Installation Manual

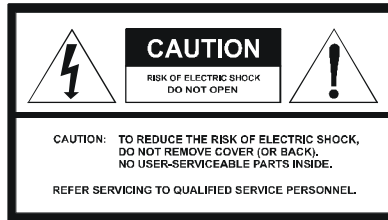## DCT700
### Digital Consumer Terminal

MOTOROLA
intelligence everywhere™

Graphical symbols and supplement warning marking locations on the bottom of the appliance.

This symbol indicates that dangerous voltage levels are present within the equipment. These voltages are not insulated and may be of sufficient strength to cause serious bodily injury when touched. The symbol may also appear on schematics.

This symbol calls attention to a critical procedure, or means refer to the instruction manual for opening or service information. Only qualified service personnel are to install or service the equipment. The symbol may also appear in text and on schematics.

WARNING:

TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE.

CAUTION:

TO PREVENT ELECTRICAL SHOCK, DO NOT USE THIS PLUG WITH AN EXTENSION CORD, RECEPTACLE, OR OTHER OUTLET UNLESS THE BLADES CAN BE FULLY INSERTED TO PREVENT BLADE EXPOSURE.

FCC Compliance: Federal Communications Commission Radio and Television Interface Statement for a Class 'B' Device

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in the residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If the equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the receiver antenna
- Increase the separation between the equipment and the affected receiver
- Connect the equipment into an outlet or on a circuit different from that to which the receiver is connected
- Consult the dealer or experienced radio/TV technician for help
- Ensure that the cover plate for the security card is secured and tight

Changes or modification not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Declaration of Conformity: According to 47 CFR, Parts 2 and 15 for Class B Personal Computers and Peripherals; and/or CPU Boards and Power Supplies used with Class B Personal Computers, Motorola, Inc., 6450 Sequence Drive, San Diego, CA 92121, 1-800-225-9446, declares under sole responsibility that the product identifies with 47 CFR Part 2 and 15 of the FCC Rules as a Class B digital device. Each product marketed is identical to the representative unit tested and founded to be compliant with the standards. Records maintained continue to reflect the equipment being produced can be expected to be within the variation accepted, due to quantity production and testing on a statistical basis as required by 47 CFR 2.909. Operation is subject to the following condition: This device must accept any interference received, including interference that may cause undesired operation. The above named party is responsible for ensuring that the equipment complies with the standards of 47 CFR, Paragraphs 15.107 to 15.109

Repairs: If repair is necessary, call the Motorola Repair Facility at 1-800-227-0450 for a Return for Service Authorization (RSA) number before sending the unit. The RSA number must be prominently displayed on all equipment cartons. Pack the unit securely; enclose a note describing the exact problem, and a copy of the invoice that verifies the warranty status. Ship the unit PRE-PAID to the following address:

Motorola, Inc.
Attn: RSA #_____
c/o Rudolph Miles and Sons
2500 Courage Boulevard
Brownsville, TX 78521

NOTE TO CATV SYSTEM INSTALLER: This reminder is provided to call CATV system installer's attention to Article 820-40 of the NEC that provides guidelines for proper grounding and, in particular, specifies that the cable ground shall be connected to the grounding system of the building, as close as possible to the point of cable entry as practical.

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Section 1
Introduction

The Motorola DCT700 is an interactive digital consumer terminal that enables cable operators to cost-effectively deploy an all-digital network. The DCT700:

- Supports services such as an electronic program guide (EPG), impulse pay-per view (IPPV), and video on demand (VOD)

- Is compatible with existing Motorola analog and digital set-top products

- Is compatible with MediaCipher conditional access technology

- Provides a real-time return path

The DCT700 requires a remote control to operate (remote control sold separately).

Figure 1-1
DCT700 set-top front and rear views
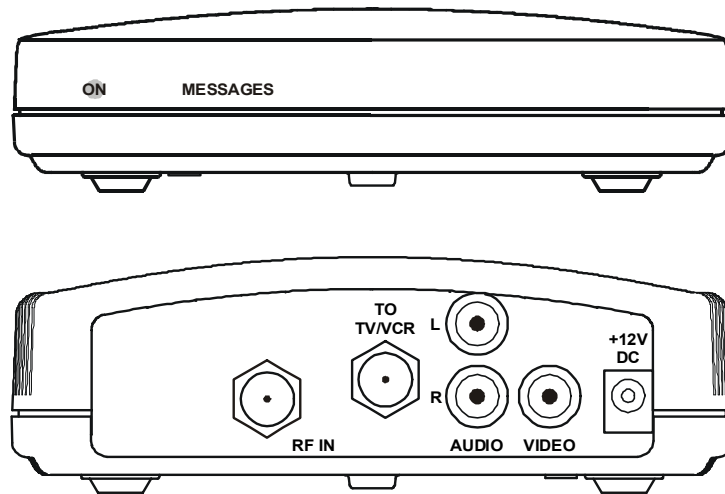
Standard Features

- MPEG-2 digital video processor
- ATSC standard Dolby® Digital (AC-3) audio processor
- ITU standard 64/256 QAM FEC enhanced adaptive equalizer
- On-board real-time RF return (256 Kbps)
- Bitmapped graphics display (4/8-bit)
- 88.75 to 858 MHz tuner
- DES based encryption/DCII access control
- Digital diagnostics
- Frequency agile 2.048 Mbps out-of-band data receiver
- Macrovision copy protection
- IR support for remote control

Standard Interfaces

- RF remod output (ch. 3, 4)
- Baseband video and audio Outputs

Using This Manual

This manual provides instructions to install and configure a DCT700:

Section 1	**Introduction** provides a product description, a list of related documentation, the technical helpline telephone number, and the repair/return procedure.
Section 2	**Overview** describes the DCT700 and provides an overview of its use. This section also identifies the front-panel displays and switches and describes the rear-panel features.
Section 3	**Installation** provides instructions on how to install the DCT700 in a subscriber location and perform operational tests.
Section 4	**Troubleshooting** provides guidelines for troubleshooting the equipment.
Appendix A	**Specifications** provide the technical specifications for the DCT700.
Appendix B	**Diagnostics** provide instructions on accessing and interpreting the built-in diagnostics.
Abbreviations and Acronyms	The **Abbreviations and Acronyms** list contains the full spelling of the short forms used in this manual.

Related Documentation

Although the *DCT700 User Guide* may be useful, it is not necessary to install or operate the DCT700 if you have this manual.

Document Conventions

Before you begin working with this manual and using the DCT700, familiarize yourself with the stylistic conventions used in this manual:

SMALL CAPS	Denotes silk screening on the equipment, typically representing front- and rear-panel controls, input/output (I/O) connections, and LEDs
* (asterisk)	Indicates that several versions of the same model number exist and the information applies to all models; when the information applies to a specific model, the complete model number is given
Italic type	Used for emphasis
`Courier font`	Displayed text

If You Need Help

If you need assistance while working with the DCT700, contact the Motorola Technical Response Center (TRC):

- Inside the U.S.: **1-888-944-HELP** (**1-888-944-4357**)

- Outside the U.S.: **215-323-0044**

- Online: http://broadband.motorola.com/noflash/websupport.html.

The TRC is open from 8:00 AM to 7:00 PM Eastern Time, Monday through Friday and 10:00 AM to 5:00 PM Eastern Time, Saturday. When the TRC is closed, emergency service *only* is available on a call-back basis. Web Support offers a searchable solutions database, technical documentation, and low priority issue creation/tracking 24 hours per day, 7 days per week.

Calling for Repairs

If repair is necessary, call the Motorola Repair Facility at **1-800-227-0450** for a Return for Service Authorization (RSA) number before sending the unit. The RSA number must be prominently displayed on all equipment cartons. The Repair Facility is open from 8:00 AM to 5:00 PM Central Time, Monday through Friday.

When calling from outside the United States, use the appropriate international access code and then call **956-541-0600** to contact the Repair Facility.

When shipping equipment for repair, follow these steps:

1 Pack the unit securely.

2 Enclose a note describing the exact problem. Complete and enclose the checklist provided with the unit.

3 Enclose a copy of the invoice that verifies the warranty status.

Ship the unit **PREPAID** to the following address:

Motorola, Inc.
Broadband Communications Sector
Attn: RSA #_____
c/o Rudolph Miles and Sons
2500 Courage Boulevard
Brownsville, TX 78521

Section 2
Overview

This section describes the DCT700's displays and connectors. Before you begin to install the DCT700, familiarize yourself with these displays and connectors.

