DIRECTV Set-top box information for the installer

Published by

DTV-MD-0058

(Rev. 1.3)

January 3, 2007

REVISION HISTORY			
Revision	**Date of Issue**	**Author**	**Scope**
1.0	September 1, 2005	D. K.	Initial version
1.1	October 19, 2005	J. G.	Updated formating
1.1.a	November 17, 2005	J. G.	Fixed 155200 typo and USB 2.0 default data rate in Table 3. Deleted duplicate table of Amplifier codes (Table 17)
1.2	November 18, 2005	J. G.	Intermediate version. Never released.
1.3	January 3, 2007	W. M.	Updated D11 default baud rate and added R15 in Table 2 and Table 3. Fixed baud rate in Section 3.9.

Table of Contents

Table of Figures

List of Tables

1 Introduction

1.1 Disclaimer

DIRECTV makes no representations or warranties, express or implied, that use of the technologies described in this specification will not infringe patents, copyrights, or other intellectual property rights of third parties. Nothing in this specification should be construed as granting permission to use any of the technologies described. Anyone planning to make use of technology covered by the intellectual property rights of others should first obtain permission from the holder(s) of the rights. This specification is subject to change without notice. DIRECTV does not accept any responsibility whatsoever for any damages or liability, direct or consequential, which may result from use of this specification or any related discussions. These specifications are provided "as is" and the user of these specifications assumes any and all risks associated with the use of these specifications. DIRECTV expressly disclaims any and all representations or warranties, express or implied, regarding the specifications, including without limitation any warranty as to merchantability, fitness for a particular purpose, non-interruption of use, or non-infringement.

1.2 Scope

This document provides information on the DIRECTV Set-top box data port, front panel, and remote control commands as an aid for installers, and auxiliary devices. This document is relevant to set-top box (STB) models D10-100, D10-200, D10-300, D11, R15 and H10. Other models are not supported by this document.

1.3 Feedback

Email feedback to **custominstallsupport@directv.com**

2 Set-top box Front Panel Shortcut Keys

The following shortcut key combinations are implemented by pressing the front panel keys simultaneously. The shortcut keys may not work if user interface graphics are on the screen instead of video. Table 2 shows which shortcut keys are supported by each model.

Table 1: Shortcut Keys Combinations

Key Combination	Action
ACTIVE and UP	Access the **System Setup: System Info & Test** screen.
ACTIVE and RIGHT	Access the **System Setup: System Diagnostic** (hidden) screens. The System Diagnostic screen contains menu items to change the LNB configuration to stacked/unstacked; input phone settings for prefixes and call waiting, and a modem test.
ACTIVE and DOWN	Skip Guided Setup and display **Startup: Full Screen (Live TV)** on the default channel

Table 2: Supported Shortcut Keys

STB Model	ACTIVE and UP	ACTIVE and RIGHT	ACTIVE and DOWN
D10-100		X	
D10-200		X	
D10-300		X	
D11		X	
H10	X	X	X
R15	X	X	X

3 Data Port Connectors

Table 3 shows what type of connector and data rate the STB data port has.

Table 3: Type of Data Port Connector

STB Model	Type of Data Port Connector	Data Rate (baud)
D10	RJ22	9600
D11	USB	9600
H10	RJ22	9600
R15	USB	9600

3.1 Low-Speed Data Port Connector

The STB connector type will be a standard DB-9F or RJ22 (4 way/4 position jack). The pins for the DB-9F are as shown in Figure 1. The STB will use three (3) lines (L2-Rx, L3-Tx and L5-Grnd) for bi-directional full-duplex communications. Figure 2 shows the orientation of the RJ22 (4 way/4 position jack).

Line positions, designated as “optional”, may be provided (but are not required to be provided) by the STB as a convenience to source a “TRUE” state to those PC serial interface lines that may require a “TRUE” state for data transfer.

