

CADCO
SYSTEMS
BROADBAND EQUIPMENT

Operating Manual

for the

Model 475/475T
Agile Demodulator

System M/N

2363 Merritt Drive • Garland, Texas 75041
Phone 972-271-3651 • FAX 972-271-3654 • 800-877-2288

Table of Contents

Table of Contents	2
Important Notices	3
Suggestions for Headend Racking and Maintenance	4
Forward, Features and Options	5
Operating Instructions	6
RS232 Instructions	9
Questions, Complaints, Problems	13
Troubleshooting Guide	14
Figures	15

Important Notices

Shipping Loss or Damage

Before signing the Common Carrier's delivery receipt, count the number of cartons and inspect each for visible damage. If the number of cartons does not agree with the receipt or there is damage, make note of these discrepancies on all copies of the receipt before signing.

Immediately unpack the equipment and inspect for concealed damage. If damage is found, notify the carrier immediately. We suggest you keep the shipping carton and packaging material should the equipment ever need to be returned.

After filing your claim, notify CADCO for assistance on repair or replacement disposition.

CAUTION – Unauthorized Repair

Unauthorized repair, modification or disassembly during the warranty period may cancel the warranty. Should field repairs or modifications be desired, CADCO technicians may be able to provide helpful suggestions, saving you both time and money.

Notice of Proprietary Data and Changes

Data, drawings, designs represented and all other material contained herein are the proprietary property of CADCO Systems, Inc., and may not be reproduced or duplicated in any form without written authorization by CADCO Systems, Inc. All material is subject to change without notice or obligation.

Equipment Return

Should you desire to return the equipment for service, please call CADCO prior to shipping. Enclosing as much information as possible on the reason for return and the work desired will expedite service and help to insure your satisfaction. If possible, pack the equipment in the original carton and materials. If the original packaging material is no longer available, pack the equipment in cushioning material sufficient to provide a minimum of 1.5 inches separation between the carton and the equipment. No Return Authorization number is required. Include your return address, telephone number and method of return shipment. Ship the equipment prepaid to the address in this manual.

Reasons for using CADCO Factory Service:

- CADCO services exclusively CADCO equipment
- Designed and manufactured your CADCO equipment
- Knows CADCO equipment better than any other service provider
- Technicians are trained on all CURRENT and PAST technical product information
- Technicians use specialized testing and alignment tools designed for CADCO equipment
 - Technicians may often help with a specialized application
 - Toll-free factory sales and service hotline
 - Factory service rates are very competitive and in many cases less expensive than non-factory service stations
 - Guarantees factory service for two years
 - Is known for fast, friendly customer service

Suggestions for Headend Racking and Maintenance

For prolonged equipment life and operating stability, *CADCO* makes the following recommendations:

- All headends should be installed in an environmentally controlled dust-free room having a nominal temperature of 80°F (26°C) and 60% humidity. The room should be protected from rodents and insect pests.
- All equipment should be mounted in standard equipment racks or cabinets
- All equipment should be rack spaced at one panel height, 1.75 inches (4.44cm). There should be nothing between the equipment preventing air circulation.
- Please make certain headend wiring and current capacity has adequate safety margins. Never cascade AC powering strips. Use separate outlets. If AC power is subject to fluctuation we recommend a constant voltage transformer be used. Beware of ground loops and be certain all wiring is bonded and properly grounded. Consult a code book as needed.
- All equipment racks should be electrically bonded together and earth grounded
- All equipment interconnecting RF cables should be a minimum of double shielded and quad shielded is recommended. Poorly shielded cable causes cross-modulation picture degradation between equipment.
- Always use the coax connector intended for the coaxial cable used. Be certain it is installed as recommended by the manufacturer. Connectors should be RFI shielded.
- RF Input and RF Output cables should be on opposite sides of the equipment rack. Never bundle input and output RF cables together.
- Operate each demodulator at the RF output level recommended. If it is necessary to reduce the RF Output level, always operate the equipment as recommended and reduce the RF
- Equipment RF test points are only relative indicators of the actual RF output level. All RF operating level measurements should be made at the RF Output of each unit.
- When the headend is initially placed in service, create a record of all operating parameters for each channel's equipment. Referring to these records during routine maintenance provides a helpful record of operating changes.