Figure 2-1
Front panel
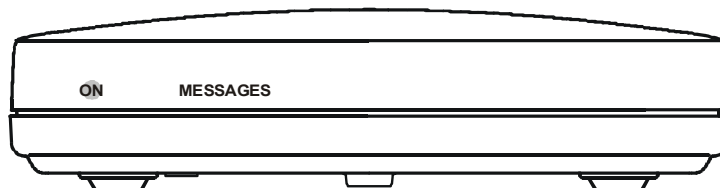
The DCT700 front panel has two LEDs:

ON Indicates that the unit is on

MESSAGES Indicates that a message is present

Figure 2-2
Rear panel
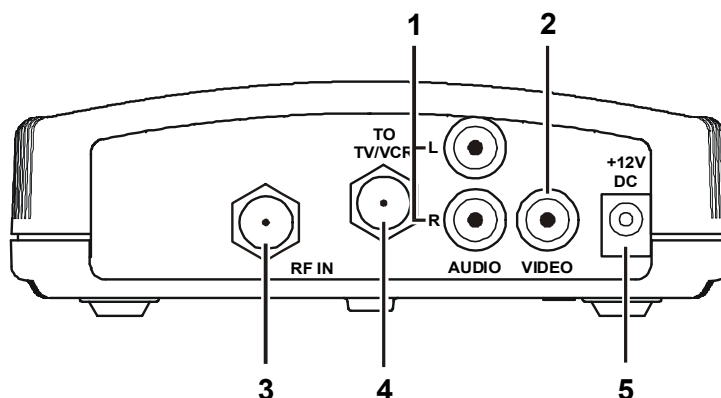
Table 2-1
Rear panel features

Key	Function
1	Left and right audio RCA jacks used for stereo audio output.
2	RCA jack used to connect the DCT700 to a composite (baseband) video TV or a monitor; in some configurations this jack connects to a VCR.
3	F-type connector used for DCT700 input from the TO RF IN connector.
4	F-type connector used to connect the DCT700 to a standard TV or VCR.
5	DC power connection.

For instructions on connecting the DCT700, see Section 3, "Installation."

A remote control is required to operate the DCT700. We recommend the Motorola DRC450. See "Remote Control" in this section for information.

Remote Control

A remote control is required to operate the DCT700. We recommend the Motorola DRC450 Universal Remote Control:

Figure 2-3
Motorola DRC450 Universal Remote Control
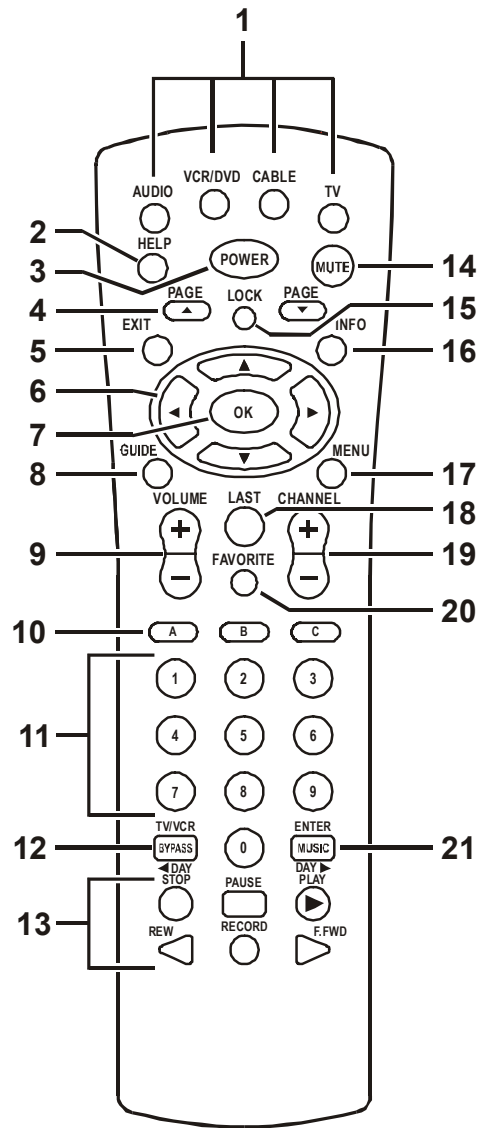
Table 2-2
DRC450 remote control keys

Key	Item	Description
1	AUDIO, VCR/DVD, CABLE, or TV	Selects a device to control. The selected mode will remain active until you press another device key.
2	HELP	Displays the help screen.
3	POWER	Turns the currently selected home entertainment component on or off.
4	PAGE ▲ or PAGE▼	Pages through menu screens and the program guide.
5	EXIT	Exits a menu or program guide.
6		Moves the cursor around the program guide and menu screens.
7	OK	Selects menu options, Pay-Per-View events or tune programs from the program guide.
8	GUIDE	Displays the program guide.
9	VOLUME + or VOLUME -	Increases or decreases the volume of the VCR, TV, or audio device. The device must be selected before you can increase or decrease the volume.
10	A, B, or C	Functionality is determined from services offered by the service provider.
11	NUMBER KEYS	Directly selects a channel.
12	TV/VCR BYPASS	When in VCR mode, toggles between television and VCR. Bypass is not available.
13	◄ Day Day ►	Moves the program guide ahead or back 24 hours.
	STOP, PAUSE, PLAY, REW, RECORD, F.FWD	Controls the VCR.
14	MUTE	Toggles the sound on and off.
15	LOCK	Limits viewing of selected programs; and is used to view the Pay-Per-View menu.
16	INFO	Displays the current channel and program information (not supported by all applications).
17	MENU	Displays the main menu.
18	LAST	Recalls the last channel or goes back one screen in the menu.
19	CHANNEL + or -	Changes the channels by moving up or down.
20	FAVORITE	Displays preset favorite cable channels.
21	ENTER/MUSIC	Displays digital music channel menus. On some TV models, press to enter channels.

Installing Batteries in the Remote Control

Before using the remote control, you must install two AA (1.5 V) alkaline batteries. Figure 2-4 illustrates battery access on the back of the remote control.

To install batteries in a DRC450:

1   Press and slide the battery compartment cover off.

2   Place the batteries in the compartment; be careful to observe the correct polarity.

3   Slide the battery compartment cover back into place.

Battery installation will vary with each style of remote control. Refer to the instructions included with your remote control for installing batteries.

Figure 2-4
Back view of DRC450 remote control
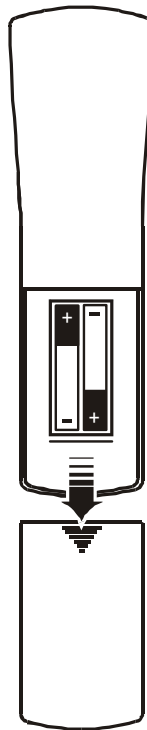
NOTE!

Use and dispose of batteries in accordance with all applicable laws, rules and regulations. Motorola will not be liable to anyone for the user's failure to use and/or dispose of batteries in the proper manner and in accordance with such laws, rules and regulations, or for any defect contained in batteries that may cause injury damage to persons or property.

Installation

This section provides instructions for installing and cabling the DCT700. To complete the installation, you must:

- Connect the cables
- Supply power to equipment
- Download configuration information and software
- Run operational check and diagnostics

This section also includes the procedure for performing a cold initialization of the DCT700.

Before You Begin

Before you begin, review the installation instructions, gather the required items, and complete the tasks listed below:

- Verify that you have 75-ohm coaxial cables with F-type connectors and RCA baseband phono-type cables.
- Determine if you are connecting the set-top to a standard TV or a composite (baseband) monitor.
- Place the set-top on a smooth, flat surface and remove any obstructions that could interfere with the free flow of air over, under, or around it. Advise the subscriber not to place anything on top of the unit.

Installing the DCT700

To install the DCT700:

1 Determine if you are connecting the set-top to a conventional TV or to a monitor. To install the video connection:

   - For a conventional TV, use a 75-ohm coaxial cable with F-type connectors.
   - For a monitor, use an RCA phono cable to connect the VIDEO connector to the monitor.

2 Locate the cabling diagram that matches the subscriber's configuration requirement.

3 Connect the cables as illustrated in the diagram.

4 Perform the basic operational check in this section after the set-top is installed.

Standard Cabling Diagram

The DCT700 outputs on either channel 3 or 4 depending on the configuration message from the addressable controller.

