card within that host.

> It is it is unsafe to send commands to the API of a card within a given computer while the Control Application is connected to that card via the Control Application's "Local" connection. This can create conflicts within the OPTIMOD-PC software that could cause system instability. Moreover, it is unsafe to simultaneously connect a local and remote instance of the OPTIMOD-PC Control Application to a given OPTIMOD-PC card.
>
> To resolve this issue safely and without any performance compromise, do not use the Local connection. Instead, connect the Control Application to a local card via a "localhost" TCP/IP connection. To do this, create a new profile, following the instructions in step 10 on page 2-10. Use IP address 127.0.0.1 (localhost). Then connect the Control Application to the local card as you would to any card residing in a remote computer (step 11on page 2-12).
>
> If you are not using the 1101's API, it is OK to use the Local connection.

Section 2 of this manual provides detailed, systematic instructions for setting up a network of OPTIMOD-PC cards.

Location of OPTIMOD-PC for Netcasting

It is usually best to locate OPTIMOD-PC cards in the same machine that runs the encoding software, like Orban OPTICODEC-PC, Microsoft Windows Media Encoder or Real Networks HELIX Producer. This is because the output of the encoder is at a much lower data rate than the audio used to drive the OPTIMOD-PC input(s), so it is less expensive to transport encoded audio than unencoded audio. In Windows installations, the encoder receives the processed output of OPTIMOD-PC through the standard Windows' WAVE signal handling mechanism. You control mixing and routing through the OPTIMOD-PC I/O Mixer application, which you call from the TOOL>I/O MIXER menu item in the OPTIMOD-PC Control application.

OPTIMOD-PC's digital inputs accept stereo pairs of uncompressed PCM-format digital audio. OPTIMOD-PC's AES3 digital inputs will not accept "bitstream" inputs encoded with formats like Dolby Digital® or DTS®. Inputs must be two-channel "PCM" (Pulse-Code Modulation) format with sample rates from 32 to 96 kHz and 8 to 24 bit word length, following standard AES3 or SPDIF protocols. Because both digital inputs have sample rate converters, both inputs can be mixed (even if asynchronous with each other) and neither need be synchronous with the output.

If the netcasting servers are located remotely, then there is a particular advantage to transporting the compressed stream instead of the raw PCM. If the data rate of the compressed stream is less than 128kbps, it can be transported on an ISDN line. If the rate is greater, or if more than one stream is being transported, a fractional T1 line is often suitable. In general, IP connection via the Internet is insufficiently reliable for "broadcast contribution quality" connections, introducing a risk of gaps and

dropouts in the stream. Therefore, it is desirable to use an encoder (such as OPTICODEC-PC) that can automatically reconnect to the server in the unlikely event that the connection is dropped.

Genlocking OPTIMOD-PC Cards to a Reference Sample Frequency

Many facilities have a reference sample frequency to which all digital equipment is locked. While OPTIMOD-PC's word clock input is not supported in 1101 v1.0 software (it will be supported in a future free software upgrade), either AES3 input can accept a reference sample frequency via an AES3 or AES11 signal. OPTIMOD-PC's output sample frequency can then be locked to this reference [see step (4.B) on page 2-22.]

This reference can be the sample frequency of one of the active audio inputs. On the other hand, if you have an AES3 stream available exclusively as a sample frequency reference, you can then connect this stream to the input that you specify as the "reference" and mute the reference input in the Orban I/O Mixer application. (See *Figure 1-4: OPTIMOD-PC Signal Flow and I/O* on page 1-13, and *Figure 1-5: Typical I/O mixer* on page 1-16.)

Because of hardware limitations in the sample rate converters, input frames are not necessarily phase-aligned to output frames according to the strictest interpretation of the AES-11 standard. However, the sample frequency of the output will be identical to the sample frequency of the input. In addition, these limitations prevent the passing of AES3 user bits from digital input to digital output.

Using OPTIMOD-PC's internal crystal reference, you can also set the output sample frequency to be independent of the input sample frequency. In this case, you can freely set the output to 32, 44.1, 48, 88.2, or 96 kHz.

> If the input reference sample frequency deviates from the preset output sample frequency by more than ±4%, the output sample frequency will lock automatically to OPTIMOD-PC's internal crystal reference instead of the input reference.
>
> In all cases, OPTIMOD-PC's internal processing operates at 48 kHz, locked to OPTIMOD-PC's internal crystal reference. The output sample rate converter, which is always in-line, determines the output sample rate.

Studio-Transmitter Link in Digital Broadcasting

The following information is mainly relevant to digital radio broadcasters who have their transmitters and studios at different locations. It assumes that you are using OPTIMOD-PC as a replacement for a stand-alone audio processor. In this context, you use OPTIMOD-PC's external analog or digital inputs and outputs and do not route the audio through the host computer.

Most netcasters will not find the information in this section relevant because if netcasters need to ship audio beyond their LAN, they ordinarily ship it from one location to another in the form of encoded audio through low-capacity Telco-supplied digital links like ISDN or E-1/T-1.

Transmission from Studio to Transmitter

There are five types of studio-transmitter links (STLs) in common use in broadcast service: uncompressed digital, digital with lossy compression (like MPEG, Dolby®, or APT-x®), microwave, analog landline (telephone/post line), and audio subcarrier on a video microwave STL.

> At this writing, we believe that the Internet is insufficiently reliable to serve as a carrier for a real-time STL because of the risk that network interruptions may randomly interrupt the audio feed.

STLs are used in two fundamentally different ways. Either they can pass unprocessed audio for application to OPTIMOD-PC's input or they can pass OPTIMOD-PC's peak-controlled output. The two applications have fundamentally different performance requirements.

- A link that passes unprocessed audio should have very low noise and low nonlinear distortion, but its transient response is not important.
- A link that passes processed audio does not need as low a noise floor as a link passing unprocessed audio. However, its transient response is critical. In DAB applications, such a link *must* be uncompressed digital and *must* use digital inputs and outputs to achieve best results. We will elaborate below.

Digital links

Digital links may pass audio as straightforward PCM encoding, or they may apply lossy data reduction processing to the signal to reduce the number of bits per second required for transmission through the digital link. Such processing will almost invariably distort peak levels, and such links must therefore be carefully qualified before you use them to carry the peak-controlled output of OPTIMOD-PC to the transmitter. For example, the MPEG Layer 2 algorithm can increase peak levels up to 4dB at 160kb/sec by adding large amounts of quantization noise to the signal. While the desired program material may psychoacoustically mask this noise, it is nevertheless large enough to affect peak levels severely. For any lossy compression system the higher the data rate, the less the peak levels will be corrupted by added noise, so use the highest data rate practical in your system.

It is practical (though not ideal) to use lossy data reduction to pass unprocessed audio to OPTIMOD-PC's input. The data rate should be at least of "contribution quality"—the higher, the better. If any part of the studio chain is analog, we recommend using at least 20-bit A/D conversion before encoding.

Because OPTIMOD-PC uses multiband limiting, it can dynamically change the frequency response of the channel. This can violate the psychoacoustic masking assumptions made in designing the lossy data reduction algorithm. Therefore, you

should leave "headroom" in the algorithm so that OPTIMOD-PC's multiband processing will not unmask quantization noise. This is also true of any lossy data reduction applied in the studio (such as hard disk digital delivery systems).

> For MPEG Layer 2 encoding, we recommend 384 kb/second or higher.

Some links may use straightforward PCM (pulse-code modulation) without lossy data reduction. If you connect to these through an AES3 digital interface, these can be very transparent, provided they do not truncate the digital words produced by the devices driving their inputs and they do not require downward sample rate conversion.

> Downward sample rate conversion can cause overshoot due to spectral truncation and asynchronous re-sampling of the 48 kHz peak-controlled samples.

If the link does not have an AES3 input, you must drive its analog input from OPTIMOD-PC's monitor output. This is not recommended because OPTIMOD-PC's monitor output will overshoot in the analog domain because of the physics of the system. For many of the same reasons, avoid using external digital-to-analog converters.

> Peak control in OPTIMOD-PC occurs at a 48 kHz sample frequency. This is sufficient to prevent any samples from exceeding the threshold of limiting. However, after reconstruction, the analog output may overshoot the nominal 100% level because these overshoots "fall between the samples," so the processing cannot be aware of them. If you use this output to feed the analog input of a digital STL, the new samples in the STL will not be synchronous with the samples inside OPTIMOD-PC. Therefore, they may well fall on the overshoots, causing loss of peak modulation control. It is thus important to use a link with an AES3 input to ensure correct peak control.
>
> The same sort of thing can happen if you use the output sample rate converter, because the output samples are no longer synchronous with the peak-controlled samples in the processing. Always use 48 kHz output sample rate to achieve best peak control.
>
> If you *must* use an analog input, you may bypass any anti-aliasing filters in digital links driven by OPTIMOD-PC because OPTIMOD-PC's output spectrum is tightly controlled. This ensures the most accurate possible transient response, given the limitations of asynchronous sampling described above.
>
> Using analog outputs or non-48kHz sample rates will seldom introduce more than 0.5 dB of overshoot, so it is usually sufficient to allow 0.5 dB of headroom in these non-ideal setups. For example, one would set OPTIMOD-PC's digital output level to –0.5 dB to prevent clipping.

NICAM is a sort of hybrid between PCM and lossy data reduction systems. It uses a block-companded floating-point representation of the signal with J.17 preemphasis.

Older technology converters (including some older NICAM encoders) may exhibit quantization distortion unless they have been correctly dithered. Additionally, they can exhibit rapid changes in group delay around cut-off because their analog filters

are ordinarily not group-delay equalized. The installing engineer should be aware of all of these potential problems when designing a transmission system.

You can minimize any problems by always driving a digital STL with OPTIMOD-PC's AES3 digital output, which will provide the most accurate interface to the STL. The digital input and output accommodate sample rates of 32 kHz, 44.1 kHz, 48, 88.2, and 96 kHz.

Some NICAM hardware is known to have inadequate low frequency response, compromising peak control if OPTIMOD-PC's processed output is passed through this hardware. Such hardware should be tested and qualified.

Microwave STLs

In general, an analog microwave STL provides high audio quality as long as there is a line-of-sight transmission path from studio to transmitter of less than 10 miles (16 km). If not, RF signal-to-noise ratio, multipath distortion, and diffraction effects can cause serious quality problems. However, the noise and non-linear distortion characteristics of such links are likely to be notably poorer than 16-bit digital even if propagation conditions are ideal.

As discussed above, asynchronous resampling will cause overshoots if *any* analog path (even a perfectly transparent one) passes OPTIMOD-PC's processed output to the transmitter. Lack of transparency in the analog path will cause even more overshoot. Unless carefully designed, microwave STLs can introduce non-constant group delay in the audio spectrum, distorting peak levels when used to pass processed audio. Nevertheless, in a system using a microwave STL, OPTIMOD-PC is sometimes located at the studio and any overshoots induced by the link are tolerated or removed by the transmitter's protection limiter (if any). OPTIMOD-PC can only be located at the transmitter if the signal-to-noise ratio of the STL is good enough to pass unprocessed audio. The signal-to-noise ratio of the STL can be used optimally if an Orban Studio AGC, another OPTIMOD-PC, or an Orban Transmission Limiter protects the link from overload.

If OPTIMOD-PC is located at the transmitter and receives unprocessed audio from a microwave STL, it may be useful to use a companding-type noise reduction system (like dbx Type 2 or Dolby SR) around the link. This will minimize any audible noise buildup caused by compression within OPTIMOD-PC.

Some microwave links may be modified such that the deviation from linear phase is less than $\pm 10^{\circ}$ 20-20 kHz, and frequency response is less than 3dB down at 0.15Hz and less than 0.1dB down at 20 kHz. This specification results in less than 1% overshoot with processed audio. Many such links have been designed to be easily configured at the factory for composite operation, where an entire FM stereo baseband is passed. 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).

Further, it is not unusual for a microwave STL to bounce because of a large infrasonic peak in its frequency response caused by an under-damped automatic frequency control (AFC) phase-locked loop. This bounce can increase the STL's peak carrier deviation by as much as 2dB, reducing average modulation. Many commercial STLs have this problem.

Some consultants presently offer modifications to minimize or eliminate this problem. If your exciter or STL has this problem, you may contact Orban Customer Service for the latest information on such services.

Analog Telephone/Landline (PTT/Post Office Line)

Analog landline quality is extremely variable, ranging from excellent to poor. (Fortunately, they are largely obsolete, having been replaced by digital links.) Whether landlines should be used or not depends upon the quality of the lines locally available, and upon the availability of other alternatives. Due to line equalizer characteristics and phase shifts, even the best landlines tend to veil audio quality slightly. They will certainly be the weakest link in a DAB broadcast chain.

Slight frequency response irregularities and non-constant group delay characteristics will alter the peak-to-average ratio, and will thus reduce the effectiveness of any peak limiting performed prior to their inputs.

Location of OPTIMOD-PC in Digital Radio Service

At the Transmitter is Best

The best location for OPTIMOD-PC is as close as possible to the transmitter so that OPTIMOD-PC's AES3 output can be connected to the transmitter through a circuit path that introduces no change in OPTIMOD-PC's output bitstream. A high-quality AES3 cable is ideal.

Where Access to the Transmitter is not Possible

Sometimes it is not possible to locate OPTIMOD-PC at the transmitter. Instead, it must be located on the studio side of the link connecting the audio facility to the transmitter. If the transmitter is not accessible, all audio processing must be done at the studio, and you must tolerate any damage that occurs later.

If an uncompressed digital link is available, this is an ideal situation because such a link will pass OPTIMOD-PC's output with little or no degradation. However, such a link is not always available.

> If only a 32 kHz sample rate link is available, the sample rate conversion necessary to downsample the audio will cause overshoots when OPTIMOD-PC is operated at 20 kHz bandwidth because the sample rate converter removes spectral energy. In this case, you can minimize overshoot by operating OPTIMOD-PC at 15 kHz bandwidth. (Set it from the CONFIGURATION tab in the I/O Mixer application.)

Unless the path is a digital path using no lossy compression, this situation will yield lower performance than if OPTIMOD-PC is connected directly to the transmitter be-

cause artifacts that cannot be controlled by OPTIMOD-PC will be introduced by the link to the transmitter. These artifacts can decrease average modulation by 2-4dB and can also add noise and audible non-linear distortion. In the case of lossy digital compression, this deterioration will be directly related to the bitrate. For an analog path, the deterioration will depend on the amount of linear and non-linear distortion in the path. In addition, there will be an unavoidable amount of overshoot caused by asynchronous re-sampling (see page 1-24).

One strategy is to apply to OPTIMOD-PC's output signal the same lossy compression that the DAB transmitter would apply. If a digital link is available with sufficient bitrate to pass this compressed signal, it can then be passed directly to the DAB transmitter without further processing if synchronization issues can be resolved. Consult with the manufacturer of your DAB transmitter to see if this can be done.

Where only an analog or lossy digital link is available, feed the audio output of OPTIMOD-PC directly into the link. If available, the transmitter's protection limiter should be adjusted so that audio is normally just below the threshold of limiting: The transmitter protection limiter should respond only to signals caused by faults or by spurious peaks introduced by imperfections in the link.

Where maximum quality is desired, it is wise to request that all equipment in the signal path after the studio be carefully measured, aligned, and qualified to meet the appropriate standards for bandwidth, distortion group delay and gain stability. Such equipment should be measured at reasonable intervals.

OPTIMOD-PC at the Transmitter: Gain Control before the STL

The audio received at OPTIMOD-PC's input should have the highest possible quality. To achieve the full audible benefit of OPTIMOD-PC processing, use a studio-transmitter link (STL) that is as flat as the bandwidth of OPTIMOD-PC as used in your facility (usually 20 kHz). Ideally, you should use a 20-bit (or better) uncompressed digital link with at least 44.1 kHz sample frequency.

Because the audio processor controls peaks, it is not important that the audio link feeding OPTIMOD-PC's input terminals be phase-linear. However, the link should have low noise, the flattest possible frequency response from 20-20,000Hz, and low non-linear distortion.

If the audio link between the studio and the transmitter is noisy (or, if digital, is limited to 16 bits or less), performing the AGC function at the studio site can minimize the audibility of this noise. AGC applied before the audio link improves the signal-to-noise ratio because the average level on the link will be greater. Further, many STLs require level control to prevent the STL from being overloaded.

To apply such level control and compression, we recommend an Orban AGC/Limiter/HF Limiter (like another Optimod-PC or an Orban 6300 stand-alone multipurpose processor or an OPTIMOD-PC) before the STL transmitter. This unit performs the function of OPTIMOD-PC's internal broadband automatic gain control (AGC) while simultaneously protecting the STL. If this is done, defeat the transmitter-side OPTIMOD-PC's broadband AGC by accessing the AGC function (within the CONFIG screen in the I/O Mixer application menu) and setting it to DISABLE.

Using Lossy Data Reduction in the Audio Chain before OPTIMOD-PC

Many broadcasters and netcasters are now using lossy data reduction algorithms like MPEG-1 Layer 2 to increase the storage time of digital playback media. In addition, source material is often supplied through a lossy data reduction algorithm, whether from satellite or over landlines. Sometimes, several encode/decode cycles will be cascaded before the material is finally presented to OPTIMOD-PC's input.

All such algorithms operate by increasing the quantization noise in discrete frequency bands. If not psychoacoustically masked by the program material, this noise may be perceived as distortion, "gurgling," phasiness, or other interference. Psychoacoustic calculations are used to ensure that the added noise is masked by the desired program material and not heard. Cascading several stages of such processing can raise the added quantization noise above the threshold of masking, such that it is heard. In addition, there is at least one other mechanism that can cause the noise to become audible at the radio. OPTIMOD-PC's multiband limiter performs an "automatic equalization" function that can radically change the frequency balance of the program. This can cause noise that would otherwise have been masked to become unmasked because the psychoacoustic masking conditions under which the masking thresholds were originally computed have changed.

Accordingly, if you use lossy data reduction in the studio, you should use the highest data rate possible. This maximizes the headroom between the added noise and the threshold where it will be heard. In addition, you should minimize the number of encode and decode cycles, because each cycle moves the added noise closer to the threshold where the added noise is heard.

Interfacing to the Transmitter

Sync Input

In the DAB system, several programs are combined into one "ensemble multiplex." This requires synchronization of the sample rates applied to the transmitter. DTV and HD Radio® also require synchronization. OPTIMOD-PC allows you to use one of the AES3 inputs to accept "house sync," which permits OPTIMOD-PC's output to be synchronized to a master sync generator. Regardless of whether its analog or digital inputs are used, its AES3 output will be synchronized to the AES3 signal at this input. Because OPTIMOD-PC's digital inputs are equipped with sample rate converters, locking the output sample rate to the house sync reference allows an asynchronous digital input to be applied to OPTIMOD-PC's remaining AES3 input while ensuring that OPTIMOD-PC's output is in sync with the master sync generator. See also page 1-22: *Genlocking OPTIMOD-PC Cards to a Reference Sample Frequency*

Sample Rate and Audio Bandwidth

Most DAB audio is at 48 kHz sample rate. However, AM HD Radio operates at 32 kHz, requiring 15 kHz audio bandwidth. The DAB system offers a 24 kHz sample rate option, requiring 10 kHz audio bandwidth.

OPTIMOD-PC's bandwidth can be adjusted from 10 kHz to 20 kHz to provide correctly anti-aliased audio for any of these systems. If any anti-aliasing filters following OPTIMOD-PC's output are phase-linear and have integer-sample time delays, these filters will pass the band-limited OPTIMOD-PC output without introducing overshoot because they remove no further spectrum and do not cause their output samples to become asynchronous with the peak-controlled samples at OPTIMOD-PC's output.

OPTIMOD-PC always operates at 48 kHz sample rate internally. Its output is equipped with a sample rate converter that can output at 32 kHz, 44.1 kHz, 48, 88.2, or 96 kHz. These rates can be synchronized to either AES3 digital input (see page 1-22).

We expect that transmitters that transmit sample rates below 32 kHz will provide internal sample rate conversion, and that most will probably accept audio at 48 kHz sample rate regardless of the final sample rate of the transmission. Any sample rate conversion may cause the transmitted sample to become asynchronous to the peak-controlled samples emerging from OPTIMOD-PC and may therefore introduce overshoot. Fortunately, as the audio bandwidth becomes lower this becomes less of the problem because the 48 kHz sample rate within OPTIMOD-PC oversamples the audio. It is therefore less likely that peaks will "slip between the samples."

Subframe Delay

OPTIMOD-PC provides an adjustable time delay of up to 60 milliseconds. This allows the installer to force the total delay through the processing to equal one frame (which is useful in sound-for-picture applications). The definition of "frame" depends on the system in which OPTIMOD-PC is installed.

> The selections are MINIMUM (typically 24 ms delay; depends on crossover settings and whether 2-band or 5-band processing is active), 30 fps (NTSC monochrome video), 29.97 fps (NTSC color video), 25 fps (most PAL video), and 24 fps (film). You can also adjust the delay in one-millisecond increments from 33 to 60 ms.

Setting Output/Modulation Levels

In a perfect world, one could set the peak level at OPTIMOD-PC's output to 0dBfs. However, there are at several potential problems that may make it desirable to set the modulation level slightly lower.

- First is asynchronous re-sampling, which we have discussed at length earlier in this chapter. (See page 1-24, for example.) If any digital processing that causes its output samples to be asynchronous to its input samples is used after OPTIMOD-PC's output, this can cause the peak levels of individual samples to increase above the nominal threshold of limiting. This increase is typically less than 0.5dB.
- Second is additional processing, such as equalization. Equalization that applies boosts at certain frequencies is very likely to add peak level and thus cause clip-

ping. However, equalization that attenuates certain frequencies can also cause overshoots because of added phase shifts. So be wary of any equalization and allow headroom to accommodate it.

- Third is headroom in lossy data compression systems. A well-designed perceptual encoder will accept samples up to 0 dBfs and will have internal headroom sufficient to avoid clipping. However, there is no guarantee that *receiver* manufacturers or *decoder* providers will implement perceptual decoders with sufficient headroom to avoid clipping overshoots. Such overshoots are the inevitable side effect of increasing the quantization noise in the channel, and can be as large as 3-4dB. Most perceptual encoder algorithms are designed to have unity gain from input to output. So if peak levels at the input frequently come up to 0dBfs, peak levels at the output will frequently exceed 0dBfs (and will be clipped) unless the decoder algorithm is adjusted to be less than unity gain.

  Canny engineers will therefore familiarize themselves with the performance of real-world receivers and will reduce the peak modulation of the transmissions if it turns out that most receivers are clipping due to perceptual encoding overshoots. Our experience to date indicates that allowing 3dB headroom should prevent audible overshoot-induced clipping in low bite-rate systems (e.g., 32 kbps streams), while 2dB is adequate for 128kbps and above. While some clipping may still occur, it will have a very low duty cycle and will almost certainty be inaudible.

Monitoring on Loudspeakers and Headphones

In live operations, highly processed audio often causes a problem with **the DJ or presenter's headphones.** When its built-in inputs and outputs are used, the delay through OPTIMOD-PC can be as much as 25 ms (or more, if the installer purposely adds frame-makeup delay). This delay, although not usually audible as a distinct echo, can cause bone conduction comb filtering of the DJ/presenter's voice in his/her ears. This is almost always very uncomfortable to them.

> Delays through the computer's internal WAVE audio can be much larger. These delays are difficult or impossible for the user to control because they are functions of the computer's operating system. To minimize delay, use OPTIMOD-PC's hardware inputs and outputs.

OPTIMOD-PC's processing has a second output after the multiband compressor but before the look-ahead peak limiter, which is where the majority of the delay occurs. This output feeds one of the inputs to the output routing switcher in the Orban I/O Mixer application.

When driven by the multiband compressor alone, the input/output delay is approximately 3-4 ms (depending on whether the analog or digital input is used and whether sample rate conversion is used). This delay can still be uncomfortable to some, but many DJ/presenters find it acceptable and almost anyone can get used to it.

Such problems can be avoided completely if the DJ/presenter's headphones are driven directly from the program line or, better, by an inexpensive analog compressor connected to the program line. If the DJ/presenter relies principally on headphones to determine whether a digital radio station is on the air, simple loss-of-data and loss-of-audio alarms should be added to the system. Such alarms could be configured to cut off audio to the DJ/presenter's phones when an audio or carrier failure occurs.

Streaming and Netcasting Applications

This section was written in early 2006. As the state of the art in netcasting is changing with ferocious rapidity, we expect it to become outdated quickly. Please check Orban's web site, www.orban.com, for newer information.

Using OPTIMOD-PC in Streaming Applications

You need an audio source connection (either analog, AES3 digital, or SPDIF digital). The digital input can accept any sample rate from 20 to 96 kHz. You can also use any stream available within the computer's internal WAVE audio system, such as a digital playout system.

One of the outputs of OPTIMOD-PC's routing switcher sends audio back into the computer's internal WAVE audio system. You will ordinarily connect this stream to the input of an encoder application, like Orban OPTICODEC-PC, RealNetworks Real/Helix Producer, or Microsoft Windows Media Encoder running on the same host as OPTIMOD-PC. You then apply the encoded output of the encoder to a netcast server application, which may operate on the same machine as the encoder, or on a different machine on your network. In the latter case, you will route the encoded audio to the netcast server application through your network. (See *Processing for Low Bitrate Codecs* on page 3-5.)

Using OPTIMOD-PC to Prepare Audio Files for Download

Functionally, OPTIMOD-PC is a full-duplex sound card and is seen as such by the computer's operating system. This means that it can support record and playback functions simultaneously. You can use any application that allows simultaneous playback and recording of audio files to process the raw files before they are encoded with an application. Depending on the encoder application's design, you may have to first write a file containing the OPTIMOD-PC-processed audio and then apply that file to the input of the encoding application.

Any audio editing application that is Microsoft Windows WDM-compliant will work with OPTIMOD-PC. For example, Adobe Audition supports batch processing, so you could use it to process many audio files while unattended.

Most streaming encoders have a mode to record/encode in their native file formats in real time. If you do not need the interim .WAVE file, encoding directly will eliminate a step and will save disk space and time.

Loudness

You can expect a significant increase in loudness from OPTIMOD-PC processing by comparison to most unprocessed audio.

> An exception is recently mastered CDs, which may have already been aggressively processed for loudness when they were mastered.

In radio broadcasting, it is generally believed that loudness relative to other stations attracts an audience that perceives the station as being more powerful than its competition. We expect that the same subliminal psychology will also hold true in netcasting.

Choosing your Encoder

The state of the art in encoder technology is changing rapidly. At this writing, the best audio encoder technology available is Coding Technologies AAC/aacPlus v2 (MPEG-4 Enhanced HE-AAC). Orban is the first provider of this technology for streaming audio applications with OPTICODEC-PC. OPTICODEC-PC can provide entertainment-quality stereo streams at 32 kbps. At 48 kbps, many listeners prefer the sound to that of FM.

OPTICODEC-PC PE is designed to work exclusively with OPTIMOD-PC to form an overall audio processing / coding chain with the highest audio quality possible for a given bitrate. These two components are also available from Orban as part of a turnkey system called OPTICODEC-PC Encoder, which includes a rack mount Windows XP computer with both components pre-installed and pre-configured. www.orban.com has more information.

Files encoded with OPTICODEC-PC can be experienced through RealPlayer® 10 (or higher), QuickTime 6.5 (or higher), or Winamp 5.05 (or higher) as well as Apple iTunes and iPods® and all other AAC/aacPlus-enabled 3GPP cellular devices. OPTICODEC-PC FE is ideal for podcasters and can even encode ringtones, which are now an important new source of revenue for production houses.

Be aware that different encoders are optimized for different bitrates, and you should match your encoder to your potential audience. An encoder appropriate for a dial-up rate of 20kb/sec may not be optimum for ISDN, DSL, or E-1/T-1 rates. This makes it necessary to use more than one algorithm to optimally serve audiences with these disparate connection speeds.

MPEG-1 Layer 3 has become a de-facto standard for distribution of non-streaming, high fidelity audio on the Internet, although aacPlus, as used in OPTICODEC-PC, is far more efficient. OPTIMOD-PC is well matched to MP3 and can effectively preprocess audio intended for MP3 playback. Choose an MP3 encoder wisely, as not all MP3 encoders are created equal and provide different levels of quality.

Shipping Instructions

Use the original packing material if it is available. Place the card in a conductive plastic bag to protect it from static damage, then pack it in the carton with at least 1

inch (2.5 cm) of cushioning on all sides of the unit. "Bubble" packing sheets, thick fiber blankets, foam "popcorn" and the like are acceptable cushioning materials; crumpled newspaper is not. Wrap cushioning materials tightly around the card and tape them in place to prevent the card from shifting out of its packing.

Close the carton without sealing it and shake it vigorously. If you can hear or feel the card move, use more packing. Seal the carton with 3-inch (8 cm) reinforced fiberglass or polyester sealing tape.

Mark the package with the name of the shipper, and with these words in red:

DELICATE INSTRUMENT, FRAGILE!

Insure the package properly. Ship prepaid, not collect. Do not ship parcel post. Your **Return Authorization Number** must be shown on the label, or the package will *not* be accepted.

Warranty, User Feedback

User Feedback

We are very interested in your comments about this product. We will carefully review your suggestions for improvements to either the product or the manual. Please email us at custserv@orban.com.

LIMITED WARRANTY

[Valid only for products purchased and used in the United States]

Orban warrants Orban products against defects in material or workmanship for a period of two years from the date of original purchase for use, and agrees to repair or, at our option, replace any defective item without charge for either parts or labor.

IMPORTANT: This warranty does not cover damage resulting from accident, misuse or abuse, lack of reasonable care, the affixing of any attachment not provided with the product, loss of parts, or connecting the product to any but the specified receptacles. This warranty is void unless service or repairs are performed by an authorized service center. No responsibility is assumed for any special, incidental, or consequential damages. However, the limitation of any right or remedy shall not be effective where such is prohibited or restricted by law.

Simply take or ship your Orban products prepaid to our service department. Be sure to include a copy of your sales slip as proof of purchase date. We will not repair transit damage under the no-charge terms of this warranty. Orban will pay return shipping. (See *Shipping Instructions* on page 1-32.)

No other warranty, written or oral, is authorized for Orban Products.

This warranty gives you specific legal rights and you may have other rights that vary from state to state. Some states do not allow the exclusion of limitations of incidental or consequential damages or limitations on how long an implied warranty lasts, so the above exclusions and limitations may not apply to you.

INTERNATIONAL WARRANTY

Orban warrants Orban products against evident defects in material and workmanship for a period of two years from the date of original purchase for use. This warranty does not cover damage resulting from misuse or abuse, or lack of reasonable care, or inadequate repairs performed by unauthorized service centers. Performance of repairs or replacements under this warranty is subject to submission of this Warranty/Registration Card, completed and signed by the dealer on the day of purchase, and the sales slip. Shipment of the defective item for repair under this warranty will be at the customer's own risk and expense. This warranty is valid for the original purchaser only.

EXTENDED WARRANTY

Any time during the initial two-year Warranty period (but not thereafter), you may purchase a three-year extension to the Warranty (yielding a total Warranty period of five years) by remitting to Orban ten percent of the gross purchase price of your Orban product. This offer applies only to new Orban products purchased from an authorized Orban Dealer. To accept the extended five-year warranty, please sign and date below, and fax this copy along with a copy of your original invoice (showing date of purchase) to Gareth Paredes at (510) 351-0500.

I ACCEPT THE EXTENDED FIVE-YEAR WARRANTY

_____

DATE_____

MODEL NUMBER: 1101

SERIAL NUMBER_____

Section 2

Installation

Installing OPTIMOD-PC in Windows® Computers

Allow about 2 hours for installation.

Installation consists of: (1) unpacking and inspecting OPTIMOD-PC, (2) inserting OPTIMOD-PC into a free PCI slot in the powered-down host computer, (3) starting the computer, (4) inserting the OPTIMOD-PC driver CD into the computer's CD-ROM drive and following the prompts on the screen, and (5) optionally connecting inputs and outputs. When you have finished installing OPTIMOD-PC, proceed to *Setup: The OPTIMOD-PC Control Application* on page 2-18.

Note that as of this writing, we have not thoroughly tested OPTIMOD-PC with Windows Vista. Therefore, the following instructions apply specifically to XP.

If you are upgrading your OPTIMOD-PC software, it is unnecessary to uninstall the old software first—we recommend installing the new software over the old software. If the new software requires a driver update, you will have to reboot your computer after the installation process finishes. The installer will offer to do this automatically.

1. Unpack and inspect.

A) If you note obvious physical damage, contact the carrier immediately to make a damage claim. Included in the package are:

1 OPTIMOD-PC PCI card
1 Operating Manual
1 Driver and software CD-ROM.

B) Save all packing materials! If you should ever have to ship OPTIMOD-PC (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. In particular, *static discharge can damage OPTIMOD-PC,* and it should always be stored and shipped in the anti-static bag in which it was shipped from the factory. *Your warranty does not cover damage from static discharge*.



C) Complete the Registration Card and return it to Orban. (please)

The Registration Card enables us to inform you of new applications, performance improvements, software updates, 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. (The Registration Card is located after the cover page).

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

2. Mount OPTIMOD-PC in a free PCI slot in your computer.

OPTIMOD-PC should be compatible with most IBM-compatible computers as long as they do not use PCI-X or require low-profile PCI cards. The computer's PCI bus must be Plug & Play PCI Version 2.2 compliant, 32-bit, 33MHz, with a transfer rate up to 132MBytes/sec. OPTIMOD-PC will operate in a 3.3V or 5V PCI slot, and with bus expansion. More than one OPTIMOD-PC card can be installed in a given host computer.

Remove AC power from the computer. Using proper static control procedures, remove OPTIMOD-PC from its anti-static packaging bag and insert it in a free PCI slot in your computer.

If you are installing more than one OPTIMOD-PC card, insert all cards at this time.

3. Install driver and software.

A) Apply power to your computer and let it boot.

After most of the normal boot process is finished, the Windows "New Hardware Detected" wizard will appear.

B) Click *Cancel* as many times as necessary to close the "New Hardware Detected" wizard.

When you run the Orban installer according to the instructions below, it will automatically install the correct driver.

C) (Optional) If you have installed more than one card, Windows will continue to present "New Hardware Detected" windows until you have installed all cards. Continue to cancel out of the "New Hardware Detected" wizard until it no longer appears.

D) Insert your OPTIMOD CD-R in your computer's CD-R reader.

E) Navigate to Start/Run on your computer. In the Run dialog box, type `x:setup`, where "x" is the drive letter of your CD-ROM drive, and click "OK."

This will install the 1101's driver and its control and server software on your computer. The server runs as a Windows service and will automatically run at boot time.

IMPORTANT: Your computer must be rebooted to load the new driver before you can use your newly installed cards. The installer will offer to reboot your computer automatically at the end of the installation.

F) Answer the questions when prompted by the Orban installer.

The installer will allow you to create a desktop icon pointing to the OPTIMOD-PC control application and will allow you to create an "agent" in the System Tray that launches the OPTIMOD-PC control application via a single click.

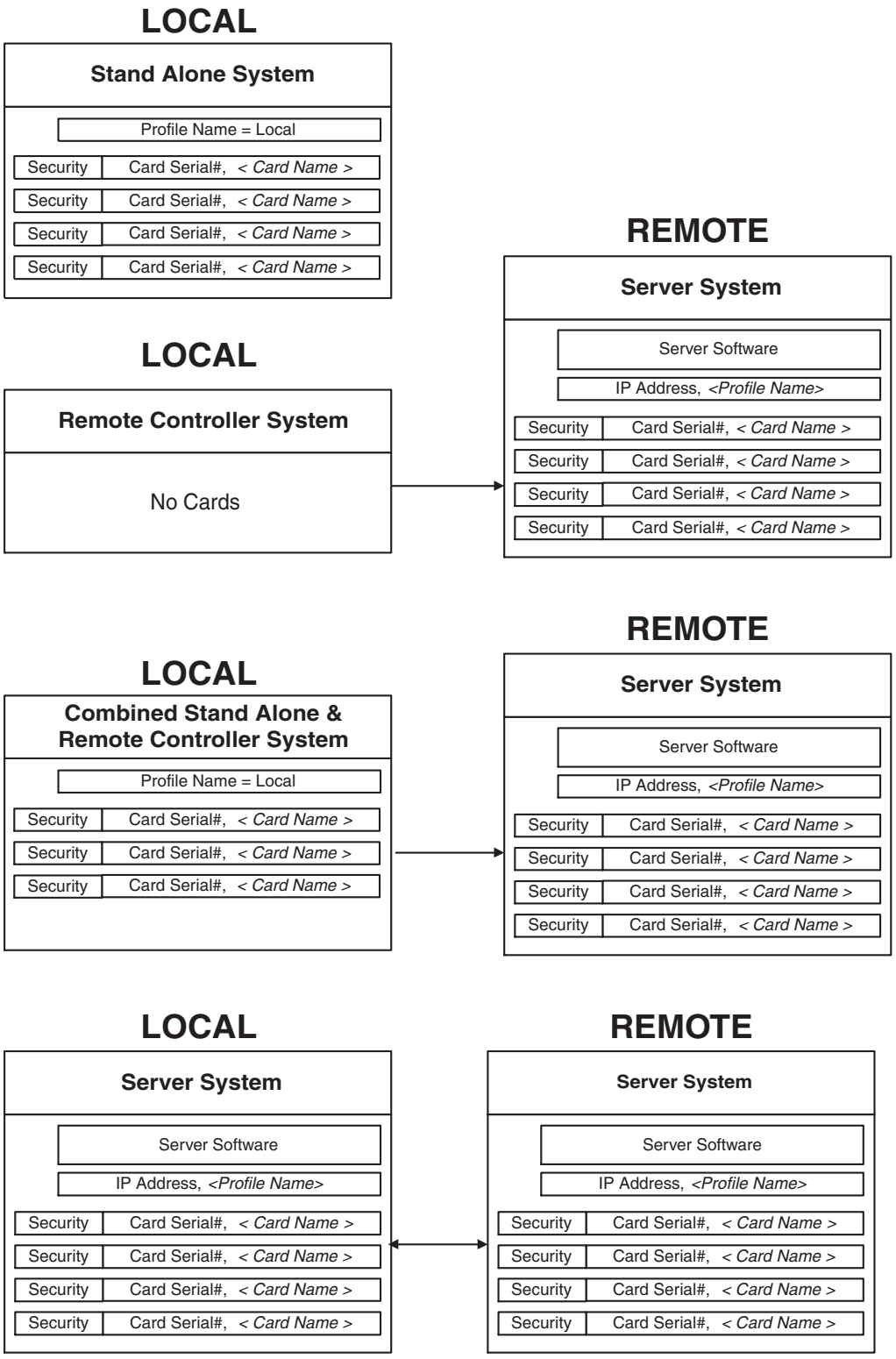


Figure 2-1: OPTIMOD-PC Network Scenarios



If you are upgrading from an earlier software version: If the versions of the driver, service, and application are incompatible, each OPTIMOD-PC card will function in its default "sound card mode." The application will display the following message when you try to connect to an incompatible card:

The OPTIMOD-PC driver version is incompatible with this application. Please install latest driver and software.

If you get this error message, repeat the installation process by running Setup from the Orban CD-R or as downloaded from ftp.orban.com/1101. *Do not uninstall the old version of OPTIMOD-PC before running the upgrade application*. If you do so, you must reboot your computer before running the Orban setup application.