Forward

INTRODUCTION: CADCO Systems thanks you for purchasing the Model 475 Agile Demodulator. This demodulator contains the latest in CATV electronics including synthesized crystal-referenced phase locked oscillators, SAW-filtered intermediate frequency (IF), hybrid amplifiers and microprocessor control. These economical demodulators are designed for outstanding performance in any CATV system up to 750MHz. Featuring multiple output configurations, such as factory-set, selectable separate or composite video + 4.5MHz audio sub-carrier (System M/N only) and two additional video-only ports, the Model 475 also economically satisfies many TV station, LPTV and MMDS requirements. The Model 475 Agile Demodulator also contains a Synchronous Detector and Zero Chopper (the zero-carrier reference signal used to accurately set video depth of modulation (VDOM) without a spectrum analyzer). Rear panel composite and vertical sync ports provide sources for frame synchronization of auxiliary equipment. SAW filtering, hybrid amplifiers and independent power supplies provide years of stable service in a minimum maintenance headend.

FEATURES

- Fully microprocessor controlled
- Frequency Agile Input Channel Selection
- Selectable Input Channels
 - Off Air Channels: 2 through 69 (VHF & UHF)
 - Cable Standard Channels: 2 through 118 (54MHz – 750MHz)
 - Cable HRC Channels: 1 through 118 (54MHz – 750MHz)
- SAW filtered – designed for adjacent channel operation
- External Composite IF Loop
- Front Panel Controls with Digital Display
- Multiple Video Output Ports
- Composite Sync and Vertical Sync Output Ports
- Selectable Composite Audio/Video Output (Factory Preset – NTSC System M/N only)
 - Composite Video and 4.5MHz Aural Subcarrier Output; or
 - 4.5MHz Aural Subcarrier Output (no video)
- Independent Internal Power Supply
- Non-volatile Channel Memory
- Surface Mount Technology (SMT)

AVAILABLE OPTIONS

- T-Channel Input: T7 through T14 (7MHz – 54MHz)
- Dual RS-232 Control with “daisy chain” capability
 - Allows for remote control of up to 255 units from PC workstation
 - Allows mix of demodulators, modulators and processors

GENERAL SETUP AND OPERATION

1. Become familiar with the placement and function of the front panel controls and the rear panel connectors. See Figure 1-1a and Figure 1-1b.
2. Position the CADCO 475 Agile Demodulator in its installation mount or rack, or in its test rack.
3. Connect the CADCO 475 to a proper AC electrical source. The correct electrical input type for the unit is marked on the rear panel, directly under the entrance of the power cord into the unit.

NOTE: CADCO power supplies are designed so that, under certain power line or heat buildup conditions, the unit shuts off. An indication is no RF output, although the POWER LED on the front panel remains illuminated. If this occurs, unplug the power cord and wait at least two (2) minutes before reapplying power. Upon reapplying power, you should again have RF output. If the unit fails to provide RF output again, or should the unit return to shutdown mode, telephone your distributor for assistance or call CADCO Systems direct at 800-877-2288. Remember: CADCO recommends a 1.75" air circulation space between each piece of rack-mounted equipment.

4. Observe the front panel when power is applied. The power LED will illuminate and the front panel display will cycle and settle on the last tuned channel.

NOTE: The front panel display will provide the following information:

First number displayed:	All-segments test
Second number displayed:	Software version used
Third number displayed:	Unit ID (for RS232 remote use)
Fourth number displayed:	Last channel tuned

5. Locate the antenna lead or cable drop that will provide the input signal for the 475 demodulator.
6. Ensure that the input signal source is providing an active signal at an adequate level. The recommended input level for best performance from the CADCO 475 demodulator is 0 to +10dBmV (+60dBuV to +70dBuV or -49dBm to -39dBm).
7. Connect the input-source cable drop or antenna lead to the F-connector marked "RF INPUT", on the rear panel of the 475. Ensure that the rear panel T-channel select switch, if the unit is so equipped, is in the "OFF" position.

NOTE: For the 475T (input T-channel option), connect the return channel (T-channel) input-source cable drop to the rear panel F-connector marked "T-CHANNEL INPUT". If not using the "RF INPUT" connection, the "RF INPUT" jack should be fitted with a 75Ω terminator.

8. On the front panel, set the INPUT SOURCE SELECT switch to the correct source for the input/channel you are tuning.

Off-air:	Channels 2-13 (VHF), Channels 14-69(UHF)
Cable Standard:	Channels 2-125
Cable HRC:	Channels 1-125

NOTE: To select the T-input channels, move the rear-panel T-channel select switch to the “ON” position. When this switch is in the “ON” position, only the T-channels can be tuned and displayed on the front panel display.