Figure 3-1
Connecting the DCT700 to a TV using RF connectors
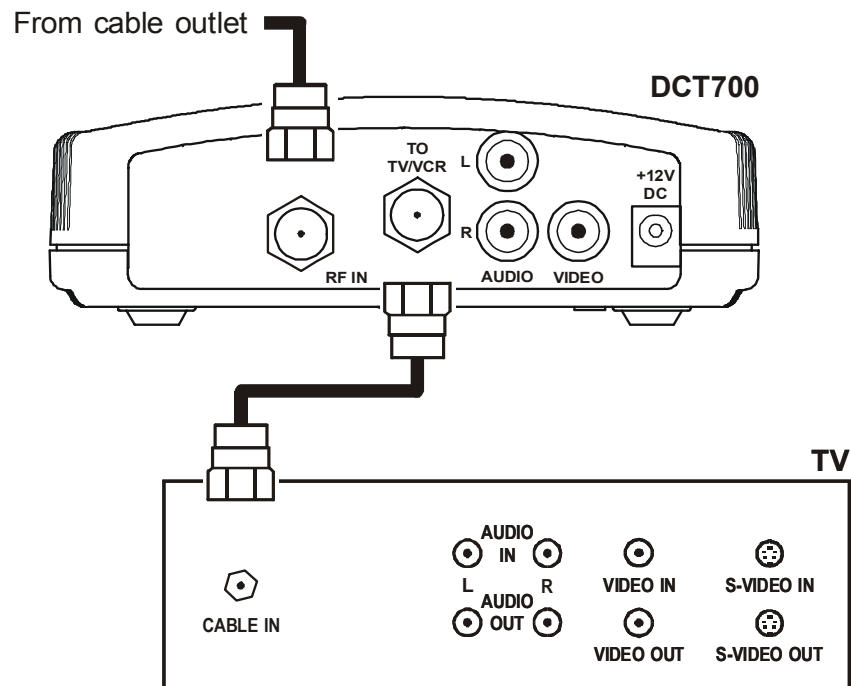
The remodulated channel, 3 or 4, does not carry stereo for digital channels. To receive stereo, connect the DCT700 using RCA baseband connectors. These connections are illustrated later in this section.

Standard VCR Cabling Diagram

Figure 3-2 illustrates cabling using an RF connector that enables the subscriber to record the channel being viewed:

Figure 3-2
Standard VCR cabling
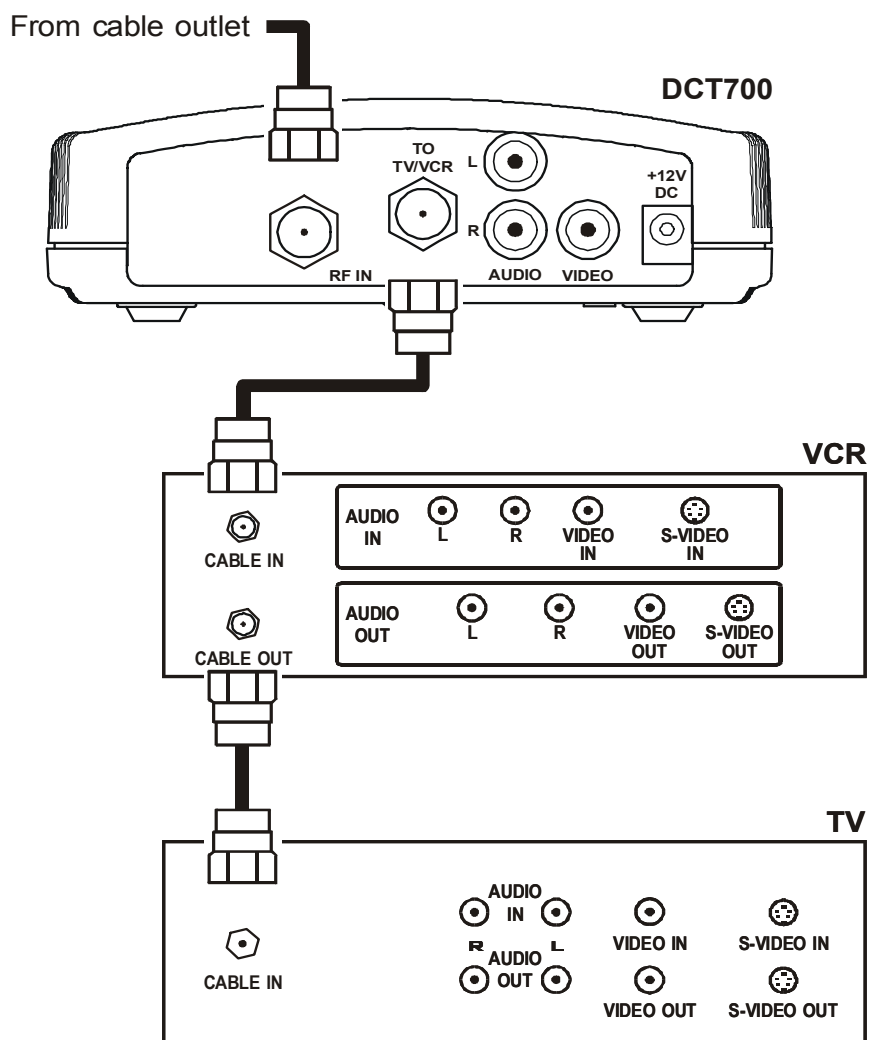
From cable outlet

DCT700

TO TV/VCR   L   +12V DC

RF IN   R   AUDIO   VIDEO

VCR

AUDIO IN   L   R   VIDEO IN   S-VIDEO IN

CABLE IN

AUDIO OUT   L   R   VIDEO OUT   S-VIDEO OUT

CABLE OUT

TV

AUDIO IN

CABLE IN   R   L   VIDEO IN   S-VIDEO IN

AUDIO OUT   VIDEO OUT   S-VIDEO OUT

The remodulated channel, 3 or 4, does not carry stereo for digital channels. To receive stereo, connect the DCT700 using RCA baseband connectors. These connections are illustrated later in this section.

Composite Baseband Cabling Diagrams

Connecting the DCT700 using the baseband RCA type outputs enables the subscriber to experience stereo and Dolby Surround® sound when available on digital channels.

Figure 3-3 illustrates the standard baseband audio and video outputs of the DCT700:

Figure 3-3
Standard baseband cabling
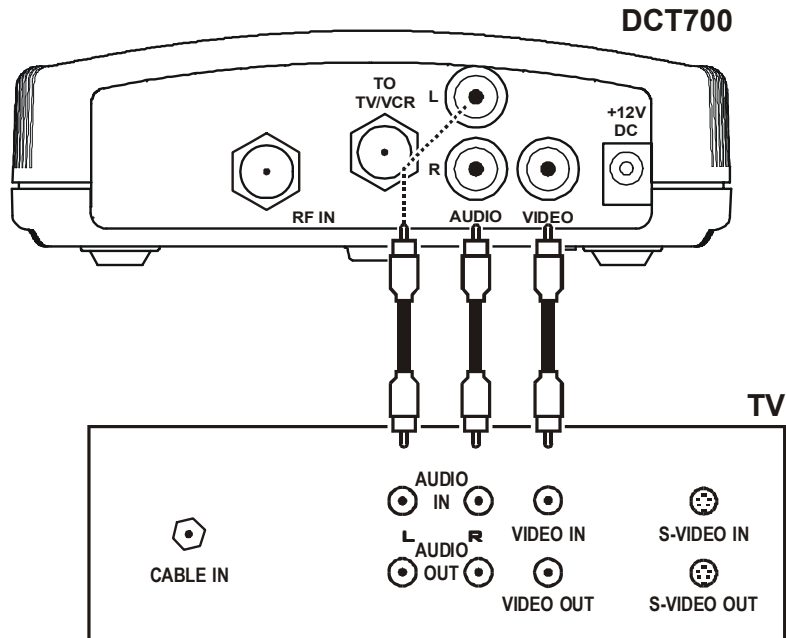
Figure 3-4
Baseband audio and video connections to a VCR and TV
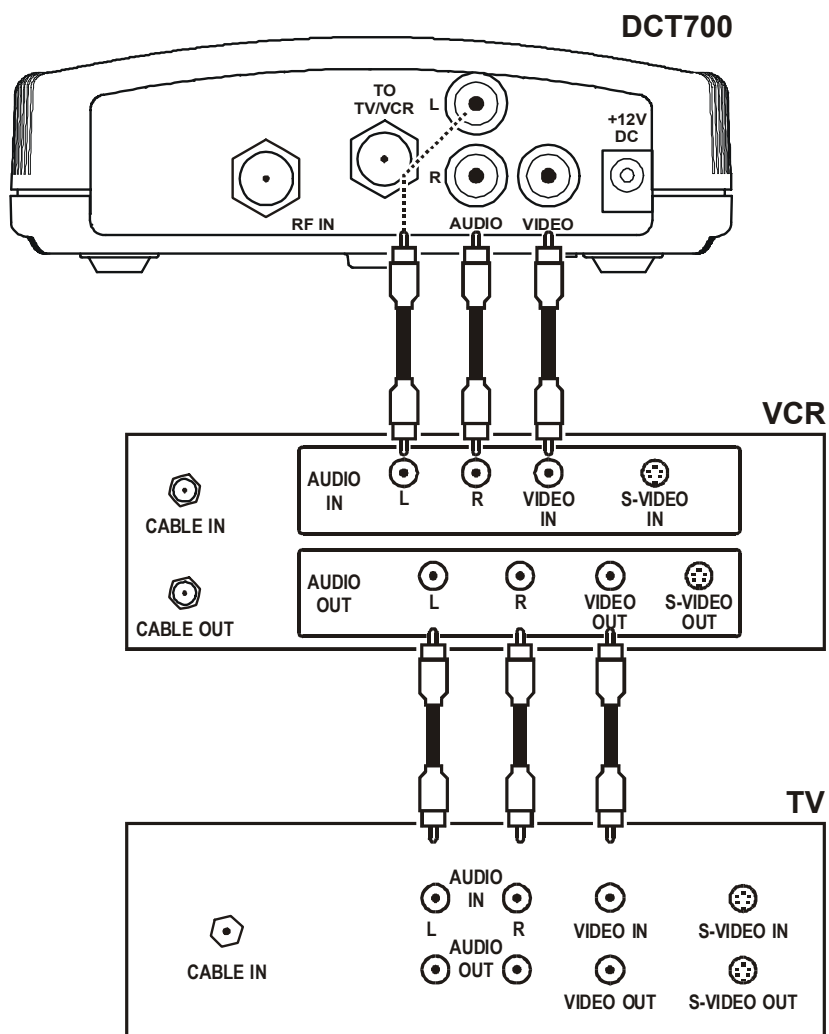
Stereo Cabling Diagrams (Baseband)