4. Plan your installation.

Figure 2-1 on page 2-3 shows four possible installation scenarios:

A) OPTIMOD-PC cards are located on and are controlled from the local computer

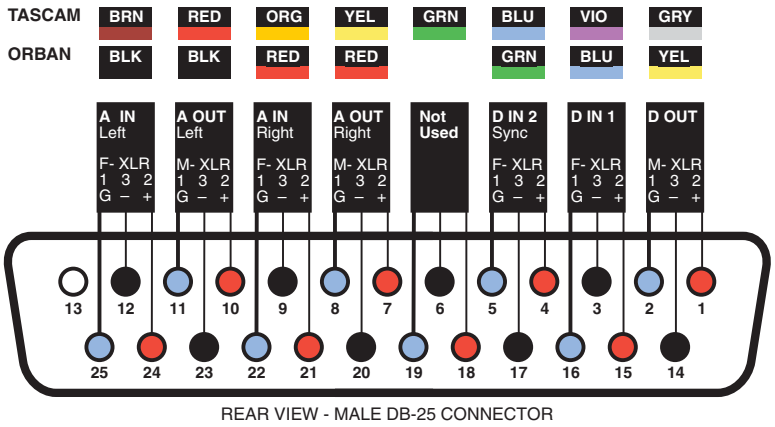


Figure 2-2: Wiring Diagram for the OPTIMOD-PC XLR Cable Assembly

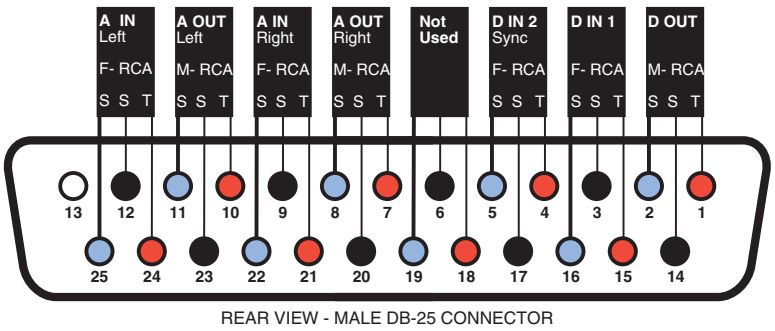


Figure 2-3: Wiring Diagram for the OPTIMOD-PC RCA Cable Assembly

only.

B) OPTIMOD-PC cards are located elsewhere on the network, to be controlled by a local computer that has no installed OPTIMOD-PC cards.

C) OPTIMOD-PC cards are located both locally and elsewhere on the network. Local cards cannot be controlled from remote computers.

D) OPTIMOD-PC cards are located both locally and elsewhere on the network. All cards are controllable from any machine on the network, whether local or remote.

If your installation corresponds to scenario (A), skip to step 15 on page 2-14. This scenario is typically true for simple, single-card installations such as those where OPTIMOD-PC is used in a production studio.

5. Connect hardware inputs and outputs. (optional)

The wiring harness containing input and output cables is an optional accessory because some OPTIMOD-PC users will use only its software WAVE inputs and outputs and do not need its hardware inputs and outputs.

There are three versions of the cable assembly available: one terminated with XLR connectors for balanced operation, one terminated with RCA connectors for unbalanced operation, and one with bare wires. *Figure 2-2* on page 2-4 shows how these cable assemblies are wired and can be used as a guide for making your own harness.

Note that the diagram shows the rear view of the male connector that terminates the cable assembly, not the front view. This is the same as the front view of the female connector mounted on OPTIMOD-PC.

In the Orban XLR cable assembly, pin 2 of the XLR connectors is wired

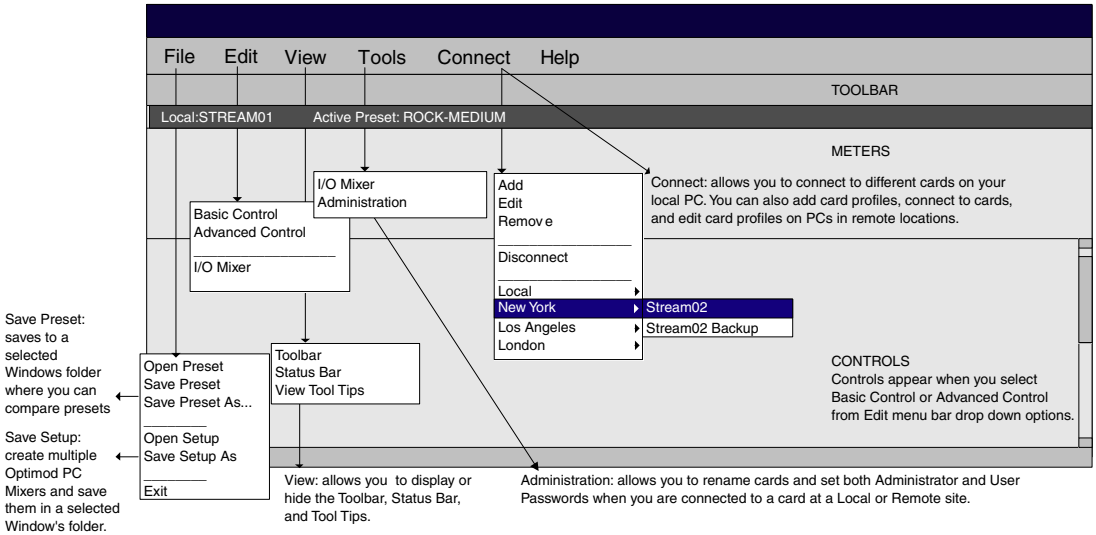


Figure 2-4: The Orban Control Application

HIGH and pin 3 is wired LOW. Pin 1 is ground.

In the Orban RCA cable assembly, the center pin is HIGH, while the LOW and SHIELD are wired together.

In the unterminated harness, the white and white/blue striped wires are HIGH; the blue and blue/white striped wires are LOW. The shield is ground.

Note that balanced cables wired to the Tascam® standard are also compatible with OPTIMOD-PC. Unbalanced cables may not work with all inputs and/or outputs. *Figure 2-2* also shows the Tascam color codes.

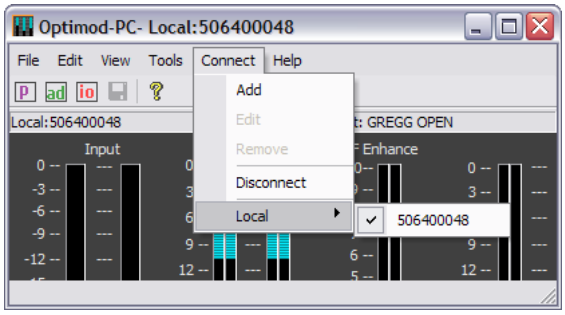
6. Set up passwords and card names for cards in your computer. (optional)

A) Start the Optimod-PC control application, `Optimod.exe`, by clicking its icon ("agent") in your computer's system tray, or from Start > Programs > Orban > Optimod-PC. (See Figure 2-4 on page 2-5.)

Newly installed cards have no passwords. You do not need to assign a password to a card unless you want that card to be accessible to a network connected to your computer.

> Once you have assigned passwords, these passwords can be changed either locally or on the network by anyone with the Administrator password for that card, but no one else. Do not lose the Administrator password you assign in the steps below.

B) Connect to the local card to which you are assigning a name and password.



C) From the Tools menu bar, choose "Administration."

Initially, Optimod-PC software identifies a card by its serial number, which it reads from the card. You can give the card an easily remembered name ("alias") by filling in the CARD NAME field.

Optimod-PC software will then identify the card by this name from anywhere on the network.

D) Assign a User Password to the card by filling in the USER PASSWORD and CONFIRM PASSWORD fields identically. This password allows you to connect to a card via the OPTIMOD-PC Control Application.

E) Assign a Terminal Password to the card by filling in the TERMINAL PASSWORD and CONFIRM PASSWORD fields identically. This password allows you to connect to a card via OPTIMOD-PC TCP/IP terminal server to allow external control of the OPTIMOD-PC cards from either a Telnet/SSH client or a custom third party application. See *Optimod-PC System/Mixer Control API* on page 6-1.

If you do not assign a Terminal Password in this step, your installation will not be secure unless USE LOCALHOST ONLY FOR TERMINAL ACCESS is checked (step (7.G) on page 2-9).

F) Assign an Administrator Password to the card by filling in the ADMINISTRATOR PASSWORD and CONFIRM PASSWORD fields identically.

> Do not make the User and Administrator passwords identical.

Be sure to write down and remember the Administrator Password because you must have it to change the card's User Password or the Card Name in the future. You may check REMEMBER ADMIN. PASSWORD, but be aware that this will allow *anyone* with access to your computer to change the User *and* Administrator passwords for this card. If this privilege was used maliciously, it could lock you out of the card, requiring an inconvenient editing of your computer's Registry to remove the unwanted password.

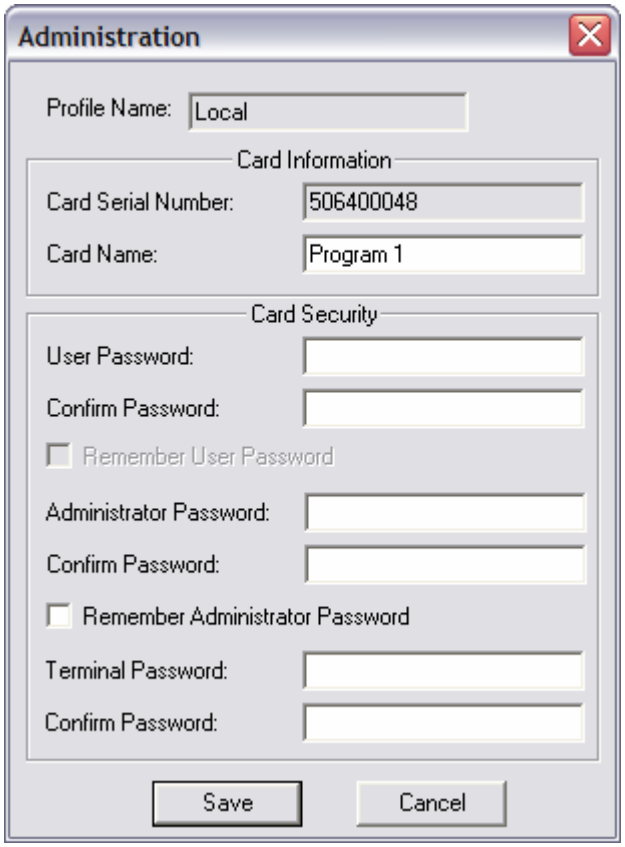


Figure 2-5: Card & Security Administration

G) Click SAVE to confirm your entries.

H) Repeat steps (B) through (G) for each new card installed in your local computer.

When you re-enter the CONNECT menu, you will now see the cards listed by the names you have assigned to them, not by their serial numbers.

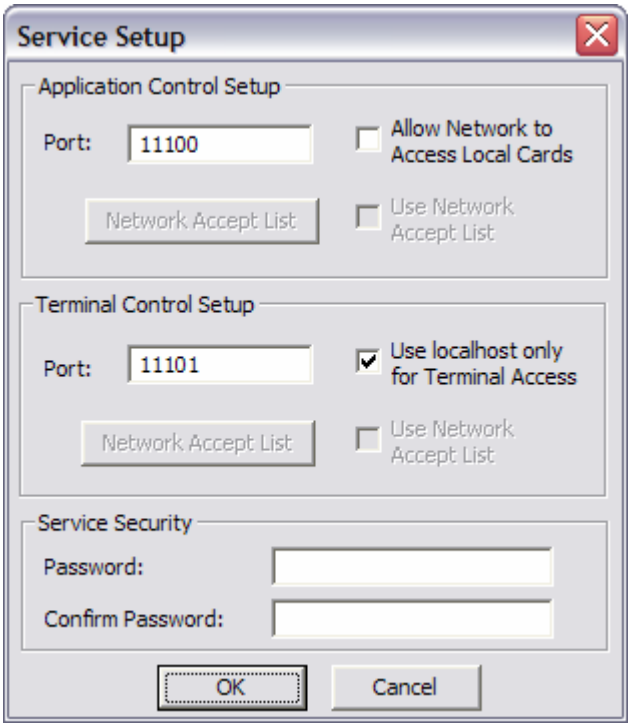
7. Set up network access for all OPTIMOD-PCs on your computer. (optional)

If you want other computers to be able to access local cards via a TCP/IP network, you must complete the following steps:

A) If the OPTIMOD-PC application is currently connected to a card, disconnect it by choosing DISCONNECT from the CONNECT menu.

B) Navigate to
TOOLS > SERVICE SETUP

C) Set the "Application Control Setup" port through which the OPTIMOD-PC Control Application running on networked computers can access the OPTIMOD-PC Service running on your local computer.



The OPTIMOD-PC Service allows you to access all cards on a given computer through the same port.

The default port is 11100. If a given computer also has OPTIMOD-PC 1100 cards installed, you must assign the 1101 and 1100 cards different port numbers to prevent conflicts.

D) Set the "Terminal Control Setup" port through which the OPTIMOD-PC Control Application running on networked computers can access the OPTIMOD-PC TCP/IP terminal server to allow external control of the OPTIMOD-PC cards from either a Telnet/SSH client or a custom third party application. See *Optimod-PC System/Mixer Control API* on page 6-1.

The default port is 11101. If a given computer also has OPTIMOD-PC 1100 cards installed, you must assign the 1101 and 1100 cards different port numbers to prevent conflicts.

E) Set ALLOW NETWORK TO ACCESS LOCAL CARDS as appropriate.

By default, this box is not checked. When it is not checked, no card in your computer can be accessed through the OPTIMOD-PC Control Application running on the network.

Before you check this box, be sure that you have assigned a password to each OPTIMOD-PC card in your computer (step 6 on page 2-6).

F) If you wish to allow only specified computers to access local cards via the OPTIMOD-PC Control Application, check the Application Control Setup USE NETWORK ACCEPT LIST.

The Network Accept List adds another layer of security beyond password security. It is not strictly necessary to use this feature if you have assigned passwords to all cards in your computer.

a) Click the NETWORK ACCEPT LIST button.

b) Click the ADD button.

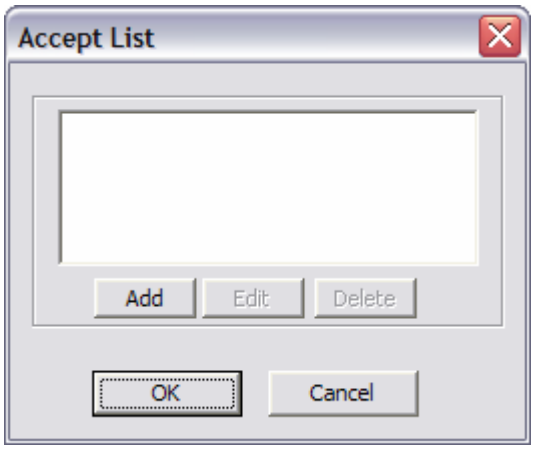
c) Enter host name, domain name, IP address, or subnet address in CIDR format.

Examples:

```
host.domain.com              Single Computer
domain.com                   Entire Domain
123.45.67.8                  Single Computer
123.45.67.8/24               Entire IP (subnet) Range
123.45.67.8/255.255.255.0    Entire IP (subnet) Range
```

d) If you wish to add another computer, repeat steps (a) through (c).

e) When you are finished adding computers, click OK.



G) Set USE LOCALHOST ONLY FOR TERMINAL ACCESS as appropriate.

This box is checked by default. This prevents any external computer on the network from connecting to a local OPTIMOD-PC via the OPTIMOD-PC TCP/IP Terminal Server.

Before you uncheck this box, be sure that you have assigned a password to each OPTIMOD-PC card in your computer (step 6 on page 2-6).

H) If you wish to allow only specified computers to access local cards via the OPTIMOD-PC TCP/IP Terminal Server, check the Terminal Control USE NETWORK ACCEPT LIST.

The Network Accept List adds another layer of security beyond password security. It is not strictly necessary to use this feature if you have assigned passwords to all cards in your computer.

a) Click the NETWORK ACCEPT LIST button.

b) Click the ADD button.

c) Enter host name, domain name, IP address, or subnet address in CIDR format.

d) If you wish to add another computer, repeat steps (a) through (c).

e) When you are finished adding computers, click OK.

I) Create a Service Security Password.

Enter identical passwords in the SERVICE SECURITY PASSWORD and SERVICE SECURITY CONFIRM PASSWORD fields.

J) Click OK.

Your cards now have full security. Any OPTIMOD-PC control application on the network will be unable to detect a card's presence without knowing its User Password in advance—the OPTIMOD-PC control application cannot automatically poll the network to discover cards.

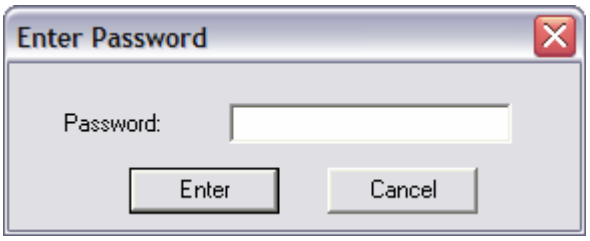
8. Edit the local OPTIMOD-PC server's network accessibility, port numbers, and Service Security Password. (optional)

A) If the OPTIMOD-PC application is currently connected to a card, disconnect it by choosing DISCONNECT from the CONNECT menu.

B) Navigate to TOOLS > SERVICE SETUP.

C) Enter the Service Security Password that you originally set in step (7.I) on page 2-9.

The Service Setup Window appears.



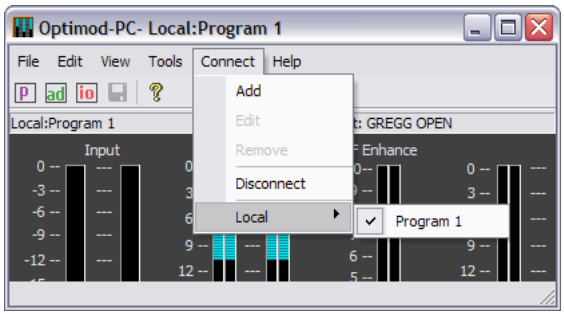
D) Edit parameters in this window as desired. Then click OK. (See step 7 on page 2-7.)

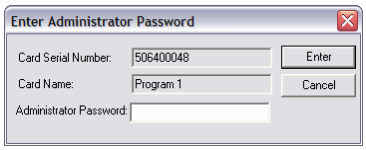
9. Edit a given card's name and/or passwords. (optional)

A) Connect to the local card to which you are assigning a name and password.

B) From the Tools menu bar, choose "Administration."

The Enter Administrator Password window appears. Enter the card's Administrator password and hit *Enter*.





If you did not enter an Administrator Password in step (6.E), you will not see the "Enter Administrator Password" dialog box and the Card and Security Administration window will appear immediately.

C) The Card and Security Administration window opens. Edit the fields as required. (See *Figure 2-5* on page 2-7.)

D) Click "Save" to confirm your changes.

10. Add remote cards to your list of available cards. (optional)

To maintain security, all OPTIMOD-PC cards in the remote machines on your network are initially hidden from the Orban Control application on your computer. You must explicitly "add" each card that you wish to control locally. To do so, you must know three things: (1) the IP address of the remote computer in which

the card resides, (2) the port that was assigned to the Optimod Cards running on the remote computer, and (3) the User or Administrator password of each card.

To add cards, you must be able to connect to the Orban server software on the remote computer containing those cards. That is, the remote computer must be on-line and connected to the network, and the Orban server software on that computer must be running. If you are using a modem connection, this connection must already be established.

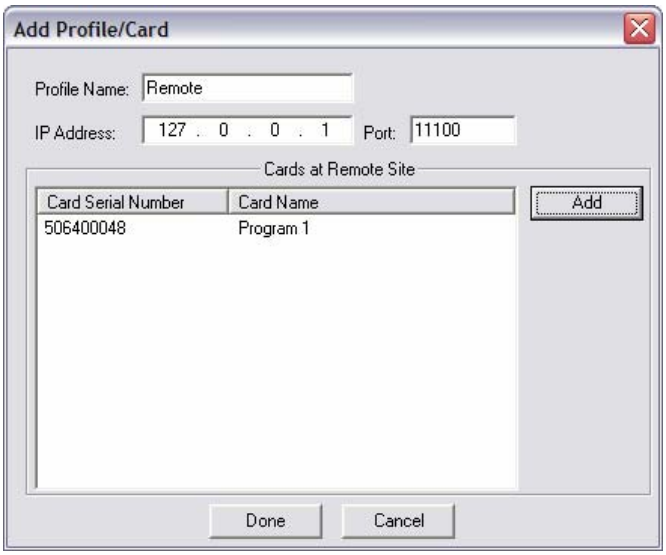
> The Orban server software will be running if the remote computer is turned on, you have installed your card and driver on that computer, the OPTIMOD-PC Control software is installed on that computer, and the "Allow Network to Access Local Cards" box in SERVICE SETUP (step 7.E) on page 2-8) is selected on a card in that system.
>
> Orban server software does not have to be running on your local computer.

A) Add a remote computer to the list of available computers containing OPTIMOD-PC cards:

a) Select CONNECT/ADD.

> The ADD PROFILE / CARDS(S) menu appears.

b) Enter the Profile Name, IP Address, and Port of the remote computer

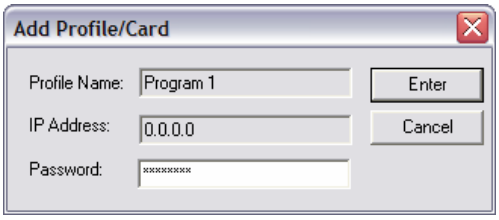


> The Profile Name can be any name you wish to use—for example, "Boston." The profile name is known only to your local computer. The network identifies a given computer by its IP address and port, not its profile name. The profile name is merely a convenient alias that you use to help identify a remote computer hosting OPTIMOD-PC cards without your having to memorize the computer's IP address.

B) Add the remote computer's cards to the list of cards that you can access:

> You must have the User Passwords of all cards you wish to add.

a) Click ADD.



The ADD PROFILE/CARD dialog box opens.

b) Enter the card's User Password into the PASSWORD field.

c) Click ENTER to confirm your entry.

The newly added card(s) will appear in the list of "Cards at Remote Site."

d) Repeat steps (a) through (c) for each card in the remote computer.

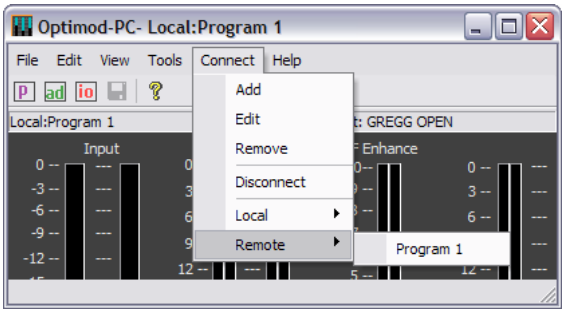
C) Click DONE when you have added all cards in a given remote computer.

D) Add remote computer Profiles and the cards in each Profiled computers as desired, by repeating steps (A) through (C) for each remote computer.

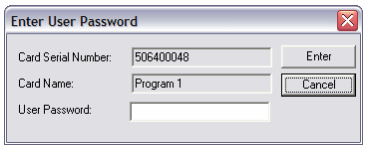
11. Connect to a remote card. (optional)

You can now connect to any card that you added in step 8 on page 2-10 if this card's server is running and connected to the network.

A) Click the CONNECT menu. A drop-down menu appears containing a list of all remote computers. Drag your mouse down to the desired computer to reveal a submenu containing all cards within it that have been added. Select the desired card to connect to it.



B) The "Enter User Password" dialog box appears. Enter the password and click ENTER. If you wish to bypass this dialog box automatically in the future, check the REMEMBER USER PASSWORD box in the CARDS AND SECURITY ADMIN screen on your local computer. (Only Administrators of your local Machine can restore this dialog box once you have specified that it is to be bypassed.)



After you click ENTER, the Control application will display the state of the card to which you just connected, and you can recall presets, adjust input/output levels, edit and save presets, etc.

12. Change passwords and card names over a network. (optional)

If you have the Administrator password for a card, you can change the card's Name, User Password, and Administrator Password from anywhere on the network. This can be particularly useful if you are in a large broadcast group that has one administrator for audio processing throughout the group's stations.

To administer a card, Orban server software must be running on the computer in which the card is installed and that computer must be connected to the network.

A) Select TOOLS > ADMINISTRATION

The "Enter Administrator Password" dialog box appears.

B) Enter the administrator password for that card and click ENTER.

The "Card and Security Administration" dialog box appears. (See *Figure 2-5* on page 2-7.)

You can enter a new User Password, Administrator Password, and/or Card Name in the appropriately named fields in the dialog box. If you do not explicitly change the value in a field, it will remain unchanged.

> We do not recommend checking REMEMBER ADMINISTRATOR PASSWORD because this action introduces considerable security risk.

C) Click SAVE to confirm your changes.

13. Delete a remote computer's profile. (optional)

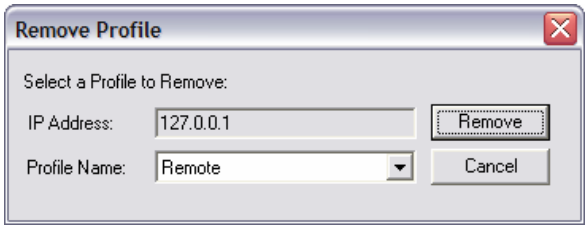
If you no longer wish to have a particular remote computer appear in the list of available computers, you can delete it from the list.

A) Select CONNECT/REMOVE.

B) Specify the remote computer you wish to remove by selecting its name in the drop-down PROFILE NAME list.

C) Click REMOVE

The remote computer's profile (and the profiles of all of its corresponding cards) is removed from your local computer. This action does not affect any other computer on the network.



You can restore the remote computer's profile by following the instructions in step (10.A) on page 2-10. If you do so, you will also have to re-add all of the cards in the host computer to the client computer by executing step (10.B).

14. Defeat the OPTIMOD-PC service in a computer that does not contain OPTIMOD-PC cards. (optional)

If a computer running the OPTIMOD-PC control application contains no OPTIMOD-PC cards, you may wish to defeat the OPTIMOD-PC service on that computer (although this is not required).

> This scenario applies to computers that control OPTIMOD-PC cards on a network, yet contain no local cards.

A) On the computer, navigate to
START > SETTINGS > CONTROL PANEL > ADMINISTRATIVE TOOLS > SERVICES.

B) Locate `OptimodPcService` in the list of services. Right-click it and select STOP.

C) Right-click `OptimodPcService` and select PROPERTIES.

D) In the STARTUP TYPE drop-down list, select DISABLED or MANUAL. (Either will defeat the service.)

> If you wish to reactivate the service in the future, reset the STARTUP TYPE to AUTOMATIC. Then right-click `OptimodPcService` and select START.

15. Simple installations: Connecting to an OPTIMOD-PC card.

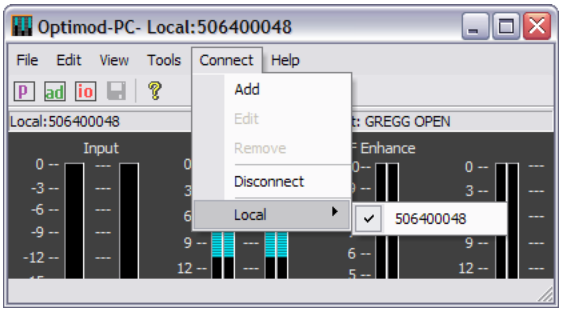
In the simplest possible installation (one card being controlled locally in one computer), the OPTIMOD-PC control application, `Optimod.exe`, will automatically connect to (and control) the card when you start the software by clicking its "agent" icon (in the right-hand side of the Windows taskbar).

> The installer will ordinarily place a shortcut to the OPTIMOD-PC control application in your computer's START menu under `Orban/OPTIMOD-PC2`. ("PC2" indicates that the software is for a model 1101 card, not an 1100 card). If you so specified during installation, there will also be an icon for `OptimodPC2.exe` on your desktop and a small icon (agent) in your system tray. When you click on the agent icon, it will open the OPTIMOD-PC control application and automatically connect to your card. On the other hand, if you start the software from the START menu or from a desktop icon, it will not automatically connect to your card; you must do this manually from the OPTIMOD-PC control application's CONNECT menu.
>
> The installer will also install the "Orban OPTIMOD-PC 1101" Windows Service application and set it to start automatically at boot-up. Please note that the network cannot see your OPTIMOD-PC card(s) unless you explicitly expose them to the network as described in step 7 on page 2-7.
>
> Auto-starting the Service at boot time allows it to automatically reload OPTIMOD-PC's DSP code on boot, which can be invaluable in a streaming application where the stream must automatically restart after a system crash. The server application has no user controls and you do not have to interact with it or otherwise worry about it other than to be aware that it is normal for it be running in the background as a Windows service.

If you have more than one card installed in your computer, you must select the one you are controlling by choosing it from a list available from the CONNECT menu. If you did not edit the names of the cards, then the list will show the cards' serial numbers.

If, for convenience in identifying them, you wish to assign them easily remembered names ("aliases"), you must edit their profiles as described in step 6 on page 2-6.

To connect to a card (thereby controlling it), left-click CONNECT and drag the mouse to LOCAL. Continue to drag the mouse to the desired card name that appears in the submenu, and release the mouse button.



16. Connect inputs and outputs. (optional)

This is not required if you are going to be using only WAVE inputs and outputs, which are routed through your computer's operating system. In this case, skip to *Setting up OPTIMOD-PC: the Orban Control Application* on page 2-18.

If you are using hardware inputs or outputs, see the hookup and grounding information on the following pages.

Audio Input and Audio Output Connections.....Page 2-15
AES3 Digital Input and Output .....Page 2-16
Grounding .....Page 2-16

Audio Input and Output Connections

Cable

We recommend using two-conductor foil-shielded cable (such as Belden 8451/1503A/1504A/1508A or equivalent for analog signals and Belden 1800B/1801B or equivalent for digital signals), because signal current flows through the two conductors only. The shield does not carry signal, and is used only for shielding.

Connectors

The cable assemblies are optional and must be purchased separately from OPTIMOD-PC. If you order the model 1101/CBLXLR assembly, input and output connectors are XLR. If you order OPTIMOD-PC/CBLRCA assembly, input and output connectors are RCA. If you order OPTIMOD-PC/CBL assembly, the cables are terminated in bare wires so you can terminate them with the connectors of your choice.

> 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. However, we arbitrarily call pin 2 HIGH and pin 3 LOW to conform to AES standards.
>
> In the RCA-type connectors, the center pin (called "T" [for "tip"] in the diagram) is HIGH, while the outer sleeve (called "S" in the diagram) is LOW and SHIELD.
>
> See *Figure 2-2: Wiring Diagram for the OPTIMOD-PC XLR* and *Figure 2-3: Wiring Diagram for the OPTIMOD-PC RCA Cable Assembly* on page 2-4.

Analog Audio Input

Using Orban's mixer application (available from the TOOLS menu on the Orban Control application or from your computer's control panel in Multimedia), you can choose a nominal input level of either –10dBV (IHF consumer level) or +4dBu (professional level).

> (0dBu = 0.775Vrms. For this application, the dBm@600Ω scale on voltmeters can be read as if it were calibrated in dBu. 0dBV = 1.0Vrms.)

The peak input level that causes overload depends on whether you have set the input for –10 dBV (–7.8 dBu) or +4dBu. Overload occurs at approximately +9.2 dBV (+11.4 dBu) for the –10 dBV setting and +20 dBu for the +4 dBu setting.

The electronically balanced input uses an ultra low noise and distortion differential amplifier for best common mode rejection. It 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 not co-located with an RF transmitter), connect the cable shield at OPTIMOD-PC input only—it should not be connected at the source end. In high RF fields (like a transmitter site), also connect the shield to pin 1 of the male XLR-type connector at the source driving OPTIMOD-PC.
- If the output of the driving unit is unbalanced and does not have separate CHASSIS GROUND and (–) (or LOW) output terminals, connect both the shield and the black wire to the common (–) or ground terminal of the driving unit.

Analog Audio Monitor Output

Electronically balanced and floating outputs simulate a true transformer output. The source impedance is 50Ω. The output is capable of driving loads of 600Ω or higher. The peak output level is adjustable up to +20dBu before clipping occurs. The outputs are EMI suppressed.

- If an unbalanced output is required (to drive unbalanced inputs of other equipment), it should be taken between pin 2 and pin 3 of the XLR-type connector. Connect the LOW pin of the XLR-type connector (#3 or #2, depending on your organization's standards) to circuit ground, and take the HIGH output from the remaining pin. No special precautions are required even though one side of the output is grounded.
- Use two-conductor foil-shielded cable (Belden 8451, or equivalent).
- At OPTIMOD-PC's output (and at the output of other equipment in the system), do not connect the cable's shield to the CHASSIS GROUND terminal (pin 1) on the XLR-type connector. Instead, connect the shield to the input destination. 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.

AES3 Digital Input and Output

There are two AES3 inputs and two AES3 outputs. With v1.0 software, the two outputs emit the same signal. Both inputs accept program audio and can be mixed; either input can also accept AES11 house sync. The program inputs and output are both equipped with sample rate converters. The output can operate at 32, 44.1, 48,

88.1, and 96 kHz. The inputs can receive sample rates between 30 and 96 kHz; two asynchronous digital inputs can therefore be mixed.

Per the AES3 standard, each digital input or output line carries both the left and right stereo channels. The connection is 110Ω balanced. The AES3 standard specifies a maximum cable length of 100 meters. While almost any balanced, shielded cable will work for relatively short runs (5 meters or less), longer runs require use of 110Ω balanced cable like Belden 1800B, 1801B (plenum rated), multi-pair 180xF, 185xF, or 78xxA. Single-pair category 5, 5e, and 6 Ethernet cable will also work well if you do not require shielding. (In most cases, the tight balance of Category 5/5e/6 cable makes shielding unnecessary.)

The AES3id standard is best for very long cable runs (up to 1000 meters). This specifies 75Ω unbalanced coaxial cable, terminated in BNC connectors. A 110Ω/75Ω balun transformer is required to interface an AES3id connection to your Optimod's digital input or output.

The digital input clip level depends on the setting on the DIGITAL 1 INPUT and DIGITAL 2 INPUT mixer controls. To avoid clipping, set these so that the PROCESSOR MIXER OUTPUT meters never indicate red.

A Backup function allows inputs to be programmed to automatically mute unless digital lock is lost on another input. Such loss of lock causes the backup input to be unmuted. You can arrange this function so that, for example, loss of lock on digital input 1 causes digital input 2 to unmute, and loss of lock on both digital inputs causes the analog input to unmute. This allows you to connect backup program sources to ordinarily unused inputs and have the backup inputs activate automatically if the primary program feed is lost.

Note that OPTIMOD-PC does not fully implement the AES11 standard because it also does not pass AES3 user bits and does not control the phasing of the AES data frames between reference and output. However, it correctly locks the sample frequency of the output to the sample frequency of the reference.

Grounding

Very often, grounding is approached in a "hit or miss" manner. However, 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.

  OPTIMOD-PC has balanced inputs.

- 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 destination (input) 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 or phono connectors.

Power Ground

Ground the computer 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.

Audio ground loop or hum problems are often solved by proper shield connections and/or by making sure that analog inputs and outputs are correctly balanced. They should never be solved by disconnecting or lifting power grounds. Refer to the previous section, *Grounding*, for details.

Setup: The OPTIMOD-PC Control Application

Once you have connected the Orban Control application to an OPTIMOD-PC card, the software allows you to control the card as if it were a dedicated hardware processor like an Orban OPTIMOD. The Control application displays gain reduction meters, as well as controls that allow you to edit the sound of the factory presets to your liking. Section 3 of this manual explains these sound editing controls in detail.

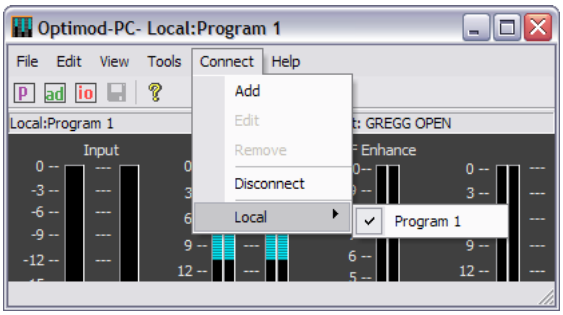
This section of the manual tells you how to set up the input and output controls of an OPTIMOD-PC card, with emphasis on connections that use OPTIMOD-PC's external analog or digital inputs and outputs to emulate a hardware audio processor. Starting on page 2-33, we provide additional instructions for users who want to connect OPTIMOD-PC's inputs and outputs to other programs (like streaming encoders) through the Windows WAVE multimedia mechanism inside your computer. Even if you are only using OPTIMOD-PC's WAVE input and output, you should still work through all of the instructions below, ignoring those that apply only to OPTIMOD-PC's hardware I/O.

1. **From the Tools menu, bring up the I/O Mixer.**

   The I/O Mixer is a tabbed control panel that allows you to configure many global OPTIMOD-PC parameters, like input and output levels. If you are familiar with Orban's hardware processors (like our Optimod-PC 6200/6200S), you will recognize many functions as being similar to those found in OPTIMOD-PC's SYSTEM SETUP menu. However, the OPTIMOD-PC I/O Mixer is more powerful.

2. Select the card you are setting up.

A) From the Connect menu on the Control application, select the card you are setting up by connecting to it.



If you have only one card installed in your machine and you open the OPTIMOD-PC application from the agent, you do not need to connect manually because you will automatically be connected to this card already.

If you wish, you can edit the factory default Input/Output ("IO") setup. You also have the option to OPEN SETUP or SAVE SETUP AS in the Control application's FILE menu. Therefore:

- You can save your current setup to a file and then apply it to another card.
- You can load a previously saved setup into the card that is currently selected.

B) To copy an IO setup from a source card to a destination card *(optional):*

a) If you have not already saved the IO setup you wish to apply to the destination card, use the Orban Control application to connect to the source card. Then go to FILE/SAVE SETUP and save the IO setup of the source card.

When saving, use any legal operating system filename other than `default.orbfs`, which is a reserved name. Setup files have the form `*.orbs`.

A given card's setup is stored in the Registry on the computer where that card resides.

The current active setup file is always the last file that was recalled by the FILE/OPEN SETUP operation. If you have never recalled a setup file this way, the current active setup is stored in a file named `system.orbs`.

The current active setup file is a transient file. That is, the Orban Control application updates it whenever you change the setup manually. The Orban Control application also automatically updates the file when the application starts and reads the setup information from the Registry. *You cannot assume that a *.orbs setup file (other than* `default.orbfs`*) is static or that it will retain its original information.*

The factory default system setup is stored as `default.orbfs`. This is a read-only file. It is the only system setup file that is static and unchanging. For further security, it is automatically regenerated each time the Orban Control Program or Service starts up.

b) Connect the Orban Control application to the destination card.

c) Go to FILE/OPEN SETUP.

d) Navigate to the folder containing the setup file you wish to retrieve.

This will usually be the file you saved in step (a).

The OPTIMOD-PC file system labels the card folders by their serial numbers. Look for the folder labeled with the source card's serial number. In that folder will be a preset folder containing the setup you wish to restore.

e) Highlight the setup file and select OPEN.

The Orban Control application will automatically make a copy of just-opened setup file in the destination card's Presets folder. It will automatically update this file if you make manual changes to the destination card's IO setup. The original setup file is not changed.

C) If you wish to edit an existing (or factory) setup, proceed to step 3 below.

D) When you are finished setting up each card, close the I/O MIXER window by clicking DONE.

3. Configure global audio processing parameters.

A) From the TOOLS menu, open the I/O Mixer and click the Configuration tab

The Configuration page appears:

B) Set the MAX LOWPASS FILTER cutoff frequency.

[10.0 kHz] to [20.0 kHz]

You can set OPTIMOD-PC's audio bandwidth in two places:

(1) in the I/O Mixer's CONFIGURATION tab, and (2) in the main window's EQ tab. (If the EQ tab is not visible, click the AD button on the toolbar.) OPTIMOD-PC's bandwidth is always the *lowest* of these settings. The frequency in CONFIGURATION is a technical parameter that determines the *highest* bandwidth available. The installing engineer should set it to be appropriate for the sample rate of the digital system that OPTIMOD-PC is driving. For example, if OPTIMOD-PC is driving a system with a 32 kHz sample rate, set the MAX LOWPASS FILTER cutoff frequency to 15.0 kHz. That way, a setting of 20 kHz in the EQ tab will not cause excessive bandwidth and aliasing because OPTIMOD-PC will automatically override it with the MAX LOWPASS FILTER cutoff frequency setting.