9. Choose the appropriate output port(s) for your needs (Video1, Video2, Composite Output, Composite Sync, and Vertical Sync) and connect the output device to the correct port. Also connect the audio output jack¹ to an appropriate device.

NOTE: For best results, terminate any unused port with a 75Ω terminator.

NOTE: The video and audio output levels are factory set during final testing. However, CADCO suggests that you attach a monitor to one video output jack and a waveform monitor, a vectorscope and an oscilloscope connected in series to the other video output jack, making sure that the series connection terminates in a 75Ω terminator or monitor, and the audio output to the second channel of the oscilloscope. With this arrangement, you can confirm that the unit output levels were not disturbed during shipping and can properly adjust them if required.

10. Apply power to the unit, if not already done in Step 4.
11. Tune the unit to a known good channel.

NOTE: For proper operation, CADCO recommends that the signal strength of the input channel be between -10dBmV and +20dBmV (-59dBm and -29dBm). The optimum range for best signal-to-noise performance is between +10dBmV and +20dBmV (-39dBm and -49dBm). Input channel signal levels less than 0dBmV (-39dBm) may require an antenna-mounted amplifier to increase the signal level. While the automatic gain control (AGC) circuits in the CADCO Model 475 Demodulator will increase gain to full output within the above parameters, with inadequate input signal level, the video S/N ration will suffer.

NOTE: The CADCO Model 475 Agile Demodulator is equipped with a delay feature to reduce accidental channel changes should the channel select paddle switch be accidentally moved. To select a channel, hold the channel select switch in the up- or down position for at least three (3) seconds, then tune normally. Releasing the switch for more than one (1) second will allow the delay feature to activate.

NOTE: The Frequency Lock Detect LED should extinguish during tuning and illuminate within a few seconds after tuning has stopped.

12. Observe the video monitor for picture and listen for sound. Also observe the test equipment connected to the video and audio output jacks. If necessary, adjust the front panel controls as follows for optimum picture:

Step	Control	Observe	Setting
a.	Video Output Level	Oscilloscope	1V _{pp} ±0.5V into 75Ω
b.	Audio Output Level	Oscilloscope	1V _{pp} into 600Ω

¹ See Fig. 1-2 for correct wiring of output jack.

13. Zero-Carrier Reference. The Zero-Carrier Reference should only be used while setting video levels. To use the Zero-Reference Carrier to set the video level, tune to a known good channel or tune to a channel which is modulated with any standard NTSC test pattern (7-step, color-bar, etc. – do not use full-white screen). Set the front panel Zero-Carrier switch to the “ON” position (toggle it up). Observe the screen of the waveform analyzer scope. A “square wave pulse” covering one complete field of the pattern displayed should be visible. Using the front panel “VIDEO ADJUST” control set the Zero-Carrier Reference to the 100IRE level on the screen of the waveform analyzer scope. Turn the Zero-Carrier switch to the “OFF” position.

NOTE: In normal operation, the Zero-Carrier Reference should be off.

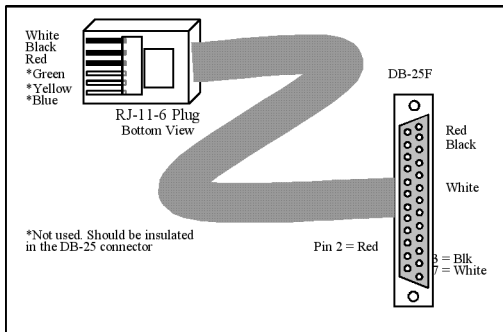
14. Disconnect test equipment. Complete installation as desired.

GENERAL SETUP AND OPERATION – DUAL RS-232 REMOTE CONTROL OPTION

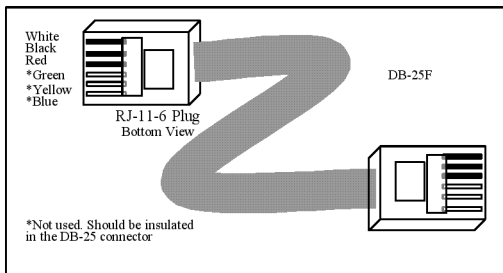
INTRODUCTION If you have chosen the DUAL RS-232 Remote Control option for your agile unit, CADCO thanks you for your choice. We think you will agree that this option adds many useful capabilities to the product.