This audio configuration does not provide for a TV playing through the stereo. Figure 3-5 illustrates how to connect the DCT700 to a stereo using the audio connectors on the VCR:

Figure 3-5
Audio on the VCR
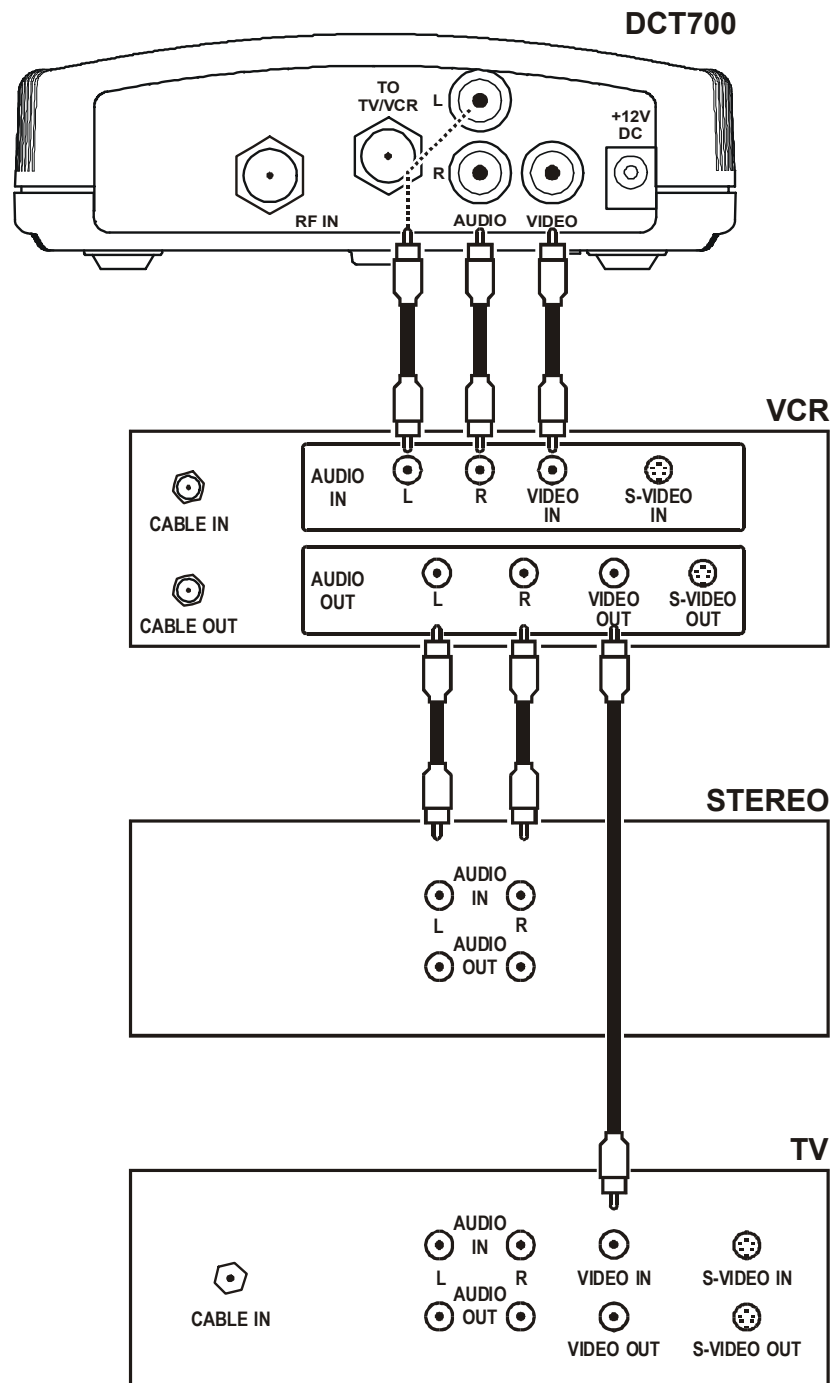
This audio configuration enables the TV to play through the stereo. Figure 3-6 shows how to connect the DCT700 to a stereo using the audio loop-through connectors on the VCR and the audio output ports on the TV monitor:

Figure 3-6
Audio on VCR/Audio output on TV
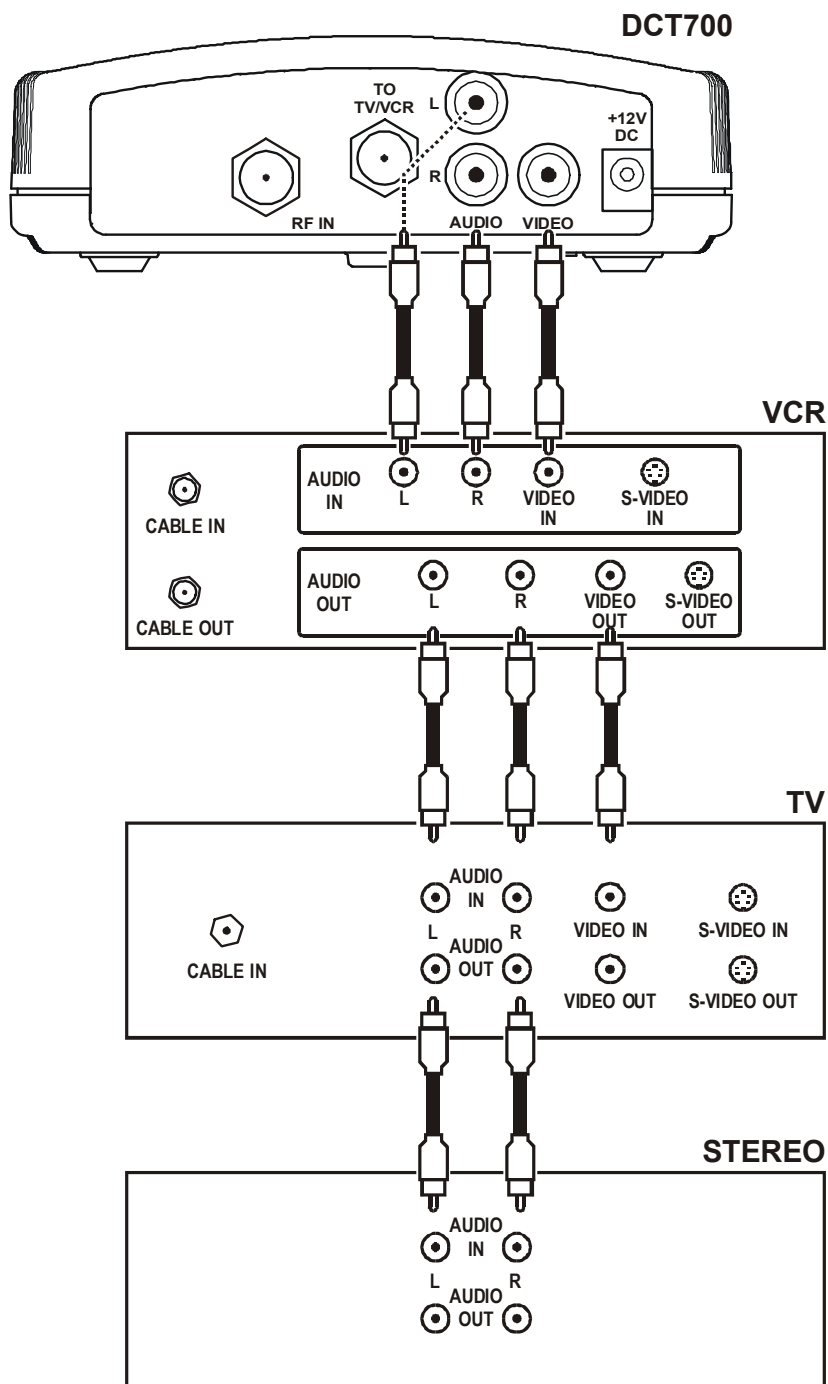
Operational Check