Note that the LP filter on the EQ tab is part of the active preset, like any other equalization control in the preset. If you recall a different preset, the LOWPASS FILTER cutoff frequency control in the new preset will now determine the system bandwidth (unless, of course, the LOWPASS FILTER cutoff frequency setting in the new preset is higher than the MAX LOWPASS FILTER cutoff frequency parameter in the CONFIGURATION page).

C) Set the AGC mode as appropriate for your installation.

[Enabled] or [Disabled]

This control turns OPTIMOD-PC's internal AGC (Automatic Gain Control) on [enabled] or off [disabled].

In radio applications, it is common to have an external AGC at the studio side of a studio-to-transmitter link to protect the link from overload. Most of the processing structures in OPTIMOD-PC control level with a

preliminary AGC internal to OPTIMOD-PC. If you are using an external AGC device (such as an Orban 6300 multipurpose audio processor or another OPTIMOD-PC) in front of OPTIMOD-PC, set OPTIMOD-PC's internal AGC to DISABLED. This is to ensure that the internal and external AGCs do not "fight" each other and that they do not simultaneously increase gain (resulting in increased noise).

If you are using an Orban 4000 Transmission Limiter, set the AGC to ENABLED (so that the AGC function in OPTIMOD-PC continues to work). The Orban 4000 is a transmission system overload protection device; it is normally operated below threshold. It is not designed to perform an AGC or gain-riding function and it cannot substitute for the AGC function in OPTIMOD-PC.

Temporarily set AGC to ENABLED so that the Analog and Digital Input reference level alignment steps (below) will work correctly. After you have finished with these steps, set the AGC parameter appropriately for your installation.

D) Set the Processing Delay.

[Minimum], [30 fps], [29.97 fps], [25 fps], [24 fps], [24-57 ms]

OPTIMOD-PC can add time delay to make its input/output delay exactly one frame, using a variety of different standards. The selections are MINIMUM (depends on software version; typically between 14 and 24 ms), 24 milliseconds, 30 fps, 29.97 fps (NTSC color video), 25 fps (most PAL video), and 24 fps (film).

You can also choose delay in one-millisecond intervals from 24 to 60 milli-

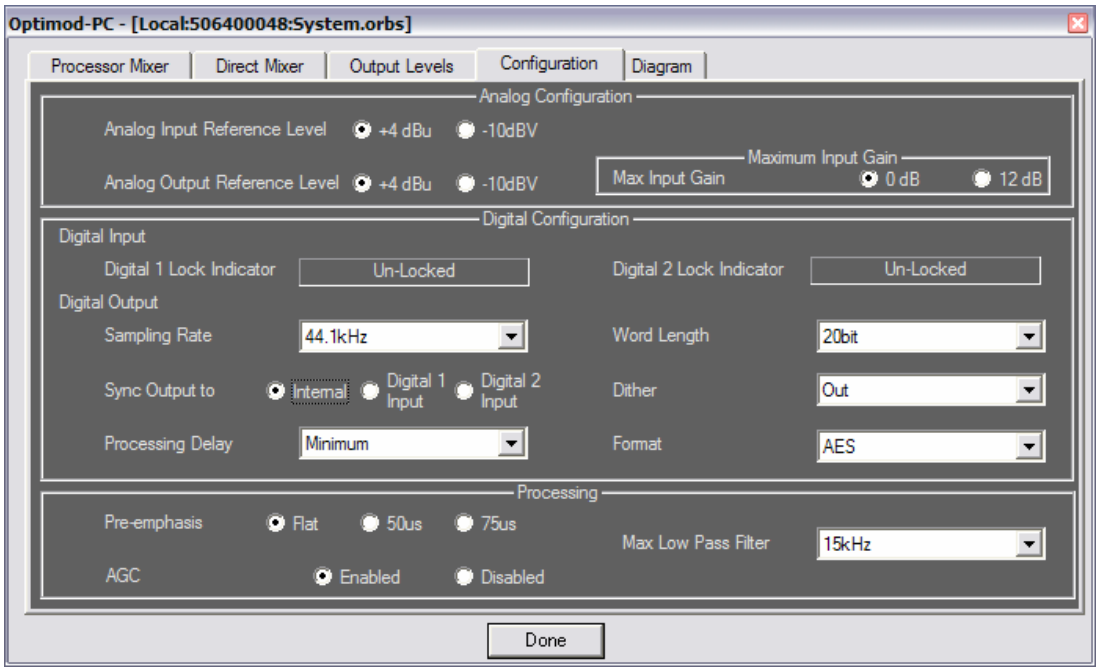


Figure 2-6: Configuration Page in the I/O Mixer

seconds by choosing the desired value from the bottom entries in the drop-down list.

4. Set digital output properties. (optional)

[Skip to "Input Setup" on page 2-24 if you will not be using OPTIMOD-PC's WAVE output or AES3 digital output.]

There are several properties you can set to match OPTIMOD-PC's AES3 digital outputs to your requirements.

A) Set the AES3 Digital Output sample rate.

[32], [44.1], [48 kHz], [88.2 kHz] or [96 kHz]

48 kHz or 96 kHz are preferred because their samples are synchronous with the peak-controlled samples in the processing.

Selecting a 32 kHz output sample rate will automatically set the highest available audio bandwidth to 15 kHz.

B) Set the Digital Output Sync mode to internal or external.

[Internal], [Digital 1 Input], or [Digital 2 Input]

OPTIMOD-PC's AES3 output has a hardware sample rate converter that allows the output sample rate to be synchronized to a source.

- The INTERNAL sync setting synchronizes the output words at the AES3 output to OPTIMOD-PC's internal clock.
- The EXTERNAL setting synchronizes the output rate to the input rate. You can use either the DIGITAL 1 INPUT or the DIGITAL 2 INPUT as the sync source. The same input can also supply audio. If a given input is used *only* as a sync source, it is wise to check the MUTE box for that input in the Processor mixer and Direct Mixer.

If a valid AES3 signal is present at the designated sync input, it will be used for synchronization. If lock is unavailable, OPTIMOD-PC automatically switches to INTERNAL. OPTIMOD-PC automatically returns to external sync after one second of continuously valid AES3 signal lock at a valid sample rate. Furthermore, external lock is only permitted when the output rate matches the sync (or AES3 input) rate.

C) Set the desired output word length.

[14 bits], [16bits], [18bits], [20bits], and [24bits]

The largest valid word length in OPTIMOD-PC is 24 bits. OPTIMOD-PC can also truncate its output word length to 20, 18, 16, or 14 bits. If the input material is insufficiently dithered for these lower word lengths, OPTIMOD-PC can add dither (see the next step), which is wise if the input material is insufficiently dithered for these lower word lengths.

D) Adjust DITHER to on or off, as desired.

[in] or [out]

OPTIMOD-PC can add "high-pass" dither before any truncation of the output word. The amount of dither automatically tracks the setting of the WORD LENGTH control.

OPTIMOD-PC's dither is first-order noise shaped dither that adds less noise in the midrange than white PDF dither. However, unlike extreme noise shaping, it adds a maximum of 3dB of excess total noise power when compared to white PDF dither. It is therefore a good compromise between white PDF dither and extreme noise shaping.

In many cases, you will not need to add dither because the source material has already been correctly dithered. However, particularly if you use the Noise Reduction feature, the processing can sometimes attenuate input dither so that it is insufficient to dither the output correctly. In this case, you should add dither within OPTIMOD-PC.

E) Set digital output format.

[AES3], [SPDIF]

This control determines whether the status bits supplied at the digital output are in Professional (AES3) or Consumer (SPDIF) mode.

> It does not affect the output level or source impedance, both of which correspond to the AES3 standard.

5. Set preemphasis curve on which the look-ahead limiting operates.

[Flat], [50 μs], [75 μs]

Normally, OPTIMOD-PC will feed transmission channels that do not use preemphasis and you should set this control FLAT. Rarely, the transmission channel uses preemphasis. (An example is an analog microwave studio-transmitter link in broadcast applications.) For these applications, you can apply preemphasis before OPTIMOD-PC's look-ahead limiter so it will control the peaks of the preemphasized audio. A deemphasis filter after the look-ahead limiter then restores "flat" audio at OPTIMOD-PC's output; it is assumed that the transmitter driven by OPTIMOD-PC will restore the preemphasis before the signal is transmitted.

When in doubt, choose FLAT operation.

> Unlike OPTIMOD-FM and OPTIMOD-TV, OPTIMOD-PC cannot emit the preemphasized signal, which would allow the transmitter's preemphasis filter to be bypassed. Instead, you must always use the transmitter's built-in preemphasis filter.
>
> Because its processing is configured to be most effective with "flat media," OPTIMOD-PC cannot provide extreme loudness for preemphasized radio channels. Use one of Orban's Optimod-FM processors for this application. For analog television with FM aural carrier(s), use Optimod-TV 8382.
>
> When operated with preemphasis, the look-ahead limiter should only be used for light protection limiting with a low duty cycle. Otherwise, you may hear pumping on material with a lot of high frequency energy like

sibilance and cymbals. The cure is lowering the LIMITER DRIVE control until the problem is no longer audible.

If you find that lowering the LIMITER Drive causes too much loudness loss, you can use the Band 5 compressor as a high frequency limiter to compromise between loudness and limiting artifacts. Set B5 DELTA RELEASE to +6 and B5 STEREO COUPLING to OFF. Adjust B5 THRESHOLD control until you see gain reduction on the Band 5 GR meter with problematic material. Continue to lower the B5 THRESHOLD control until you no longer hear gain pumping. Instead, you will probably hear some high frequency loss. This loss is less subjectively objectionable than gain pumping.

You can use the AGC+LIMITER factory presets as an example of how to do this. See *AGC+[FLAT, 50 µs, 75 µs] LIMITER* on page 3-18.

Input Setup

There are two input mixers in the I/O Mixer: the PROCESSOR MIXER and the DIRECT MIXER (see Figure 2-7 on page 2-24).

- The Processor Mixer drives the input of OPTIMOD-PC's audio processing.
- The Direct Mixer drives the direct input of OPTIMOD-PC's Output Routing Switcher.

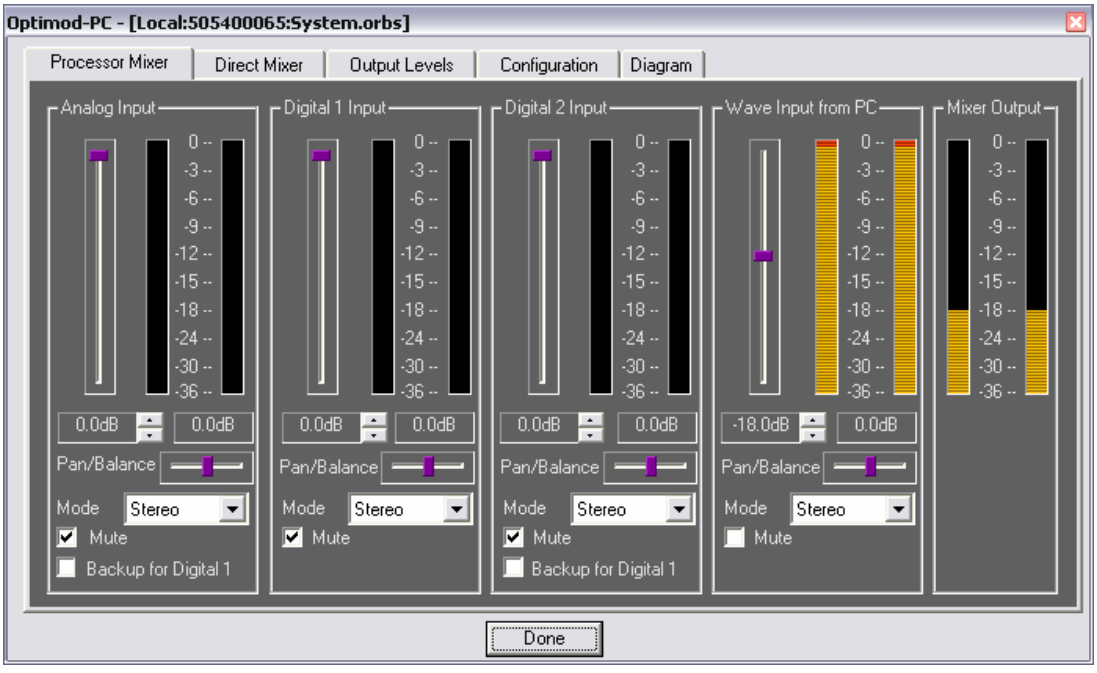


Figure 2-7: Processor Mixer Page in I/O Mixer

Both mixers are functionally identical. They have four inputs:

- Analog Left/Right
- Digital 1 Input
- Digital 2 Input
- WAVE Out from PC.

About the Interaction between the OPTIMOD-PC Input Mixers and the Microsoft Windows Mixer

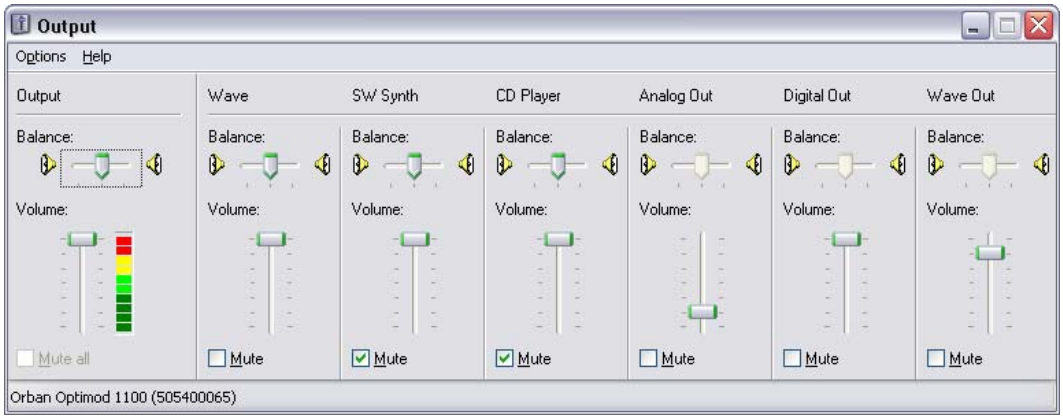


Figure 2-8: MS Mixer Output

Most PCs have a master WAVE volume control that you can access from the speaker icon in the System Tray (Figure 2-8). If you are using the OPTIMOD-PC as your computer's default sound card, OPTIMOD-PC's driver defeats the MS Mixer's Wave In Volume (Figure 2-9), forcing it to full gain. This attempts to ensure that the OPTIMOD-PC I/O Mixer's gain is calibrated correctly. The reason it cannot predictably do this is that there is another WAVE gain control in series with the master volume control. This control is located in the Windows Mixer.

Right clicking the speaker icon and choosing Volume opens the Windows Mixer. This mixer has several controls. One is the Output control, which is the same control that appears when you click the speaker icon and (to repeat) is defeated by the OPTIMOD-PC driver. The other controls are typically (1) WAVE (the culprit mentioned above), (2) Music Synthesizer, and (3) CD Player controls. Your computer's operating system sums the outputs of these controls; their sum is the WAVE signal applied to the WAVE inputs in the OPTIMOD-PC I/O Mixer.

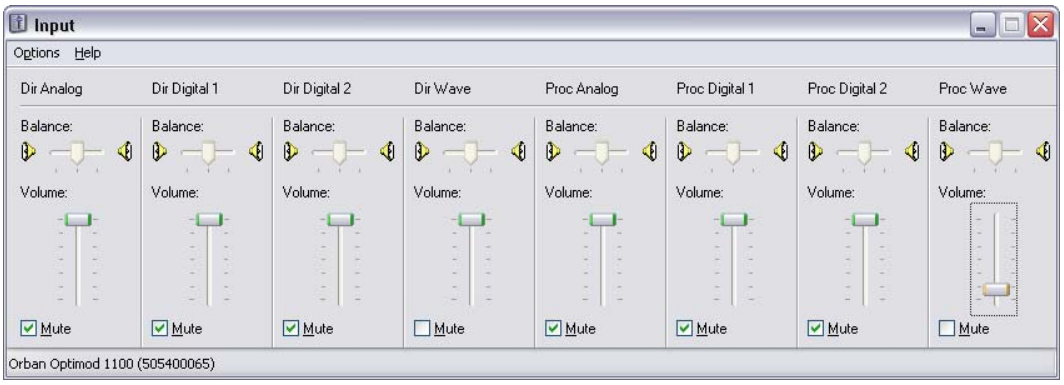


Figure 2-9: MS Mixer Input

To ensure correct calibration of the OPTIMOD-PC I/O Mixer WAVE Input, set the Windows Mixer WAVE control to full-scale. There are certain applications (at this writing, RealPlayer® is one of them) whose dedicated volume controls operate by resetting the Windows Mixer WAVE control. If the WAVE level in the OPTIMOD-PC mixer seems unexpectedly low, check the setting of the Windows Mixer WAVE control to ensure that it is still at full scale and that another application has not changed it.

There is also an OPTIMOD-PC record volume control available in CONTROL PANELS>SOUNDS AND AUDIO DEVICES>AUDIO—click VOLUME in the SOUND RECORDING box to see it. The Recording or Input Mixer mirrors with the OPTIMOD-PC mixer and can therefore be accessed by any standard Windows audio application that enumerates Windows audio controls.

Because OPTIMOD-PC supports the Windows Mixer API, Windows makes the controls associated with OPTIMOD-PC appear automatically in the MS Mixer Input and Output. However, it is better to use the Orban application to adjust these controls because the faders in the Orban I/O mixer have better resolution and the Orban mixer has more functionality.

Input Setup Procedure

1. **Adjust the Analog Input Reference Level control.**

   [If you will not be using OPTIMOD-PC's analog input, continue with step 6 on page 2-30.]

   A) In the I/O Mixer, click the CONFIGURATION tab (see Figure 2-6 on page 2-21).

   B) Set the ANALOG INPUT REFERENCE LEVEL to +4DBU or –10DBV depending on whether you are driving the OPTIMOD-PC's analog input with professional or consumer equipment, respectively.

   If the ANALOG INPUT REFERENCE LEVEL is set to –10DBV and the level meter on the ANALOG L/R INPUT control hits full scale when you apply normal program material to the analog input, reset the ANALOG INPUT REFERENCE LEVEL to +4DBU.

ANALOG L/R INPUT controls are found on the PROCESSOR MIXER and DIRECT MIXER pages.

Using +4dBu as the reference level, the system is calibrated correctly when the INPUT LEVEL CONTROL adjusted to 0dB (maximum). This will produce –20dBfs at the WAVE output for recording/encoding applications.

The input stage has 20dB of headroom prior to the Input Level Control. Hence, a +4dBu tone at the analog input indicates –20dB on the analog input level meter. If the level meter hits full-scale when the ANALOG INPUT REFERENCE LEVEL is set to +4DBU, you are exceeding a peak level of approximately +24dBu at OPTIMOD-PC's analog input and you must reduce the output level of the device driving OPTIMOD-PC.

2. Adjust the Analog Output Reference Level control.

If you are using the Processing w/Limiting Output: An output level fader setting of –12dB produces approximately +4dBu at the output with normal arbitrary processed audio.

When the analog output is set to receive PROCESSING WITH LIMITING, a –20dBfs 1kHz sinewave tone produces –18dB at the Analog Output Meter and +2dB on an external meter with VU ballistics calibrated so that 0 VU = +4 dBu and connected to Optimod-PC's analog output. This assumes that:

- The Active Preset is Rock Medium.
- The LIMITING control in the preset is set to 0.0dB.

The Optimod-PC digital and WAVE output meters indicate –6 dBfs when their respective OUTPUT LEVEL controls are set to 0 dB (maximum).

If you are using the Direct Mixer Output: The Direct Mixer Output is used when Optimod-PC is used without processing as a sound card only.

Set the ANALOG OUTPUT LEVEL CONTROL to 0dB (maximum) to achieve correct level calibration for the corresponding analog output reference level (+4 dBu or –10 dBV).

- When the Analog Output is set to DIRECT MIXER, a –20dBfs 1kHz sinewave file produces –20dB at the Analog Output Meter and 0dB on an external meter with VU ballistics connected to Optimod-PC's analog output. This assumes that the external meter is calibrated so that 0 VU = +4 dBu.
- When the ANALOG INPUT control is set to 0dB (maximum) and the ANALOG OUTPUT control is set to 0dB (maximum), the system is properly calibrated and set to unity gain with 20dB of headroom.
- When the ANALOG INPUT REFERENCE LEVEL is set to +4dBu, a +4dBu input level produces a –20dBfs digital output signal at the DIGITAL or WAVE outputs, and a –20dBfs input signal from the DIGITAL or WAVE INPUTS produces a +4dBu output level when the ANALOG OUTPUT REFERENCE LEVEL is set to +4dBu.

- If you use a digital reference level higher than –20dBfs or an analog reference level higher than +4dB, you will lose headroom if you wish to retain unity gain. Because the analog input's absolute clipping level is +24 dBu (with the ANALOG INPUT REFERENCE LEVEL set to + 4 dBu), reducing the setting of Optimod-PC's ANALOG INPUT control will not regain the lost headroom. For example, a +8 dBu analog reference level can provide no more than 16 dB of headroom. For this reason, elevated reference levels are not recommended for use with Optimod-PC unless you fully understand the headroom tradeoffs that result.

3. Select the Stereo/Mono input mode for the analog input.

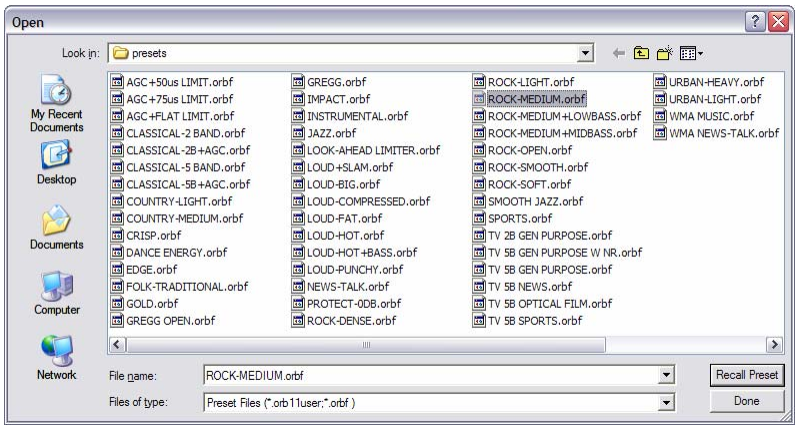
You can choose whether the fader operates on both stereo channels applied to the analog input or if it operates in mono, driving the left and right channels of the processing with identical signals. The choices are:

- Stereo
- Mono from the left-channel input
- Mono from the right-channel input
- Mono from the sum of the left and right channel inputs

Choose the functionality you want from the STEREO/MONO drop-down list (found on the I/O mixers below the corresponding faders). The default is STEREO.

4. Adjust the Processor mixer analog input fader.

This step adjusts the drive to OPTIMOD-PC's audio processing so that it operates in its preferred range.



A) Open the ROCK-MEDIUM factory processing preset.

a) On the Orban Control application, choose FILE/OPEN PRESET.

The Open Preset dialog box appears.

b) Click ROCK-MEDIUM in the preset list.

The ROCK-MEDIUM preset becomes active. The dialog box remains open until you explicitly close it by clicking DONE.

B) Calibrate using tone—feed a test tone at your reference level to OPTIMOD-PC.

[Skip this step if you are using program material to calibrate OPTIMOD-PC to your standard studio level. Skip to step (C) on page 2-29]

a) If you are not using a studio level controller, feed a tone through your console or mixer at the level at which you normally peak program material (typically 0 VU if your console uses VU meters).

If you are using a studio level controller that performs an AGC function, such as another OPTIMOD-PC or an Orban 6300, adjust it for normal operation.

b) In the I/O Mixer, click the CONFIGURATION tab.

c) Click the PROCESSOR MIXER tab.

d) Set the ANALOG L/R INPUT fader to make the MIXER OUTPUT meter indicate –20dBfs.

For more information, refer to the notes under step 1 on page 2-26.

e) Note the setting of the ANALOG L/R INPUT fader. Click the DIRECT MIXER tab and set the ANALOG L/R INPUT fader to the same value.

f) Skip to step 5 on page 2-30.

C) Calibrate using program: Feed normal program material to OPTIMOD-PC's analog input.

[Skip this step if you are using tone to calibrate OPTIMOD-PC to your standard studio level—see step (B) above.]

a) Play program material from your studio, peaking at the level to which you normally peak program material (typically 0 VU if your console uses VU meters).

b) In the Mixer application, click the CONFIGURATION tab.

c) Verify that AGC is set to ENABLED.

Refer to step (0 on page 2-20.

d) Click the PROCESSOR MIXER tab.

e) Set the ANALOG L/R INPUT fader to make the AGC GAIN REDUCTION meter (on the main meter screen in the Orban Control application) indicate an average of 10 dB gain reduction when normal levels are applied to the OPTIMOD-PC's analog input.

If necessary, drag the Mixer window so that the AGC GAIN REDUCTION meter is visible.

If the AGC gain reduction meter averages less than 10dB gain reduction (higher on the meter), or if the GATE indicator stays on when program material is present, turn the ANALOG L/R INPUT fader up.

If the AGC gain reduction meter averages more gain reduction (lower on the meter), turn the ANALOG L/R INPUT fader down.

f) Note the setting of the ANALOG L/R INPUT fader. Click the DIRECT MIXER tab and set the ANALOG L/R INPUT fader to the same value.

g) When finished, reset AGC to DISABLED, if required.

5. Adjust the Analog L/R Input Balance Control. (optional)

[Skip this step if the channels are already balanced satisfactorily.]

[This step can only be accurately performed with test tones.]

A) Click the PROCESSOR MIXER tab.

B) Make your console or other program source output a correctly balanced test tone, such that its left and right output level meters indicate identical levels.

C) If the MIXER OUTPUT meters on the PROCESSOR MIXER tab do not indicate identically, adjust the PAN/BALANCE control in the ANALOG L/R INPUT block until they do.

6. Adjust the remaining input faders. (optional)

If you are using any of the other inputs (DIGITAL 1, DIGITAL 2, WAVE OUT FROM PC), perform steps 3 through 5 (above) for these sources, substituting the appropriate fader and balance control for the analog control referenced in these steps. Be sure that you are driving only the input you are adjusting; you can mute the other inputs by checking their MUTE boxes temporarily.

You can use a program like Adobe Audition to generate .WAVE files for tone calibration.

7. Set up the automatic backup feed function. (optional)

You may wish to configure your system so that OPTIMOD-PC will automatically switch to a backup feed if a primary feed fails. The ANALOG L/R and DIGITAL 2 inputs can be programmed to mute automatically if the DIGITAL 1 input is locked to an AES3 input signal, and to unmute if the DIGITAL 1 input loses lock.

To do this, check (by clicking) the BACKUP INPUT FOR DIGITAL 1 box on either (or both) of the ANALOG L/R and DIGITAL 2 inputs. If both are checked, then a failure of the DIGITAL 1 INPUT will automatically unmute only the DIGITAL 2 INPUT. If the DIGITAL 2 INPUT then fails, the ANALOG L/R INPUT will automatically unmute.

You can set these functions separately on the Processor mixer and the Direct Mixer. The two mixers will behave independently according to their individually set programming.

If both "backup for digital 1" and "mute" are selected, the backup function will override the mute function.

Output and Routing Switcher Setup

The three-switch output routing switcher determines the feed to:

- The OPTIMOD-PC card's stereo analog output
- The OPTIMOD-PC card's two AES3 digital outputs, which emit identical signals in v1.0 software.
- The WAVE input to the computer.

Each output can receive any of the following four sources:

- The WAVE output from the computer
- The output of the direct mixer
- The output of the OPTIMOD-PC audio processing that follows all processing

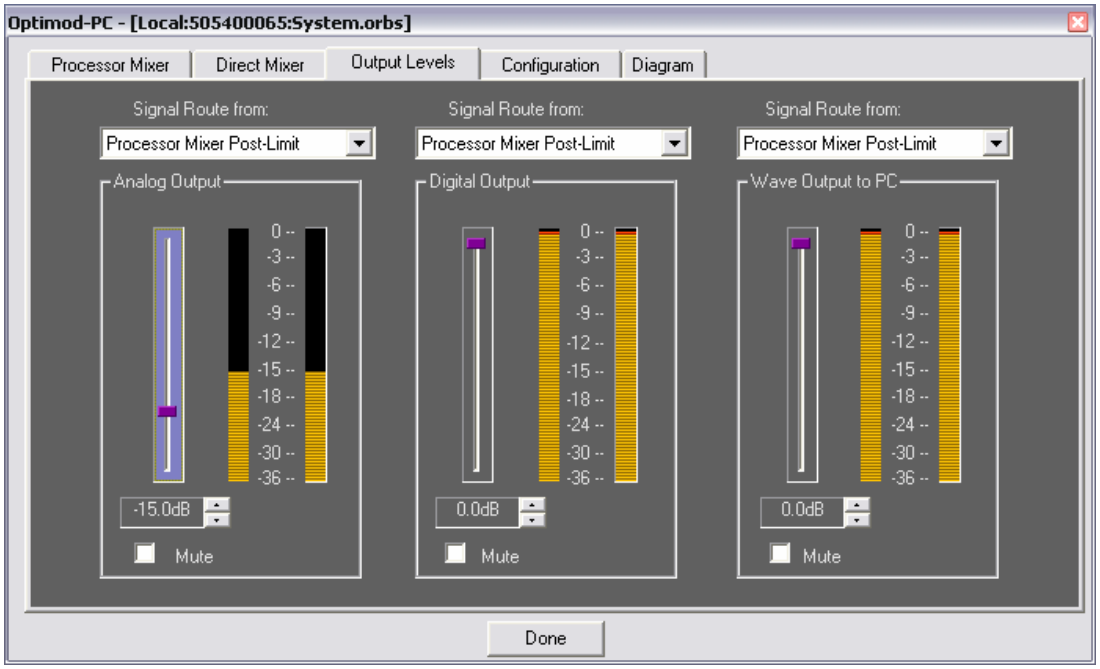


Figure 2-10: Output Levels Page in I/O Mixer

except final peak limiting

- The output of the OPTIMOD-PC audio processing that follows all processing, including peak limiting.

> The "processed without limiting" output can provide a low-delay monitor feed back to live talent headphones because it has significantly lower throughput delay than the "processed with limiting" output. Because the look-ahead limiter contributes most of the time delay through the system, listening from the output of the multiband compressor (ahead of the look-ahead limiter) can be more comfortable to a DJ or presenter who is monitoring his or her voice live through headphones.

Each of the three outputs has an attenuator and a stereo peak-reading meter, which indicates the post-attenuator level.

A) Using the drop-down menu, choose the source that feeds each output.

B) Set the output level of each output as desired, using its attenuator.

> See the notes under step 2 on page 2-27 for more information on headroom and calibrating for unity input/output gain.
>
> Refer to *Setting Output/Modulation Levels* on 1-29 of this manual for advice on setting output levels and on their relationship to headroom.

C) If you wish to save the entire setup (that is, the settings of all controls in all tabbed pages), click SAVE SETUP on the File menu in the Orban Control application. Then follow the prompts.

Saving a setup is useful mainly if you wish to be able to paste this entire setup to another OPTIMOD-PC card later. Any changes you have made to the setup of the currently active card will be saved automatically for that card when you click DONE; it is unnecessary to use SAVE SETUP to avoid losing changes you made. See step (2.B) on page 2-19.

The Direct Mixer

The Direct Mixer looks the same as the Processor Mixer (see Figure 2-7 on page 2-24). The Direct Mixer determines the gain applied to input signals before these signals are sent directly (without OPTIMOD-PC processing) to the output routing switcher. If the output attenuator in the routing switcher is set to "0dB" and the analog input and output reference levels are set identically (to +4dBu or –10dBv), then the Direct Mixer faders will indicate the input/output gain directly in dB.

The default settings of "0dB" provide unity gain in and out of the OPTIMOD-PC card for both the analog and the digital inputs. If you want to change a reference level between a source and destination (for example, from –16dBfs to –18dBfs), you can do so by adjusting the fader corresponding to the source (in our example, by setting it to –2dB).

Note that you are limited by input headroom: if you set the DIGITAL 1 fader to –2dB, OPTIMOD-PC's digital output level cannot exceed –2dBfs because this level corresponds to 0dBfs at OPTIMOD-PC's digital 1 input.

If you are using a digital input and an analog output, note that OPTIMOD-PC's internal gain for both input and output is such that 0dBfs = +24dBu. OPTIMOD-PC's output line amplifiers can drive +24dBu into a *balanced* load. However, the maximum analog output level they can drive into an *unbalanced* load is +18dBu. Therefore, to match analog and digital clipping levels when driving an unbalanced load with ANALOG REFERENCE LEVEL = +4dBu, set the ANALOG OUTPUT fader to –6dB.

> The ANALOG OUTPUT fader is located in the OUTPUT LEVELS page.

If you are mixing more than one active input, be careful not to exceed the headroom of OPTIMOD-PC's mix bus, whose peak level is indicated by the MIXER OUTPUT meters on both the PROCESSOR MIXER and DIRECT MIXER pages. To prevent clipping, do not permit the "0" SEGMENT OF this meter to light.

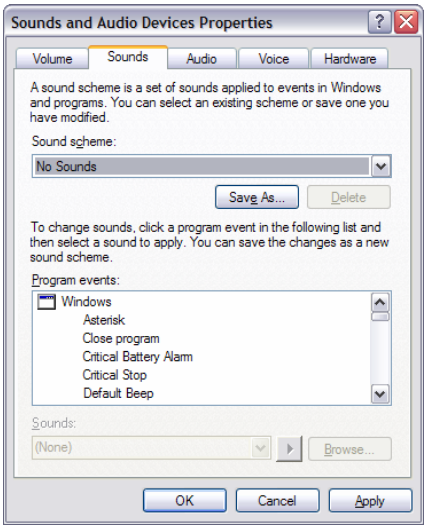
Interfacing OPTIMOD-PC with WAVE Devices

Turning Off Windows Sounds

If OPTIMOD-PC is the Windows Preferred or Default Device, to prevent Windows' OS-generated and application-generated sounds from going "on the air" or over your stream, you must turn them off.

> This caveat applies only when you are using OPTIMOD-PC's WAVE inputs. If you are using only OPTIMOD-PC's hardware inputs and have the WAVE inputs turned off in the OPTIMOD-PC I/O mixer, then the system WAVE sounds will not mix with your desired program material.

- In Windows XP, navigate to CONTROL PANEL/SOUNDS AND AUDIO DEVICES/SOUNDS. In the "sound scheme" drop-down box, choose NO SOUNDS.



Applying Output from WAVE Applications to OPTIMOD-PC

Windows mixes the audio outputs of all simultaneously operating WAVE applications that have been set up to feed OPTIMOD-PC as a Windows sound device. The resulting mix feeds the OPTIMOD-PC's WAVE OUT FROM PC faders in both the PROCESSOR MIXER and DIRECT MIXER pages. Because the volume controls on most WAVE applications are attenuators only (providing no gain at any setting), it is usually wise to set them to maximum and to set levels via the OPTIMOD-PC Mixer's WAVE OUT FROM PC faders.

> Windows Media Player does not allow you to specify its target Windows Sound Device, instead always feeding the Windows Default Sound De-

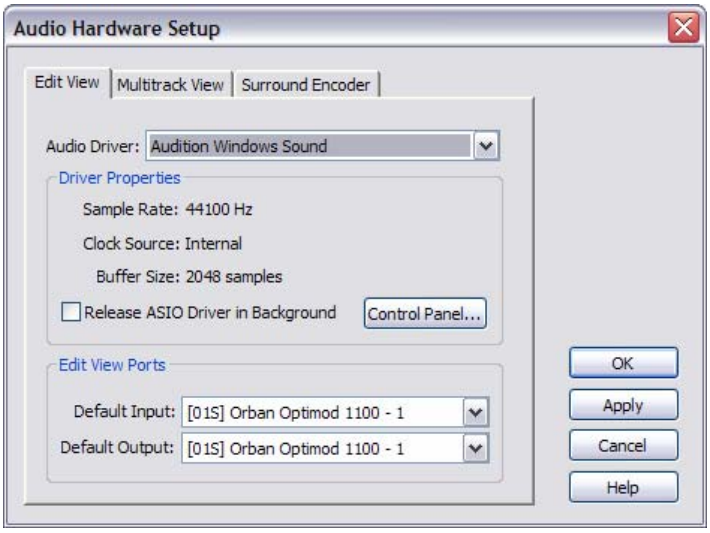
vice. Therefore, to use WMP as a playout application, you must set OPTIMOD-PC as the Default Sound Device in Windows.

The OPTIMOD-PC DirectSound Driver allows digital audio playout applications to output multiple sources simultaneously to one sound device. This eliminates the need for multiple sound cards or sound cards with multiple sound devices for each player and allows multiple players to mix automatically in automated operation, independent of sample-rate and/or bit-rate. If individual outputs for each player are not needed, this feature of DirectSound eliminates the need to mix all player outputs together externally,

Please note that some applications (like RealPlayer, as of this writing) have volume controls that affect the Windows master volume instead of just their own output levels. See *About the Interaction between OPTIMOD-PC's Input Mixers and Your PC's Built-In Mixer* on page 2-25.

Note also that if the sample rate of the source material is different from 48 kHz (OPTIMOD-PC's native sample rate), the operating system will apply the appropriate sample rate conversion.

Applying OPTIMOD-PC's Output to WAVE Devices



OPTIMOD-PC's WAVE output looks like the output of a sound card to the host computer. Any application that can receive the output of a standard Windows WAVE device can use this output. Most such applications have a menu item that lets you select the particular WAVE device from which they are receiving input; select "OPTIMOD-PC." Once you have done this, you can set the drive level to the application via the WAVE output attenuator in the OPTIMOD-PC I/O Mixer. You can select the source that drives the application (PC WAVE output, output of Direct Mixer, output of OPTIMOD-PC pre-limiter, or output of OPTIMOD-PC post-limiter) via the drop-down selector located above this attenuator.

For example, the figure shows Adobe Audition 2.0 Audio Hardware Setup.

If you have more than one OPTIMOD-PC card installed, these will be known to Windows as "Orban Optimod 1101 (serial number of card #1)," "Orban Optimod 1101 (serial number of card #2))," etc.

This is mainly relevant to users running multiple instances of a streaming encoder program like Orban Opticodec-PC, Real/Helix Producer or Windows Media Encoder. Typically, each instance of the streaming program is connected to a separately named OPTIMOD-PC WAVE device. For example, if you were running two streams, one instance of HELIX Producer

would be connected to "Orban OPTIMOD-1101 (serial number of card #1)" and the other instance would be connected to "Orban OPTIMOD-1101 (serial number of card #2)."

Because Windows XP fully supports OPTIMOD-PC's multiclient driver, it is possible to drive several record/encode applications from a single output of OPTIMOD-PC. For example, this would allow the output of one OPTIMOD-PC to drive several instances of an encoder, several encoders, or any other record application.

Enabling the Windows 2003 Server Audio Service

By default, some versions of Windows 2003 server have the Audio Service Disabled. To use audio Wave I/O with OPTIMOD-PC, you must enable the Windows 2003 Server Audio Service. This service is unnecessary if you are only using OPTIMOD-PC with its hardware audio I/O.

Do one of the following:

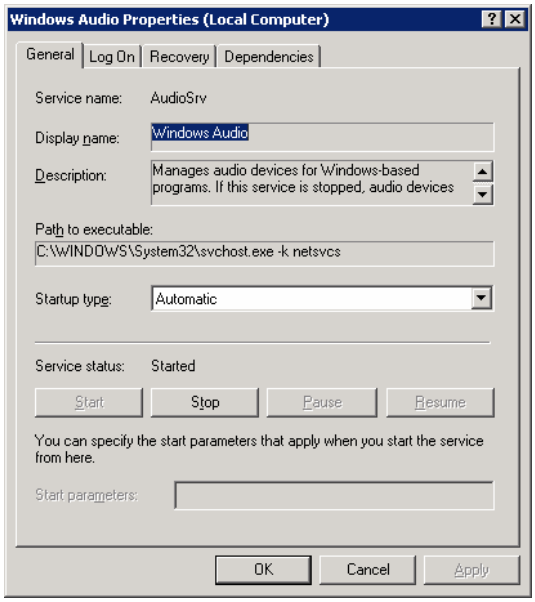
1. In Windows, navigate to:

CONTROL PANEL > ADMINISTRATIVE TOOLS > SERVICES > WINDOWS AUDIO > PROPERTIES.