All of the CADCO frequency-agile products are equipped with a microprocessor that controls many functions within the unit. The RS-232 option gives the user remote access to all of the monitoring and control functions *via* a standard RS-232 communications link. To facilitate use of the DUAL RS-232 option, each unit is assigned an individual identification code at the factory. That code is displayed during the unit's initial POST (Power On Self Test) and can be changed at any time through the RS-232 link.

CONNECTION Connection to the unit and between units is *via* RJ-11-6 jacks on the rear panel. The unit communication jack is marked J1 and is the outermost jack on the rear panel (the one nearest the RF OUTPUT connector). The interface cable, readily constructed by the customer, should have an RJ-11-6 modular connector on one end and the appropriate connector on the other end for the terminal or modem to which the unit will connect. See Figure 2-1a, below.



Connection between units is also *via* an interface cable, but with an RJ-11-6 connector on each end and wired in "straight-through" configuration. See Figure 2-1b, below. J2 is the throughput jack and connects to J1 on another unit, allowing units to be linked together. Up to 255 units can be daisy-chained in this fashion.



COMMUNICATION The RS-232 option communicates with the CADCO unit by “dumb” terminals, by computers running terminal emulation software or by high level computers with custom software. The CADCO unit automatically recognized the source type. Any leading ASCII character that lies between HEX 00 and HEX 7F will identify the source to be a ‘dumb’ terminal. Any leading ASCII character from HEX 80 to HEX FF will identify the source as high level.

SETUP AND OPERATION – DUAL RS232 OPTION

1. After completing **SETUP AND OPERATION** for the CADCO units in the appropriate Operation Manual, install and setup the CADCO units which have the RS-232 option.
2. Connect together, in “daisy-chain” fashion, all units (up to 255) which will be communicating *via* the RS-232 option. Link these units with RJ-11-6 interface cables wired in straight-through fashion as shown below in Figure 2-2. Connections should go from J2 on one unit to J1 on the next. Unit ID, at this point, is not relevant. When all units are linked together, the first unit in the chain will have an open J1; the last unit will have an open J2.

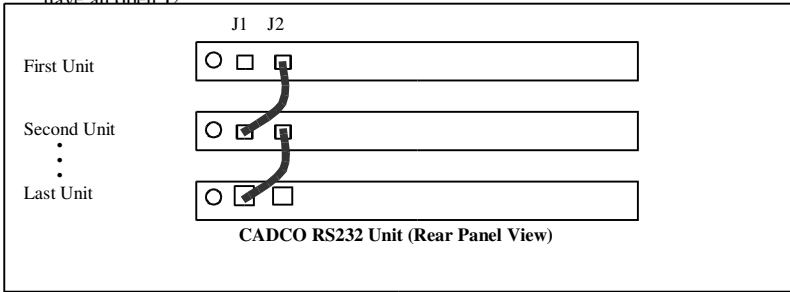


Figure 2-2

3. Using the customer-made interface cable which will connect to the interface device (terminal modem port or modem) RS-232 port, connect the first unit to port of the interface device. See Figure 2-3.

NOTE: If power has not yet been applied to the units, it may be applied now. However, it is recommended that power be applied to each unit in the link sequentially, in order to read and notate the unit ID for each unit and to facilitate changes in the event of duplicate unit ID. Alternatively, each unit can be individually tested and the unit ID set, following the steps below, prior to installation and link with other units.

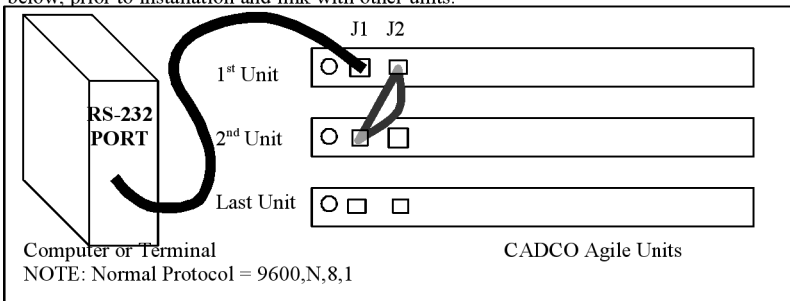


Figure 2-3

4. To identify the unit ID of a CADCO product, observe the front panel display at the time the unit is connected to a power source. The display will flash in the following sequence, providing the following information:

<u>Seq</u>	<u>Observe</u>
<u>Function</u>	
1	All segments flash ("8 . 8 . 8") Segment test
2	Specific number to two (2) decimal places Microprocessor version
3	Three- (3-) digit number from 0 to 255 Unit ID followed by
4	Number from 2-125, possibly preceded by minus sign (" - ") Last channel selected

5. To initialize communications with a CADCO product equipped with the DUAL RS-232 option, enter the following keyboard sequence:

^#

where ^ is the symbol obtained by pressing the <SHIFT> and <6> keys, and # is the unit ID number (from 0 to 255, obtained from step four (4), above) of the unit to which a connection is desired.

5. The menu which appears (see Figure 2-4) shows the current configuration of the unit with which communication is established. On the initial communication, it may be necessary to press <ENTER> to allow the unit to communicate initial information for each parameter command displayed in the "ENTER SELECTION" field until that field is clear. Each time <ENTER> is pressed, new information will appear in the appropriate

CADCO Remote Control Unit Menu v1.94

CADCO UNIT:	P379 RS-232
CONFIG SWITCH:	11011000
UNIT ID:	255
SWITCH STATUS:	ENABLED
CARRIER STATUS:	CARRIER ON
INPUT CHANNEL:	21 – OFF AIR
OUTPUT CHANNEL:	33 – CABLE
STANDARD	

U	=	Enter new Unit ID text	
S	=	Enable/Disable Front Panel Switch and Mode	
C	=	Toggle Carrier ON/OFF	
I	=	Enter new Input Channel	
O	=	Enter new Output Channel	
^#<CR>	=	Enter Unit Comm ID (# = 0 to 255)	

Figure 2-4

6. To change parameters in the unit, follow the instructions provided on the menu. Changeable parameters, with their field entry code, are:

<u>Code</u>	<u>Meaning</u>
U	Enter New Unit ID
S	Enable/Disable Front panel Switches and Offsets
T or C	Turn output [RF Carrier] On or Off or Toggle Carrier ON/OFF

I Enter New Input Channel
O Enter New Output Channel
^#<CR> Enter Unit Communication ID (# = 0 to 255)

NOTE: Depending upon whether your CADCO unit is a processor or a modulator, the menu will have slight variations. For example, the menu for the modulator will not display "I" for "Enter New Input Channel" because a modulator cannot tune an input channel. Different versions of units with different features may result in similar variations, but all will be understandable from the menu.

7. To address a new unit in the network, or after a power-up, enter a ^ followed by a valid unit number (0 – 255) and <CR> or <ENTER>. If a unit in the network matches the unit ID number sent, that unit will respond by returning a menu. When a ^ is sent, no further characters will be echoed from any of the units on the network until a valid unit number and carriage return are also sent. This is to avoid collisions on the network.

NOTE: If you are sending a ^ followed by a known valid unit ID number and are still not receiving a menu, check to ensure that the unit ID number is not duplicated in another unit. To check this, each unit which has not already been tested and confirmed to have a valid unit ID number will have to be powered down and repowered and the unit ID recorded from the POST sequence on the front panel LED display.

HIGH LEVEL MODE. High level commands are used for faster computer-to-Agile Unit communications. Commands from an external computer take on the form of a command byte, followed by any data bytes required, and ending with a checksum byte used for ensuring message accuracy. Upon receiving a high-level command, data and a checksum, the unit will respond with one or more bytes of data and a checksum.

Available high level commands consist of:

POLLING Determines if any unit changes have taken place;
READING Unit sends current configuration data; and
WRITING Unit configuration is modified.

QUESTIONS, PROBLEMS, COMPLAINTS, SUGGESTIONS OR RETURNS

If you purchased your CADCO product through a distributor, please contact that distributor first should you have any questions, problems, complaints, or suggestions concerning your CADCO product. If you need to return the product for any reason, check with your distributor. They may have an exchange or loaner policy in order to minimize any down-time the loss of the unit may cause; or they may prefer that any returns or repairs be processed through them.

If you purchased your product directly from CADCO, or even if you purchased through a distributor, you may contact your CADCO sales representative at 800-877-2288 or 972-271-3651. Simply tell the receptionist the city and state from which you are calling and your call will be directed to the proper representative.