The operational check tests communications between the remote control and the set-top and verifies the set-top response to remote control commands:

Table 3-1
Operational check procedures

Feature	Testing Procedure
Power on	1 Press **POWER** on the remote control to turn on the set-top.
	2 Turn on the TV and tune it to the set-top output channel (3 or 4).
Channel Selection	Tune to several channels by entering the channel number with the numeric keys on the remote control.

If the set-top does not operate properly, refer to Section 4, "Troubleshooting."

Selecting the OOB Frequency

Use the Motorola universal remote control to operate the DCT700.

To select the OOB frequency:

1   From the O2 OOB STATUS diagnostic, press the **MENU** button to enter the frequency selection mode. The OSD displays a new MANUAL FREQ line at the bottom of the screen, indicating the LKC frequency.

2   Press the **MENU** key a second time to exit the frequency change mode.

Or

Press the **UP/DOWN** channel or cursor keys to scroll through the frequencies to locate the desired OOB frequency. The frequency selection appears on the MANUAL FREQ line of the OSD.

The first frequency to display is 75.25. The system scrolls through each frequency until it reaches the last, 103.75, and then scrolls back to the beginning. This diagnostic scrolls through the OOB frequencies in the following order:

- 75.25 MHz
- 104.20 MHz
- 72.75 MHz
- 92.25 MHz
- 98.25 MHz
- 107.25 MHz
- 107.40 MHz
- 110.25 MHz
- 116.25 MHz
- 103.75 MHz

3   Press **SELECT** to begin searching for the OOB frequency.

On the OSD the MANUAL FREQ line of text clears, the HUNT MODE displays FIX to indicate the fixed frequency search, and the CUR FREQ field changes to the frequency selected to search.

If the frequency is found with the proper EMM Provider ID, the OSD LKC field changes to display the new frequency.

If after 40 seconds the frequency search is not successful, the set-top performs a warm reset and returns to the last known carrier frequency.

4   To abort a search without waiting the 40 seconds, press **POWER** to cause a warm reset.

Set-top Cold Initialization

The DCT700 has no front panel buttons. To perform a cold initialization, or *reset*, using the remote control:

1   Hold down any key while disconnecting and reconnecting AC power to the set-top.

After booting up, the POWER LED on the set-top front panel flashes.

2   Within 3 seconds, press **3**.

The POWER LED flashes at a decreased rate.

3   Within 3 seconds, press **2**.

The POWER LED flashes at an increased rate.

4   Within 3 seconds, press **8** to initiate the cold reset.

During the cold initialization procedure, if the appropriate remote control key is not pressed within the three-second time period, the procedure terminates and the set-top resumes normal operation.

Section 4
Troubleshooting

This section provides information to assist you in quickly detecting, isolating, and resolving error conditions that might occur when using the DCT700.

If you need assistance while working with the DCT700, contact the Motorola Technical Response Center (TRC):

- Inside the U.S.: **1-888-944-HELP** (**1-888-944-4357**)

- Outside the U.S.: **215-323-0044**

- Online: http://broadband.motorola.com/noflash/websupport.html.

The TRC is open from 8:00 AM to 7:00 PM Eastern Time, Monday through Friday and 10:00 AM to 5:00 PM Eastern Time, Saturday. When the TRC is closed, emergency service *only* is available on a call-back basis. Web Support offers a searchable solutions database, technical documentation, and low priority issue creation/tracking 24 hours per day, 7 days per week.

Table 4-1 is a list of possible problems and solutions:

Table 4-1
Troubleshooting guidelines

Problem	Possible Solution
No power to the DCT700	Check the power outlet for AC power.
	Be sure the TV is tuned to the output channel of the DCT700 (channel 3 or 4).
	Verify that cable connections are correct from the TV set or monitor to the DCT700.
	Check that the power cord is properly plugged into the outlet and DCT700.
Remote control is not responding	Check for an obstruction between the remote control and the DCT700. Aim the remote control directly at the DCT700, not the TV or VCR.
	Be sure you firmly and deliberately press and release operation keys one at a time.
	Check that the DCT700 has been initialized correctly; refer to Diagnostics.
	Change the batteries in your remote control according to the instructions in Section 2, "Overview".
The DCT700 is not receiving a cable signal	Check the cable connections and hand-tighten if necessary.
	Verify that the cable connections are correct.
	Verify the TV is working and has a clear picture.
Guide has no data	Unplug the power to the DCT700 and plug in the unit again. Wait for the DCT700 to collect the data.

Appendix A
Specifications

Input frequency	88.75 to 858 MHz (excluding data carrier frequency)
HRC/IRC frequency assignments	Downloadable
Number of channels:	128 carriers per cable; more than one digital channel per carrier, content dependent
Average digital input level:	
64 QAM	–15 dBmV to +15 dBmV
256 QAM	–12 dBmV to +15 dBmV
Data carrier:	QPSK-modulated carrier
Frequency	Agile
Bandwidth	1.5 MHz
Level	–15 dBmV to +15 dBmV
Video signal to noise ratio	57 dB minimum for baseband output, unified weighted, 4.2 MHz bandwidth
Remod output frequency accuracy	±80 kHz
Return loss:	
Input	4 dB minimum
Output	8 dB minimum
Spurious output	–57 dBc maximum, in band
Remod output level	10 to 15 dBmV
Isolation (input/output)	70 dB minimum
On-screen display (OSD):	
Screen size	352 x 480 pixels (configuration dependent)
Message/barker capacity	Up to 40 pages (configuration dependent)
Operating environment range:	
Temperature	0° to 40°C (32° to 104°F)
Humidity	5 to 95% (non-condensing)
AC voltage:	
USA and Canada	105 to 125 V, 60 Hz
Mexico	114 to 140 V, 60 Hz
Power dissipation	16 W at 115 V
Surge protection	Provided on power supply and RF ports
Size	5.5 x 6.7 x 1.8 inches
Weight	0.85 pounds

Diagnostics

This section describes the on-screen diagnostics to confirm proper DCT700 installation, including:

- Checking error states and signal integrity
- Identifying the set-top on the network
- Verifying communications with the headend

For the diagnostics provided here:

- All indicators are in decimal notation unless otherwise noted.
- All screens self-refresh at a minimum rate of once every five seconds.
- All sample displays are illustrative; actual data will differ from the examples.

Using Diagnostics

To access and navigate the diagnostics using the Motorola universal remote control:

1 Press **POWER** to turn on the set-top.

2 Wait five seconds and then press **POWER** again to turn off the set-top.

3 To enable diagnostic mode, press **OK** within two seconds after powering off. The DIAGNOSTICS main menu is displayed on the OSD:

```
DIAGNOSTICS
01      GENERAL STATUS
02      OOB STATUS
03      IN BAND STATUS
04      AUDIO/VIDEO STATUS
05      UNIT ADDRESS
06      FIRMWARE VERSION
07      CURRENT CHANNEL STATUS
08      RENEWABLE SECURITY
09      UPSTREAM MODEM
10      APP CODE MODULES
11      MEMORY CONFIG
12      INTERACTIVE INFO
13      MAC FREQUENCY TABLE
14      CONTROL CHANNELS
15      MESSAGE TYPES
16      IN BAND PAT
17      IN BAND PMT
18      TASK STATUS
19      USB STATUS
20      IB MCA STATUS
21      KEYBOARD / LED
```

4 Use the **CHANNEL** or **cursor** keys to select the desired diagnostic.

5 Press **cursor <**, **cursor >**, **ENTER**, or **OK** to run the selected diagnostic.

6 To exit the diagnostic mode, press **POWER** on the remote control. The set-top exits the diagnostic mode and powers off.