A) Set the STARTUP TYPE to AUTOMATIC.

B) Click START.

C) Click OK.



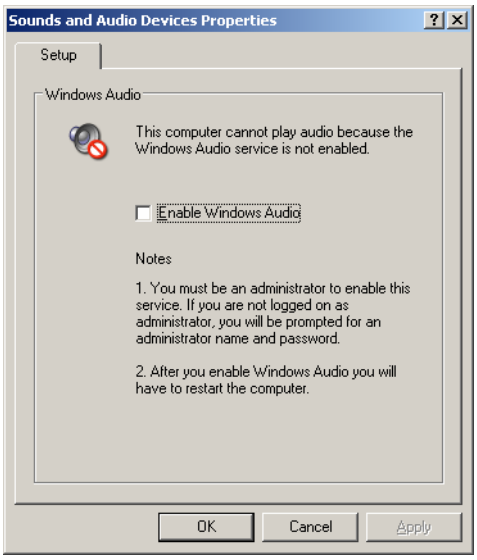
...or

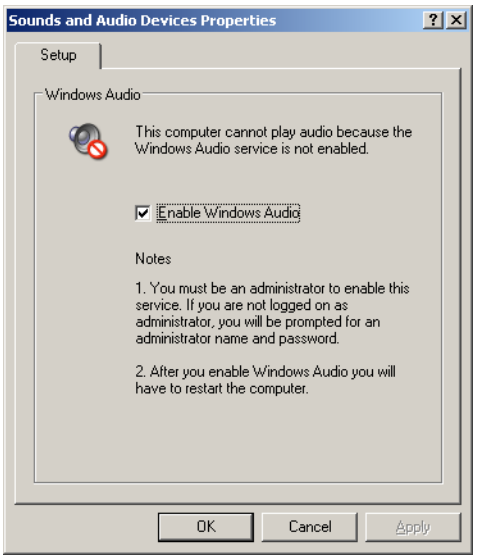
2. Enable and configure the Windows audio service.

A) Navigate to CONTROL PANEL > SOUNDS AND AUDIO DEVICES

B) Check "Enable Windows Audio."

If the Windows Audio Service is already enabled, the dialog box will not appear. The dialog box will not reappear unless Windows Audio Service is disabled in CONTROL PANEL > ADMINISTRATIVE TOOLS > SERVICES > WINDOWS AUDIO > PROPERTIES.





Problems and Possible Causes

Always verify that the problem is not the source material being fed to OPTIMOD-PC, or in other parts of the system.

When I first turn on my computer, the sound seems wrong.

This is normal. Upon boot, the OPTIMOD-PC driver loads a "placeholder" preset and I/O setup into the OPTIMOD-PC's DSP so that the card will pass audio. After the OPTIMOD-PC Service application starts (as part of the computer's boot sequence), it will automatically load the last active preset and I/O setup.

> The driver does not restore the Processing Delay, AGC, and I/O Lowpass Filter Configuration parameters at startup. They are restored at startup if the OPTIMOD-PC service is being started automatically. If the OPTIMOD-PC service is not being started automatically, these parameters will be restored when the OPTIMOD-PC Control application is launched.
>
> All others IO settings are restored when the driver loads.

When I Launch the OPTIMOD-PC control application, the meters do not move and I cannot control my card.

Unless you have only one OPTIMOD-PC card installed in your computer, you must connect the application to a given card (via the CONNECT Menu item) before you can control it. This is because the Control Application is designed to address more than one card in multi-card installations. See the steps starting with step 4 on page 2-4.

I can't connect to a given OPTIMOD-PC card from my network.

You must check the ALLOW NETWORK TO ACCESS LOCAL CARDS box in the CARDS AND SECURITY ADMINISTRATION dialog box for that card.

Other possible causes are:

- Your computer's firewall is blocking the connection. See page 2-42.
- Password is wrong.
- The target card is open on another computer on the network.
- The system that houses the target card is not on.
- The Orban Windows service routine, `OptimodPcService`, is not running in the computer housing the target card.
- The Orban Windows service routine has malfunctioned. If all else fails, try ending and then restarting `OptimodPcService` in the Windows Task Manager:

  A) Right-click the Windows task bar and choose "Task Manager."

  B) Click the Process tab and `OptimodPcService` to highlight it.

  C) Click the "End Process" button.

  D) Right-click `OptimodPcService` and choose "Start process."

I get clicks when I source my WAVE material from a CD.

CD audio playback can sometimes have dropouts if the CD player is being accessed by the IDE controller using PIO mode. Usually, this can be fixed by setting the IDE controller to DMA mode. Here are the steps to change the setting on Windows XP:

A) Open the SYSTEM control panel.

B) Select the HARDWARE tab.

C) Select DEVICE MANAGER...

D) Expand the node labeled IDE ATA/ATAPI CONTROLLERS.

E) Right-click the first device labeled SECONDARY IDE CHANNEL and choose PROPERTIES.

F) Select the ADVANCED SETTINGS tab.

G) Change the TRANSFER MODE dropdown menu from "PIO only" to "DMA if available."

H) Repeat steps (E) through (G) for any other devices labeled SECONDARY IDE CHANNEL.

I get clicks when I source my WAVE material from my computer's hard drive.

If Windows XP detects several hard disk read errors in a row, it will automatically set the hard disk data transfer mode, usually DMA, to PIO. This can cause clicks in the OPTIMOD-PC audio if the hard drive is sourcing the WAVE material driving OPTIMOD-PC. See *I Get Clicks When I Source My WAVE Material from a CD* above.

Note that Windows' automatically setting the HD data transfer mode to PIO can be an early warning of impending hard disk failure. It is wise to search the Windows System log for instances of hard drive read or write problems (CONTROL PANEL > ADMINISTRATIVE TOOLS > EVENT VIEWER > SYSTEM LOG).

I get clicks in the 1101's WAVE output.

Wrap-around glitches can occur at the peaks of OPTIMOD-PC's processed output when you are recording or streaming it via the Windows WAVE mechanism at sample rates other than 48 kHz and OPTIMOD-PC's WAVE output level is set to 0 dBfs. We believe that overshoots in the computer's WAVE sample rate converter cause this; it is not caused by OPTIMOD-PC's DSP. To prevent such glitches, set the 1101's WAVE output level lower than –0.5 dBfs for 44.1 kHz recording/streaming and lower than –1.0 dBfs for 32 kHz recording/streaming.

The 1101's hardware outputs do not have this issue.

I am running Windows 2003 and I cannot get audio to pass through OPTIMOD-PC's WAVE inputs and outputs.

See *Enabling the Windows 2003 Server Audio* Service on page 2-35.

Meters on Optimod-PC Control Application freeze temporarily but audio continues to be processed normally.

This is by design. The software thread controlling the meters is given lower than "normal" priority in Windows to prevent the meters from interrupting important threads that maintain audio continuity through the Windows WAVE mechanism.

RFI, hum, clicks, or buzzes

A grounding problem is likely. Review the information on grounding on page 2-17.

OPTIMOD-PC has been designed with substantial RFI suppression on its analog and digital input and output ports. It will usually operate adjacent to high-powered transmitters without difficulty. In the most unusual circumstances, it may be necessary to reposition the host computer to reduce RF interference, and/or to reposition OPTIMOD-PC's input and output cables to reduce RF pickup on their shields.

The AES3 inputs and output are transformer-coupled and have good resistance to RFI. If you have RFI problems and are using analog connections on either the input or output, using digital connections will probably eliminate the RFI.

Poor peak level control

OPTIMOD-PC audio processing ordinarily controls its output peak levels to an accuracy of ±2% when operated with 48 kHz output sample rate. As explained in the note on page 1-24, output sample rate conversion will slightly compromise this control because the peak control occurs with reference to individual sample values at 48 kHz. The converted samples no longer have the same peak values as the 48 kHz samples, and some values can be slightly higher. However, the overshoot of the converted signal almost never exceeds 0.5 dB and is therefore not a significant problem.

Using the analog output will cause similar amounts of overshoot because the samples in the transmitter or encoder are not synchronous with the peak-controlled samples in OPTIMOD-PC. Further, analog connections can cause analog-domain overshoot if the connection is not phase linear and has a low-frequency cutoff of greater than 0.15Hz (at –3dB).

Audible distortion

Make sure that the problem can be observed on more than one sound system and at several locations.

Verify that the source material at OPTIMOD-PC's audio inputs is clean. Heavy processing can exaggerate even slightly distorted material, pushing it over the edge into unacceptability.

The subjective adjustments available to the user have enough range to cause audible distortion at their extreme settings. Advancing the FINAL LIMIT control too far will inevitably cause distortion. (Distortion is very probable if gain reduction in the final limiter frequently exceeds 8 dB.) Setting the LESS-MORE control beyond "9" will cause audible distortion of some program material.

If you are using analog inputs, you must correctly match the headroom of the unit's analog-to-digital (A/D) converter to the peak audio levels expected in your system. If your peak program level exceeds the peak level you have specified, OPTIMOD-PC's A/D converter will clip and distort. See step 1 on page 2-26.

Be sure that the output meters for the processor mixer and Direct Mixer never go into the red. If they do, turn down the input attenuator(s) connected to the signal causing the overload.

Audible noise in processed audio

(See also "RFI, Hums, Clicks, or Buzzes" on page 2-38.)

Excessive compression will always exaggerate noise in the source material. OPTIMOD-PC reduces this problem with its *compressor gate,* which freezes the gain of the AGC and compressor systems whenever the input noise drops below a level set by the GATE THR (Gate Threshold) control, preventing noise below this level from being further increased.

If you are using OPTIMOD-PC's analog input, the overall noise performance of the system is usually limited by the overload-to-noise ratio of the analog-to-digital converter used by OPTIMOD-PC to digitize the input. (This ratio is better than 100dB.)

It is important to specify the ANALOG INPUT REFERENCE LEVEL correctly (see step 1 on page 2-26). You should specify the level as the highest peak level that OPTIMOD-PC will receive under normal operation. If, in an attempt to build in a "safety factor" or increase headroom, you specify a higher level than this, every 1dB of extra headroom that you gain will increase OPTIMOD-PC's noise floor by 1dB.

OPTIMOD-PC's AES3 input is capable of receiving words of up to 24 bits although the dynamic range of its input sample rate converters limits the worst-case dynamic range to 20 bits. A 20-bit word has a dynamic range of approximately 120dB. OPTIMOD-PC's digital input will thus never limit the unit's noise performance even with very high amounts of compression.

In digital radio applications, if an analog studio-to-transmitter link (STL) is used to pass unprocessed audio to OPTIMOD-PC, the STL's noise level can severely limit the overall noise performance of the system because compression in OPTIMOD-PC can exaggerate the STL noise. For example, the overload-to-noise ratio of a typical analog microwave STL may only be 70-75dB. In this case, it is wise to use an Orban Studio Level Controller (like an Orban 6300 or another OPTIMOD-PC) to perform the AGC function prior to the STL transmitter and to control the STL's peak modulation. This will optimize the signal-to-noise ratio of the entire transmission system. An uncompressed digital STL will perform much better than any analog STL. Section 1 of this manual has a more detailed discussion.

Shrill, harsh sound; excessive sibilance

Excessively high settings of the HF GAIN control can cause this problem. It can also be caused by excessively high settings of the B5 THRESHOLD (Band 5 Compression Threshold) control. In the latter case, you are first likely to notice the problem as harsh sibilance on voice.

Gain pumping when high frequency energy is present

This will occur with most OPTIMOD-PC factory presets when OPTIMOD-PC's preemphasis is set to 50 μs or 75μs. [See step 5 on page 2-23.] The gain pumping happens because the preemphasis creates a large high frequency boost before the look-ahead limiter, so the look-ahead limiter must produce large amounts of gain reduction to control peak levels.

To correct this problem, turn down the FINAL LIMIT DRIVE control (page 3-40) until the pumping is no longer audible (see *Processing for Low Bitrate Codecs* on page 3-5). It may also be helpful to adjust band 5 so that it produces some high frequency limiting. (The AGC+75US LIMITER factory preset illustrates this technique; see page 3-18.) Then save your work as a User Preset.

System receiving OPTIMOD-PC's AES digital output will not lock

Be sure that OPTIMOD-PC's output sample rate is set to match the sample rate that the driven system expects. Be sure that OPTIMOD-PC's digital output format control is set to match the standard expected by the driven system (either AES3 or SPDIF). (See step 4 on page 2-22.)

System will not pass line-up tones at full output level/100% modulation

This is normal in OPERATE mode. Sine waves have a very low peak-to-average ratio by comparison to program material. The processing thus automatically reduces their peak level to bring their average level close to that of program material, promoting a more consistent and well-balanced sound quality.

To pass line-up tones transparently, recall OPTIMOD-PC's PROTECT preset. If necessary, adjust its gain and save your edited preset as a User Preset.

These tones should be injected into the transmitter after OPTIMOD-PC, or OPTIMOD-PC should be temporarily switched to PROTECT to pass the tones.

Alternatively, you can you can bypass OPTIMOD-PC's processing of the tones by patching OPTIMOD-PC's digital output into one of its digital inputs. This leaves you with one analog or one digital input into which you can connect the unprocessed audio. Use the remaining unused input to receive the output of the tone generator. Use the Direct mixer to mix the tone generator and processed signal as desired. In OPTIMOD-PC's Output Levels tab (in the I/O mixer), assign to the Direct Mixer the OPTIMOD-PC output driving your target system.

> This scenario is particularly practical if the final output of the system is a WAVE stream. Otherwise, the only remaining available output is the analog output. Of course, you can reverse the scenario by using the OPTIMOD-PC analog output and input for the loop-through connection, in which case the final mixed output could be the digital output.

General dissatisfaction with subjective sound quality

OPTIMOD-PC is a complex processor that can be adjusted for many different tastes. For most users, the factory presets, as augmented by the gamut offered by the LESS-MORE control for each preset, are sufficient to find a satisfactory "sound." However,

some users will not be satisfied until they have accessed other Modify Processing controls and have adjusted the subjective setup controls in detail to their satisfaction. Such users *must* fully understand the material in Section 3 of this manual to achieve the best results from this exercise.

Technical Support

If you require technical support, contact Orban customer service. See http://www.orban.com/contact/ for contact information. Be prepared to describe the problem accurately. Know the serial number of your 1101 and the software and driver versions are you running. (The driver version number is available through Settings/Control Panel/Sounds and Multimedia/Hardware/Orban Optimod 1101 /Properties/Driver.)

Before you return a product to the factory for service, please refer to this manual. Make sure you have correctly followed installation steps, operation procedures, and any appropriate troubleshooting suggestions. If you are still unable to solve a problem, contact our Customer Service department. Often, a problem is relatively simple and can be fixed quickly after telephone or email consultation.

If you must return a product for factory service, please notify Customer Service by telephone or email *before* you ship the product; this helps us to be prepared to service your unit upon arrival. In addition, when you return a product to the factory for service, we strongly recommend you include a letter describing the problem.

Please refer to the terms of your Limited One-Year Standard Warranty, which extends to the first end user. After expiration of the warranty, a reasonable charge will be made for parts, labor, and packing if you choose to use the factory service facility. Returned units will be returned C.O.D. if the unit is not under warranty. Orban will pay return shipping if the unit is still under warranty. In all cases, the customer pays transportation charges to the factory (which are usually quite nominal).

Adding a Custom Logo

A user defined bitmap can be displayed at the right of the meter dialog in the PC Control application. Separate bitmaps must be assigned to each OPTIMOD-PC that you have configured; there is no “global” or default bitmap available.

To use this feature, create or copy a standard Windows format .bmp file and name it `logo.bmp`. Then place this file in the directory associated with the desired Alias. To identify this directory, open the Properties dialog by right clicking on the Alias name in the Control Application’s connection list and look at the entry for "Local Folder.” This will usually be:

```
c:\Program Files\Orban\OPTIMOD-PC2\[serial number]\presets\
```

The Control Application will automatically change the bitmap’s size so that it is displayed 120 pixels wide x 60 pixels high. (The original file will not be altered.) Build custom logos or art to exactly 120 x 60; save the file in .bmp format.

Using Windows Firewall with Optimod-PC

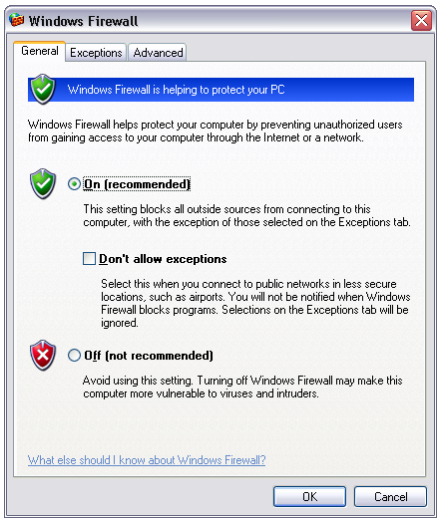
Depending upon your network security requirements, it may be necessary to configure a software firewall application like Windows Firewall, included with Windows XP SP2 and higher.

1. **Enable Windows Firewall:**

   A) Navigate to CONTROL PANEL > WINDOWS FIREWALL

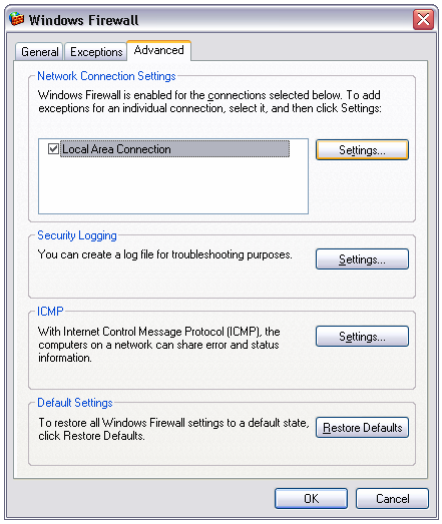
   B) Enable the On (recommended) button.

   C) Select the Advanced tab.

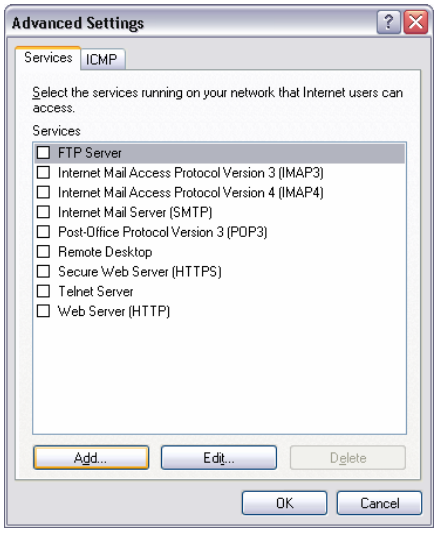


2. **Choose the network device that will be used for Optimod-PC access and will be protected with Windows Firewall.**

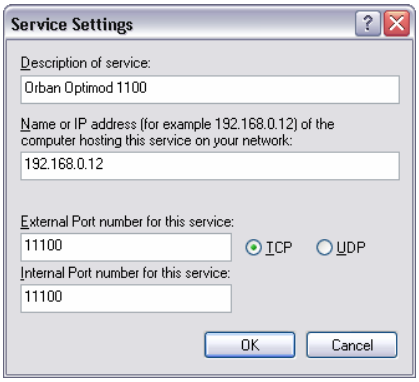
   A) Click Settings…



B) Click Add…



C) Enter the Description of the service, the name or IP address, the External Port number, and the Internal Port number.



D) Select TCP.

The IP address will be that of the computer. To avoid any conflict, we recommend choosing a Port higher than 1024 that is not otherwise assigned according to IANA:

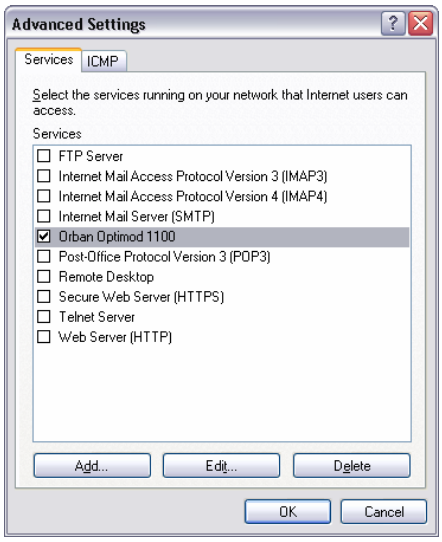
http://www.iana.org/assignments/port-numbers

- Port 11100 is the default for the Optimod-PC Control Application.
- Port 11101 is the default for the Optimod-PC Terminal Application.

If you have 1100 and 1101 cards in the same computer, they must be assigned different ports numbers.

E) Select OK.

A dialog box appears, indicating that the Orban Optimod 1101 Service is accessible through Windows Firewall.

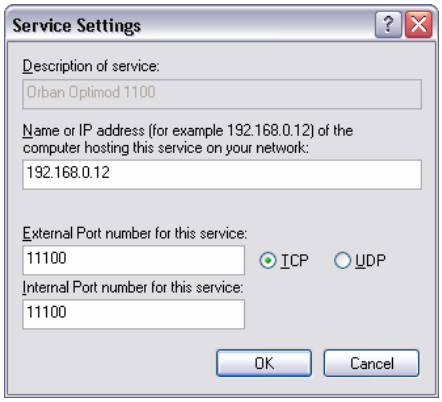


F) If any changes are required (like IP address or port):

a) Click Edit.

b) Make the changes.

c) Click OK.



NAT (Network Address Translation) Firewalls

If the computer containing Optimod-PC is on a network behind a NAT firewall, you must configure the firewall to allow outside access to the Optimod-PC computer from another computer outside the firewall. This is usually done via router port forwarding: The Optimod-PC port(s) are forwarded to the Optimod-PC computer by configuring the NAT firewall accordingly. The Optimod-PC computer is then addressed with the network IP address (WAN) instead of the actual IP address of the Optimod-PC computer.

For a single IP addressable network, each port can only be used once. Therefore, if you have more than one computer with Optimod-PC requiring outside access, each computer must have a unique OPTIMOD-PC port.

Refer to your router/firewall documentation for the exact configuration procedure, paying close attention to the network security risks inherent in configuration changes.

Section 3

Operation

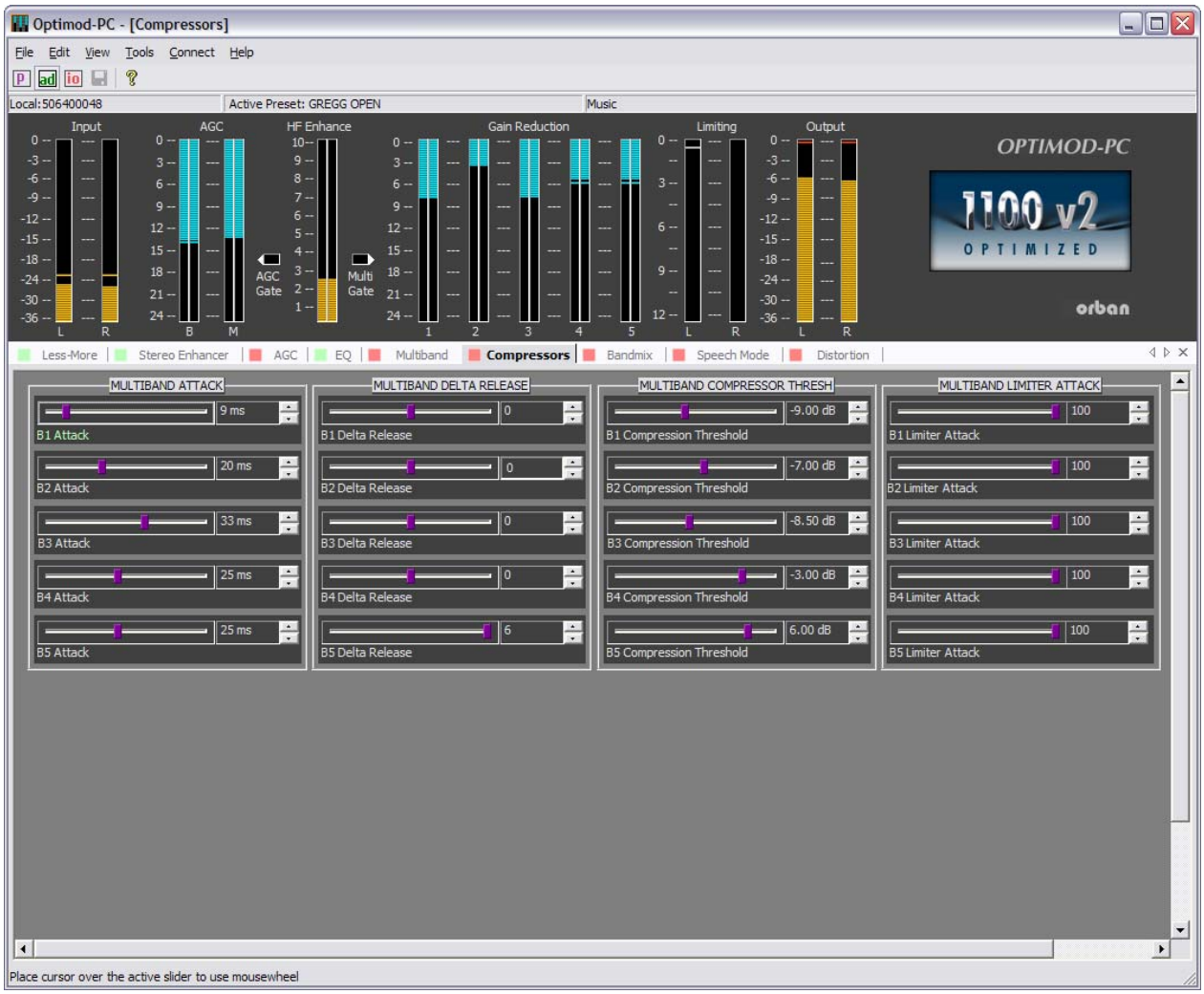


Figure 3-1: The OPTIMOD-PC Control Application

The OPTIMOD-PC Control Application

- **AGC** meter shows the gain reduction of the slow AGC processing that precedes the multiband compressor. Full-scale is 24dB gain reduction.

Because the AGC is a two-band unit with Orban's patented bass coupling system, this meter actually reads the gain reduction of the AGC Master band.

- **Gate indicators** show gate activity. They light when the input audio falls below the threshold set by the gate threshold controls. (There are two gating circuits—one for the AGC and one for the multiband compressor/limiter—each with its own gate threshold control.) When gating occurs, the AGC and compressor's recovery times slow drastically to prevent noise rush-up during low-level passages.

- **Multiband gain reduction meters** show the gain reduction in the multiband compressor. Full-scale is 25 dB gain reduction. Because of the 1101V2's dual-mono architecture, each meter is split vertically to show the gain reduction in the left and right channels.

- **Input Meters** show the input level applied to the audio processing following the Processor mixer. Normal levels are around –20dB. This is because the Processor Mixer has sufficient headroom to drive the AGC into full 25 dB of gain reduction without clipping.

- **Output Meters** show the output levels of the processed signal before it is applied to the output routing switcher in the I/O Mixer.

- **Limiter** meters show the amount of low-IM look-ahead peak limiting in the left and right channels, which we chose not to couple because the fast release time of this circuit would otherwise cause elements in one channel to modulate the opposite channel objectionably. Full-scale is 12 dB gain reduction.

- **Control Pane** shows editing controls that allow you to customize the factory presets. There are two levels of control: Basic Control and Advanced Control. The control pane is organized in tabs. Clicking a given tab will bring up the controls pertaining to the tab's title.

  Sliders can be grouped according to the following rules. When sliders are grouped, adjusting one slider will cause all other sliders in that group to move by the same number of increments.

  - At least one slider in a given window is always active and will be the base for any grouping.

  - SHIFT CLICK will toggle a slider's status (ADD or REMOVE) with the current group of one or more sliders.

  - CONTROL CLICK will add a slider to the current group.

  - CLICK DRAG will un-group all current sliders and make a new group consisting of the sliders within the hatched selection box.

  - CONTROL CLICK DRAG will add the sliders within the hatched-selection box to the current group
  - CLICKing on a part of the window outside of any slider will ungroup all but one slider.
  - CLICKing a slider outside the group will ungroup all current sliders and select the clicked one.

- **I/O Mixer Window** allows you to set input and output levels, system setup parameters, and audio routing.
- **File Menu** allows you to open factory and user presets and to save user presets that you have created by editing factory presets or older user presets. When you save a preset, it is saved on the computer housing OPTIMOD-PC card on which you created the preset and to the computer running the Control Application. To share presets between cards, use a file manager or Windows Explorer to copy preset files from one folder to another.

  You can also save and restore the state of the OPTIMOD-PC Mixer by using the SAVE SETUP and OPEN SETUP menu items.
- **Edit Menu** brings up the Basic Control, Advanced Control, and the OPTIMOD-PC Mixer screens, which allow you to edit presets to get the sound you want.
- **View Menu** allows you to display or hide the Toolbar, which contains icon-based shortcuts for common tasks. It also allows you to hide or display the status bar and control help.
- **Tools Menu** allows you to access the OPTIMOD-PC Mixer and the Cards and Security Administration Screen.
- **Connect Menu** allows you to connect to an OPTIMOD-PC card to perform the various tasks implemented by the Control application and the OPTIMOD-PC Mixer application. It also allows you to add, edit and remove cards and to disconnect from a card.
- **Help Menu** provides access to the Help and About functions.
- **Info Bar** shows OPTIMOD-PC card to which you are currently connected and the preset that the card is running.
- **Toolbar** contains icons that implement common functions, like recalling and saving presets, opening the mixer screen, opening the modify screens, saving presets, and Help.

Introduction to Processing

Some Audio Processing Concepts

Reducing the peak-to-average ratio of the audio increases loudness. If peaks are reduced, the average level can be increased within the permitted modulation limits. The effectiveness with which this can be accomplished without introducing objectionable side effects (such as pumping or intermodulation distortion) is the single best measure of audio processing effectiveness.

Compression reduces the difference in level between the quiet and loud sounds to make more efficient use of permitted peak level limits, resulting in a subjective increase in the loudness of quiet sounds. It cannot make loud sounds seem louder. Compression reduces dynamic range relatively slowly in a manner similar to riding the gain. Limiting and clipping, on the other hand, reduce the short-term peak-to-average ratio of the audio.

Limiting increases audio density. Increasing density can make loud sounds seem louder, but can also result in an unattractive busier, flatter, or denser sound. It is important to be aware of the many negative subjective side effects of excessive density when setting controls that affect the density of the processed sound.

Clipping sharp peaks does not produce any audible side effects when done moderately. Excessive clipping will be perceived as audible distortion.

Look-ahead limiting is limiting that prevents overshoots by examining a few milliseconds of the unprocessed sound before it is limited. This way the limiter can anticipate peaks that are coming up.

Distortion in Processing

In a competently designed processor, distortion occurs only when the processor is controlling peaks to prevent the audio from exceeding the peak modulation limits of the transmission channel. The less peak control that occurs, the less likely that the listener will hear distortion. However, to reduce the amount of peak control, you must decrease the drive level to the peak limiter, which causes the average level (and thus, the loudness) to decrease proportionally.

Loudness and Distortion

In processing, there is a direct trade-off between loudness and distortion. You can improve one only at the expense of one or both of the other two. Thanks to Orban's psychoacoustically optimized designs, this is less true of Orban processors than of any others. Nevertheless, all intelligent processor designers must acknowledge and work within the laws of physics as they apply to this trade-off.

> In AM and FM processing, we have long said that there is a direct trade-off between loudness, *brightness*, and distortion, However, because DAB and netcasting systems don't use preemphasis, there is no problem getting the audio to sound bright and the trade-off is only between loudness and distortion.

Perhaps the most difficult part of adjusting a processor is determining the best trade-off for a given situation. We feel that it is usually wiser to give up ultimate loudness to achieve low distortion. A listener can compensate for loudness by simply adjusting the volume control. However, a listener cannot make an excessively compressed or peak-limited signal sound clean again.

If processing for high quality is done carefully, the sound will also be excellent on small playback systems. Although such a signal might fall slightly short of ultimate loudness, it will tend to compensate with an openness, depth, and punch (even on small speakers) that cannot be obtained when the signal is excessively squashed.

If women form a significant portion of the station's audience, bear in mind that women are more sensitive to distortion and listening fatigue than men. In any format requiring long-term listening to achieve market share, great care should be taken not to alienate women by excessive stridency, harshness, or distortion.

Speech/Music Detector

The Speech/Music Detector allows OPTIMOD-PC to change its processing parameters depending on whether the input program material is speech or other material (usually music).

The algorithm is straightforward: Speech is detected if (1) the input is mono, and (2) there are syllabic pauses at least once every 1.5 seconds. Speech with a stereo music background will usually be detected as "music," or the detector may switch back and forth randomly if the stereo content is very close to the stereo / mono detector's threshold. Mono music with a "speech-like" envelope may be incorrectly detected as "speech." Music incorrectly detected as "speech" can exhibit a slight loss of loudness and punch, but misdetection will never cause objectionable distortion on music.

Speech that is not located in the center of the stereo sound field will always be detected as "music" because the detector always identifies stereo material as "music."

Processing for Low Bitrate Codecs

V2 software employs Orban's PreCode™ technology to minimize codec artifacts. To exploit PreCode technology fully, do not set up OPTIMOD-PC for very bright sound (with large amounts of high frequency energy) because this is likely to exacerbate codec artifacts. Some appropriate presets include JAZZ, SMOOTH JAZZ, GOLD, ROCK SOFT, and the CLASSICAL presets. Avoid presets like CRISP and EDGE; these are very bright-sounding presets and are more appropriate for uncompressed channels or compressed channels with relatively high bitrates.

OPTIMOD-PC has several controls whose settings determine brightness. To control excessive brightness when using the Five-band structure:

- Use little or no high frequency boost in the equalization section.
- Set Band 4>5 coupling to 100%.
- Set the band 5 compression threshold to match the codec. Adjust the threshold until you find a good compromise between presence and high frequency codec artifacts. We find the range from –6.0 to +6.0 dB to be useful.
- Use a moderate Band 5 attack time. 25 ms works well.
- If necessary, lower the Band 4 compression threshold.

In addition, it is unwise to use stereo enhancement with low bitrate codecs. At low bitrates, codecs use various parametric techniques for encoding the spatial attrib-

utes of the sound field. Stereo enhancement can unnecessarily stress this encoding process.

Starting with one of our suggested presets will help keep you out of trouble when you edit them to create user presets.

We have supplied several presets tuned for the Microsoft WMA (V9) at 32 kbps. This codec has severe artifacts (particularly with speech) at this bitrate and no preprocessing can mask them completely. The 1101's WMA presets strictly limit the amount of high frequency energy applied to the codec, so these presets will sound dull compared to other OPTIMOD-PC presets. To prevent the processing from adding L–R energy, these presets operate with full stereo coupling and without stereo enhancement.

> Professional netcasters committed to providing their audiences with the best audio possible at a given bitrate should consider the use of a higher performance codec like Orban's Opticodec-PC, which uses standards-based MPEG-4 AAC/HE-AAC/aacPlus™. HE-AAC is the most efficient codec available at the time of this writing. It can provide good entertainment-quality audio at bit rates as low as 32kbps stereo or 24kbps mono, allowing coverage of audiences listening on dial-up connections or via wireless devices. The lower bitrates also penetrate crowded networks with fewer audio interruptions.

OPTIMOD-PC's ability to maintain source-to-source spectral consistency is also an important advantage. Once you have set up the processing to minimize codec artifacts caused by a given piece of program material, OPTIMOD-PC's will automatically minimize codec artifacts with any program material.

Optimod-PC in Radio-Oriented Applications: From Bach to Rock

OPTIMOD-PC can be adjusted so that the output sounds:

- as close as possible to the input at all times (using the Two-Band Protection Limiter preset)
- open but more uniform in frequency balance (and often more dramatic) than the input (using the Two-Band structure or running the Five-band structure with slow release time)
- dense, quite squashed, and very loud (using the Five-band structure with faster release times)

The dense, loud setup will make the audio seem to jump out of car and table radios, but may be fatiguing and invite tune-outs on higher quality home receivers. The loudness/distortion trade-off explained above applies to any of these setups.

In professional broadcasting environments, you will achieve best results if Engineering, Programming, and Management go out of their way to communicate and cooperate with each other. It is important that Engineering understand the sound that Programming desires, and that Management fully understands the trade-offs involved in optimizing one parameter (such as loudness) at the expense of others (such as distortion or excessive density).

Never lose sight of the fact that, while the listener can easily control loudness, he or she cannot make a distorted signal clean again. If such excessive processing is permitted to audibly degrade the sound of the original program material, the signal is irrevocably contaminated and the original quality can never be recovered.

Sound for Picture Applications: Controlling Dynamic Range

The most crucial commandment in sound for picture is this: *dialog must always be intelligible.* Sound for picture is usually heard under less-than-ideal conditions and its dynamic range must be controlled accordingly. Apartment-dwellers must set their volume controls to avoid disturbing neighbors or even other members of the family. At the quiet side, intelligibility of dialog is often impacted by environmental noise such as children playing or a dishwasher going in the kitchen. When one considers that the hearing acuity of a significant portion of the audience is somewhat impaired compared to that of a healthy 20-year-old, one concludes that *the dynamic range of dialog must not exceed 15dB* if it is to be intelligible to 99% of viewers under common domestic viewing conditions. Feature-film dynamic range is inappropriate for home viewing (except in dedicated home theaters) and the dynamic range of a significant portion of video source material must be compressed to best serve the audience. The challenge (which Optimod-PC effectively meets) is to compress dynamic range unobtrusively.

OPTIMOD-PC can be adjusted so that the output sounds as close as possible to the input at all times (using the Two-Band Protection Limiter preset), *or* so that it sounds open but more uniform in frequency balance than the input (using the Two-Band structure or running the Five-band structure with slow release time), or so that it sounds dense, quite squashed, and very loud (using the Five-band structure with faster release times).

The dense, loud setup is almost always inappropriate for sound for picture unless the station has unusual programming and goals. Most stations will want to use simple protection processing when broadcasting material that has been carefully produced by people cognizant of the dynamic range limitations of sound for picture. For most other program material, the Two-Band or Slow Five-Band structures are appropriate.

The subjective setup controls on OPTIMOD-PC give you the flexibility to adapt the processing to individual program segments. In most cases, your goal should be to choose the type of processing that best optimizes dynamic range while controlling the loudness of the loudest sounds so that they are not irritating and are consistent with the loudness of other stations or sources.

Protection Limiting

OPTIMOD-PC has an advanced look-ahead limiter that is competitive with the best mastering peak limiters. The LOOK-AHEAD LIMITER preset allows you to use OPTIMOD-PC as a mastering-style look-ahead limiter.

Studio AGC

You can use OPTIMOD-PC as a studio AGC and STL protection peak limiter. In a typical application, OPTIMOD-PC substitutes for the AGC in an Optimod at the transmitter and provides protection limiting for the STL, which can be flat or preemphasized at 50 or 75 μs. The AGC is turned off in the transmitter-side Optimod.

> If the STL has at least 16 bits of dynamic range, it is often practical to drive it with the AGC alone, allowing additional headroom for the overshoots that OPTIMOD-PC's peak limiter would have otherwise removed. Defeating the peak limiter will remove about 16 milliseconds of delay from the signal path.

OPTIMOD-PC's AGC uses the same dual-band, window-gated, matrix technology as the AGCs in Orban's 2300, 5300, 8300, 8382, 8400, 8500, 9300, and 9400 Optimods. Therefore, it can accurately substitute for the AGCs in these devices and can help maintain an all-digital signal path throughout the facility. Because OPTIMOD-PC's AGC is more advanced than the AGCs in Orban's 2200, 8200, and 9200 Optimods, OPTIMOD-PC can upgrade the performance of these older products when substituted their AGCs.

Moreover, because OPTIMOD-PC supports presets that be recalled by remote control, it can be automatically synchronized to the presets on-air at a transmitter-side Optimod when presets are dayparted.