BEFORE RETURNING ANY PRODUCT DIRECTLY TO CADCO FOR CREDIT, REPAIR OR TRADE-IN, PLEASE CONTACT YOUR CADCO REPRESENTATIVE TO OBTAIN A RETURN AUTHORIZATION NUMBER. Failure to do so may delay any credit due your account or may extend repair turnaround time. Our address for returns is:

CADCO Systems
2363 Merritt Drive
Garland, TX 75041

If returning a product for repair, please include the name and telephone number of the contact technician, a fax number, and a brief description of the symptoms. CADCO recommends that, prior to returning a product for repair, an on-site technician review the **PROBLEM TROUBLESHOOTING GUIDE** in this booklet. However, to preserve your warranty, please contact the CADCO repair department for authorization to break the warranty seal before opening the unit.

THANK YOU FOR CHOOSING CADCO PRODUCTS

PROBLEM TROUBLESHOOTING GUIDE

The guide below covers some typical symptoms, possible associated causes and suggested actions to follow before returning the unit for repair. It is not meant to be all-inclusive.

<u>Symptom</u>	<u>Possible Cause</u>	<u>Suggested Action</u>
No output Weak output	Unit tuned to input channel different from desired (this occurs particularly on the units which have green LED on the front panel to indicate "T" channels and channels above 99)	Ensure selected output channel is desired channel Check INPUT SOURCE SELECT switch for proper source selection
	Unit tuned to input channel in a different range than desired	Ensure input signal strength is within specified range
	Input signal is too weak	Check IF loop cable is securely attached
	IF loop cable on rear of unit loose/disconnected	Check power cord and power source, fuse
	Unit not plugged in or not getting power	
Bad/noisy/weak or no video	Aural carrier interfering with video carrier	Measure Aural Carrier level and adjust at source
	Low video gain out	Adjust video gain control for $\pm 1V_{PP}$ output on oscilloscope measured at video output jacks
White line in picture	Zero-carrier in "ON"	Ensure zero-carrier switch is in "OFF" position
Weak/no audio	Audio gain too low	Adjust front-panel audio gain for $\pm 1V_{PP}$ audio signal on oscilloscope
	Audio distorted/unbalanced	Ensure audio connected to outer (600 Ω) contacts at correct gain
Channels do not change	Delay feature active	Hold channel change switch in raised/lowered position for at least three seconds

Figures

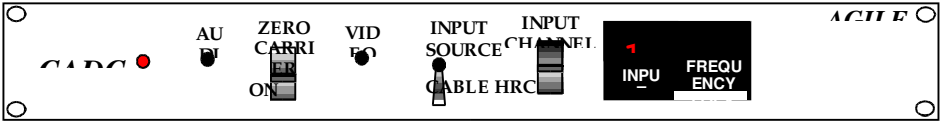


Figure 1.1a
Front Panel Layout of CADCO 475 Agile Demodulator
(Not to Scale)

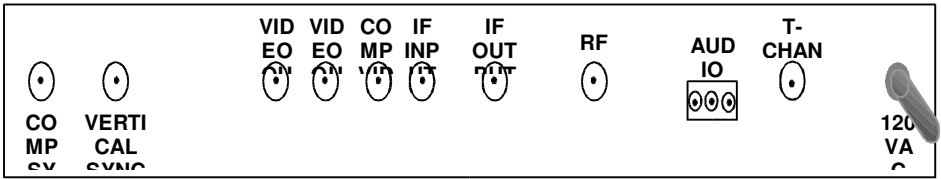


Figure 1.1b
Rear Panel Layout of CADCO 475 Agile Demodulator
(Not to Scale)

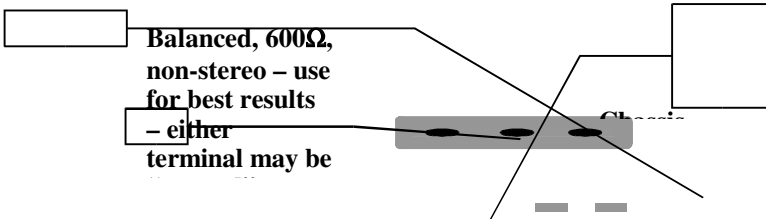


Figure 1.2
Audio Output Plug
Non-Stereo, Balanced 600Ω Connection on outer terminals