The complete list of remote control buttons you can use to navigate the diagnostics is:

Button	Function using the diagnostics main menu	Function using a diagnostic
POWER	Exits diagnostic mode and enters OFF state	Exits diagnostic mode and enters OFF state
CH/CUR +, CURSOR UP	Moves the cursor up	Displays the DIAGNOSTICS main menu
CH/CUR - , CURSOR DOWN	Moves the cursor down	Displays the DIAGNOSTICS main menu
CURSOR RIGHT, CURSOR LEFT, OK, ENTER	Runs the selected diagnostic	Displays the DIAGNOSTICS main menu
GUIDE	None	None
MENU	None	None
INFO	None	None

d 01: General Status

This diagnostic displays the error code, a short description of the error, the purchase count, and specific model information:

```
DCT700 STATUS

ERROR                 :  E 00

NO ERROR

PURCHASES             :  0

Platform ID:          :  0x0060

Family ID             :  0x0000
Model ID              :  0x008F


TUNER                 :  tuner type


Remod Channel         :  3
Time Zone
(hhhhhhhh)                MMMM min


DS Entry Time
1/1/1999                  00:00 GMT


DS Exit Time
1/1/1999                  00:00 GMT


Current GPS Time
1/1/1999                  00:00 GMT
```

The General Status fields are:

Field	Description
Error Codes	A sequence of LED flashes communicates errors when they occur. The Error Code field displays the code for the active error when appropriate.
Purchases	Indicates the number of unreported purchases.
Platform ID	A 16-bit hexadecimal number used to differentiate between digital platform images in the field. It is also called the ROM ID.
Family ID	A hexadecimal number that indicates the set-top manufacturer and product family.
Model ID	A hexadecimal number that indicates the set-top model.
Tuner	Indicates the tuner type.
Remod Channel	The Remod Channel can be 3 or 4 (NA systems). The output port configuration displays the configuration of the set-top output or re-modulated (remod) port. The output port/remod port is the interface from the set-top to the subscriber TV.
Time Zone	Indicates the time zone offset (in minutes) relative to GMT.
DS Entry Time	Indicates the daylight savings entry time.
DS Exit Time	Indicates the daylight savings exit time.
Current GPS Time	Indicates the current time.

Error Codes

A sequence of LED flashes communicates errors when errors occur. The errors associated flash sequences, causes, and remedies are:

Code	Flash Sequence	Cause	Remedy
E 00	None; no error condition exists	Indicates normal condition after initialization	Not applicable
E 01	MESSAGES LED flashes on and off	The set-top did not receive a connect message	Restore out-of-band signal Send a connect message
E 02	Repeating series of two MESSAGES LED flashes, separated by a pause	Init Error	The set-top needs a power cycle to recover
E 03	Repeating series of three MESSAGES LED flashes, separated by a pause	DRAM error	Not used at this time
E 04	Repeating series of four MESSAGES LED flashes, separated by a pause	DP-SRAM error	Not used at this time
E 07	Repeating series of seven MESSAGES LED flashes, separated by a pause	ROM verification failure	Power cycle the set-top; if repetitive, return for repair
E 08	Repeating series of eight MESSAGES LED flashes, separated by a pause	Faulty RAM, ROM, EEPROM, or POST failure (this is a hardware failure)	Return the set-top for repair
E 09	Repeating series of nine MESSAGES LED flashes, separated by a pause	Dead battery or the memory has not been initialized; occurs if the battery fails to keep the RAM alive during power-down; causes set-top to be disconnected	Return the set-top for repair; requires factory initialization message
E 10	POWER LED flashes on and off; MESSAGES LED remains off	Invalid serial number	Not used at this time
E 11	POWER LED flashes once; MESSAGES LED flashes once	Invalid unit address	Return the set-top for repair; requires a unit creation message
E 12	POWER LED flashes once; MESSAGES LED flashes twice	POST failed	Not used at this time
E 13	POWER LED flashes once; MESSAGES LED flashes three times	Sys_boot initialization failure	Power cycle the set-top; if repetitive, return for repair
E 14	POWER LED flashes once; MESSAGES LED flashes four times	System startup failure	Power cycle the set-top; if repetitive, return for repair
E 15	POWER LED flashes once; MESSAGES LED flashes five times	TSI structure is corrupted	Power cycle the set-top; if repetitive, return for repair
E 16	POWER LED flashes once; MESSAGES LED flashes six times	Bad flash number specified for Initiate Flash Platform	Error logged, ignore
E 17	POWER LED flashes once; MESSAGES LED flashes seven times	Bad platform validation step number	Error logged, ignore

Only the ALPS TDER1-0001 A appears on the on-screen display.

d 02: Out-of-Band (OOB) Status

This diagnostic indicates the status of the out-of-band control channel.

```
OOB DIAGNOSTIC

DATA                 *           SNR   23 dB GOOD

EMM DATA             *

CARRIER LOCK       YES           COUNT             1

HUNT MODE          None

CUR FREQ

LKC

EMM PRVDR ID       0x0001
```

The OOB Diagnostic fields are:

Field	Description
Data	The OSD indicates with a "*" that data has been received. The indicators cover all packet processors regardless of which stream they are monitoring and are cleared when you enter the diagnostic.
EMM Data	Indicates whether the set-top is receiving a message on the EMM stream:
	Blank No data received.
	* Data received. *The set-top can receive only 12 PIDs at once. Data on PIDs can be present on the out-of-band multiplex that the set-top is not receiving.*
Carrier Lock	The CARRIER LOCK is reset to "1" after an initialization from the DAC 6000 or a power cycle. Each time the set-top detects a drop in OOB connectivity, the counter increments. The following Carrier Lock variables can display:
	YES Carrier locked
	NO Carrier unlocked
Hunt Mode	Indicates the state of OOB stream acquisition. The Hunt Mode can be:
	None The set-top is locked to an OOB carrier.
	RR (Round Robin) The set-top is searching OOB frequencies trying to find an EMM Provider of 0 or 1.
	EMM The set-top received a Provider ID change and is searching OOB frequencies for the new ID.
	FIX The set-top has been commanded to attempt to lock onto a frequency.
	SRCH The set-top at some point had a valid Provider ID on the OOB frequency and is attempting to re-acquire it.
CUR Freq	Indicates the current out-of-band frequency.
LKC	Indicates the last known carrier (OOB frequency that had correct Provider ID).
EMM Provider ID	The ID of the provider of the Entitlement Management Message (EMM).

Selecting the OOB Frequency

To select the OOB frequency:

1   From the OOB STATUS diagnostic, press **MENU** on the remote control to enter the frequency selection mode. The OSD displays a new MANUAL FREQ line at the bottom of the screen, indicating the LKC frequency.

2   Press **MENU** a second time to exit the frequency change mode.

Or

Press the **CHANNEL** or **cursor** keys to scroll through the frequencies to locate the desired OOB frequency. The frequency selection appears on the MANUAL FREQ line of the OSD.

The first frequency to display is 75.25. The system scrolls through each frequency until it reaches the last, 103.75, and then scrolls back to the beginning. This diagnostic scrolls through the OOB frequencies in the following order:

- 75.25 MHz
- 104.20 MHz
- 72.75 MHz
- 92.25 MHz
- 98.25 MHz
- 107.25 MHz
- 107.40 MHz
- 110.25 MHz
- 116.25 MHz
- 103.75 MHz

3   Press **SELECT** to begin searching for the OOB frequency.

On the OSD the MANUAL FREQ line of text clears, the HUNT MODE displays FIX to indicate the fixed frequency search, and the CUR FREQ field changes to the frequency selected to search.

If the frequency is found with the proper EMM Provider ID, the OSD LKC field changes to display the new frequency.

If after 40 seconds the frequency search is not successful, the set-top performs a warm reset and returns to the last known carrier frequency.