To achieve this match:

A) Recall one of the STUDIO AGC presets. There are three such presets, for flat, 50 μs, and 75 μs preemphasized STLs. See *AGC+[FLAT, 50 μs, 75 μs] LIMITER* on page 3-18.

> You must also configure the peak limiter to match the preemphasis that your STL uses. See step 5 on page 2-23.

B) Edit AGC parameters of the OPTIMOD-PC preset so they are the same as the AGC parameters on-air at the transmitter-side Optimod. Then save your work as an OPTIMOD-PC User Preset.

> If you use more than one preset in the transmitter-side Optimod, make one OPTIMOD-PC User preset for each transmitter-side Optimod preset.

C) Adjust the transmitter-side Optimod's input reference level so that the Optimod performs the correct amount of multiband gain reduction (i.e., the same amount of GR that it would have performed if its internal AGC were active).

About OPTIMOD-PC's Signal Processing Features

Dual-Mono Architecture

OPTIMOD-PC implements full dual-mono architecture in both the AGC and the five-band compressor sections. You can couple each band in both the AGC and five-band compressors to a variable extent—anywhere from perfect stereo coupling to completely uncoupled operation. The coupling control determines the maximum

amount of gain imbalance permitted between the left and right channels in a given band, and therefore the amount of stereo image shift permitted in each frequency band.

Although the processing is dual-mono, you cannot adjust setup controls independently on the left and right channels. We assumed that OPTIMOD-PC would always process stereo program material or dual program sources requiring the same amount of processing (like dual-language programming in video applications).

To operate in dual mode, you must create a five-band user preset with the following settings:

AGC Matrix.....L/R
AGC MaxDelta GR..... Off
Stereo Enhancer.....Out
Band 1-5 MaxDeltGR ..... Off

Audio Processing Signal Flow

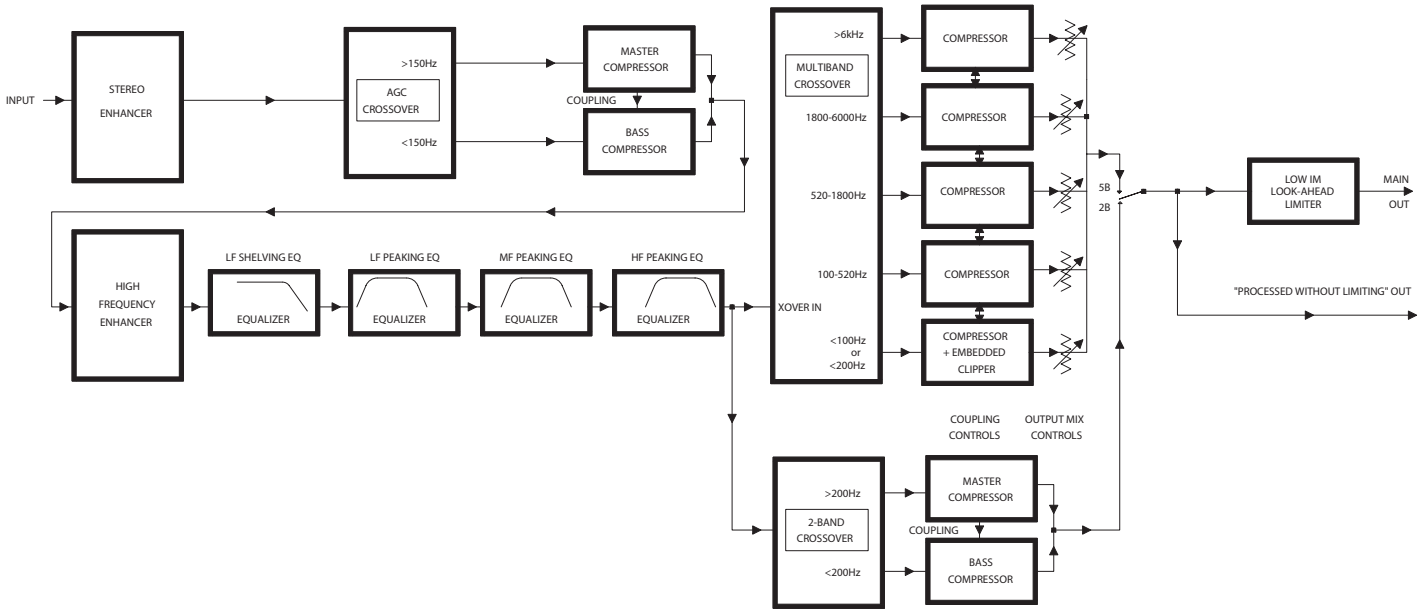


Figure 3-2: Simplified OPTIMOD-PC Digital Signal Processing Diagram

The signal flows through OPTIMOD-PC through the following:

- **Stereo Enhancement**, with two user selectable algorithms

- **Input Conditioning**, including defeatable highpass filtering and defeatable phase rotation
- **Two-Band Gated AGC**, with target-zone window gating and silence gating
- **Equalization**, including high-frequency enhancement
- **Multiband Compression** in either two or five bands, depending on the processing structure
- **Low-IM Distortion Look-Ahead Limiting**

Stereo Enhancement: OPTIMOD-PC provides two different stereo enhancement algorithms. The first is based on Orban's patented analog 222 Stereo Enhancer, which increases the energy in the stereo difference signal (L–R) whenever a transient is detected in the stereo sum signal (L+R). By operating only on transients, the 222 increases width, brightness, and punch without unnaturally increasing reverb (which is usually predominantly in the L–R channel).

The second stereo enhancement algorithm is based on the well-known "Max" technique. This passes the L–R signal through a delay line and adds this decorrelated signal to the unenhanced L–R signal. Gating circuitry similar to that used in the "222-style" algorithm prevents over-enhancement and undesired enhancement on slightly unbalanced mono material.

Use stereo enhancement with care if you are driving a low bitrate codec. At low bitrates, these codecs use various parametric techniques for encoding the spatial attributes of the sound field. Stereo enhancement can unnecessarily stress this encoding process.

Input Conditioning: Before the stereo enhancer, a sample rate converter converts the sample rate at the digital input to OPTIMOD-PC's internal 48 kHz rate. This 48 kHz rate accommodates a 20 kHz audio bandwidth with a comfortably wide 4 kHz transition band for the anti-aliasing filter. We are aware of no bias-controlled double-blind studies that have ever demonstrated that sample rates higher than 48 kHz are audibly superior to 48 kHz (or even that there is any audible difference at all). Moreover, the noise and distortion produced by a given digital filter at 48 kHz is about 6 dB lower than the N&D produced by a filter having the same frequency response but operating at 96 kHz. OPTIMOD-PC uses many digital filters, both in its equalizer section and for the crossovers in the multiband compressor. Hence, we believe that 48 kHz is the ideal rate for OPTIMOD-PC's audio processing.

A sweepable 18 dB/octave highpass filter and a defeatable phase rotator (located after the stereo enhancer) complete the input-conditioning block. The highpass filter is useful for production applications where it is necessary to remove low frequency rumble from a recording. The phase rotator makes speech more symmetrical, reducing its peak-to-average ratio by as much as 6 dB without adding nonlinear distortion. Hence, phase rotation can be very useful for loudness processing of speech.

Gating circuitry detects "mono" material with slight channel or phase imbalances and suppresses enhancement so this built-in imbalance is not exaggerated. It also

allows you to set a "width limit" to prevent over-enhancement of material with significant stereo content, and will always limit the ratio of L–R / L+R to unity or less.

Two-Band Gated AGC: The AGC is a two-band device, using Orban's patented "master / bass" band coupling. It has an additional important feature: target-zone gating. If the input program material's level falls within a user-settable window (typically 3dB), then the release time slows to a user-determined level. It can be slow enough (0.5 dB/second) to effectively freeze the operation of the AGC. This prevents the AGC from applying additional, audible gain control to material that is already well controlled. It also lets you run the AGC with fast release times without adding excessive density to material that is already dense.

The AGC contains a compression ratio control that allows you to vary to ratio between 2:1 and essentially ∞:1. Lower ratios can make gain riding subtler on critical formats like classical and jazz.

The AGC has its own silence-gating detector whose threshold can be set independently of the silence gating applied to the multiband compressor.

Equalization: OPTIMOD-PC has steep-slope bass shelving equalizer and three bands of fully parametric bell-shaped EQ.

You can set the slope of the bass shelving EQ to 6, 12, or 18 dB/octave, adjust the shelving frequency and set the amount of equalization.

OPTIMOD-PC's bass, midrange, and high frequency parametric equalizers have curves that were modeled on the curves of Orban's classic analog parametrics (like the 622B), using a sophisticated, proprietary optimization program. The curves are matched to better than 0.15dB. This means that their sound is very close to the sound of an Orban analog parametric. They also use very high quality filter algorithms to ensure low noise and distortion.

OPTIMOD-PC HF Enhancer is a program-controlled HF shelving equalizer that intelligently and continuously analyzes the ratio between broadband and HF energy in the input program material. It can equalize excessively dull material without over-enhancing bright material. It interacts synergistically with the five-band compressor to produce sound that is bright and present without being excessively shrill.

Multiband Compression: The multiband compressor can be operated in five-band or two-band mode. Several band-coupling controls allow the gain reduction of a given band's compressor to be partially controlled by the gain reduction in its neighboring band's compressor. These coupling controls allow anything from quasi-wideband compression to fully independent multiband compression.

A clipper, embedded in the crossover, protects bands 1 and 2 from transient overshoot. This clipper has a shape control, allowing you to vary the "knee" of its input/output transfer curve from hard (0) to soft (10) (see *Figure 3-3* on page 3-39).

Low-IM Look-ahead Limiter: OPTIMOD-PC's peak limiter prevents overshoots by examining a few milliseconds of the unprocessed sound before it is limited. This way, the limiter can anticipate and control peaks.

> It is important to minimize audible peak-limiter-induced distortion when one is driving a low bitrate codec because one does not want to waste precious bits encoding the distortion. Look-ahead limiting can achieve this goal; hard clipping cannot.
>
> One can model any peak limiter as a multiplier that multiplies its input signal by a gain control signal. This is a form of amplitude modulation. Amplitude modulation produces sidebands around the "carrier" signal. In a peak limiter, each Fourier component of the input signal is a separate "carrier" and the peak limiting process produces modulation sidebands around each Fourier component.
>
> Considered this way, a hard clipper has a wideband gain control signal and thus introduces sidebands that are far removed in frequency from their associated Fourier "carriers." Hence, the "carriers" have little ability to mask the resulting sidebands psychoacoustically. Conversely, a look-ahead limiter's gain control signal has a much lower bandwidth than that of a clipper and produces modulation sidebands that are less likely to be audible.
>
> Simple wideband look-ahead limiting can still produce audible intermodulation distortion between heavy bass and midrange material. The look-ahead limiter in your Optimod uses sophisticated techniques to reduce such IM distortion without compromising loudness capability.

Two-Band Purist Processing

OPTIMOD-PC's two-band algorithm can be set to be phase-linear. We believe that this is the ideal processing for classical music and jazz programming because it does not dynamically re-equalize high frequencies; the subtle HF limiter only acts to reduce high frequency energy when it would otherwise cause overload because of the TV preemphasis curve. OPTIMOD-PC's two-band phase-linear structure therefore keeps the musical spectrum coherent and natural.

Input/output Delay

The input/output time delay of the processing is typically 19 ms—approximately two-thirds of an NTSC frame. To make intelligent decisions about how to process, OPTIMOD-PC needs to look ahead at the next part of the program waveform. As digital transmission processing advances further and further from its analog roots, this is the inevitable price of progress.

To avoid lip sync problems in video applications, OPTIMOD-PC allows you to pad the delay to one full frame of 24, 25, or 29.97 fps video, which makes matching audio and video delays convenient. See step (3.D) on page 2-21.

If talent monitors off-air through headphones they are in the same location as OPTIMOD-PC, you can configure OPTIMOD-PC's analog outputs to supply a special low-delay monitor signal to drive talent headphones only. (See *Output and Routing Switcher* on page 2-31.)

Customizing OPTIMOD-PC's Sound

See *Figure 3-2: Simplified OPTIMOD-PC Digital Signal Processing Diagram* on page 3-9.

The subjective setup controls on OPTIMOD-PC give you the flexibility to customize your station's sound. Nevertheless, as with any audio processing system, proper adjustment of these controls consists of balancing the trade-offs between loudness, density, and audible distortion. The following pages provide the information you need to adjust OPTIMOD-PC controls to suit your format, taste, and competitive situation.

When you start with one of our Factory presets, there are two levels of subjective adjustment available to you to let you customize the Factory preset to your requirements: Basic Control and Advanced Control.

Basic Control

The single LESS-MORE control changes many different subjective setup control settings simultaneously according to a table that we have created in OPTIMOD-PC's factory presets, which are Read-Only. In this table are sets of subjective setup control settings that provide, in our opinion, the most favorable trade-off between loudness, density, and audible distortion for a given amount of processing. We believe that most OPTIMOD-PC users will never need to go beyond the LESS-MORE level of control, because the combinations of subjective setup control settings produced by this control have been optimized by Orban's audio processing experts on the basis of years of experience designing audio processing, and upon hundred of hours of listening tests.

The LESS-MORE control has a different effect in the "radio" presets than it does in the "video" presets. In the "radio" presets the air sound will become louder as you go from less to more, but (as with any processor) processing artifacts will increase. In the "video" presets (except for those few based on "radio" presets), the LESS-MORE control sets the average amount of dynamic range control provided by the processing. As you go from less to more, the loudness of loud sounds will stay about the same but the loudness of quieter sounds will increase. Because of OPTIMOD-PC's sophisticated gating circuits, very quiet material like background sounds, quiet underscoring, hiss, and hum will not be pumped up.

Please note that, in the "radio" presets, the highest LESS-MORE setting is purposely designed to cause unpleasant distortion and processing artifacts! This helps assure

you that you have chosen the optimum setting of the LESS-MORE control, because turning the control up to this point will cause the sound quality to become obviously unacceptable.

You need not (in fact, cannot) create a sound entirely from scratch. All User Presets are created by modifying Factory Presets or by further modifying Factory Presets that have been modified previously. It is wise to set the LESS-MORE control to achieve a sound as close as possible to your desired sound before you make further modifications at the Advanced Modify level. This is because the LESS-MORE control gets you close to an optimum trade-off between loudness and artifacts, so any changes you make are likely to be smaller and to require resetting fewer controls.

In OPTIMOD-PC, LESS-MORE affects only the dynamics processing (compression, limiting, and clipping)—OPTIMOD-PC's equalization and stereo enhancement are decoupled from LESS-MORE. You can therefore change EQ or stereo enhancement and not lose the ability to use LESS-MORE. When you create a user preset, OPTIMOD-PC will automatically save your EQ and stereo enhancement settings along with your LESS-MORE setting. When you recall the user preset, you will still be able to edit your LESS-MORE setting if you wish.

If you want to create a signature sound for your broadcast or netcast that is far out of the ordinary, if your taste differs from the people who programmed the LESS-MORE tables, or if you are using OPTIMOD-PC in mastering or production applications, you will find Advanced Modify useful. At this level, you can customize or modify any subjective setup control setting to create a sound exactly to your taste. You can then save the settings in a User Preset and recall it whenever you wish. This sort of customization is usually unnecessary and inappropriate for sound for picture but can be very useful for radio and production applications.

Compressor attack time, release time, and threshold controls are available. These controls can be dangerous in inexperienced hands, leading you to create presets that sound great on some program material but overdrive the look-ahead peak limiter on other material, causing objectionable pumping or distortion. We therefore recommend that you create custom presets at the Advanced Modify level only if you are experienced with audio processing sound design and if you are willing to take the time to double-check your work on many different types of program material.

In production and mastering applications, you will usually be working with one piece of program material at a time. Here, you can use all of Advanced Modify's power to get the sound you want without being concerned about how your settings will sound with other material.

The PC Remote software organizes its controls in tabbed screens. The first three tabs (EQUALIZATION, STEREO ENHANCER, and LESS-MORE) access the Basic Modify controls. The remaining tabs combine the Full Modify and Advanced Modify controls, logically organized by functionality.

> **Important Note:** Once you have edited a preset's dynamics parameters in Advanced Modify, LESS-MORE control is no longer available in Basic Modify. As noted above, we strongly recommend using the LESS-MORE

control to achieve a sound as close as possible to your desired sound before you make further modifications at the Advanced Modify level.

Gain Reduction Metering

Unlike the metering on some processors, when any OPTIMOD-PC gain reduction meter indicates full-scale (at its bottom), it means that its associated compressor has run out of gain reduction range, that the circuitry is being overloaded, and that various nastinesses are likely to commence.

Because the various compressors have 25 dB of gain reduction range, the meter should never come close to 25 dB gain reduction if OPTIMOD-PC has been set up for a sane amount of gain reduction under ordinary program conditions.

Further, be aware of the different peak factors on voice and music—if voice and music are peaked identically on a VU meter, voice may cause up to 10 dB more peak gain reduction than does music! (A PPM will indicate relative peak levels much more accurately.)

The AGC meter can be switched (within the Full Control screens) so that it either reads the gain reduction of the Master (above-200 Hz) band, or the difference between the gain reduction in the Master and Bass bands.

> The latter reading is useful for assessing the dynamic bass equalization that the AGC produces and it helps you set the AGC BASS COUPLING control.

Fundamental Requirements: High-Quality Source Material and Accurate Monitoring

A major potential cause of distortion is excess peak limiting. Another cause is poor-quality source material, including the effects of your playback machines, electronics, and studio-to-transmitter link (if any). If the source material is distorted even slightly, that distortion can be exaggerated by OPTIMOD-PC—particularly if a large amount of gain reduction is used. Very clean audio can be processed harder without producing objectionable distortion.

A high-quality monitor system is essential. To modify your sound effectively, you must be able to hear the results of your adjustments. In too many facilities, the best monitor is significantly inferior to the sound systems found in many listeners' homes!

About the Processing Structures

If you want to create your own User Presets, the following detailed discussion of the processing structures is important to understand. If you only use Factory Presets or if you only modify them with LESS-MORE, you may still find the material interesting but you do not need to understand it to get excellent sound from OPTIMOD-PC. We

have carefully designed OPTIMOD-PC's factory presets and most users will not need to go beyond these.

In OPTIMOD-PC, a processing structure is a program that operates as a complete audio processing system. Only one processing structure can be active at a time. Just as there are many possible ways of configuring a processing system using analog components (like equalizers, compressors, limiters, and clippers), OPTIMOD-PC's DSP hardware realizes two processing structures that run simultaneously, permitting graceful switching between them. Unlike an analog system, where creating a complete processing system involves physically wiring its various components together, OPTIMOD-PC realizes its processing structures as a series of high-speed mathematical computations made by Digital Signal Processing (DSP) integrated circuit chips.

There are two basic structures: **Two-Band** and **Five-Band**, both of which are phase-linear. To select a structure, choose a factory preset having the desired structure, and, if you wish, edit it to create a user preset. To put a given structure on the air, recall a factory or user preset associated with that structure.

Five-Band: The Five-Band structure is very flexible, enabling you to fine-tune your sound. There are several basic Factory Presets for the Five-Band structure. Each of these presets can be edited with the LESS-MORE control.

This control affects the video-oriented presets differently than it does the music presets. When a video-oriented preset is on the air, the LESS-MORE control adjusts the average amount of gain reduction by adjusting the drive level to the Five-Band structure's input. This also adjusts the *idle gain*—the amount of gain reduction in the AGC section when the structure is gated. (It gates whenever the input level to the structure is below the user-adjustable threshold of gating.)

When a music preset is on the air, the LESS-MORE control sets the amount of overall processing, making optimum tradeoffs between loudness, brightness, and distortion. In sound for picture, there are no loudness wars; for music presets, there is probably never a need to advance the LESS-MORE control beyond 5.

The stereo enhancer, AGC, equalizer, and look-ahead limiter are common to both Two-Band and Five-Band processing and therefore stay the same when OPTIMOD-PC switches between two-band and five-band operation. However, different controls appear in the screens containing dynamics processing controls, as appropriate for Two-Band or Five-Band multiband compression. The meters also change, displaying the Two-Band or Five-Band gain reduction as appropriate.

The Two-Band and Five-Band multiband compressors are always running. Switching between Two-Band and Five-Band therefore occurs with an cross-fade. Even though no audio mute occurs, switching still can sound obtrusive if the loudness normally produced by the two-band and five-band presets are very different. It is usually possible to eliminate audibly obtrusive switching artifacts by tweaking one (or both) of the presets to make them sound closer to each other and saving the results as user presets.

Two-Band: The Two-Band structure consists of a slow two-band gated AGC (Automatic Gain Control) for gain riding, followed by a gated two-band compressor and a look-ahead limiter. By choosing the AGC crossover mode correctly, the Two-Band Structure can be made phase-linear throughout to maximize sonic transparency.

The Two-Band structure has an open, easy-to-listen-to sound that is similar to the source material if the source material is of good quality. However, if the spectral balance between the bass and high frequency energy of the program material is incorrect, the Two-Band structure (when its B2-B1 COUPLE control is operated toward 0%) can gently correct it without introducing obvious coloration.

In radio-oriented applications, the Two-Band structure is mainly useful for classical or "fine arts" programming that demands high fidelity to the original program source. The PROTECTION preset is a Two-Band preset that provides the highest fidelity; other Two-Band presets provide more processing.

The Two-Band structure preserves the frequency balance between midrange and high frequency elements in the programming while permitting gentle automatic re-equalization of the balance between these elements (in the "Master" band, which is above 200 Hz) and elements in the "Bass" band (below 200 Hz).

The AGC and two-band crossovers can be configured to be either phase-linear (i.e., constant-delay) or "allpass." "Allpass" provides minimum time delay along with a frequency response that is free from peaking or dipping when band gains are unequal. "Allpass" also helps make speech waveforms more symmetrical. The delay-line derived phase-linear crossover has the same desirable smoothness in its frequency response as "allpass," while adding 4 ms of delay to the processing. Most two-band presets use the delay-line derived phase-linear crossover configuration.

Factory Programming Presets

Factory Programming Presets are our "factory recommended settings" for various program formats or types. The Factory Programming Presets are starting points to help you get on the air quickly without having to understand anything about adjusting OPTIMOD-PC's sound.

You can easily edit any of these presets with the LESS-MORE control to optimize the trade-off between loudness and distortion according to the needs of your format, although this is often unnecessary. It is OK to use unmodified factory presets on the air. These represent the best efforts of some very experienced transmission processing sound designers. We are sometimes asked about unpublished "programming secrets" for Optimods. In fact, there are no "secrets" that we withhold from users. This manual reveals our "secrets" and the presets embody all of our craft as processing experts. The presets are editable because other sound designers may have different preferences from ours, not because the presets are somehow mediocre or improvable by those with special, arcane knowledge that we withhold from most of our customers.

Start with one of these presets. Spend some time listening critically to your sound. Listen to a wide range of program material typical of your format and listen on several types of audio systems (not just on your studio monitors). Then, if you wish, cus-

tomize your sound using the information in the Protection Limiter, Two-Band and Five-Band sections that follow.

Each factory preset has full LESS-MORE capability. The table shows the presets, including the source presets from which they were taken and the nominal LESS-MORE setting of each preset. Some of the Five-Band presets appear several times under different names because we felt that these presets were appropriate for more than one format; these can be identified by a shared source preset name.

> **Important!** If you are dissatisfied with the sound available from the factory presets, please understand that each named preset is actually 19 presets that can be accessed via the LESS-MORE control. Try using this control to trade off the amount of dynamic range reduction against processing artifacts and side effects. Once you have used LESS-MORE, save your edited preset as a User Preset.

Do not be afraid to choose a preset other than the one named for your programming if you believe this other preset has a more appropriate sound. Also, if you want to fine-tune the frequency balance of the programming, feel free to use Basic Modify and make small changes to the Bass, Mid EQ, and HF EQ controls. OPTIMOD-PC lets you make changes in EQ (and stereo enhancement) without losing the ability to use Less-More settings.

> Of course, LESS-MORE is still available for the unedited preset if you want to go back to it. There is no way you can erase or otherwise damage the Factory Presets. So, feel free to experiment.

If a preset has "2B" or "2BAND" in its name, it will activate the Two-Band structure. (The Protection presets are two-band as well.) Other presets use the Five-Band structure.

Protection and AGC Presets

AGC+[FLAT, 50 μs, 75 μs] LIMITER: These presets allow OPTIMOD-PC to serve as a studio AGC, substituting for the AGC in an Optimod at a radio or television transmitter and providing protection limiting for the STL that links the output of OPTIMOD-PC to the input of the Optimod at the transmitter. See *Studio AGC* on page 3-8.

Choose the preset that matches OPTIMOD-PC's preemphasis setting, visible in the CONFIGURATION page of the I/O Mixer (see step 5 on page 2-23). This step explains how to choose OPTIMOD-PC's preemphasis setting to match your STL.

The 50 μS and 75 μS presets have been tuned so that the five-band compressor serves only as a subtle high frequency limiter that uses bands 4 and 5 to perform a few dB of fast gain reduction with program material having strong high frequency content. Band 5 operates without stereo coupling. This way, HF limiting triggered by high frequency energy in one audio channel will not modulate high frequencies in the opposite channel.

The FLAT preset is tuned so that it does not normally trigger gain reduction in OPTIMOD-PC's five-band compressor — the Optimod at the transmitter should be the processor that performs this multiband compression.

All AGC presets use the look-ahead limiter to prevent overloading the STL on peaks. Compared to FLAT, the 50 μS and 75 μS presets progressively reduce the drive level

to the look-ahead limiter to prevent strong high frequency energy from triggering audible gain pumping or ducking. The high frequency limiting action in the five-band compressor also helps prevent this artifact.

LOOK-AHEAD LIMITER: The LOOK-AHEAD LIMITER preset is a Two-Band preset that turns off the stereo enhancer, AGC, equalizer, and two-band compressor so that you can use the processing as a fast look-ahead protection limiter.

This preset's LESS-MORE control is set to 1.0. With this setting, there is unity gain from the input to the output of the audio processing block, which does not include the Processor Mixer. Even though the gain is unity through the processing block, you can still use the Processor Mixer to adjust the I/O gain according to your requirements.

When LESS-MORE = 1, the threshold of the look-ahead limiter is the same as the Processor Mixer's output clipping level. This means that there can be no look-ahead limiter gain reduction because the Processor Mixer will clip before any gain reduction could occur. Functionally, LESS-MORE = 1 bypasses the processing.

> This is equivalent to setting the input, threshold, and make-up gain controls of a studio-style protection limiter to "0 dB."

To produce look-ahead limiter gain reduction, turn up the LESS-MORE control. Each step of the LESS-MORE control increases the drive level to the look-ahead limiter by 1 dB and increases the input/output gain by 1 dB for signals below the limiter threshold. At LESS-MORE = 10, the processor's gain below threshold has increased to 9 dB and the input headroom (the difference between the processor mixer clipping level and the look-ahead limiter threshold) is also 9 dB.

Instead of adjusting LESS-MORE, you could adjust the FINAL LIMIT DRIVE control (which what LESS-MORE actually does). The FINAL LIMIT DRIVE control allows you to achieve up to 12 dB of look-ahead limiting.

> Do not set the FINAL LIMIT DRIVE control below "0" with this preset; doing so will compromise system headroom.
>
> Adjusting the LESS-MORE or FINAL LIMIT DRIVE controls is equivalent to simultaneously decreasing the threshold and increasing the make-up gain in a protection limiter having threshold and output make-up gain controls.

When the output level controls in the I/O Mixer are set to their maximum values, the

FACTORY PROGRAMMING PRESETS (PROTECTION; AGC)		
Preset Names	**Source Preset**	**Normal Less-More**
AGC+FLAT LIMITER	AGC+FLAT LIMITER	5.0
AGC+50us LIMITER	AGC+50us LIMITER	5.0
AGC+75us LIMITER	AGC+75us LIMITER	5.0
LOOK-AHEAD LIMITER	LOOK-AHEAD LIMITER	1.0

Table 3-1: Protection and AGC Presets

look-ahead limiter always constrains the peak level to 0 dBfs at the digital outputs and to +24 dBu at the analog output, which prevents any output from clipping. To produce a lower peak level at a given output, turn down the corresponding output level control in the I/O Mixer. Another use for the output level controls is to produce unity below-threshold gain between the active input and output, which is sometimes desired in protection limiting applications.

> The analog output can produce +24 dBu into a balanced load without clipping. If you are driving an unbalanced load (by grounding one side of the output), the gain does not change. However, the clipping level declines to slightly above +18 dBu, so you must turn down the analog output level control to –6.0 dB or lower to avoid clipping.

PROTECT-0DB: This preset is an alias for CLASSICAL 2BAND.

Radio-Style Presets

The presets (*Table 3-2* on page 3-21) have been named similarly to their radio counterparts in Orban's OPTIMOD-FM 8400 and 8500. The basic audio texture of corresponding OPTIMOD-PC and 8500 presets (heard through the 8500's digital radio output) is similar, although the 1101 will tend to have 1-2 dB more bass. In addition, all 1101 presets have the stereo enhancer turned off to reduce potential codec stereo encoding artifacts.

> If you wish to reduce the bass, set the Band 1 and/or Band 2 compression thresholds lower to taste. Then save your work as a User Preset.

The texture of the corresponding OPTIMOD-PC and 8382 presets is quite similar, although the OPTIMOD-PC presets will usually have a less restricted high frequency sound because OPTIMOD-PC performs no high frequency limiting other than that created by gain reduction in Band 5 in the Five-band presets.

> Unlike the presets in Orban's FM processors, no OPTIMOD-PC preset uses phase rotation. Therefore, if you use OPTIMOD-PC to process the main digital channel in HD Radio, some care must be applied in cross fading to avoid momentary audible comb filtering because of the different phase responses of the analog and digital channels. In practice, this means that the cross-fade should be quite fast—perhaps 50 milliseconds.
>
> Broadcasters using Orban's Optimod-FM 8300, 8400, or 8500 will ordinarily use these processors' HD FM digital outputs to feed the digital channel in an IBOC transmission. This eliminates any potential comb filtering because both analog and digital outputs have identical amounts of phase rotation.
>
> Of course, if OPTIMOD-PC is used to process a secondary channel in HD Radio, there is no need to worry about smoothness of crossfades. This is an excellent application for this product.

RADIO-STYLE PRESETS		
Preset Names	**Source Preset**	**Normal Less-More**
CLASSICAL-2 BAND	CLASSICAL-2 BAND	7.0
CLASSICAL-2B+AGC	CLASSICAL-2B+AGC	7.0
CLASSICAL-5 BAND	CLASSICAL-5 BAND	7.0
CLASSICAL-5B+AGC	CLASSICAL-5B+AGC	5.0
COUNTRY-MEDIUM	ROCK-SMOOTH	7.0
COUNTRY-LIGHT	ROCK-LIGHT	7.0
CRISP	CRISP	9.5
DANCE ENERGY	DANCE ENERGY	9.0
EDGE	EDGE	10.0
FOLK-TRADITIONAL	ROCK-SOFT	8.5
GOLD	GOLD	9.5
GREGG	GREGG	9.5
GREGG OPEN	GREGG OPEN	9.5
IMPACT	IMPACT	9.5
INSTRUMENTAL	JAZZ	7.0
JAZZ	JAZZ	7.0
LOUD-BIG	LOUD-BIG	9.0
LOUD-FAT	LOUD-FAT	7.0
LOUD-HOT	LOUD-HOT	8.5
LOUD-HOT+BASS	LOUD-HOT+BASS	9.5
LOUD-PUNCHY	LOUD-PUNCHY	9.0
LOUD+SLAM	LOUD+SLAM	9.0
NEWS-TALK	NEWS-TALK	7.0
ROCK-DENSE	ROCK-DENSE	7.0
ROCK-LIGHT	ROCK-LIGHT	7.0
ROCK-MEDIUM	ROCK-MEDIUM	7.0
ROCK-MEDIUM+MID-BASS	ROCK-MEDIUM+MID-BASS	7.0
ROCK-MEDIUM+LOW BASS	ROCK-MEDIUM+LOW BASS	7.0
ROCK-OPEN	ROCK-OPEN	7.0
ROCK-SOFT	ROCK-SOFT	8.5
SMOOTH JAZZ	SMOOTH JAZZ	9.0
SPORTS	SPORTS	7.0
WMA MUSIC	WMA MUSIC	9.5
WMA NEWS-TALK	WMA NEWS-TALK	7.0
URBAN-LIGHT	URBAN-LIGHT	7.0
URBAN-HEAVY	URBAN-HEAVY	7.0

Table 3-2: Radio-Style Presets

CLASSICAL: As their names imply, the CLASSICAL 5-BAND and CLASSICAL 2-BAND presets are optimized for classical music, gracefully handling recordings with very wide dynamic range and sudden shifts in dynamics. The Five-Band version uses heavy inter-band coupling to prevent large amounts of automatic re-equalization,

which could otherwise cause unnatural stridency and brightness in strings and horns and which could pump up very low frequency rumble in live recording venues.

The Five-Band preset defeats the AGC, using only the five-band compressor for gain reduction. It also defeats phase rotation to ensure the most transparent Five-Band sound available.

Even more transparent, "purist" classical processing is available from the CLASSICAL 2-BAND preset, which is phase-linear and which preserves the spectral balance of the original material as much as possible. However, if you need a bit more automatic re-equalization than the CLASSICAL 2-BAND preset provides, use the CLASSICAL 5-BAND preset.

CLASSICAL-5B+AGC uses the AGC set for 2:1 compression ratio. Because of the AGC, it affects more of the total dynamic range of the recording than does the CLASSICAL-5 BAND preset. However, the AGC provides extremely smooth and unobtrusive compression because of the gentle ratio and window gating. This preset uses the Five-Band compressor very lightly with a fast release time as a peak limiter. The AGC does almost all of the compression.

There is also a corresponding two-band preset called CLASSICAL-2B+AGC.

COUNTRY: The COUNTRY-MEDIUM preset uses the ROCK-SMOOTH source preset. It has a gentle bass lift and a mellow, easy-to-listen-to high end, along with enough presence energy to help vocals to stand out. The COUNTRY-LIGHT preset uses the ROCK-LIGHT source preset. Modern country broadcasters might also find ROCK-MEDIUM or ROCK-OPEN useful if they want a brighter, more up-front sound.

CRISP: CRISP provides a bright upper midrange sound by emphasizing frequencies around 6 kHz. It is a loud preset that is appropriate for mass-appeal music formats. It has the same bass texture as the IMPACT presets.

DANCE ENERGY: This preset is designed to preserve the punch and slam in dance music percussion (such as the beater click in kick drums). It is loud and has a bright high frequency texture. As LESS-MORE is turned down, this preset get quieter, yet punchier.

EDGE: This preset is designed for hit music broadcasters who prefer extremely punchy bass to fastidious distortion control. It is loud and has a bright high frequency texture.

FOLK / TRADITIONAL: FOLK / TRADITIONAL is an alias for the ROCK-SOFT preset. It assumes that the recordings are of relatively recent vintage and require relatively subtle processing.

If the recordings you play are inconsistent in texture and equalization, you may prefer the ROCK-SMOOTH or ROCK-LIGHT presets.

GOLD: GOLD is loud and "hi-fi"-sounding while still respecting the limitations and basic flavor of the recordings from the era of the 1950s through 1970s.

For example, we do not attempt to exaggerate high frequency energy in the GOLD preset. The highs in recordings of this era are often noisy, distorted, or have other technical problems that make them unpleasant sounding when the processor over-equalizes them in an attempt to emulate the high frequency balance of recently recorded material.

GREGG: GREGG and GREGG OPEN all use a 200 Hz band1/band2 crossover frequency to achieve a bass sound similar to the classic five-band Gregg Labs FM processors designed by Orban's Vice President of New Product Development, Greg Ogonowski. Dynamically, these presets produce a slight increase in bass energy below 100 Hz and a decrease of bass energy centered at 160 Hz. This bass sound works particularly well with speakers having good bass response.

In terms of loudness, midrange texture, and HF texture, these presets are similar to the LOUD-HOT+BASS presets.

IMPACT: IMPACT is intended for CHR and similar formats where attracting a large audience (maximizing cume) is more important than ensuring long time-spent-listening. This is a loud, bright, "major-market" preset that has a great deal of presence energy to cut through on lower-quality speakers.

Its sound changes substantially as the LESS-MORE control is turned down—fast peak limiting decreases while bass punch and transparency improve. Therefore, exploring various Less-More settings is worthwhile with IMPACT, because, for many circumstances, this preset will be "over the top" if it is not turned down with Less-More.

INSTRUMENTAL: An alias for the JAZZ preset.

JAZZ: JAZZ is specifically tailored toward broadcasters that play mostly instrumental music, particularly classic jazz (Coltrane, Mingus, Monk, etc.). It is a quiet preset with a very clean, mellow high end to prevent stridency on saxes and other horns. It preserves much of the qualities of the original recordings, doing light re-equalization. The preset produces very low listening fatigue, so it is a good choice for broadcasters that want listeners to stay all day. Note that broadcasters programming "smooth jazz" should investigate the SMOOTH JAZZ preset, which is much louder and more "commercial"-sounding.

LOUD: There are several LOUD presets.

LOUD-BIG compromises between LOUD-HOT and LOUD-HOT+BASS. It uses a 12 dB/octave bass equalizer slope to achieve punchy bass that still has enough mid-bass boost to help smaller radios.

LOUD-FAT has dramatic punch on percussive material and a very fat-sounding low end. It avoids overt bass distortion despite the full bass sound. It is slightly quieter than the loudest of the "loud" preset family.

LOUD-HOT is very bright and present, with up-front vocals. Release time is medium.

LOUD-HOT+BASS is based on LOUD-HOT. It is tuned for the maximum amount of bass we could add without creating objectionable artifacts on some program mate-

rial. For maximum punch, it uses the HARD bass clipper at higher LESS-MORE settings.

This amount of bass may be excessive with certain consumer systems (particularly "boom-boxes") that already have substantial bass boost. Use it with care.

LOUD-PUNCHY is the quietest of the "loud" preset family. It is designed for a bright, sizzling top end and very punchy lows. It is a good choice for broadcasters that feel that the LOUD-HOT presets are too aggressive, but that think that the ROCK presets are insufficiently loud for their market position.

LOUD+SLAM is similar to LOUD-HOT+BASS, but uses HARD bass clipping mode with a SHAPE of 7.6, a BASS SLOPE of 18 dB/octave. It has modified tuning in the band-1 compressor (to control bass clipping distortion that could otherwise be introduced by Hard bass clipping). This preset provides slamming bass punch, which it trades off against bass cleanliness on certain program material. Because of the 18 dB/octave BASS SLOPE, its advantages will be appreciated most through radios with good low bass response.

NEWS-TALK: This preset is quite different from the others. It is based on the fast multiband release time setting so it can quickly perform automatic equalization of substandard program material, including telephone. It is useful for creating a uniform, intelligible sound from widely varying source material, particularly source material that is "hot from the field" with uncontrolled quality.

SPORTS: Similar to NEWS-TALK except the AGC Release (AGC Release Time) is slower and the Gate Thresh (Gate Threshold) is higher. This recognizes that most sports programming has very low signal-to-noise ratio due to crowd noise and other on-field sounds, so the preset does not pump this up as the NEWS-TALK preset would tend to do.

ROCK: ROCK-DENSE, ROCK-MEDIUM, and ROCK-OPEN are appropriate for general rock and contemporary programming. They provide a bright high end and punchy low end (although not as exaggerated as the URBAN presets). A midrange boost provides enough presence energy to ensure that vocals stand out. A modest amount of high frequency coupling (determined by the Band Clipping 3>4 setting) allows reasonable amounts of automatic HF equalization (to correct dull program material), while still preventing exaggerated frequency balances and excessive HF density. Dense, medium, and open refer to the compression density, which is determined by the release time settings in the AGC and multiband compressor sections.

ROCK-LIGHT has an open sound with little audible compression and less brightness than the first three presets. It is a compromise between ROCK-OPEN and ROCK-SOFT.