4   To abort a search without waiting the 40 seconds, press **POWER** to cause a warm reset.

d 03: In-band Status

This diagnostic displays for the last attempted channel tune. If a digital carrier is not present, the diagnostics indicate the carrier lock is analog. When the carrier lock is analog, all fields for digital (other than a carrier lock channel) are blank.

```
IN BAND DIAGNOSTIC

DATA                                   *

EMM DATA                               *

CARRIER LOCK                           YES

PCR LOCK                               YES

SNR                         36 dB      ssss

MODULATION MODE                        QAM 64

SHORT TERM ERROR COUNT                 0000

LONG TERM ERROR COUNT                  9999

TUNED FREQ                             543.000
```

The In-band Diagnostic fields are:

Field	Description
Data Activity Indicator	Lights when the set-top is receiving data on the in-band channels. The indicator covers all packet processors regardless of which stream they are monitoring. The following variables can display:
	Blank No data received
	∗ Data received
EMM Data Indicator	Lights when the set-top is receiving a message on the EMM stream. The indicator is clear when entering this diagnostic. The following variables can display:
	Blank No data received
	∗ Data received
Carrier Lock	Indicates that the digital in-band receiver is locked to the carrier with the following variables:
	YES Carrier locked
	NO Carrier unlocked
	Analog Analog channel
PCR Lock	Indicates a program-clock-reference lock with the current digital data stream.
SNR	Displays an estimate of the carrier signal-to-noise ratio. The SNR displayed is a measure of the QAM cluster variance, which is proportional to the SNR.
	Analog channels display analog for carrier lock. The SNR displays a number for the numeric value and blank for the ssss value.
	The following variables can display:
	Blank The digital section is still in the initial state. If this occurs, check diagnostic d07.
	GOOD Good value
	FAIR Marginal signal level; check the signal
	POOR Unusable signal
Modulation Mode	Indicates the modulation mode — QAM 64 or QAM 256

Field	Description
Short Term Error Count	Indicates the FEC errors (maximum count of 65535) at 5-second intervals. The Short Term Error Count is cleared after polling.
Long Term Error Count	Indicates the accumulation of the Short Term Error Count (maximum count of 65535). The Long Term Error Count is cleared every 24 hours.
Tuned Frequency	Indicates the actual frequency the tuner is programmed (Carrier Definition Frequency + 1.75 MHz).

d 04: Audio/Video Status

This diagnostic displays the audio and video information for the current tuned channel:

```
AUDIO/VIDEO STATUS

ADP Lock            YES

Audio Mode          STEREO

Audio SPDIF         N/A


VP Lock             YES

MPEG Method         MUTE BLACK
```

The Audio Video Status fields are:

Status	Description
ADP Lock	The Audio Processor locked status: YES or NO
Audio Mode	The audio modes are: ▪ N/A ▪ Mono ▪ Stereo ▪ Surround
VP Lock	The Video Processor locked status: YES or NO
MPEG Method	The MPEG Method selected: ▪ Unmuted ▪ Mute Still ▪ Mute Black

d 05: Unit Address

This diagnostic displays the 16-digit (40-bit) unit address of the set-top.

On the unit address OSD, the unit, network, and TV PassCard (TVPC) addresses are in decimal form (13 address digits and three check digits). The multicast 16-bit address is in TCP/IP decimal byte form.

```
DCT700 UNIT ADDRESS:
000-02831-99902-038

Network Address:
085-14316-55765-159

TVPC:
000-00000-00000-000

Multicast 16 Address:
085.085   102.102
119.119   136.136
DATA
068.068   051.051
034.034   017.017

Seed Health     0xFF
```

The Unit Address fields are:

Field	Description
DCT700 Unit Address	Indicates the unit address
Network Address	Indicates the network address
TVPC	Indicates the TV Passcard Address.
Multicast 16 Address	The Multicast 16 address numbers change to display the values for each data stream. The following is a list of Multicast 16 addresses: ▪ NET ▪ EMM ▪ SCC ▪ DWLD ▪ DATA ▪ VCN ▪ POLL
Seed Health	This value represents the health of the set-top and should be 0xFF. If it is not 0xFF, see the "Troubleshooting" section for more information.

d 06: Firmware Version

This diagnostic displays the:

- Dena firmware version or revision number
- Build date and time
- TSODA firmware version number
- CAMEL (CMLBK) firmware version number (always 0000)

The BOOT is the lowest level of firmware code that can be used on the DCT700.

```
FIRMWARE VERSION
02.06                    BOOT 02.03
Oct 6, 2003
19:18:46

TSODA t16

CMLBK 0000
```

d 07: Current Channel Status

This diagnostic displays the instantaneous status of the last attempted channel tune on the in-band tuner. It shows the channel type (analog/digital), acquisition state, purchasable indicator, preview indicator, parental control status, and mute status.

```
CURRENT CHANNEL STATUS

TYPE  DIGITAL           aaa  bb
STATUS                  ccccc
dddd                    CONNECTED
PREVIEW                 NO

                        CURR      NEXT
PURCHASABLE             NO        --
PURCHASED               NO        --
EPOCH NUM               0X0       1
EPOCH TYPE              0x0       0x0
AUTH                    0X0       0X0

SERVICE 0  STATUS  1 ID  0X0004 0X00
CH 204     TUNED FREQ   543.000
```

The Current Channel Status fields are:

Field	Description
Type	Indicates whether the current channel is analog or digital.
Status	Indicates the channel type with the following variables: ▪ Authorized ▪ Unauthorized ▪ Encrypted ▪ Unencrypted
Connected	Indicates whether the set-top is connected or disconnected. If the value is connected, the program is viewable.
Preview	Indicates whether the program is in the free preview state (YES or NO).
Purchasable	Indicates whether the current or next program can be purchased (YES or NO).
Purchased	Indicates whether the current or next program has been bought (YES or NO).
EPOCH Number	For Motorola use only.
EPOCH Type	For Motorola use only.
Authorization	For Motorola use only.
Service	For Motorola use only.
Status	For Motorola use only.
ID	For Motorola use only.
CH	Indicates the channel currently tuned when the OSD appeared.
Tuned Frequency	Indicates the actual frequency the tuner is programmed (Carrier Definition Frequency + 1.75 MHz).

The CURRENT CHANNEL STATUS variables are:

OSD Variable	State	
aaa	ENC	encrypted
	UNE	unencrypted
	FWK	fixed key
	FPK	fixed program key
bb	Current epoch authorization reason in the current_epoch_auth_reason field. This is displayed in hex:	
	00	missing program re-key
	01	missing working key epoch message
	02	missing event blackout message
	03	missing category rekey
	04	old category sequence in program, rekey message
	10	program bought
	11	program bought without taping
	12	subscribed with taping
	13	subscribed without taping
	14	subscribed with taping purchasable
	15	IPPV with taping
	16	IPPV without taping
	20	bad seed checksum
	21	bad debit buffer checksum
	30	IPPV not enabled
	31	insufficient credit to purchase
	32	show count limit exceeded
	33	debit register will overflow
	34	no AFP records available
	36	maximum package cost exceeded
	37	no IPPV overlay in message
	40	not subscribed
	41	regional blackout
	42	event blackout
ccccc	INIT – Initialized state	
	CONFI – Configured	
	ACQUI – Acquiring the program	
	AUTH – Authorized for the program	
	Not A – Not authorized for the program	
ddd	blank – Connected	
	NOT – Not connected	

d 08: Renewable Security

This diagnostic includes a TVPC card that returns the security status to current.

```
RENEWABLE SECURITY

TVPC NOT REQUIRED

CRYPTO      NOT MATED

STATUS      00

VERSION     00
```

The Renewable Security fields are:

Field	Description
TVPC Required / Not Required	Indicates whether further operation of the set-top requires the TVPC.
CRYPTO	Lists the current mode as displayed on the CRYPTO OSD (Stand Alone, Support, or Not Mated).
Status	Indicates the TVPC status:
	00 OK
	01 TVPC communication problem
	02 TVPC required
	03 Validator does not match between GK and TVPC
	04 Invalid unit key number
	05 Old TVPC unit address
	0a TVPC not mated
	0b TVPC /base module unit address mismatch
	0C New TVPC, but wrong version number
	0d TVPC unit address mismatch
Version	Indicates the version of renewable security being used.

d 09: Upstream Modem (STARVUE II Diagnostics)

This diagnostic shows the status and operating parameters for the STARVUE II RF return:

```
STARVUE II DIAGNOSTICS
STATUS:                 DISABLED
FREQUENCY:              23.000 MHz
LEVEL:                  39
IPPV:                   DISABLED


170          6-15-01         20:49:33
```

The STARVUE II Diagnostics fields are:

Field	Description
Status	Indicates the transmitter status:
-	Idle
t	Transmitting
Frequency	Indicates the transmitting frequency.
Level	Indicates the approximate power value of the STARVUE II transmitter in dBmV. The difference between the power value on the diagnostic screen and the actual power of the STARVUE II module may be ± 5 dBmV.
IPPV	Indicates the Interactive Pay-Per-View status with the following variables:
ENABLED	IPPV enabled
UNSENT −##	The set-top contains unsent IPPV transactions. *The variable −## is the number of unsent transactions.*
DISABLED	IPPV disabled
Last Line	Displays the sequence number, time, and date of the last poll message.

d 10: Application (APP) Code Modules

This diagnostic displays the currently downloaded code modules. This can be a multi-page display. Press **SELECT** to display additional pages. This is an example of an OSD screen for a set-top that contains ROM:

```
APP CODE MODULES

ASTB xxxx     aaa     bbb      ccc
MODULE              VER     STATUS     ID

0-8-0772            07.72   ENABLED    0001
Appl_____          02.00   DOWNLD     07DA
```

The Application Code Modules fields are:

Field	Description
ASTB	*xxxx* indicates: ▪ INVD — Not configured for code suite downloads ▪ VALD — Configured for code suite downloads ▪ BLDG — Building code suite If *xxxx* is VALD or BLDG: ▪ *aaa* — The code suite list ID ▪ *bbb* — The code suite list version ▪ *ccc* — The code suite time remaining
Module	Indicates the object name
Version	Indicates the object version
Status	The available modes are: ▪ LOADING ▪ DELETED ▪ ENABLING ▪ ENABLED ▪ DSABLNG ▪ DISABLD ▪ DELETNG ▪ POSTPND ▪ ENNORUN ▪ DISNORUN
ID	Indicates the object AppID

d 11: Memory Status

This diagnostic displays the set-top memory status. The format depends on the installed memory types.

```
MEMORY STATUS


EEPROM VER.NO.                              00.00


                   PLATFORM                 APPLICATION
NVMEM              238k                      20k
DRAM               8192k                     8192k
FLASH              1408k                     2048k
```

The Memory Status fields are:

Field	Description
EEPROM Version Number	Indicates the EEPROM version (never used, should always be 00.00).
Platform	Indicates sizes of memory types allocated to platform code.
Application	Indicates sizes of memory types allocated to application code.
System Heap	Indicates breakdown of DRAM allocations.

d 12: Interactive Info

This diagnostic tool gathers data about your system:

```
INTERACTIVE INFO

IP                :    0.0.0.0
UPM               :    0X000021
UPSTREAM ID       :    0X0000
DOWNSTREAM ID     :    0X0000
STATE             :    UNCONFIG
MAC ABORT CNTR    :    0000

GOOD PACKETS:
ERROR PACKETS:

SOCKET PORT STATE
0            UNUSED
1            UNUSED
2            UNUSED
3            UNUSED
4            UNUSED
5            UNUSED
```

The Interactive Info fields are:

Field	Description
IP	Indicates the set-top IP address assigned by the NC 1500, in dotted-decimal format; for example, *xxx.xxx.xxx.xxx* where each *xxx* ranges from 000 to 255.
UPM	Indicates the upstream modem address. This UPM value is the same as the terminal ID assigned by the DAC 6000. The UPM is a unique, system-generated, eight-digit integer between 1 and 16777215 displayed in hexadecimal format.
Upstream ID	The set-top transmission parameter assigned by the DAC 6000. It is a four-digit value ranging from 0000 to 9999 displayed in hexadecimal format.
Downstream ID	The set-top transmission parameter assigned by the DAC 6000. It is a four-digit value ranging from 0000 to 9999 displayed in hexadecimal format**.**
State	The state modes are: ▪ MAC CONNECT ▪ UNCONFIG ▪ INIT_WAIT_DC_OR_ ▪ WAIT_LM_ACK ▪ WAIT_SO_ACK ▪ WAIT_LA_OR_SO ▪ INIT_STOPPED ▪ RUN_WAIT-DC-OR-C ▪ RUNNING ▪ RUN_STOPPED ▪ INVALID

Field	Description
MAC Abort Cntr	The MAC Abort Counter increments every time the MAC layer reaches the Cell Abort Count limit. The MAC Abort Counter is reset by the successful upstream transmission of a cell, for example, when an ACK is received by the set-top.
Good Packets	Not implemented.
Error Packets	Not implemented.
Socket Port State	The Socket Port State modes are: ▪ UNUSED ▪ OPENED ▪ READY ▪ RECVING ▪ SENDING

d 13: MAC Frequency Table

The set-top uses a range of frequencies set by the host for upstream communications. The MAC FREQUENCY TABLE that displays your frequency and signal power:

```
MAC FREQUENCY TABLE


FREQ        POWER
```

The MAC Frequency Table fields are

Field	Description
Frequency	Indicates the frequency, in Hz, for an upstream channel.
Power	Indicates the power level, in dBmV, used on a particular upstream channel to send data to the RPD.

d 14: Control Channels

This diagnostic lists channels, band types, PIDs, and counts.

```
Control Channel Info

CHN    BAND    PID    Cnt     Ovfl   Err

0      INB     0000   1       0      0

1      INB     00A9   2198    0      0
.
.

8      OOB     0777   15207   1      0
```

d 15: Message Types

This diagnostic displays a listing of PIDs and counts. In addition the message types with IDs and counts are shown:

```
Message Types (hex data)
Msg          Id    Cnt    Msg    Id    Cnt
0            -     216    9A     E     0
1            2     89     A0     15    0
```

The Message Types fields are:

Field	Description
Msg	The message type
ID	The connection ID
Cnt	The number of messages received of this type

d 16: In-Band Program Association Table (PAT)

This diagnostic displays the Program Association Table Information. (For Motorola use only.)

```
IN BAND PAT (hex data)

    PAT       SN      PID
    001      0001     0029
```

d 17 In-Band Program Map Table (PMT)

This diagnostic displays the Program Map Table information. (For Motorola use only.)

```
IN BAND PMT (hex data)

    PMT      TYPE     PID      PCR      0210
    001      0080     0210     ECM      0211
```

d 18: Task Status

This diagnostic displays a listing of tasks. (For Motorola use only.)

```
TASK STATUS (hex data)

TID     RID    PRI   STARTS   RUNTIME   STK%
 64      00     2    21553    47441     26
 63

  ...

  0
```

d 19: USB Diagnostics

This diagnostic is used to verify the functionality of the USB port. (For Motorola use only)

```
USB DIAGNOSTICS
NOT INSTALLED
```

d 20 In-Band Multicast Address Filter

This diagnostic displays in-band multicast filter information:

```
     IN BAND MULTICAST ADDRESS FILTER
Filter Table:
          DMCA    MCA   PQ      RQ      APP    CID
     NA   0000   0000    -01     -01    0000    0000 0000
     NA   0000   0000    -01     -01    0000    0000 0000
     NA   0000   0000    -01     -01    0000    0000 0000
     NA   0000   0000    -01     -01    0000    0000 0000


REGISTER VALUES:
            MCA    PID
           0000   0000
           0000   0000
           0000   0000
           0000   0000
```

The In-Band Multicast Address Filter fields are:

Field	Description
Filter Table	
DMCA	Indicates the default multicast 16 address.
MCA	Indicates the current multicast 16 address.
PQ	Indicates the preemption notification queue ID.
RQ	Indicates the response queue ID.
APP	Indicates the application ID.
CID	Indicates the connection ID.
Register Values	
MCA	Indicates Multicast 16 filter register contents.
PID	Indicates PID filter register contents.

d 21: Keyboard / LED Diagnostics

This diagnostic does not apply to the DCT700.

Abbreviations and Acronyms

CSR	Customer Service Representative
DCT700	Digital Consumer Terminal 700
EMM	entitlement management message(s)
EPG	electronic program guide
HRC	harmonically related carriers
IPG	interactive program guide
IPPV	impulse pay-per-view
IRC	incrementally related carriers
MPAA	Motion Picture Advisory Association
NVOD	Near Video on Demand
NVRAM	Non-volatile random-access memory
OSD	on-screen display
PCR	program clock reference
PID	packet identifier
PPV	Pay-Per-View
QAM	quadrature amplitude modulation
QPSK	quadrature phase shift keying
RSA	Return for Service Authorization
TCP/IP	Transmission Control Protocol/Internet Protocol
TRC	Technical Response Center
TvPC	TV PassCard
VOD	video on demand

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