ROCK-SOFT has a mellow, easy-to-listen-to high frequency quality that is designed for female-skewing formats. It is also a candidate for "Quiet Storm" and "Love Songs" light rock or light urban formats.

ROCK-SMOOTH has the same mellow, easy-to-listen-to high frequency quality as ROCK-SOFT, but with more density. Again, it is a good choice for female-skewing formats, but where you need more compression and density than you get with ROCK-SOFT.

For Contemporary Hit Radio (CHR) we recommend the ROCK-DENSE or ROCK-MEDIUM versions. In competitive situations, you may need to use LOUD-HOT (you can use LESS-MORE to get it even louder) or even LOUD-HOT+BASS or IMPACT. However, the "rock" presets are somewhat cleaner and are therefore more likely to encourage longer times spent listening than are the "loud" presets.

For Album-Oriented Rock (AOR) we recommend the ROCK-MEDIUM or ROCK-OPEN versions, although you might prefer the more conservative ROCK-LIGHT or ROCK-SMOOTH versions.

ROCK-MEDIUM+LOWBASS is an open-sounding preset with a lot of bass punch. Its Five-band Release control is set to Slow2 so that the sound is relaxed and not at all busy. At the same time, the preset is competitively loud. It is an excellent choice for "adult contemporary" and "soft rock" formats where long time-spent-listening is desired.

SMOOTH JAZZ: This preset is designed for commercial broadcasters playing smooth jazz (Kenny G., etc.). It is a loud preset that is designed to prevent stridency with saxes and other horns. This preset is based on a custom 8400 preset that has been used successfully by a major-market smooth jazz station with very good ratings. However, if the loudness/density tradeoff is not to your taste, use LESS-MORE to turn it down, producing lower loudness with less density.

WMA MUSIC: This preset is based on GREGG SLOW but has been edited to minimize artifacts in the Windows Media Audio V9 codec when operated at bitrates below 64 kbps. See *Processing for Low Bitrate Codecs* on page 3-5.

WMA NEWS-TALK: This preset is based on NEWS-TALK but has been edited to minimize artifacts in the Windows Media Audio V9 codec when operated at bitrates below 64 kbps.

URBAN: There are two URBAN (Rap) presets: HEAVY and LIGHT. These are similar to ROCK-MEDIUM and ROCK-OPEN but with a different bass sound. They use the 3-pole (18 dB/octave) shape on the bass equalizer. URBAN-HEAVY is appropriate for Urban, Rap, Hip-Hop, Black, R&B, Dance and other similar formats. URBAN-LIGHT is appropriate for light R&B formats. Highly competitive Urban broadcasters might also use LOUD-HOT+BASS or LOUD+SLAM, modified versions of LOUD-HOT that maximize bass punch.

Sound for Picture Presets

FACTORY PROGRAMMING PRESETS (Video)		
Preset Names	**Source Preset**	**Normal Less-More**
TV 2B-GEN PURPOSE	TV 2B-GEN PURPOSE	5.0
TV 5B-GEN PUR W NR	TV 5B-GEN PURPOSE	5.0
TV 5B-GEN PURPOSE	TV 5B-GEN PURPOSE	5.0
TV 5B-NEWS	TV 5B-NEWS	5.0
TV 5B-OPTICAL FILM	TV 5B-OPTICAL FILM	5.0
TV 5B-SPORTS	TV 5B-SPORTS	5.0

Table 3-3: Factory Programming Presets (Video)

The sound for picture presets have been named similarly to their counterparts in Orban's OPTIMOD-TV 8382. The texture of the corresponding OPTIMOD-PC and 8382 presets is quite similar, although the OPTIMOD-PC presets will usually have a less restricted high frequency sound because OPTIMOD-PC performs no high frequency limiting other than that created by gain reduction in Band 5 in the Multiband presets.

TV 2B–GEN PURPOSE (TV Two-Band General Purpose): This preset is designed to accommodate most dramatic programming, providing gentle gain control that limits dynamic range to a level that provides the general audience with consistently intelligible dialog. It sounds very similar to Orban's analog OPTIMOD-TV (Model 8182A) when that unit is adjusted for "General" programming according to the instructions in its operating manual. This preset retains the spectral balance of its input as much as possible. TV 2B-GEN PURPOSE is usually not the best choice for live news, sports, or films with optical soundtracks. The Five-Band presets (see below) can automatically equalize such program material when its spectral balance is inappropriate and can also apply single-ended dynamic noise reduction.

TV 5B-GEN PUR W/NR (TV Five-Band General Purpose with Noise Reduction): provides effective dynamic range control and "automatic re-equalization" of most dramatic material. It applies single-ended noise reduction to the material, which will reduce unwanted noise like hiss, hum, or stage rumble. However, it will also reduce ambience. If the program material is carefully produced (as are most contemporary feature-film soundtracks), you may wish to use TV 5B-GEN PURPOSE (which does not apply noise reduction), or, if the material is so well produced that it would not benefit from "automatic re-equalization," use TV 2B-GEN PURPOSE.

TV 5B-GEN PURPOSE (TV Five-Band General Purpose without Noise Reduction): is identical to TV 5B-GEN PUR W/NR except that the single-ended dynamic noise reduction system is off.

TV 5B-NEWS (TV Five-Band News): rides gain more quickly than the general-purpose presets. Its AGC release time is faster so it will bring up low-level material more quickly. It is designed for live news programs where input levels may be quite unpredictable. It also automatically re-equalizes substandard audio (which is quite common in live news broadcasts).

TV 5B-SPORTS (TV Five-Band Sports): is similar to TV 5B-NEWS, except the AGC release time is slower to resist pumping up crowd noise in play-by-play sports broadcasting.

TV 5B-OPTICAL FILM (TV Five-Band Optical Film): is designed to make the best of the low-quality audio provided with optical film sound tracks (particularly 16mm). The gate threshold is quite high to avoid pumping up hiss, thumps, and other optical artifacts. The threshold of the single-ended dynamic noise reduction system is also high so that this system can reduce artifacts as far as possible. Release times are slow, because we assumed that material encoded on optical film has already been carefully level-controlled to accommodate the very limited dynamic range of the medium, and that little gain riding is therefore required from OPTIMOD-PC.

Equalizer Controls

The table summarizes the equalization controls available for the Five-Band structure. Except for BRILLIANCE and DJ BASS, these equalization controls are common to both the Two-Band and Five-Band structures. The equalizer is located between the AGC and five-band compressor sections of both structures.

Any equalization that you set will be automatically stored in any User Preset that you create and save. For example, you can use a User Preset to combine an unmodi-

Equalizer Controls		
Group	**Name**	**Range**
Bass Shelf	Bass Frequency	80, 85, 90, 95, 100, 105, 110, 115, 120, 125, 130, 135, 140, 145, 150, 160, 170, 180, 190, 200, 210, 220, 230, 240, 250, 270, 290, 310, 330, 350, 380, 410, 440, 470, 500Hz
	Bass Gain	0 … 12 dB
	Bass Slope	6,12,18 dB/Oct
Low	Low Frequency	20 ... 500 Hz
	Low Gain	–10.0 … +10.0 dB
	Low Width	0.8 ... 4 octaves
Mid	Mid Frequency	250 ... 6000 Hz
	Mid Gain	–10.0 … +10.0 dB
	Mid Width	0.8 ... 4 octaves
High	High Frequency	1.0 … 15.0 kHz
	High Gain	–10.0 … +10.0 dB
	High Width	0.8 ... 4 octaves
HF Enhancer	High Frequency Enhancer	0 … 15
DJ Bass (5B)	DJ Bass Boost	Off, 1… +10 dB
Highpass Filter	Highpass Filter	Off, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140, 150, 170, 200 Hz
Lowpass Filter	Lowpass Filter	10, 11 ,12, 13, 14, 15, 20 kHz

Table 3-4: Equalization Controls

fied Factory Programming Preset with your custom equalization. Of course, you can also modify the Factory Preset (with Basic or Advanced Modify) before you create your User Preset.

In general, you should be conservative when equalizing modern, well-recorded program material. This is particularly true with general-purpose video programming.

Except for BASS GAIN, most of the factory presets use less than 3 dB of equalization.

Bass Shelf Controls, the Five-Band structure's low bass equalization controls, are designed to add punch and slam to rock and urban music. They provide a parametric shelving equalizer with control over gain, hinge frequency, and slope (in dB/octave).

BASS FREQ sets the frequency where shelving starts to take effect.

BASS GAIN sets the amount of bass boost (dB) at the top of the shelf.

BASS SLOPE sets the slope (dB/octave) of the transition between the top and bottom of the shelf.

The moderate-slope (12 dB/octave) shelving boost achieves a bass boost that is more audible on smaller receivers, but which can sound boomier on high-quality receivers and home theater systems. The steep-slope (18 dB/octave) shelving boost creates a solid, punchy bass from the better consumer receivers and home theater systems with decent bass response. The 6 dB/octave shelving boost is like a conventional tone control and creates the most mid-bass boost, yielding a "warmer" sound. Because it affects the mid-bass frequency range, where the ear is more sensitive than it is to very low bass, the 6 dB/octave slope can create more apparent bass level at the cost of bass "punch."

There are no easy choices here; you must choose the characteristic you want by identifying your target audience and the receivers they are most likely to be using. Often, you will not want to use any boost at all for general-purpose video programming because this can exaggerate rumble and other low frequency noise. Additionally, large amounts of boost will increase the gain reduction in the lowest band of the five-band compressor, which may have the effect of reducing some frequencies below 100 or 200 Hz (depending on the setting of the B1/B2 XOVER control). So be aware the large fixed bass boosts may have a different effect than you expect because of the way that they interact with the five-band compressor.

On the other hand, stations specializing in pop music programming will usually want to employ some bass boost to maintain the punch of this programming, particularly if urban or rap music is a significant part of the music mix.

Low Frequency Parametric Equalizer is a specially designed equalizer whose boost and cut curves closely emulate those of a classic Orban analog parametric equalizer with conventional bell-shaped curves (within ±0.15 dB worst-case). This provides warm, smooth, "analog-sounding" equalization.

LF Freq determines the center frequency of the equalization, in Hertz. Range is 20-500Hz.

LF Gain determines the amount of peak boost or cut (in dB) over a ±10 dB range.

LF Width determines the bandwidth of the equalization, in octaves. The range is 0.8-4.0 octaves. If you are unfamiliar with using a parametric equalizer, 1.5 octaves is a good starting point. These curves are relatively broad because they are designed to provide overall tonal coloration, rather than to notch out small areas of the spectrum.

The LF parametric can be used in the mid-bass region (100-300Hz) to add "warmth" and "mellowness" to the sound when boosting. When cutting, it can remove a "woody" or "boxy" sound.

The equalizer, like the classic Orban analog parametrics such as the 622B, has constant "Q" curves. This means that the cut curves are narrower than the boost curves. The width (in octaves) is calibrated with reference to 10 dB boost. As you decrease the amount of EQ gain (or start to cut), the width in octaves will decrease. However, the "Q" will stay constant.

"Q" is a mathematical parameter that relates to how fast ringing damps out. (Technically, we are referring to the "Q" of the poles of the equalizer transfer function, which does not change as you adjust the amount of boost or cut.)

The curves in OPTIMOD-PC's equalizer were created by a so-called "minimax" ("minimize the maximum error" or "equal-ripple") IIR digital approximation to the curves provided by the Orban 622B analog parametric equalizer. Therefore, unlike less sophisticated digital equalizers that use the "bilinear transformation" to generate EQ curves, the shapes of OPTIMOD-PC's curves are not distorted at high frequencies.

Midrange Parametric Equalizer is a parametric equalizer whose boost and cut curves closely emulate those of an analog parametric equalizer with conventional bell-shaped curves.

Mid Freq determines the center frequency of the equalization, in Hertz. Range is 250-6000Hz.

Mid Gain determines the amount of peak boost or cut (in dB) over a ±10 dB range.

Mid Width determines the bandwidth of the equalization, in octaves. The range is 0.8-4.0 octaves. If you are unfamiliar with using a parametric equalizer, 1 octave is a good starting point.

With Five-Band presets, the audible effect of the midrange equalizer is closely associated with the amount of gain reduction in the midrange bands. With small amounts of gain reduction, it boosts power in the presence region. This can increase the loudness of such material substantially. As you increase the gain reduction in the midrange bands (by turning the MULTIBAND DRIVE (Multiband Drive) control up), the MID GAIN control will have progressively less audible effect. The compressor for the midrange bands will tend to reduce the effect of the MID frequency boost (in an attempt to keep the gain constant) to prevent excessive stridency in program material that already has a great deal of presence power. Therefore, with large amounts of gain reduction, the density of presence region energy will be increased more than will the level of en-

ergy in that region. Because the 3.7 kHz band compressor is partially coupled to the gain reduction in the 6.2 kHz band in most presets (as set by the B4>5 COUPLING control), tuning MID FREQ to 2-4 kHz and turning up the MID GAIN control will decrease energy in the 6.2 kHz band—you will be increasing the gain reduction in both the 3.7 kHz and 6.2 kHz bands. You may wish to compensate for this effect by turning up the BRILLIANCE control.

With Two-Band presets, the midrange equalizer will behave much more as you might expect because the two-band structure cannot automatically re-equalize midrange energy. Instead, increasing midrange energy will moderately increase the Master band's gain reduction.

Use the mid frequency equalizer with caution. Excessive presence boost tends to be audibly strident and fatiguing. Moreover, the sound quality, although loud, can be very irritating. We suggest a maximum of 3 dB boost, although 10 dB is achievable. In some of our factory music presets, we use a 3 dB boost at 2.6 kHz to bring vocals more up-front.

High Frequency Parametric Equalizer is an equalizer whose boost and cut curves closely emulate those of an analog parametric equalizer with conventional bell-shaped curves.

High Freq determines the center frequency of the equalization, in Hertz. The range is 1-15 kHz

High Gain determines the amount of peak boost or cut over a ±10 dB range.

High Width determines the bandwidth of the equalization, in octaves. The range is 0.8-4.0 octaves. If you are unfamiliar with using a parametric equalizer, one octave is a good starting point.

Excessive high frequency boost can exaggerate hiss and distortion in program material that is less than perfectly clean. We suggest no more than 4 dB boost as a practical maximum, unless source material is primarily from high-quality digital sources. In several of our presets, we use this equalizer to boost the upper presence band (4.4 kHz) slightly, leaving broadband HF boost to the BRILLIANCE and/or HF ENHANCE controls.

Brilliance controls the drive to Band 5 in the 5-Band structure only. (This control is nonfunctional in the 2-Band structure.) The Band 5 compressor/limiter dynamically controls this boost, protecting the final limiter from excessive HF drive. We recommend a maximum of 4 dB of Brilliance boost and most people will prefer substantially less.

DJ Bass ("DJ Bass Boost") control determines the amount of bass boost produced on some male voices. In its default OFF position, it causes the gain reduction of the lowest frequency band to move quickly to the same gain reduction as its nearest neighbor when gated. This fights any tendency of the lowest frequency band to develop significantly more gain than its neighbor when processing voice because voice will activate the gate frequently. Each time it does so, it will reset the gain of the lowest frequency band so that the gains of the two bottom bands are equal and the response in this frequency range is flat. The result is natural-sounding bass on male voice. This is particularly desirable for most video programming.

If you like a larger-than-life, "chesty" sound on male voice, set this control away from OFF. When so set, gating causes the gain reduction of the lowest frequency band to move to the same gain reduction (minus a gain offset equal to the numerical setting of the control) as its nearest neighbor when gated. You can therefore set the maximum gain difference between the two low frequency bands, producing considerable dynamic bass boost on voice. This setting might be appropriate for news and sports.

> The difference will never exceed the difference that would have otherwise occurred if the lowest frequency band were gated independently. If you are familiar with older Orban processors like OPTIMOD-FM 8200, this is the maximum amount of boost that would have occurred if you had set their DJ BASS BOOST controls to ON.
>
> The amount of bass boost will be highly dependent on the fundamental frequency of a given voice. If the fundamental frequency is far above 100Hz, there will be little voice energy in the bottom band and little or no audio bass boost can occur even if the gain of the bottom band is higher than the gain of its neighbor. As the fundamental frequency moves lower, more of this energy leaks into the bottom band, and you hear more bass boost. If the fundamental frequency is very low (a rarity), there will be enough energy in the bottom band to force significant gain reduction, and you will hear less bass boost than if the fundamental frequency were a bit higher.
>
> This control is only available in the Five-Band structure.
>
> If the GATE THRESH (Gate Threshold) control is turned OFF, the DJ BASS boost setting is disabled.

HF Enhance is a program-adaptive, 6 dB/octave shelving equalizer with a 4 kHz turnover frequency. It constantly monitors the ratio between high frequency and broadband energy and adjusts the amount of equalization in an attempt to make this ratio constant as the program material changes. It can therefore create a bright, present sound without over-equalizing material that is already bright.

Highpass Filter determines if a sweepable 18 dB/octave highpass filter will be placed in-circuit before other processing. This filter is useful for reducing low frequency noise, particularly when OPTIMOD-PC is being used for production or mastering.

Lowpass Filter control sets the bandwidth (and therefore the amount of high frequency signal OPTIMOD-PC passes) from 10 kHz to 20 kHz. The lowpass filter can replace any anti-aliasing filters in downstream equipment. Set the filter to 20 kHz (full bandwidth) for downstream equipment with sample rates of 44.1 or 48 kHz. Set the filter to 15 kHz for 32 kHz sample rate. For other sample rates, set the filter so that it is as close as possible to 45% of the sample rate without exceeding 45%.

> This setting is unique to the preset in which it resides. Regardless of its setting, OPTIMOD-PC will not permit the system bandwidth to exceed the bandwidth set by the MAX LOWPASS FILTER parameter located in the Configuration page of the I/O Mixer.

Phase Rotator determines if the phase rotator will be in-circuit. The purpose of the phase rotator is to make voice waveforms more symmetrical. Because it can slightly reduce the clarity and definition of program material, we recommend leaving it OUT unless program material is mainly speech, where it may result in cleaner sound because it can substantially reduce the amount of gain reduction that OPTIMOD-PC's look-ahead limiter produces on speech waveforms.

Stereo Enhancer Controls

You can operate the stereo enhancer in one of two modes or "styles." The first emulates the Orban 222 analog stereo enhancer, while the second mode, called Delay, emulates a popular enhancer from another manufacturer that adds a delayed version of the L–R signal to the original L–R to create stereo enhancement. (See **Stereo Enhancement** on page 3-9 for more information.)

It is unwise to use stereo enhancement with low bitrate codecs. At low bitrates, these codecs use various parametric techniques for encoding the spatial attributes of the sound field. Stereo enhancement can unnecessarily stress this encoding process.

Both modes have gating that operates under two conditions.

- The two stereo channels are close to identical in magnitude and phase.

  In this case, the enhancer assumes that the program material is actually mono and thus suppresses enhancement to prevent the enhancement from exaggerating the undesired channel imbalance.

- The ratio of L–R / L+R of the enhanced signal tries to exceed the threshold set by the L-R / L+R Ratio Limit control.

  In this case, the enhancer prevents further enhancement in order to prevent excess L–R energy, which can increase multipath distortion.

The stereo enhancer has the following controls:

Amount sets the maximum spatial enhancement.

Enhancer In / Out bypasses the stereo enhancer. OUT is equivalent to setting the

Stereo Enhancer Controls	
Name	**Range**
Amount	0.0 ... 10.0
In / Out	Out / In
Ratio Lim	70 … 100%
Diffusion	Off, 0.3 ... 10.0
Style	222 / Delay

Table 3-5: Stereo Enhancer Controls

AMOUNT to 0.

L-R / L+R Ratio Limit sets the maximum amount of enhancement to prevent multipath distortion. However, if the original program material exceeds this limit with no enhancement, the enhancer will not reduce it.

Diffusion applies only to the DELAY enhancer. This control determines the amount of delayed L–R added to the original signal.

Style sets one of two stereo enhancer types: 222 or DELAY.

Depth sets the delay in the delay line. It applies only to the DELAY enhancer.

AGC Controls

The AGC is common to the Two-Band and Five-Band structures.

Five of the AGC controls are common to the Full Modify and Advanced Modify screens, with additional AGC controls available in the Advance Modify screen, as noted in the following table.

These controls are explained in detail below.

Each Factory Preset has a LESS-MORE control that adjusts loudness by altering the amount of dynamics processing. LESS-MORE simultaneously adjusts several of the dynamics processing controls to optimize the trade-offs between unwanted side ef-

AGC Controls	
Name	**Range**
AGC Off / On	Off / On
AGC Drive	–10 ... 25 dB
AGC Master Release	0.5, 1.0, 1.5, 2 … 20 dB / S
AGC Bass Release	1 … 10 dB/sec
AGC Gate Threshold	Off, –44 ... –15 dB
AGC Bass Coupling	0 … 24 dB, Off
AGC Window Size	–25 … 0 dB
AGC Window Release	0.5 … 20 dB
AGC Ratio	∞:1, 4:1, 3:1, 2:1
AGC Bass Threshold	–12.0 … 2.5 dB
AGC Idle Gain	–10 … +10 dB
AGC Master Attack	0.2 … 6
AGC Bass Attack	1 … 10
AGC Crossover	Allpass, LinearNoDelay,
AGC Matrix	L/R, sum/difference
AGC MaxDelta GR	0.0 … 24.0 dB, off
Master Delta Thresh	-6.0 … +6.0 dB

Table 3-6: AGC Controls

fects.

If you wish, you may adjust the Advanced Modify parameters to your own taste. Always start with LESS-MORE to get as close to your desired sound as possible. Then edit the Advanced Modify parameters using the Advanced Modify screen, and save those edits to a User Preset.

AGC ("AGC Off/On") control activates or defeats the AGC.

It is usually used to defeat the AGC when you want to create a preset with minimal processing (such as a CLASSICAL preset). The AGC is also ordinarily defeated if you are using a studio level controller to protect a transmission link before OPTIMOD-PC. However, in this case it is better to defeat the AGC globally in System Setup [see step (0 on page 2-20].

AGC Drive control adjusts signal level going into the slow dual-band AGC, therefore determining the amount of gain reduction in the AGC. This control also adjusts the "idle gain"—the amount of gain reduction in the AGC section when the structure is gated. (It gates whenever the input level to the structure is below the threshold of gating.)

The total amount of gain reduction in the Five-Band structure is the sum of the gain reduction in the AGC and the gain reduction in the five-band compressor. The total system gain reduction determines how much the loudness of quiet passages will be increased (and, therefore, how consistent overall loudness will be). It is determined by the setting of the AGC DRIVE control, by the level at which the console VU meter or PPM is peaked, and by the setting of the MULTIBAND DRIVE (compressor) control.

AGC Release ("AGC Master Release") control provides an adjustable range from 0.5 dB/second (slow) to 20 dB/second (fast). The increase in density caused by setting the AGC RELEASE control to fast settings sounds different from the increase in density caused by setting the Five-band's MULTIBAND RELEASE control to FAST. You can trade the two off to produce different effects.

Unless it is purposely speeded-up (with the AGC RELEASE control), the automatic gain control (AGC) that occurs in the AGC prior to the multiband compressor makes audio levels more consistent without significantly altering texture. Then the multiband compression audibly changes the density of the sound and dynamically re-equalize it as necessary (booming bass is tightened; weak, thin bass is brought up; highs are always present and consistent in level).

The various combinations of AGC and compression offer great flexibility:

- Light AGC + light compression yields a wide sense of dynamics, with a small amount of automatic re-equalization.
- Moderate AGC + light compression produces an open, natural quality with automatic re-equalization and increased consistency of frequency balance.

- Moderate AGC + moderate compression gives a more dense sound, particularly as the release time of the multiband compressor is sped up.
- Moderate AGC + heavy compression (particularly with a FAST multiband release time) results in a "wall of sound" effect, which may cause listener fatigue.
- Adjust the AGC (with the AGC DRIVE control) to produce the desired amount of AGC action, and then fine-tune the compression and clipping with the Five-Band structure's controls.

AGC Gate ("AGC Gate Threshold") control determines the lowest input level that will be recognized as program by OPTIMOD-PC; lower levels are considered to be noise or background sounds and cause the AGC or multiband compressor to gate, effectively freezing gain to prevent noise breathing.

In sound for picture, the setting of the gate threshold controls are quite critical if you want the processing to be undetectable to the audience. If this control is set too low, then OPTIMOD-PC will pump up quiet sounds such as ambience and underscoring to unnaturally high levels.

There are two independent silence-gating circuits in OPTIMOD-PC. The first affects the **AGC** and the second affects the **multiband compressor** (2-band or 5-band). Each has its own threshold control.

In the five-band structure, the multiband silence gate causes the gain reduction in bands 2 and 3 of the five-band compressor to move quickly to the average gain reduction occurring in those bands when the gate first turns on. This prevents obvious midrange coloration under gated conditions, because bands 2 and 3 have the same gain.

The multiband gate also independently freezes the gain of the two highest frequency bands (forcing the gain of the highest frequency band to be identical to its lower neighbor), and independently sets the gain of the lowest frequency band according to the setting of the DJ BASS boost control (in the Equalization screen). Thus, without introducing obvious coloration, the gating smoothly preserves the average overall frequency response "tilt" of the multiband compressor, broadly maintaining the "automatic equalization" curve it generates for a given piece of program material.

> If the MB GATE THR (Gate Threshold) control is turned OFF, the DJ BASS control is disabled.

AGC Bass Coupling control clamps the amount of dynamic bass boost (in units of dB) that the AGC can provide. (In V2.0, the unit of measure was percent.)

The AGC processes audio in a master band for all audio above approximately 200 Hz and a bass band for audio below approximately 200 Hz. Starting with V2.1 software, the AGC Master and Bass compressor sidechains operate without internal coupling. The gain reduction in the BASS audio path is either the output of the Bass compressor sidechain or the output of the Master band sidechain. The AGC BASS COUPLING control sets the switching threshold. For example, if the AGC BASS COUPLING control

is set to 4 dB and the master gain reduction is 10 dB, the bass gain reduction cannot decrease below 6 dB even if the gain reduction signal from the Bass compressor sidechain is lower. However, the audio path bass gain reduction can be larger than the master gain reduction without limit. In the previous example, the bass gain reduction could be 25 dB

The normal setting of the AGC BASS COUPLING control is 0 dB, which allows the AGC bass band to correct excessive bass as necessary but does not permit it to provide a dynamic bass boost.

Note that the operation of this control was changed in V2.1 software to work as explained above. You may have to tweak this control to achieve the same bass balance that you had previously with V2.0 software.

Window Size determines the size of the floating "slow zone" window in the master band of the AGC. (The Bass band is not windowed.)

The window works by slowing down changes in the AGC gain reduction that are smaller than the WINDOW SIZE. The window has 2:1 asymmetry around the current AGC gain reduction. For example, if the WINDOW SIZE is set to 4 dB, the window extends 4 dB in the release direction and 2 dB in the attack direction.

If the AGC needs to respond to a large change in its input level by making a gain change that is larger than the window, then the AGC's attack and release controls determine the AGC's response time. However, if the change in input level is smaller than the window size, the WINDOW RELEASE control determines the attack and release times. This is usually much slower than the normal AGC time constants. This prevents the AGC from building up density in material whose level is already well controlled.

The previous explanation was somewhat simplified. In fact, the window has "soft edges." Instead of switching abruptly between time constants, the attack and release times morph smoothly between the setting of the WINDOW RELEASE control and the setting of the AGC master release and attack controls.

The normal setting for the WINDOW SIZE is 3 dB.

Window Release (see WINDOW SIZE above.)

AGC Ratio determines the compression ratio of the AGC. The compression ratio is the ratio between the change in input level and the resulting change in output level, both measured in units of dB.

OPTIMOD-PC compressor can be operated at a compression ratio as low as 2:1. This can add a sense of dynamic range and is mostly useful for subtle fine arts formats like classical and jazz.

AGC Bass Threshold determines the compression threshold of the bass band in the AGC. It can be used to set the target spectral balance of the AGC.

As the AGC B CPL control is moved towards "100%," the AGC BASS THRESHOLD control affects the sound less and less.

The interaction between the AGC BASS THRESHOLD control and the AGC B CPL control is a bit complex, so we recommend leaving the AGC BASS THRESHOLD control at its factory setting unless you have a good reason for readjusting it.

AGC Idle Gain. The "idle gain" is the target gain of the AGC when the silence gate is active. Whenever the silence gate turns on, the gain of the AGC slowly moves towards the idle gain.

The idle gain is primarily determined by the AGC DRIVE setting—a setting of 10 dB will ordinarily produce an idle gain of –10 dB (i.e., 10 dB of gain reduction). However, sometimes you may not want the idle gain to be the same as the AGC DRIVE setting. The AGC IDLE GAIN control allows you to add or subtract gain from the idle gain setting determined by the AGC DRIVE setting.

You might want to do this if you make a custom preset that otherwise causes the gain to increase or decrease unnaturally when the AGC is gated. For example, to make the idle gain track the setting of the AGC DRIVE control, set the AGC IDLE GAIN control to zero. To make the idle gain 2 dB lower than the setting of the AGC DRIVE control, set the AGC IDLE GAIN control to –2.

AGC Bass Attack sets the attack time of the AGC bass compressor (below 200Hz).

AGC Master Attack sets the attack time of the AGC master compressor (above 200Hz).

AGC Bass Release sets the release time of the AGC bass compressor.

AGC Crossover allows you to choose ALLPASS or LINEARNODELAY modes.

ALLPASS is a phase-rotating crossover that introduces one pole of phase rotation at 200 Hz. The overall frequency response remains smooth as the two bands take different amounts of gain reduction—the response is a smooth shelf without extra peaks or dips around the crossover frequency. The two bands are down 3 dB at the crossover frequency. However, this mode adds group delay distortion and is therefore subtly less transparent-sounding than the LINEARNODELAY mode.

LINEARNODELAY (Linear-Phase; no delay) is a phase-linear crossover whose upper band is derived by subtracting its lower band from the crossover's input. When the upper and lower bands have the same gain, their sum is perfectly flat with no phase rotation. However, when the upper and lower bands have different gains, peaks and dips appear in the frequency response close to the crossover frequency. It is useful if you need a crossover with low delay and no phase distortion when flat. Its downside is the possibility of audible coloration when the gains of the two bands are considerably unequal.

AGC Matrix allows you to operate the AGC in left/right mode or in sum / difference mode. Usually you will operate in left/right mode. However, sum / difference mode can give a type of stereo enhancement that is different from the enhancement modes offered in OPTIMOD-PC's built-in stereo enhancer. This will only work if you allow the two channels of the AGC to have different gains. To do this, set the AGC MAXDELTGR control greater than zero.

AGC Max Delta GR determines the maximum gain difference permitted between the two channels of the AGC. Set it to "0" for perfect stereo coupling.

> This control works the same regardless of whether the AGC operates in left/right or sum / difference MATRIX modes, in both cases controlling the maximum gain difference between the "channels." Depending on the MATRIX mode setting, the "channels" will handle left and right signals or will handle sum and difference signals. When the AGC operates in sum / difference MATRIX mode, this control determines the maximum amount of width change in the stereo soundfield.

Master Delta Threshold allows you to set the difference between the compression thresholds of the sum and difference channels. (This control is only useful when you set the AGC MATRIX to SUM / DIF.) By setting the threshold of the difference channel lower than the sum channel, you can have the AGC automatically produce more gain reduction in the difference channel. This will reduce the separation of material with an excessively wide stereo image (like old Beatles records). To make this work, you must set the MAX DELTA GR control away from zero. For example, to limit an excessively wide image while preventing more than 3 dB difference in gain between the sum and difference channels, set the MAX DELTA GR control to 3.0 and the MASTER DELTA THRESHOLD control to some positive number, depending on how much automatic width control you want OPTIMOD-PC to perform.

Bass Delta Threshold works the same as MASTER DELTA THRESHOLD, but applies to the bass band. You will usually set it the same as MASTER DELTA THRESHOLD.

Distortion Control

The distortion control adjustments are common to the Two-Band and Five-Band structures except as noted in the descriptions on the following pages.

Bass Clip Threshold controls Orban's patented embedded bass clipper. The SPEECH BASS CLIP THRESHOLD control overrides the BASS CLIP THRESHOLD control when OPTIMOD-PC automatically detects speech (page 3-5).

The bass clipper is embedded in the multiband crossover so that harmonics created by clipping are rolled off by part of the crossover filters. The threshold of this clipper is ordinarily set between 0 dB and 6 dB below the threshold of the look-ahead limiter, depending on the setting of the LESS-MORE control in the parent preset upon which you are basing your Advanced Control adjustments. This provides headroom for contributions from the other four bands so that bass transients don't smash

against the look-ahead limiter, causing audible intermodulation distortion between the bass and higher frequency program material.

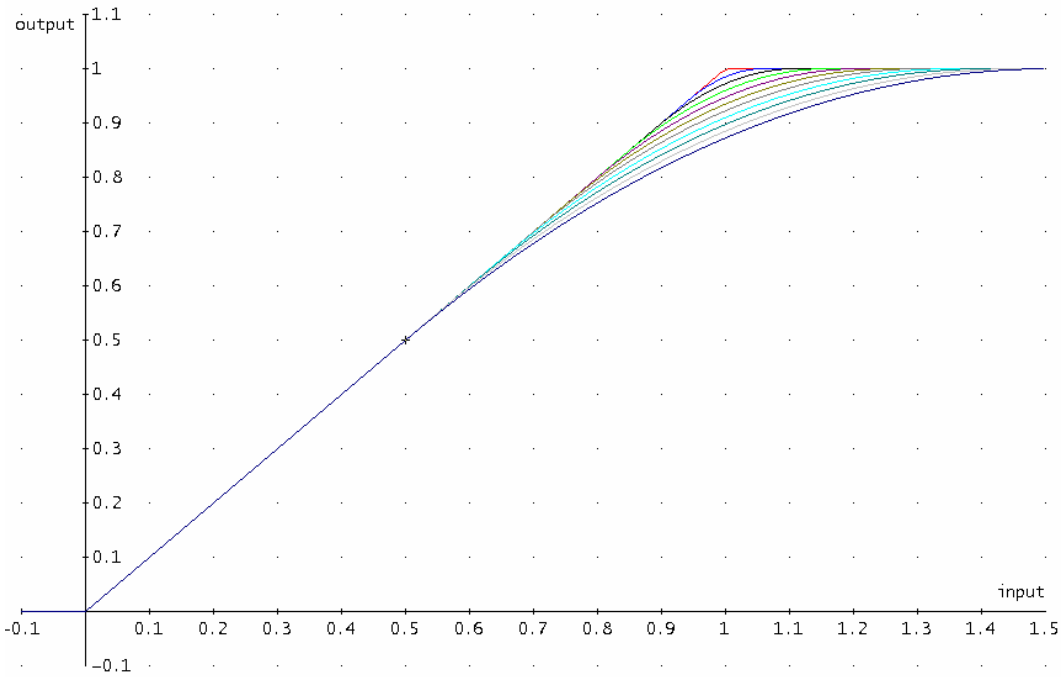


Figure 3-3: Bass Clipper Input/Output Transfer Curves as Bass Clip Shape Control is Varied from 0.0 (Hard) to 10.0 (Soft)

Some OPTIMOD-PC users feel that the bass clipper unnecessarily reduces bass punch at its factory settings. To accommodate these users, the threshold of the bass clipper is user-adjustable. The range (with reference to the look-ahead limiter threshold) is 0 to –6dB. (You can also turn the bass clipper off.) As you raise the threshold of the clipper, you will get more bass but also more distortion and pumping. Be careful when setting this control; do not adjust it casually. Listen to program material with heavy bass combined with spectrally sparse midrange material (like a singer) and listen for IM distortion induced by the bass' pushing the midrange into the look-ahead limiter. Although the low-IM technology in OPTIMOD-PC's look-ahead limiter substantially reduces this distortion, overdriving the limiter hard enough can still cause problems.

In the Five-Band structure, the sum of band 1 and 2 drives the clipper. In the Two-Band structure, the Bass band drives the clipper.

Bass Clip Shape allows you to change the knee of the input/output gain curve of the bass clipper. It allows you to control the shape of the "knee"—the transition between no clipping and flat topping. "0" provides the hardest knee, where the transition between linear operation and flat topping occurs abruptly as the clipper's input level is changed. "10" is the softest knee, where the transition starts 6 dB be-

low BASSCLIPTHRESH setting and occurs gradually. The factory default setting is "7.6." See Figure 3-3 on page 3-39.

Final Limit Drive control adjusts the level of the audio driving the low-IM look-ahead limiter that OPTIMOD-PC uses to control fast peaks, thereby adjusting the peak-to-average ratio of the processed audio. The FINAL LIMIT DRIVE control primarily determines the loudness/distortion trade-off.

Turning up the FINAL LIMIT DRIVE control drives the look-ahead limiter harder, reducing the peak-to-average ratio, and increasing the loudness on the air. When the amount of limiting is increased, the audible intermodulation distortion caused by limiting increases, even though special algorithms minimize the increase compared to less sophisticated designs. Lower settings reduce loudness, of course, but result in a cleaner sound.

When you use OPTIMOD-PC in a preemphasized mode (step 5 on page 2-23), this inserts a frequency-dependent high frequency boost before the look-ahead limiter. This boost can be as large as 20 dB at 20 kHz. When using preemphasis, you must turn down the FINAL LIMIT DRIVE control to prevent the look-ahead limiter from causing audible gain pumping.

> You may find it illuminating to recall several Factory Presets, adjust LESS-MORE to several points in its range, and then open the Full Control screen to examine the trade-offs between the release time and FINAL LIMIT drive made by the factory programmers. However, note that all Factory Presets were created to complement FLAT preemphasis. As explained above, you must turn down the FINAL LIMIT DRIVE control when using preemphasis.

Distortion Control Adjustments	
Name	**Range**
Bass Clip Threshold	–6.0 … +6.00, Off
Speech Bass Clip Threshold	–6.0 … +6.00, Off
Bass Clip Shape	0.0 … 10.0
Final Limit Drive	–10.0 … +12.0

Table 3-7: Distortion Control Adjustments

The Two-Band Structure

The Two-Band structure consists of a stereo enhancer, a slow two-band gated AGC for gain riding, an equalization section, a gated two-band compressor, and a low-IM look-ahead limiter. It shares the stereo enhancer, AGC, equalizer, and look-ahead limiter with the Five-Band structure. The Two-Band and Five-Band compressors are always active simultaneously. OPTIMOD-PC switches between the structures by sending the output of the desired compressor to the look-ahead limiter's input. Switching between the compressors occurs via a smooth cross-fade.

OPTIMOD-PC's Two-Band Structure can be made phase-linear throughout to maximize sonic transparency. However, you can also choose an allpass crossover structure (see AGC CROSSOVER on page 3-37).

The Two-Band structure has an open, easy-to-listen-to sound that is similar to the source material if the source material is of good quality. However, if the spectral balance between the bass and high frequency energy of the program material is incorrect, the Two-Band structure (when its BASS COUPLING control is operated toward 0%) can gently correct it without introducing obvious coloration.

> If you need these automatic re-equalization capabilities of the Two-Band structure, you may find one of the Five-Band presets to be even more effective.

There are several Two-Band presets. See *Table 3-2: Radio-Style Presets* on page 3-21.

The PROTECT-0DB preset uses the Two-Band structure. In this preset, the stereo enhancer, AGC, and equalizer are defeated via their user controls.

Customizing the Settings

Each Two-Band Factory Preset has a LESS-MORE control (located in the Basic Modify screen) that adjusts loudness. LESS-MORE simultaneously adjusts all of the processing controls to optimize the trade-offs between unwanted side effects as processing levels are decreased or increased.

If you wish, you may adjust the Modify parameters to your own taste. Always start with LESS-MORE to get as close to your desired sound as possible. Then edit the Modify parameters using the Basic, Intermediate or Advanced Modify screen, and save those edits to a User Preset.

The Two-Band Structure's Full and Advanced Setup Controls

The tables below show a summary of the Two-Band controls in the dynamics section.

AGC, Equalizer, Stereo Enhancer, and Clipper controls are common to both Two-Band and Five-Band structures and are described in the pages above.

Some of the Two-Band controls are common to the Full Modify and Advanced Modify screens, with additional Two-Band controls available in the Advanced Modify screen.

2B DRIVE control adjusts signal level going into the two-band compressor, and therefore controls the density of output audio by determining the amount of gain reduction in the two-band compressor. The resulting sound texture can be open and transparent, solid and dense, or somewhere in between. The range is 0 to 25dB.

Regardless of the release time setting, we feel that the optimal amount of gain reduction in the two-band compressor for popular music and talk formats is 10-15dB.

If less gain reduction is used, loudness can be lost. For classical formats, operating with 0-10 dB of gain reduction (with the gain riding AGC set to OFF) maintains a sense of dynamic range while still controlling levels effectively. Because OPTIMOD-PC's density gently increases between 0 and 10 dB of compression, 10 dB of compression sounds very natural, even on classical music.

2B REL ("2B Release") control determines how fast the two-band compressor releases (and therefore how quickly loudness increases) when the level of the program material decreases. This release time only applies when the silence gate does not gate the Two-Band Compressor.

The control can be adjusted from 0.5 dB/second (slow) to 20 dB/second (fast). Settings toward 20 dB/second result in a more consistently loud output, while settings toward 0.5 dB/second allow a wider variation of dynamic range. Both the setting of the 2B REL control and the dynamics and level of the program material determine the actual release time of the compressor. In general, you should use faster release times for mass-appeal pop or rock formats oriented toward younger audiences, and slower release times for more conservative, adult-oriented formats (particularly if women are an important part of your target audience).

> We expect that the Two-Band structure will be rarely used for pop music formats because the Five-Band structure gives better results in almost all cases.

The action of the 2B REL control has been optimized for resolution and adjustability. Its setting is critical to sound quality—listen carefully as you adjust it. There is a point beyond which increasing density (with faster settings of the 2B REL control) will no longer yield more loudness, and will simply degrade the punch and definition of the sound.

When the 2B REL control is set between 8 and 1 dB/second (the slowest settings), the amount of gain reduction is surprisingly non-critical. Gating prevents noise from being brought up during short pauses and pumping does not occur at high levels of gain reduction. Therefore, the primary danger of using large amounts of gain reduction is that the level of quiet passages in input material with wide dynamic range

Two-Band Controls	
Advanced Name	**Range**
2B Drive	–10 … 25 dB
2B Release	0.5 … 20 dB / S
2B Release Shape	Linear, Exponential
2B Gate Threshold	Off, –44 … –15 dB
2B Bass Coupling	0 … 100 %
Bass Clip Threshold	-6.0 … 0.0 dB
2B Master Compression Threshold	–15 … 0, Off
2B Bass Compression Threshold	-10.0 … 5.0 dB, Off
2B Master Attack	4 … 50, Off
2B Bass Attack	4 … 50, Off

Table 3-8: Two-Band Controls

may eventually be increased unnaturally. Accordingly, when you operate the 2B REL control between 8 and 2 dB/second, it may be wise to defeat the gain-riding AGC and to permit the two-band compressor to perform all of the gain riding. This will prevent excessive reduction of dynamic range, and will produce the most natural sound achievable from the Two-Band structures.

With faster 2B REL control settings (above 8 dB/second), the sound will change substantially with the amount of gain reduction in the two-band compressor. This means that you should activate the gain-riding AGC to ensure that the two-band compressor is always being driven at the level that produces the amount of gain reduction desired. Decide based on listening tests how much gain reduction gives you the density that you want without creating a feeling of over-compression and fatigue.

Release in the two-band compressor automatically becomes faster as more gain reduction is applied (up to about 10dB). This makes the program progressively denser, creating a sense of increasing loudness although peaks are not actually increasing. If the gain-riding AGC is defeated (with the AGC ON/OFF control), you can use this characteristic to preserve some feeling of dynamic range. Once 10 dB of gain reduction is exceeded, full loudness is achieved—no further increase in short-term density occurs as more gain reduction is applied. This avoids the unnatural, fatiguing sound often produced by processors at high gain reduction levels, and makes OPTIMOD-PC remarkably resistant to operator gain-riding errors.

2B REL SHAPE ("2B Release Shape") selects a LINear or EXPonential release shape.

LINEAR causes the Two-Band compressor to release at a constant number of dB per second, while EXPONENTIAL causes the release to commence slowly and then speed up as it progresses. The Exponential shape allows you to create the open sound of a slow release time with program material that is well controlled in level, while permitting the processing to quickly correct excessively low input levels. We recommend using EXPONENTIAL for general-purpose programming. We only recommend LINEAR for musical programming, where EXPONENTIAL may create unnatural side effects. (If the 2B RELEASE control is set between about 0.5 and 2 dB/second, an EXPONENTIAL release shape should cause no problems even with music.)

2B GATE ("2B Gate Threshold") threshold control determines the lowest input level that will be recognized as program material by OPTIMOD-PC; lower levels are considered to be noise or background sounds and will cause the AGC or two-band compressor to gate, effectively freezing gain to prevent noise breathing.

There are two independent gating circuits in OPTIMOD-PC Two-Band structure. The first affects the *AGC* and the second affects the *two-band compressor*. Each has its own threshold control.

The two-band gain reduction will eventually recover to 0 dB and the AGC gain reduction will eventually recover to –10 dB even when the silence gate is gated. However, recovery is slow enough to be imperceptible. This avoids OPTIMOD-PC's getting stuck with a large amount of gain reduction on a long, low-level musical passage immediately following a loud passage.

It is common to set the 2B GATE control to approximately –35 dB. Lower settings are sometimes useful for musical programming.

BASS CPL ("2B Bass Coupling") is used to set the balance between bass and the rest of the frequency spectrum.

The two-band compressor processes audio in a master band for all audio above approximately 200Hz, and a bass band for audio below approximately 200Hz. The BASS CPL control determines how closely the spectral balance of material below 200Hz matches that of the program material above 200Hz.

Settings toward 100% (wideband) make the output sound most like the input. Because setting the BASS CPL control at 100% will sometimes cause bass loss, the most accurate frequency balance will often occur with this control set between 70% and 90%. The optimal setting depends on the amount of gain reduction applied. Adjust the BASS CPL control until the band 1 and band 2 Gain Reduction meters track as closely as possible.

With the 2B REL (2B Release) control set to 2 dB/second, setting the BASS CPL control toward 0% (independent) produces a sound that is very open, natural, and non-fatiguing, even with large amounts of gain reduction. Such settings provide a bass boost on some program material that lacks bass.

With fast release times, settings of the BASS CPL toward 100% (wideband) do not sound good. Instead, set the BASS CPL control toward 0% (independent). This combination of fast release and independent operation of the bands provides the maximum loudness and density on small radios achievable by the Two-Band structure. However, such processing may fatigue listeners with high-quality receivers, and requires you to activate the AGC to control the average drive level into the two-band compressor, preventing uncontrolled build-up of program density. Instead of operating the Two-Band structure like this, you should choose a Five-Band preset instead.

Bass Clip ("Bass Clip Threshold"): See page 3-38.

2B Clip is a compression threshold control that equally affects the bass and master bands. It sets the drive level look-ahead limiter.

2B High Frequency Limiting sets the threshold of the high frequency limiter in the Two-Band structure. When this control is set lower, gain reduction does more high frequency limiting. When this control is set higher, distortion-cancelled clipping does more high frequency limiting. This control controls the tradeoff between loss of high frequencies (due to high frequency limiting) and excessive distortion (due to clipping).

FINAL LIMT ("Final Limit Drive"): See page 3-40.

2B Master Compression Threshold sets the level where gain reduction starts to occur in the Master (above 200Hz) band of the Two-Band Compressor.

2B Bass Threshold determines the compression threshold of the bass band (below 200 Hz) in the Two-Band Compressor. It can be used to set the target spectral balance of the Two-Band Compressor.

As the Two-Band Compressor BASS CPL control is moved towards "100%," the 2B BASS THRESHOLD control affects the sound less and less.

2B Master Attack sets the attack time of the Two-Band Compressor master compressor (above 200Hz).

2B Bass Attack sets the attack time of the Two-Band Compressor bass compressor (below 200Hz).

2B Crossover sets the structure of the two-band crossover to Allpass or Linear. See AGC CROSSOVER on page 3-37 for more detail about these modes.

The Five-Band Structure

The Five-Band structure consists of a stereo enhancer, a slow gain-riding two-band AGC, an equalization section, a five-band compressor, a dynamic single-ended noise reduction system, an output mixer (for the five bands), and a low-IM look-ahead limiter.

Unlike the Two-Band structure, whose two-band compressor has a continuously variable release time, the release time of the Five-Band compressor is switchable to seven increments between slow and fast. Each setting makes a significant difference in the overall flavor and quality of the sound.

When the input is noisy, you can sometimes reduce the noise by activating the single-ended noise reduction system. Functionally, the single-ended noise reduction system combines a broadband downward expander with a program-dependent low-pass filter. This noise reduction can be valuable in reducing audible hiss, rumble, or ambient studio noise. We use it for the news and sports factory presets.

The Five-Band structure does not have a separate Loudness Controller because its Five-Band compressor automatically re-equalizes the spectral balance of various pieces of program material in a way that tends to make their loudness more consistent.

Putting the Five-Band Structure on the Air

The Five-Band structure is very flexible, enabling you to fine-tune your sound for your target audience and desired market position. There are several basic Factory Presets for the Five-Band structure. Each of these presets can be edited with the LESS-MORE control. This control affects the video-oriented presets differently than it does the music presets (presets with "music" in their names). When a video-oriented

preset is on the air, the LESS-MORE control adjusts the average amount of gain reduction by adjusting the drive level to the Five-Band structure's input. This also adjusts the idle gain—the amount of gain reduction in the AGC section when the structure is gated. (It gates whenever the input level to the structure is below the threshold of gating.)

When a music preset is on the air, the LESS-MORE control sets the amount of overall processing, making optimum tradeoffs between loudness, brightness, and distortion. In sound for picture, there are no loudness wars; for music presets, there is no need to advance the LESS-MORE control beyond its setting in the Factory Presets.

Customizing the Settings

The controls in the Five-Band structure give you the flexibility to customize your station sound. However, as with any audio processing system, proper adjustment of these controls requires proper balancing of the trade-offs explained above. The following provides the information you need to adjust the Five-Band structure controls to suit your programming and taste.

The Five-Band Structure's Full and Advanced Setup Controls

The tables below summarize the Five-band and Band Mix controls in the dynamics section. The AGC, Equalizer, Stereo Enhancer, and Clipper controls are common to both the Two-Band and Five-Band structures and are discussed in their own sections in Section 3.

Multiband Drive control adjusts the signal level going into the five-band compressor, and therefore determines the average amount of gain reduction in the five-band compressor. Range is 25dB.

Adjust the MULTIBAND DRIVE control to your taste and programming requirements. Used lightly with a slow or medium release time, the Five-Band compressor produces an open, re-equalized sound that is appropriate for most video programming. The

Five-Band Controls	
Advanced Name	**Range**
Multiband Drive	0 ... 25
Multiband Gate Threshold	Off, –44 ... –15 dB
Downward Expander	Off, –18.0 … 12.0 dB
B5 Downward Expander	Off, –18.0 … 12.0 dB
Downward Expander Stereo Coupling	
B1/B2 XOVER	100 Hz, 200 Hz
B1 MaxDeltGr	0 … 24 dB, Off
B2 MaxDeltGr	0 … 24 dB, Off
B3 MaxDeltGr	0 … 24 dB, Off
B4 MaxDeltGr	0 … 24 dB, Off

Table 3-9: Five-band Controls

Five-Band compressor can increase audio density when operated at a fast or medium-fast release because it acts more and more like a fast limiter (not a compressor) as the release time is shortened. With fast and medium-fast release times, density also increases when you increase the drive level into the Five-Band compressor because these faster release times produce more limiting action. Increasing density can make loud sounds seem louder, but can also result in an unattractive busier, flatter, or denser sound. It is very important to be aware of the many negative subjective side effects of excessive density when setting controls that affect the density of the processed sound.

Because OPTIMOD-PC's AGC algorithm uses sophisticated window gating, it is preferable to make the AGC do most of the gain riding (instead of the five-band compressor), because the AGC can ride gain quickly without adding excessive density to program material that is already well controlled. Use the five-band compressor lightly, so it can achieve automatic re-equalization of material that the AGC has al-

Multiband Attack/Release/Threshold	
Advanced Name	**Range**
Multiband Release	Slow, Slow2, Med, Med2, MFast, MFast2, Fast
Speech Multiband Release	Slow, Slow2, Med, Med2, MFast, MFast2, Fast
B1 Compression Threshold	–16.00 … 0.0, Off
B2 Compression Threshold	–16.00 … 0.0, Off
B3 Compression Threshold	–16.00 … 0.0, Off
B4 Compression Threshold	–16.00 … 0.0, Off
B5 Compression Threshold	–16.00 … 0.0, Off
B1 Speech Compression Threshold	–16.00 … 0.0, Off
B2 Speech Compression Threshold	–16.00 … 0.0, Off
B3 Speech Compression Threshold	–16.00 … 0.0, Off
B4 Speech Compression Threshold	–16.00 … 0.0, Off
B5 Speech Compression Threshold	–16.00 … 0.0, Off
B1 Attack	4.0 … 50.0 ms, Off
B2 Attack	4.0 … 50.0 ms, Off
B3 Attack	4.0 … 50.0 ms, Off
B4 Attack	4.0 … 50.0 ms, Off
B5 Attack	4.0 … 50.0 ms, Off
Speech B1 Attack	4.0 … 50.0 ms, Off
Speech B2 Attack	4.0 … 50.0 ms, Off
Speech B3 Attack	4.0 … 50.0 ms, Off
Speech B4 Attack	4.0 … 50.0 ms, Off
Speech B5 Attack	4.0 … 50.0 ms, Off
B1 Limiter Attack	0 … 100%
B2 Limiter Attack	0 … 100%
B3 Limiter Attack	0 … 100%
B4 Limiter Attack	0 … 100%
B5 Limiter Attack	0 … 100%
B1 Delta Release	–6 … 6
B2 Delta Release	–6 … 6
B3 Delta Release	–6 … 6
B4 Delta Release	–6 … 6

Table 3-10: Multiband Attack / Release Controls

ready controlled without adding excessive density to the audio or re-equalizing to an unnatural extent.

The MULTIBAND DRIVE interacts with the MULTIBAND RELEASE. With slower release time settings, increasing the MULTIBAND DRIVE control scarcely affects density. Instead, the primary danger is that the excessive drive will cause noise to be increased excessively when the program material becomes quiet. You can minimize this effect by activating the single-ended noise reduction and/or by carefully setting the MULTIBAND GATE THRESHOLD control to freeze the gain when the input gets quiet.

When the release time of the Five-Band compressor is set towards FAST, the setting of the MULTIBAND DRIVE control becomes much more critical to sound quality because density increases as the control is turned up. Listen carefully as you adjust it. With these fast release times, there is a point beyond which increasing the Five-Band compressor drive will no longer yield more loudness, and will simply degrade the punch and definition of the sound. Instead, let the AGC do most of the work.

Because excessive loudness is an irritant in sound for picture, there is almost never any reason to push processing to the point where it degrades the audio. We recommend no more than 10dB gain reduction as shown on the meters for Band 3. More than 10dB, particularly with the fast release time, will often create a wall of sound effect that many find fatiguing.

To avoid excessive density with fast Five-Band release time, we recommend using no more than 5dB gain reduction in band 3, compensating for any lost loudness by speeding up the AGC RELEASE instead.

Multiband Release; Speech Multiband Release control can be switched to any of seven settings. To understand how to adjust this control for video programming, please see the discussion above under MB DRIVE.

The SPEECH MB RELEASE control overrides the MB RELEASE control when OPTIMOD-PC automatically detects speech (page 3-5). You may wish to set the SPEECH MB RELEASE control faster for speech (to maximize smoothness and uniformity) and slower on music (to prevent excessive build-up of density).

Compression Threshold; Speech Compression Threshold controls set the compression threshold for music and speech in each band (following OPTIMOD-PC's automatic speech/music discriminator), in units of dB. We recommend making small changes around the factory settings to preserve the internal headroom built into the processing chain. These controls will affect the spectral balance of the processing above threshold, but are also risky because they can significantly affect the amount of distortion produced by the back-end clipping system.

You can use these controls to set independent frequency balances for music and speech (page 3-5).

MB Gate ("Multiband Gate Threshold") control determines the lowest input level that will be recognized as program by OPTIMOD-PC; lower levels are considered to be noise or background sounds and cause the AGC or multiband compressor to gate, effectively freezing gain to prevent noise breathing.

There are two independent gating circuits in OPTIMOD-PC. The first affects the AGC and the second affects the five-band compressor. Each has its own threshold control.

The multiband silence gate causes the gain reduction in bands 2 and 3 of the five-band compressor to move quickly to the average gain reduction occurring in those bands when the gate first turns on. This prevents obvious midrange coloration under gated conditions, because bands 2 and 3 have the same gain.

The gate also independently freezes the gain of the two highest frequency bands (forcing the gain of the highest frequency band to be identical to its lower neighbor), and independently sets the gain of the lowest frequency band according to the setting of the DJ BASS boost control (in the Equalization screen). Thus, without introducing obvious coloration, the gating smoothly preserves the average overall frequency response "tilt" of the five-band compressor, broadly maintaining the "automatic equalization" curve it generates for a given piece of program material.

> If the MB GATE control is turned OFF, the DJ BASS control (in the Equalization screen) is disabled.

DWNEXP ("Multiband Downward Expander Threshold") determines the level below which the single-ended noise reduction system's downward expander begins to decrease system gain and below which the high frequencies begin to become low-pass filtered to reduce perceived noise. There are two controls: the MB DOWN EXPANDER control sets the expansion threshold in Bands 1-4, while the B5 DOWN EXPANDER control sets the expansion threshold in Band 5. Activate the single-ended dynamic noise reduction by setting these controls to a setting other than OFF.

The single-ended noise reduction system combines a broadband downward expander with a program-dependent low-pass filter. These functions are achieved by causing extra gain reduction in the multiband compressor. You can see the effect of this extra gain reduction on the gain reduction meters.

Ordinarily, the gating on the AGC and multiband limiter will prevent objectionable build-up of noise and you will want to use the single-ended noise reduction only on unusually noisy program material. Modern commercial recordings will almost never need it. We expect that its main use will be in talk-oriented programming, including sports.

Please note that it is impossible to design such a system to handle all program material without audible side effects. You will get best results if you set the MB DOWN EXPANDER control of the noise reduction system to complement the program material you are processing. The MB DOWN EXPANDER should be set higher when the input is noisy and lower when the input is relatively quiet. The best way to adjust the MB DOWN EXPANDER control is to start with the control set very high. Reduce the control setting while watching the gain reduction meters. Eventually, you will see the gain increase in sync with the program. Go further until you begin to hear noise modulation—a puffing or breathing sound (the input noise) in sync with the input program material. Set the MB DOWN EXPANDER control higher until you can no longer hear the noise modulation. This is the best setting.

Obviously, the correct setting will be different for a sporting event than for classical music. It may be wise to define several presets with different settings of the MB DOWN EXPANDER control and to recall the preset that complements the program material of the moment.

Note also that it is virtually impossible to achieve undetectable dynamic noise reduction of program material that is extremely noisy to begin with, because the program never masks the noise. It is probably wiser to defeat the dynamic noise reduction with this sort of material (traffic reports from helicopters and the like) to avoid objectionable side effects. You must let your ears guide you.

Band 5 is particularly critical for noise reduction because much of the Downward Expander's utility lies in hiss reduction. Hiss has most of its energy in band 5, while program material typically has less energy in this band, so the B5 DOWN EXPANDER control's setting is critical to removing hiss while minimizing removal of desired program energy.

Starting in V2.1, the Downward Expander's dynamic frequency response is no longer constrained to being strictly lowpass—Band 5 is now uncoupled from the lower bands, so the band 5 downward expander can produce less gain reduction than other bands. This can help prevent loss of desired high frequency material in the program. Moreover, the lowest threshold setting has been lowered from –6 to –18 dB. This allows the Downward Expander to operate more subtly on material that is only moderately noisy, like many old music recordings.

B3>B4 CPL ("Band 3>4 Coupling") control determines the extent to which the gain of band 4 (centered at 3.7 kHz) and 5 (above 6.2 kHz) are determined by and follows the gain of band 3 (centered at 1 kHz). Set towards 100% (fully coupled) this control reduces the amount of dynamic upper midrange boost, preventing unnatural upper midrange boost. The gain of band 5 is further affected by the B4>B5 CPL control.

Excessive HF energy is one cause of audibly objectionable artifacts in low bitrate codecs. The B3>B4 CPL AND B4>B5 CPL controls can be very useful in reducing such artifacts—setting them for large amounts of coupling will minimize OPTIMOD-PC's ability to dynamically increase high frequency energy.

B4>B5 CPL ("Band 4>5 Coupling") controls the extent to which the gain of band 5 (6.2 kHz and above) is determined by and follows the gain of band 4.

The sum of the high frequency limiter control signal and the output of the B4>B5 CPL CONTROL determines the gain reduction in band 5. The B4>B5 CPL control receives the independent left and right band 4 gain control signal. Range is 0 to 100% coupling.

B3>B2 CPL and **B2>B3 CPL** controls determine the extent to which the gains of bands 2 and 3 track each other.

When combined with the other coupling controls, these controls can adjust the five-band processing to be anything from fully independent operation to quasi-wideband processing.

B2>B1 CPL control determines the extent to which the gain of band 1 (below 100Hz or 200Hz, depending on crossover setting) is determined by and follows the gain of band 2 (centered at 400Hz). Set towards 100% (fully coupled), it reduces the amount of dynamic bass boost, preventing unnatural bass boost. Set towards 0% (independent), it permits frequencies below 100Hz (the "slam" region) to have maximum impact in modern rock, urban, dance, rap, and other music where bass punch is crucial. Accordingly, it can be useful in music video oriented formats.

Bx Out ("Band x Output Mix") controls determine the relative balance of the bands in the five-band compressor. Because these controls mix *after* the band compressors, they do not affect the compressors' gain reductions and can be used as a graphic equalizer to fine-tune the spectral balance of the program material over a ±6 dB range.

Their range has been purposely limited because the only gain control element after these controls is the look-ahead limiter, which can produce pumping or distortion if overdriven. The thresholds of the individual compressors have been tuned to prevent audible distortion with almost any program material. Large changes in the frequency balance of the compressor outputs will change this tuning, leaving OPTIMOD-PC more vulnerable to unexpected audible distortion with certain program material.

You can also get a similar effect by adjusting the compression threshold of the individual bands. This is comparably risky with reference to look-ahead limiter overload, but unlike the MB BAND MIX controls, the threshold adjustments do not affect the frequency response when a given band is below threshold and is thus producing no gain reduction.

B1-B5 On/Off switches allow you to mute any combination of bands in the five-

Band Mix	
Advanced Name	**Range**
B2>B1 Coupling	0 ... 100 %
B2>B3 Coupling	0 ... 100 %
B3>B2 Coupling	0 … 100 %
B3>B4 Coupling	0 ... 100 %
B4>B5 Coupling	0 ... 100 %
B1 Output Mix	–6.0 … +6.0
B2 Output Mix	–6.0 … +6.0
B3 Output Mix	–6.0 … +6.0
B4 Output Mix	–6.0 … +6.0
B5 Output Mix	–6.0 … +6.0
B1 On/Off	On, Off
B2 On/Off	On, Off
B3 On/Off	On, Off
B4 On/Off	On, Off

Table 3-11: MB Band Mix Controls

band compressor and permit you to "solo" any individual band.

B1-B5 Attack (Time); Speech B1-B5 Attack controls set the speed with which the gain reduction in each band responds to level changes at the input to a given band's compressor for music and speech respectively, following OPTIMOD-PC's automatic speech/music detector. These controls are risky and difficult to adjust appropriately. They affect the sound of the processor in many subtle ways. The main trade-off is "punch" (achieved with slower attack times) versus distortion and/or pumping produced in the look-ahead limiter (because slower attack times increase overshoots that the look-ahead limit must eliminate). The results are strongly program-dependent and must be verified with listening tests to a wide variety of program material.

Because there are separate controls for music and speech (page 3-5), you can set attack times faster for speech (to minimize look-ahead limiter artifacts) and slower for music (to maximize punch and transient definition).

The ATTACK time controls are calibrated in arbitrary units that very approximately correspond to milliseconds. Higher numbers correspond to slower attacks.

Limiter Attack controls allow you to set the limiter attack anywhere from 0 to 100% of normal in the Five-Band compressors, each of whose gain reduction has a fast-release (limiter) and slow-release (compressor) component. Because the limiter and compressor characteristics interact, you will usually get best audible results when you set these controls in the range of 70% to 100%. Below 70%, you will usually hear pumping because the compressor function is trying to create some of the gain reduction that the faster limiting function would have otherwise achieved. If you hear pumping in a band and you still wish to adjust the limiter attack to a low setting, you can sometimes ameliorate or eliminate the pumping by slowing down the compressor attack time in that band.

These controls have nothing to do with the final look-ahead limiter.

Delta Release controls are differential controls. They allow you to vary the release time in any band of the Five-Band compressor/limiter by setting an offset between the MULTIBAND RELEASE setting and the actual release time you achieve in a given band. For example, if you set the MULTIBAND RELEASE control to medium-fast and the BAND 3 DELTA GR control to –2, then the band 3 release time will be the same as if you had set the MULTIBAND RELEASE control to medium and set the BAND 3 DELTA GR control to 0. Thus, your settings automatically track any changes you make in the MULTIBAND RELEASE control. In our example, the release time in band 3 will always be two "click stops" slower than the setting of the MULTIBAND RELEASE control.

If your setting of a given DELTA RELEASE control would otherwise create a release slower than "slow" or faster than "fast" (the two end-stops of the MULTIBAND RELEASE control), the band in question will instead set its release time at the appropriate end-stop.

Band 1-5 MaxDeltGR controls set the maximum permitted gain difference between the left and right channels for each band in the multiband limiter. The 1101V2 five-band processing chain uses a full dual-mono architecture, so the chan-

nels can be operated anywhere from fully coupled to independent. We recommend operating band 1-4 fully coupled (BAND 1-4 MAXDELTGR = 0) for best stereo image stability. However, audio-processing experts may want to experiment with lesser amounts of coupling to achieve a wider, "fatter" stereo image at the cost of some image instability.

B5 MAXDELTGR is set OFF most factory presets. This permits band 5 to be used as a fast-operating high frequency limiter that works independently on the left and right channels. This prevents gain reduction in one channel from causing audible spectral modulation on the other channel. However, the additional stereo difference channel energy created by independent operation can adversely affect certain low bitrate codecs (like WMA). It is wise to do careful listening tests through the codec to determine if it sounds better with B5 MAXDELTGR = 0 dB.

B1/B2 Crossover (Band 1 to Band 2 Crossover Frequency) sets the crossover frequency between bands 1 and 2 to either 100 Hz or 200 Hz. It significantly affects the bass texture, and the best way to understand the differences between the two crossover frequencies is to listen.

If the Host Computer Restarts or Crashes...

When you are using OPTIMOD-PC's hardware inputs and outputs (that is, when OPTIMOD-PC is emulating a stand-alone audio processor), OPTIMOD-PC is designed to gracefully handle problems that occur in the host computer:

- If the host computer is restarted in an orderly way (using Windows' "restart" command), OPTIMOD-PC will continue to process audio normally through its hardware inputs and outputs with no gaps or interruptions. This allows you to do normal Windows security updates without interrupting the audio even if the updates require you to restart your computer.
- If the host computer crashes, OPTIMOD-PC will usually continue to pass signal normally through its hardware inputs and outputs because its processing is done with onboard DSP, independent of the computer's CPU or operating system. When you finally reset the host computer to recover from the crash (via either a hardware reset or Ctrl-Alt-Del), OPTIMOD-PC will also reset and will temporarily load unity-gain bypass DSP code. This will cause a mute lasting a fraction of a second. OPTIMOD-PC will then continue to pass signal through this bypass code until its driver has loaded, at which point the driver will load normal audio processing DSP code into OPTIMOD-PC. After another fraction-of-a-second mute to accommodate the load, OPTIMOD-PC will now operate normally, using the same preset that was active before the crash.

See *About the OPTIMOD-PC Driver and Service* on page 4-3.

Using OPTIMOD-PC for Production and Mastering

OPTIMOD-PC can be a useful tool for mastering and production applications in the professional audio industry, such as preparation of equalized, level-controlled, peak limited CD masters. We have frequently used OPTIMOD-PC in this context, achieving excellent results.

Because of their broadcast origins, most of OPTIMOD-PC's presets provide more processing than would ordinarily be required for mastering. In addition, we would expect that the mastering engineer would want to carefully tweak a preset to complement the program material being mastered. OPTIMOD-PC V2 provides important tools to allow a mastering engineer to fine-tune the processing to complement the program material:

- Three bands of parametric equalization with low-noise filter structures and curves modeled after classic second-order analog bell-shaped EQ.
- A powerful, low-noise parametric bass shelving equalizer with sweepable frequency and a choice of 6, 12, or 18 dB/octave slopes.
- Two-band and five-band compressor/limiters with phase-linear crossovers and powerful controls, including attack time, release time, and threshold for each band. These compressor/limiters also feature user-adjustable interband coupling to allow the user to operate them anywhere from quasi-wideband to fully independent.
- A look-ahead peak limiter with advanced, proprietary distortion reduction algorithms.

You cannot create a user preset "from scratch"; you must create it by modifying an existing preset, factory or user. Each preset has an "easy adjustment" facility called LESS-MORE, which is a one-knob provision for turning the amount of processing up or down.

Systematically, the following is a good method for creating mastering presets. It assumes that you have already set the processor mixer controls to achieve normal drive levels.

A) Decide whether you are going to use two-band or five-band processing.

> Two-band processing retains any fixed equalization originally applied to the program (except for a mild amount of dynamic adjustment to bass below 200 Hz); five-band processing performs an "automatic re-equalization" function. Both flavors of processing can be extremely smooth and unobtrusive. Because the five-band compressor/limiter offers user-adjustable interband coupling that determines the "discreteness" of the multiband compression, it is usually the best choice.

B) If you are going to use two-band processing, recall the 2B CLASSICAL preset. If you are going to use five-band processing, recall the 5B CLASSICAL preset.

C) In the Edit/Basic Control screen, adjust LESS-MORE to 1.0 (the lowest setting).

D) Choose Edit/Advanced Control to access the individual processing settings.

E) If you have recalled one of the CLASSICAL presets, the AGC will already be OFF. If you need a very large amount of compression for an application like processing material intended for in-flight entertainment systems, you can edit either edit the preset turn the AGC on, or start with a preset other than CLASSICAL or PROTECT.

> You can turn the AGC off globally for all presets, which is convenient if you don't expect to use it in the future. See step (0 on page 2-20.

F) Unless you will be using a large amount of compression for special applications, set the MB GATE THRESHOLD to OFF.

G) Adjust the 2B DRIVE control (two-band) or MB DRIVE control (five-band) to achieve the desired amount of multiband gain reduction.

H) Adjust the release time control (2B RELEASE or MB RELEASE) to achieve the desired compression density.

> If you are using the Five-Band structure, you can use the DELTA RELEASE controls to fine-tune the release time of each band independently.
>
> The release characteristic is always "automatic" (i.e., multiple time constant), and the RELEASE control simply scales this process. This, combined with multiband operation, makes the compression remarkably resistant to the usual compressor pumping and squashing.

I) Adjust the ATTACK TIME controls on the individual compressors to trade off overshoot control against transient punch.

J) Adjust the LIMITER ATTACK TIME controls to taste.

> These controls allow you to set the limiter attack anywhere from 0 to 100% of normal in the Five-Band compressors, each of whose gain reduction has a fast-release (limiter) and slow-release (compressor) component. Because the limiter and compressor characteristics interact, you will usually get best audible results when you set these controls in the range of 70% to 100%. Below 70%, you will usually hear pumping because the compressor function is trying to create some of the gain reduction that the faster limiting function would have otherwise achieved. If you hear pumping in a band and you still wish to adjust the limiter attack to a low setting, you can sometimes ameliorate or eliminate the pumping by slowing down the compressor attack time in that band.

K) Adjust the THRESHOLD controls in the individual bands to achieve the desired amount of gain reduction.

> This is the most effective way to set the spectral balance of the processing when the compressor is exhibiting gain reduction.

L) Adjust equalization as necessary.

> As discussed above, there a multiband equalizer available between the AGC and multiband compressor. In five-band mode, there is also a five-band mix control (functioning as a graphic equalizer) after the five-band

compressor and a threshold control for each band compressor. In five-band mode, any fixed equalization will be partially "undone" by the dynamic re-equalization effect of the five-band compression, so two-band mode is most useful when you are relying on OPTIMOD-PC's fixed EQ or on external EQ earlier in the signal path.

Note also that you can use the individual band compression threshold controls, the BASS COUPLING control, and HF COUPLING control to affect the amount of automatic re-equalization performed by the five-band compression. As you set these controls closer to 100%, they permit progressively less dynamic LF and HF program-adaptive boost. If you feel that the dynamic re-equalization is not producing enough brightness when the program material lacks high frequencies, you should turn the BAND 3>4 and BAND 4>5 COUPLING closer to 0%. Similarly, if weak bass is not sufficiently boosted, turn the BAND 2>1 COUPLING closer to 0%.

M) Set the amount of peak limiting with the FINAL LIMIT control.

In general, the less peak limiting you use, the better sounding the result will be. However, if your client demands a "loud" CD, OPTIMOD-PC's look-ahead peak limiter is a powerful tool for achieving this with minimum distortion or other side effects. Nevertheless, be aware that this function is not like some familiar "look-ahead" limiters. The release time is in the order of a few milliseconds and is not user adjustable. The purpose of the limiter is *only* to limit peaks that pass through the earlier compressors because of their finite attack times. Functionally it is used like a peak clipper, but it has vastly reduced modulation distortion by comparison to a clipper, whether "soft knee" or "hard knee."

The main potential side effects of the look-ahead limiter are gain breathing and a "warbling" sound in the midrange when heavy bass is simultaneously present. Listen carefully for this intermodulation effect (particularly on vocals) when you are adjusting the FINAL LIMIT control.

N) Adjust the BASS CLIP control to complement the amount of final limiting.

For most mastering applications, you can set it to Off. Which defeats it. However, if you hear pumping or distortion in the look-ahead limiter caused by heavy bass transients, you can reduce this effect by setting the BASS CLIP to a lower level. (The BASS CLIP control is calibrated in "dB below the final limiter threshold.")

O) If you want to compare your processed sound to the unprocessed original, recall the BYPASS preset and toggle between it and your processing preset. If there is a gross loudness disparity, you may wish to edit the gain within the BYPASS preset and save this as a user preset. However, be careful not to clip the output if you set the bypass for gain.

You can determine whether you are clipping by observing the level meter in the OUTPUT page of the mixer.

P) Save your preset using File/Save Preset.

Once you have created one "mastering" preset, you can edit it to create others and save them under different names.

Q) For a 44.1 kHz output sample rate, set the digital output level to –0.5dBfs; this will prevent overshoots caused by sample rate conversion. For a 48 kHz output sample rate, set the digital output level to –0.1dBfs.

> At 44.1 kHz, the output samples are not exactly the same ones that the look-ahead limiter controlled at the internal 48 kHz sample rate, so slight overshoot can occur. At 48 kHz output sample rate, overshoot will be less than 0.1dB.

Creating Custom "Factory" Presets

You can create custom "factory" presets that support LESS-MORE functionality. These presets will behave like Orban's factory presets.

Your 1101's software has the ability to interpolate all 19 available LESS-More increments (1.0 through 10.0) from two or more LESS-MORE "anchor" preset files. In addition, there must be a "factory preset" file. The instructions below show you how to create these files from user preset files that you have saved.

In the examples below, the specified file locations are based on OPTIMOD-PC's default locations. Using Windows Explorer, check the factory preset file locations on your computer to find out where these files are actually located. You must place your new "factory preset" files in analogous locations.

To create a custom "factory" preset:

1. **Choose a name for the preset.**

   You cannot use the name of an existing factory preset without damaging it. We will use "My Preset" as the preset name in the examples below.

2. **Create a folder for your presets.**

   Create a folder named "My Preset" within the directory

   ```
   \Program Files\Orban\OPTIMOD-PC2\presets
   ```

   > You should see all of the subdirectories for Orban's factory presets in this director

3. **Choose the default LESS-MORE value for your preset.**

4. **Using the OPTIMOD-PC Control Application, create user presets for each LESS-MORE anchor point.**

   See *User Processing Presets* starting on page 1-11.

   Because LESS-MORE works only on the dynamics processing, you must choose a set of equalizer settings for your new preset that is the same for all anchor pre-

sets. *Table 3-4: Equalization Controls* on page 3-27 shows the controls that must be set identically in all anchor presets.

You must create at least two anchor presets, one for LESS-MORE = 1.0 and one for LESS-MORE = 10.0. Additionally, if the default LESS-MORE value you chose in step 3 is neither 1.0 nor 10.0, you must create a third anchor preset for the default LESS-MORE value.

You may add as many additional anchor presets as you wish to fine-tune the behavior of LESS-MORE. Some Orban factory presets use as many as six anchor presets.

From the OPTIMOD-PC Control Application, save each preset as a user preset in plain text (unencrypted) form, naming it `My Preset LMxxx`, where `xxx` stands for the LESS-MORE setting that corresponds to that preset. For example, for LESS-MORE = 1.0, `xxx` = 010.

5. Copy the user presets you made.

Copy these presets in the `\Program Files\Orban\OPTIMOD-PC2\presets\My Preset\` folder that you made in step 2.

6. Edit the file extensions.

In Windows, change the extension of each of your preset's file names to `orbf11`

7. Edit the text within the preset files.

A) In turn, open each of your preset files in a text editor like Notepad or WordPad. The editor you use must open and save files in plain text format.

B) Edit the second line of the file as follows:

```
Preset Name=<MY PRESET LMxxx> size=126
```

where `LMxxx` agrees with the file name

Do not change the number after `size`

C) Edit the third line of the file as follows:

```
Factory Preset Name=<MY PRESET>
```

D) Edit the fifth line of the file as follows:

```
Preset File Name= <MY PRESET LMxxx.orbf11>
```

where `MY PRESET LMxxx.orbf11` is the same as the file name.

E) At the end of the file, find the "LESS-MORE" line and edit it as follows:

```
C:<LESS MORE>Cent:x;D:y;
```

Replace the "x" and the "y" with the file's associated LESS-MORE data. See Table 3-12.

F) Save your edited file as a plain text file. (This should happen automatically if you edited the file using a text editor, not a word processor.)

G) Repeat steps (A) through (F) for each anchor file you created.

8. Create the factory preset file.

A) Copy the LESS-MORE file corresponding to your preset's default LESS-MORE setting, placing the copied file in

```
\Program Files\Orban\OPTIMOD-PC2\presets
```

B) Edit the file name of the file you copied to remove `LMxxx`, including the space before the "L." The example file name is

```
MY PRESET.orbf11
```

C) Open `MY PRESET.orbf` in a text editor.

D) Edit the second line of the file as follows:

```
Preset Name<MY PRESET> size=126
```

Do not change the number after `size`

E) Edit the fifth line of the file as follows:

```
Preset File Name= <MY PRESET.orbf11>
```

LESS-MORE	x	y
1.0	100	0
1.5	150	1
2.0	200	2
2.5	250	3
3.0	300	4
3.5	350	5
4.0	400	6
4.5	450	7
5.0	500	8
5.5	550	9
6.0	600	10
6.5	650	11
7.0	700	12
7.5	750	13
8.0	800	14
8.5	850	15
9.0	900	16
9.5	950	17
10.0	1000	18

Table 3-12: LESS-MORE Reference

Your new "factory preset" is now ready for use. When you recall a preset via the OPTIMOD-PC Control Application, the new preset should appear in the OPEN PRESET window. After you recall it, LESS-MORE should be available.

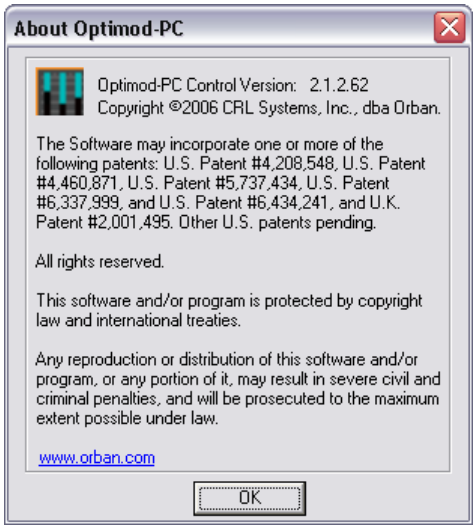
It is wise to back up your new"factory" preset (i.e., the factory preset file and less-more anchor files) elsewhere.

Section 4

Software Summary

Optimod-PC Software Summary

The Optimod-PC software version number is available through the Control Application `Help > About` menu.



Application Installation File

- `Setup1101xxx.exe` – Installer:
  - Installs the Control Application – `optimod2.exe`
  - Installs the Agent – `Optimod2Agent.exe`
  - Installs the Service – `Optimod2Service.exe`
  - Installs the Driver – `Optimod2.sys; Optimod2.inf`

    Note that you must uninstall any previous version of the Optimod-PC software via Windows Add/Remove Programs before upgrading. If you do not do this, the installer will unable to overwrite the service.

After you upgrade the driver, you must reboot of your computer to re-load the driver and to clear old DSP code from the 1101.

Driver Files

- `Optimod2.sys` – Optimod-PC Driver
- `Optimod2.inf` – Optimod-PC Driver Install Information

Driver

- Always required for operation of Optimod-PC, except as noted in the section *Hardware I/O and PCI Expansion Chassis* on page 4-3.
- Provides basic sound card operation for Windows WAVE I/O.
- Provides advanced sound card operation when used with Control Application and Service.
- Cold boot without Optimod-PC Service: driver loads default I/O and default DSP.
- Cold boot: driver loads defined I/O and default DSP.
- Warm boot: driver does not reload DSP.
- The driver is not required for Optimod-PC to pass audio from its hardware analog or digital inputs to its hardware outputs. Therefore, if Windows fails, the Optimod-PC hardware I/O continues to pass and process audio as normal. If Optimod-PC is located in an external PCI chassis, the host computer can lose power or be turned off and Optimod-PC will continue to pass and process audio normally.

Service

- During cold boot: loads all user DSP preset information.
- Provides remote control security and access.
- The Service is not required for computers that only remotely access Optimod-PC cards but where no Optimod-PC card is installed locally.

Agent (Tray Icon)

- The Optimod-PC Agent is a tray icon that allows you to launch the Optimod-PC Control Application from the Windows System Tray.
- If you right click the tray icon, a menu pops up with a checkable item named AUTO-START THE TRAY ICON. (The "Auto-start the tray icon" item will be checked by default.)

- If you uncheck AUTO-START THE TRAY ICON, the tray icon will not re-appear when you re-start the PC.
- To re-engage the icon, go to START/PROGRAMS/ORBAN/OPTIMOD-PC and select `OptimodPcAgent`.

> You do not need to open the Optimod-PC Control Application to toggle the auto-start feature on and off.

Control Application

- Provides access to all Optimod-PC I/O Mixer Controls, DSP Processing Parameters, and Presets.
- Can be used as a client to remotely access Optimod-PC cards.
- Driver and Service are not necessary for Optimod-PC Remote Client Operation.

Registry

- I/O Settings
- Active Preset
- Encrypted Security
- Application GUI Settings

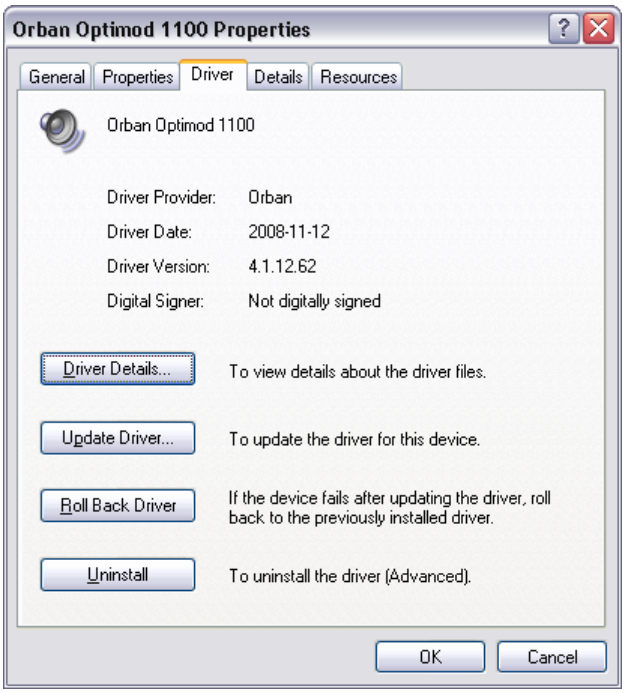
Hardware I/O and PCI Expansion Chassis

The Optimod-PC driver and software are not necessary to permit a card to pass audio from its physical input(s) to output(s). Optimod-PC cards powered from an external PCI expansion chassis continue to pass audio in the absence of the host computer or in the event of its failure. However, the driver and service *are* required to initialize the card.

About the OPTIMOD-PC Driver and Service

The Optimod-PC driver version number is available through

`Control Panel > System > Hardware > Device Manager > Sound, Video, and Game Controllers > Orban Optimod 1100.`



The OPTIMOD-PC driver is responsible for low-level communication between the OPTIMOD-PC card and your computer's operating system. When the driver starts up, it checks a flag on each OPTIMOD-PC card to determine if it needs to reload DSP code into the card.

> It does not reload DSP code or parameters when Windows reboots normally, as it might after a security update, for example.

When the computer first powers up and Windows starts, the driver temporarily loads a general-purpose preset that enables the card to pass audio. It also reloads the system parameters, like input and output levels, which it reads from the computer's Registry. As soon as the OPTIMOD-PC service finishes starting up, the service will load the same processing preset that was active on the OPTIMOD-PC card when the computer shut down. If the service does not start up for some reason, then this power-down processing preset will not be restored and the general-purpose preset (loaded by the driver) run instead.

The service is also responsible for verifying that the DSP code version running on the card is the same as the DSP code with which the service was compiled. If it is not, the service will load the more recent DSP code. Additionally, the service is an intermediary that allows the OPTIMOD-PC Control Application to talk to an OPTIMOD-PC card, whether local or on the network.

OPTIMOD-PC will continue to pass audio through its hardware inputs and outputs even if the Optimod-PC driver and service stop running.

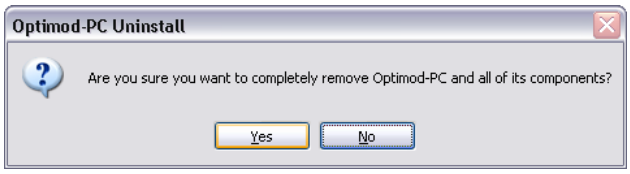
Section 5

Uninstallation

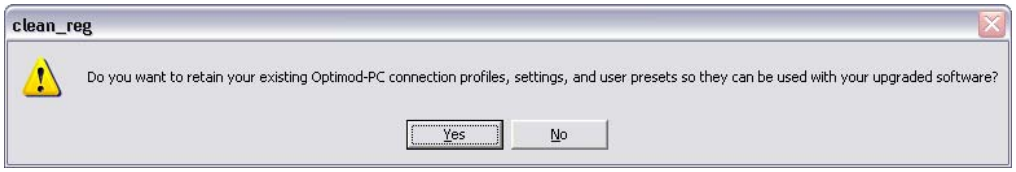
Uninstalling the OPTIMOD-PC Software

Use the normal Windows Add/Remove Programs mechanism to uninstall the OPTIMOD-PC application. Choose "Optimod-PC vX.X.X.X" in the Windows Add/Remove Programs list under the Control Panel.

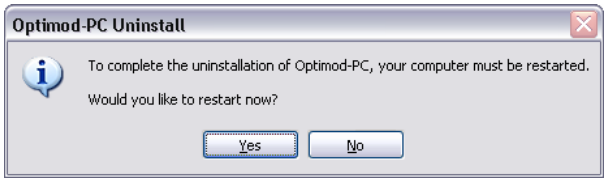
The Uninstaller will uninstall the OPTIMOD-PC Control Application, `optimod2.exe`, Service, `Optimod2Service.exe`, Driver, `optimod2.sys`, all Optimod-PC related Registry entries, and all Connection Profiles, Settings, and User Presets, if desired.



The Uninstaller will ask if you wish to retain your existing Optimod-PC connection profiles, settings, and user presets so they can be used with your upgraded software. These files should be moved, backed-up, and/or saved, if they will be used for another installation or computer.



The computer must be restarted to unload the driver and complete the uninstallation.



Section 6

Control API

Optimod-PC System/Mixer Control API

The OPTIMOD-PC Service application hosts a TCP/IP terminal server to allow external control of the OPTIMOD-PC cards from either a Telnet/SSH client or a custom third party application. All OPTIMOD-PC Mixer and System Controls are accessible and all commands are simple text strings. Upon receiving valid commands, OPTIMOD-PC will confirm by returning a simple text string status message. By implementing external control this way, multiple OPTIMOD-PC cards can be controlled using standards-based network protocols (that are not Microsoft Windows-specific) anywhere that network connectivity is available.

To protect the Terminal Server from unauthorized remote access, the default setting for the control "Use localhost only for Terminal Access" is enabled. In this case, only Telnet/SSH connections from the local host address 127.0.0.1 on the default port 11101 are accepted. Disabling this will allow Telnet/SSH connections via Ethernet or a direct RS232 serial connection from other computers, using the IP address of the host computer. This control is located in the OPTIMOD-PC remote application in the

Command	Function
ver	Retrieves control application version information.
enum	Retrieves serial numbers for each card installed in the computer.
list	Retrieves control mnemonics and a verbose name for each control.
param	Retrieves valid value for specified control.
header	Retrieves a C format header file for program integration.
<serial> <[password]> <CONTROL> ??	Retrieves all valid values for specified control.
<serial> <[password]> <CONTROL> ?	Retrieves current value for control on specified card.
<serial> <[password]> <CONTROL> <value>	Sets new current value for control on specified card.
<serial> <[password]> AP ??	Retrieves all available Presets.
<serial> <[password]> AP ?	Retrieves Active Preset.
<serial> <[password]> RP <preset>	Sets Processing Preset.
<serial> <[password]> AS ??	Retrieves all available Configurations.
<serial> <[password]> AS ?	Retrieves Active Configuration.
<serial> <[password]> RS <config>	Sets Configuration.
<serial> <[password]> STATUS	Retrieves all current control values and active preset on specified card.

Table 6-1: Telnet/SSH Command List

TOOLS>SERVICE SETUP dialog box and is accessible only when the application is disconnected from a Local card. The default port can be changed here too.

Note that you only need to supply a password in the commands shown in Table 6-1 if you previously created a Terminal Password. See step (6.E) on page 6-7.) If there is no password assigned to the card, omit the brackets [] shown in the examples.

To control OPTIMOD-PC externally, establish a Telnet/SSH connection and issue commands and parameters, either by typing them directly into a Telnet/SSH client or by placing them within batch files. Then process them with a scriptable Telnet/SSH client that supports this operation, such as PuTTY, along with its companion command-line interpreter, Plink. Both of these applications are available for free download from the following web site:

http://www.chiark.greenend.org.uk/~sgtatham/putty/

Automating control changes is possible using the Windows Task Scheduler to launch batch files at the desired time.

Custom third party applications can be developed to use this protocol. Additionally, you can include this protocol in an existing application by using small subsets of the standards-based Telnet/SSH protocols directly, or for simplicity, by using scripting or by calling batch files with a Telnet/SSH client such as PuTTY along with its companion command-line interpreter, Plink. Scripting eliminates the need to develop networking code or otherwise contend with complex, limited-function Microsoft Windows specific programming APIs, like the Windows Audio Mixer. Developing a third party application or including the protocol in an existing application eliminates having to install and configure additional applications. Using small subsets of the standards-based Telnet/SSH protocol allows more operational flexibility without a system performance hit and simplifies development compared to proprietary OEM APIs.

Commands are case-sensitive and must be entered exactly as shown. Replace "[password]" with the actual password of the card being addressed. If there is no password assigned to the card, omit the brackets [] shown in the examples.

Table 6-2 describes the available command strings and their functions. To demonstrate this functionality, you may type the commands directly into a Telnet/SSH client terminal and see OPTIMOD-PC confirmation and status messages.

Command	Values	Function
D1OSR	32kHz 44.1kHz 48kHz 88.2kHz 96kHz	Digital 1 Output Sample Rate
D1OS	Int D1 D2	Digital 1 Output Sync Source
D1OF	AES SPDIF	Digital 1 Output Format
A1IRL	+4dB -10dB	Analog 1 Input Ref Level
A1POL	+4dB -10dB	Analog 1 Proc Output Level
AGC1	Enabled Disabled	AGC 1
A1PIL	-Inf, -40.0dB to 0.0dB (in 0.1dB steps)	Analog 1 Process Mixer Input Level
D1PIL	-Inf, -40.0dB to 0.0dB (in 0.1dB steps)	Digital 1 Process Mixer Input Level

Command	Values	Function
D2PIL	-Inf, -40.0dB to 0.0dB (in 0.1dB steps)	Digital 2 Process Mixer Input Level
W1PIL	-Inf, -40.0dB to 0.0dB (in 0.1dB steps)	Wave 1 Process Mixer Input Level
A1DIL	-Inf, -40.0dB to 0.0dB (in 0.1dB steps)	Analog 1 Direct Mixer Input Level
D1DIL	-Inf, -40.0dB to 0.0dB (in 0.1dB steps)	Digital 1 Direct Mixer Input Level
D2DIL	-Inf, -40.0dB to 0.0dB (in 0.1dB steps)	Digital 2 Direct Mixer Input Level
W1DIL	-Inf, -40.0dB to 0.0dB (in 0.1dB steps)	Wave 1 Direct Mixer Input Level
A1PIM	Mute Unmute	Analog 1 Process Mixer Input Mute
A1PIB	Mute Unmute	Analog 1 Process Mixer Backup
D1PIM	Mute Unmute	Digital 1 Process Mixer Input Mute
D2PIM	Mute Unmute	Digital 2 Process Mixer Input Mute
D2IB	Mute Unmute	Digital 2 Process Mixer Backup
W1PIM	Mute Unmute	Wave 1 Process Mixer Input Mute
A1DIM	Mute Unmute	Analog 1 Direct Mixer Input Mute
A1DIB	Mute Unmute	Analog 1 Direct Mixer Backup
D1DIM	Mute Unmute	Digital 1 Direct Mixer Mute
D2DIM	Mute Unmute	Digital 2 Direct Mixer Mute
D2DB	Mute Unmute	Digital 2 Direct Mixer Backup
W1DIM	Mute Unmute	Wave Direct Mixer Input Mute
AIPB	-6.0dB to 6.0dB (in 0.1dB steps)	Analog 1 Input Process Mixer Balance
D1IPB	-6.0dB to 6.0dB (in 0.1dB steps)	Digital 1 Input Process Mixer Balance
D2IPB	-6.0dB to 6.0dB (in 0.1dB steps)	Digital 2 Input Process Mixer Balance
W1IPB	-6.0dB to 6.0dB (in 0.1dB steps)	Wave 1 Input Process Mixer Balance
A1IDB	-6.0dB to 6.0dB (in 0.1dB steps)	Analog 1 Input Direct Mixer Balance
D1IDB	-6.0dB to 6.0dB (in 0.1dB steps)	Digital 1 Input Direct Mixer Balance
D2IDB	-6.0dB to 6.0dB (in 0.1dB steps)	Digital 2 Input Direct Mixer Balance
W1IDB	-6.0dB to 6.0dB (in 0.1dB steps)	Wave 1 Input Direct Mixer Balance
A1OL	-20.0dB to 0.0dB (in 0.1dB steps)	Analog 1 Output Level
D1OL	-20.0dB to 0.0dB (in 0.1dB steps)	Digital 1 Output Level
W1OL	-20.0dB to 0.0dB (in 0.1dB steps)	Wave 1 Output Level
A1OM	Mute Unmute	Analog 1 Output Mute
D1OM	Mute Unmute	Digital 1 Output Mute
W1OM	Mute Unmute	Wave 1 Output Mute
D1OWL	14bit 16bit 18bit 20bit 24bit	Digital 1 Output Word Length (bits)
D1ODT	In Out	Digital 1 Output Dither
D1ODL	Minimum 30fps 29.970fps 25fps 24fps 33ms to 60ms (in 1ms steps)	Digital 1 Output Delay
AIDMX	Stereo MonoL MonoR MonoS	Analog 1 Input Direct Mixer Mode
D1IDMX	Stereo MonoL MonoR MonoS	Digital 1 Input Direct Mixer Mode
D2IDMX	Stereo MonoL MonoR MonoS	Digital 2 Input Direct Mixer Mode
W1DIMX	Stereo MonoL MonoR MonoS	Wave 1 Input Direct Mixer Mode
A1IPMX	Stereo MonoL MonoR MonoS	Analog 1 Input Process Mixer Mode
D1IPMX	Stereo MonoL MonoR MonoS	Digital 1 Input Process Mixer Mode
D2IPMX	Stereo MonoL MonoR MonoS	Digital 2 Input Process Mixer Mode
W1PIMX	Stereo MonoL MonoR MonoS	Wave 1 Input Process Mixer Mode
A1OR	DirWave DirMixer ProcMixer0Limit ProcMixer1Limit	Analog 1 Output Router
D1OR	DirWave DirMixer ProcMixer0Limit ProcMixer1Limit	Digital 1 Output Router
W1OR	DirWave DirMixer ProcMixer0Limit ProcMixer1Limit	Wave 1 Output Router

Command	Values	Function
AIMG	0dB +12dB	Analog 1 Input Max Gain (dB)
MLPF1	10kHz 11kHz 12kHz 13kHz 14kHz 15kHz 16kHz 17kHz 18kHz 19kHz 20kHz	Max Low Pass Frequency (kHz) 1

Table 6-2: OPTIMOD-PC System Command and Status List

Using the API and the 1100 Control Application Simultaneously

IMPORTANT: it is *unsafe to send commands to the API of a card within a given computer while the Control Application is connected to that card via the Application's "Local" connection.* This can create conflicts within the OPTIMOD-PC software that could cause system instability. Instead, you must connect the Control Application to a local card through a "localhost" TCP/IP connection.

To do this, create a new profile, following the instructions in step 10 on page 2-10 and using IP address 127.0.0.1 (localhost). Then connect the Control Application to the local card as you would to any card residing in a remote computer (step 11 on page 2-12).

Using the API: Examples

These examples show how PuTTY and Plink can be used to control OPTIMOD-PC using scripting and batch files on the same computer as the OPTIMOD-PC to be controlled. Plink and all associated scripting text, PuTTY, and batch files should be located together in the same user-defined directory unless the path is specified in the .bat files.

In all examples, replace "11111111" with the addressed card's serial number and "11101" with the card's port number. 11101 is the default; see step (7.D) on page 2-8.

Each control session requires two ASCII files:

- a .bat file that calls Plink to establish a Telnet connection to OPTIMOD-PC
- a reference.txt file that contains the actual control script.

Setting the Analog Output Level

These two functions will adjust the Analog Output Level to 0dB and –20dB respectively.

The file "analog_out_level_0.bat" contains:

```
plink -telnet -P 11101 127.0.0.1 < analog_out_level_0.txt
```

The file "analog_out_level_0.txt" contains:

```
11111111 [password] AOL 0.0dB
disconnect
```

The file “analog_out_level_-20.bat” contains:

```
plink -telnet -P 11101 127.0.0.1 < analog_out_level_-20.txt
```

The file “analog_out_level_-20.txt” contains:

```
11111111 [password] AOL -20.0dB
disconnect
```

Muting the Wave Input

These two functions will mute and unmute the Wave Processed Mixer Input.

The file “mute_wave.bat” contains:

```
plink -telnet -P 11101 127.0.0.1 < mute_wave.txt
```

The file “mute_wave.txt” contains:

```
11111111 [password] WPIM Mute
disconnect
```

The file “unmute_wave.bat” contains:

```
plink -telnet -P 11101 127.0.0.1 < unmute_wave.txt
```

The file “unmute_wave.txt” contains:

```
11111111 WPIM Unmute
disconnect
```

Toggling the Audio Inputs to Insert Replacement Commercials

The two examples will toggle the audio input between the Analog Processed Mixer input and the Wave Processed Mixer input. This is useful if a radio station requires separate commercials on-air and on its Internet stream.

In this scenario, OPTIMOD-PC processes all audio sources to achieve a consistent, professional sound. No additional sound card is required. The analog input of OPTIMOD-PC receives the radio station program audio to be streamed. Secondary playout software, running on the same computer as OPTIMOD-PC, plays commercials intended only for the stream. This software is configured to use OPTIMOD-PC as its sound device. When a commercial in the radio station’s program audio is to be replaced by a different commercial for the stream, the primary playout system starts

the streamed commercial on the secondary playout system and executes `audio_insert.bat`. When the streamed commercial ends, the secondary playout system executes `audio_norm.bat` to restore the main program feed.

In a related scenario, the digital input of OPTIMOD-PC can be used for digital studios. The .txt script file would be edited to switch the digital input. Because OPTIMOD-PC has four inputs, one can imagine advanced scenarios where the automation switches up to four audio sources.

The file "audio_norm.bat" contains:

```
plink -telnet -P 11101 127.0.0.1 < audio_norm.txt
```

The file "audio_norm.txt" contains:

```
111111111 APIM Unmute
111111111 WPIM Mute
disconnect
```

The file "audio_insert.bat" contains:

```
plink -telnet 127.0.0.1 < audio_insert.txt
```

The file "audio_insert.txt" contains:

```
111111111 WPIM Unmute
111111111 APIM Mute
disconnect
```

Microsoft Windows Mixer Control API

The Optimod-PC driver appears to Windows as a standard Windows DirectSound Device. It appears as two devices, Input/Recording and Output/Playback. The Optimod-PC serial number is appended to the device names between parentheses, especially useful in systems with multiple cards.

Windows Driver Function	Windows Audio Device Name
Sound Playback	Orban Optimod 1101 (SERIAL)
Sound Recording	Orban Optimod 1101 (SERIAL)

Table 6-3: Windows Driver Enumeration

The Optimod-PC driver supports standard Microsoft Windows mixer controls under Windows 2000 and XP only. This allows third-party software applications to control the I/O of the Optimod-PC DSP Mixer directly using the Windows Mixer API. It also presents a standard Windows Mixer Peak Meter Control that allows applications to

read the peak wave out values for both channels by using standard Windows Mixer API calls.

The Optimod-PC driver creates two mixer destinations, one for output and one for input. The following tables list the relevant enumerated Windows Mixer components by name for each destination, along with their corresponding control in the Optimod-PC Application.

Windows Mixer Component Name	Optimod-PC Application Control
Analog Out	Output Levels/Analog Output
Digital Out	Output Levels/Digital Output
Wave Out	Output Levels/Wave Output to PC

Table 6-4: Windows Mixer Output Destination Names

Windows Mixer Component Name	Optimod-PC Application Control
Dir Analog	Direct Mixer/Analog Input
Dir Digital 1	Direct Mixer/Digital 1 Input
Dir Digital 1	Direct Mixer/Digital 2 Input
Dir Wave In	Direct Mixer/Wave Input from PC
Proc Analog	Processor Mixer/Analog Input
Proc Digital 1	Processor Mixer/Digital 1 Input
Proc Digital 1	Processor Mixer/Digital 2 Input
Proc Wave In	Processor Mixer/Wave Input from PC

Table 6-5: Windows Mixer Input Destination Names

Each mixer component supports a mono volume control and a mono mute control. Windows mixer controls can support more than one channel. However, in this case, these controls only allow one channel to be set. The same setting is applied equally to both the left and right channels.

For audio source selection and muting, the Input Destination controls are commonly used. In effect, the Output Destination controls will control all of the inputs at once. Therefore, if individual input source switching, muting, or level setting is required, use the Input Destination controls.

Windows Mixer Component Name	Optimod-PC Application Control
Peak Meter	Output Levels/Wave Output Level

Table 6-6: Windows Mixer Peak Meter Data

Administering the 1101 through Serial Ports

Using a terminal program like HyperTerminal, or an ASCII programmable GPIO device, you can control an 1101 card through a serial port of the computer that hosts the 1101 you wish to access. When you are connected, you can retrieve information

and change settings on the 1101 by using simple ASCII commands, as discussed in *Optimod-PC* System/Mixer Control API starting on page 6-1.

- Valid commands are in either upper or lower case, not a combination.
- Only one valid command is permitted per line.
- The 1101 will not respond to unrecognized commands.
- The character code supported is ASCII.

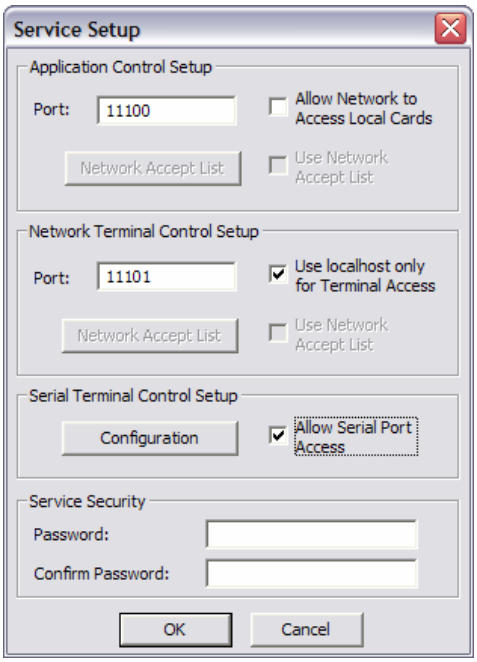
Connecting via Serial Port Using a Terminal Program on a PC

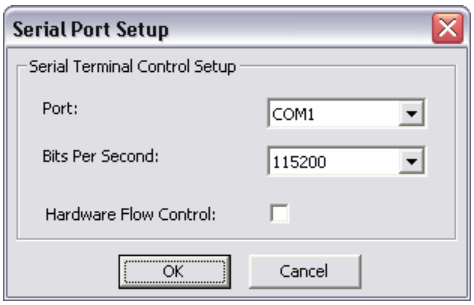
- The 1101 can be used with any computer or terminal that is compatible with the RS-232 standard interface.
- The serial port is configured via the Optimod-PC Service Settings:

  A) Using the Optimod-PC Control Application, select Tools > Service Settings.

  B) Check "Allow Serial Port Access."

  C) Select Configuration for Serial Port Settings, and configure the desired Serial port and parameters.





- Users will connect their computer or terminal with a null modem cable. Refer to the GPIO device documentation to determine which type of serial cable is required to connect to a PC, if used. Only direct serial connections are supported; there is no provision for communications via modem.
- Communications configuration is 115200, N, 8, 1, no handshaking

(flow control = none).

A) Connect an RS232 serial port (COM port) on your computer to a serial port on the 1101's host computer.

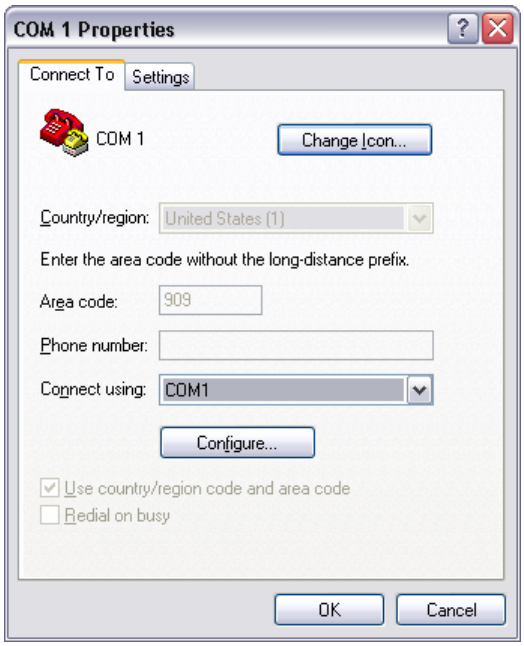
> You do not need to remove power from either your computer or the 1101 when you do this.

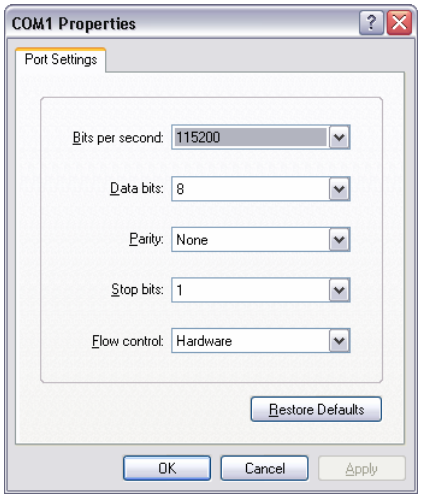
B) Start HyperTerminal. (You can usually access it from Start / Programs / Accessories / Communication.)

The NEW CONNECTION dialog box appears.

C) Give your new connection a name and choose OK.

The CONNECT TO dialog box appears.





D) Set the Connect Using field to "COMx," where "x" is the COM port you are using on your PC.

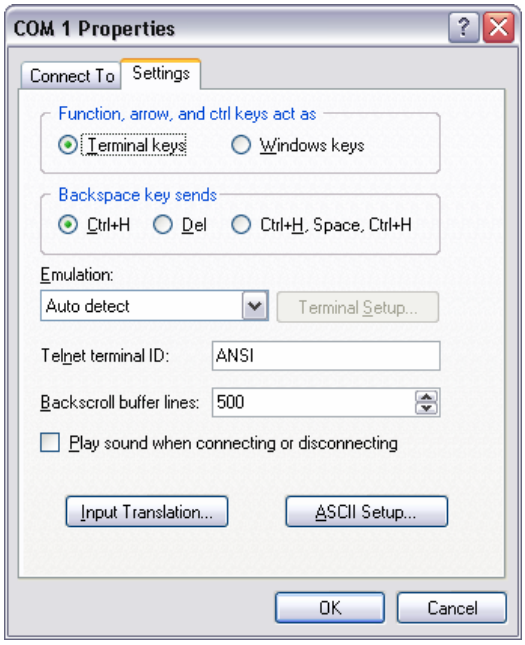
Choose OK.

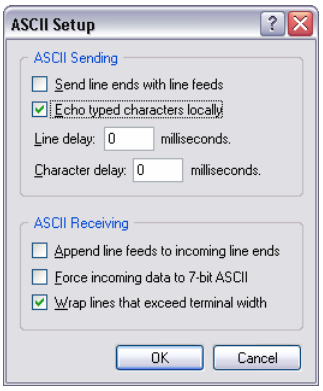
The PORT SETTINGS dialog box appears.

E) Set the port properties as follows:

Bits per second 115200
Data Bits.....8
Parity .....none
Stop bits 1
Flow control.....none

F) Choose OK.





G) Navigate to File / Properties / Settings / ASCII Setup. Set the ASCII Setup properties as follows:

Check:
- Echo typed characters locally
- Wrap lines that exceed terminal width

Uncheck:
- Send line ends with line feeds
- Append line feeds to incoming line ends
- Force incoming data to 7 bit ASCII

Leave "Line delay" and "Character delay" at their default values.

H) You can now type in commands described in the specification in *Optimod-PC System/Mixer Control API* on page 6-1.

Administering the 1101 through Ethernet TCP/IP

Using a terminal program like HyperTerminal or Telnet, you can control an 1101 card through a network Ethernet TCP/IP connection to the computer that hosts the 1101 you wish to access. An ASCII programmable GPIO device, such as a Broadcast Tools SRC-16, with an appropriate Serial-Ethernet server, can also be used for hardware control and status. Multiple connections and devices can be used. When you are connected, you can retrieve information and change settings on the 1101 by using simple ASCII commands as discussed in *Optimod-PC* System/Mixer Control API starting on page 6-1.

- Valid commands are in either upper or lower case, not a combination.

- Only one valid command is permitted per line.
- The 1101 will not respond to unrecognized commands.
- The character code supported is ASCII.

Connecting via TCP/IP Using a Terminal Program on a PC

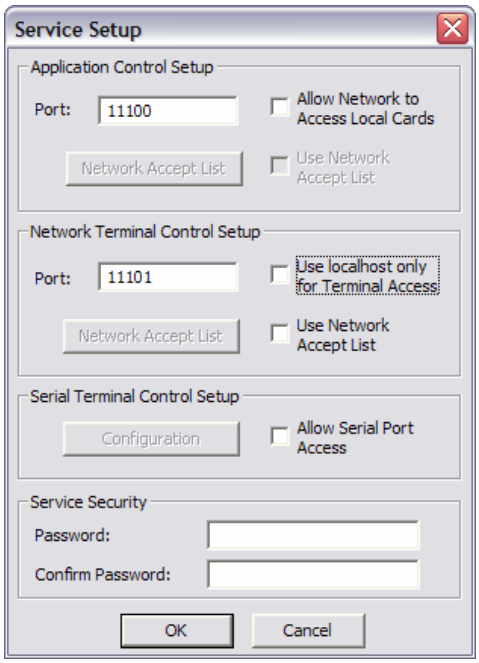
- You can use the 1101 with any computer or terminal that is compatible with TCP/IP networking.
- The Optimod-PC Service Settings determine network connection security:

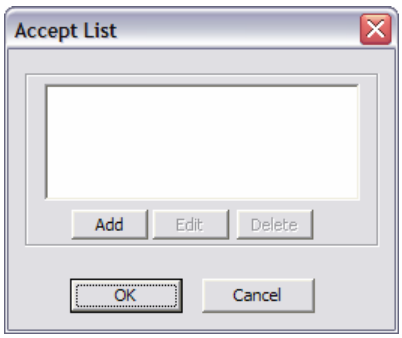
  A) Using the Optimod-PC Control Application, select TOOLS > SERVICE SETTINGS.

  B) Assign an available TCP/IP Port. (Default is 11101.)

  C) Uncheck "Use localhost only for Terminal Access."

  D) (Optional) Check "Use Network Accept List" and add allowed IP addresses to list.





- Connect your computer or terminal with an Ethernet cable:

  A) Connect an appropriate Ethernet cable on your terminal, computer, or device to either an Ethernet port on the 1101's host computer or the Ethernet network that will allow access the 1101 host computer.

  - If connecting to a standard Ethernet network, use a standard Ethernet cable and TCP/IP network connection.

- If connecting directly to another computer, use a crossover Ethernet cable.

  When a crossover Ethernet cable is used, at least one computer must have a static IP address. The other computer may have a static address or may have DHCP enabled.

  To enable DHCP in a given computer, its Internet Protocol (TCP/IP) Properties must be set to "Obtain an IP address automatically." Internet Protocol (TCP/IP) Properties is also where you set a computer's static IP address.

  In either case, when using a crossover cable, both computers should be assigned the same IP subnet unless special routing has been configured.

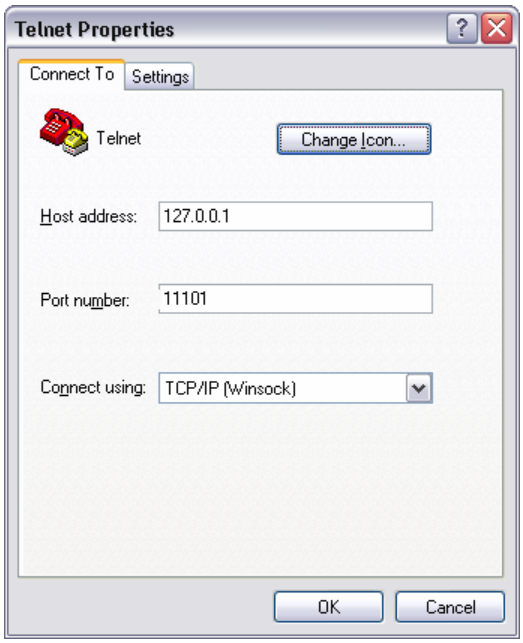
- You do not need to remove power from either your computer or the 1101 when you execute the instructions in step (A).

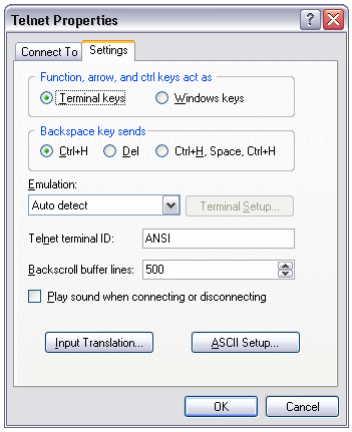
B) Start HyperTerminal. (You can usually access it from Start / Programs / Accessories / Communication.)

The NEW CONNECTION dialog box appears.

C) Give your new connection a name and choose OK.

The CONNECT TO dialog box appears.





D) Set the Connect Using field to "TCP/IP (Winsock)."

E) Set the Host Address to that of the 1101 host computer.

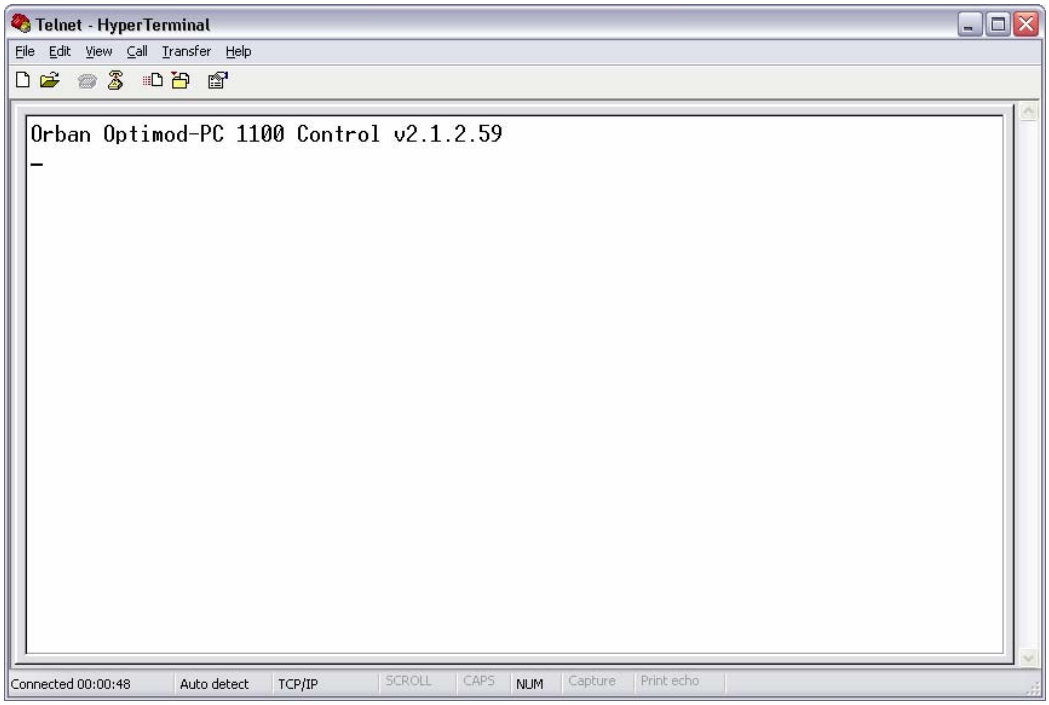
F) Set the Port Number to that of the 1101 host computer, (Default is 11101).

G) Choose OK.

Connection to the 1101 will be immediate and the 1101 connect banner will display:

```
Orban Optimod-PC 1101 Control vx.x.x.xx
```

Commands may now be sent and status received.



Optimod-PC Command and Status Reference is in *Optimod-PC System/Mixer Control API* starting on page 6-1.

- Alternatively, you can use Windows Command-Line Telnet.

A) Open a Command Box.

B) Type:

```
telnet <hostname> <hostport>
```

e.g.:
```
telnet 127.0.0.1 11101
```

Connection to the 1101 will be immediate, and the 1101 connect banner will display:

```
Orban Optimod-PC 1101 Control vx.x.x.xx
```

Commands may now be sent and status received.



Optimod-PC Command and Status Reference is in *Optimod-PC System/Mixer Control API* starting on page 6-1.