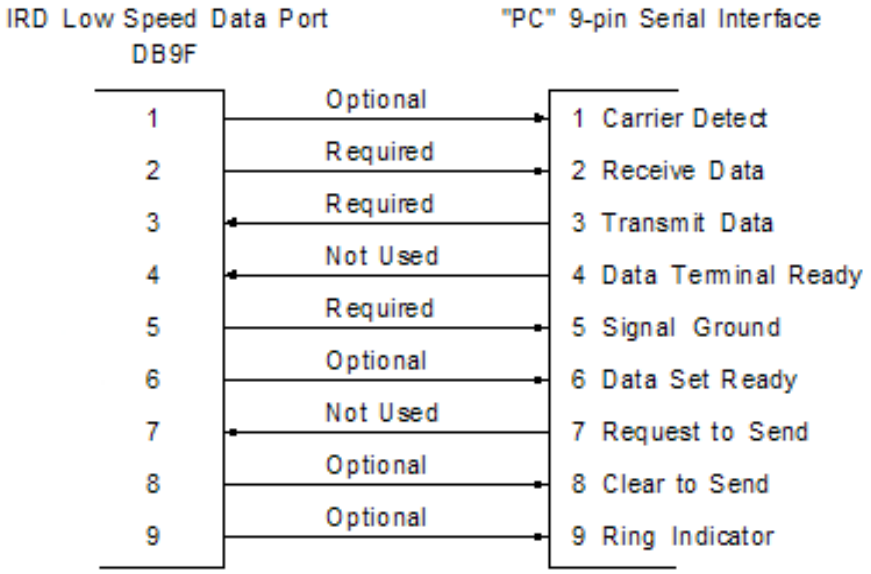

Figure 1. Low-Speed Data Port Pin Assignment Diagram

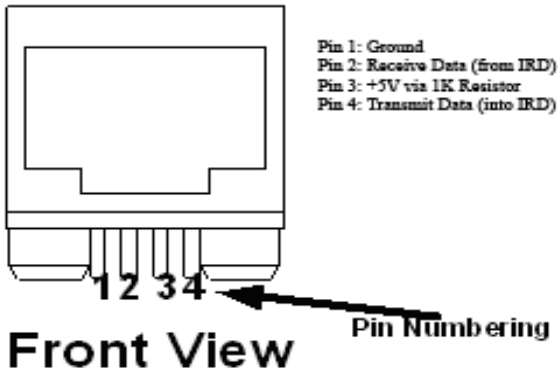

Figure 2. Orientation of the RJ22 (4 way/4 position) Jack

3.2 Low-Speed Data Port Interface

The STB low-speed data port is a PC compatible serial port, and functions as a subset of RS-574. The intended use is for direct connection to a PC or other equipment, allowing exchange of control and data between the STB and that equipment using specialized software. For successful communications with the STB, some PC serial port interface cards may require that their flow control lines be strapped internally as “enabled,” and thus disconnected from any external flow control signaling. Additionally, those PC serial ports incorporating a buffered 16550 UART may be least likely to experience communications problems.

The majority of STBs have a default baud data rate of 9600. The data format is 1 start bit, 8 data bits, no parity, 1 stop bit, and no handshaking.

3.3 Low-Speed Electrical Performance and Characteristics

The low speed timing characteristics are defined in Table 4.

Table 4: Timing Characteristics

Parameter	Requirement
Bit Timing	104 µs ±7 µs
Total Character Interval	1.04 ms ± 8 µs

3.4 Bit Timing (Start, –D0 TO –D7, and Stop)

The STB complies with the bit timing requirements as shown in Figure 3.

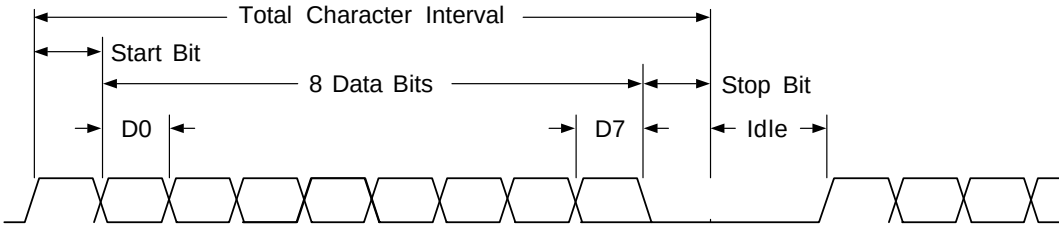

Figure 3. Bit Timing Diagram

3.5 Idle Interval, General

The general idle interval is a minimum of zero (0) msec. The maximum idle interval will be determined by the rate of transmitted data and internal STB processes when the port is "opened," or is determined by the service command parser when the port is "closed."

3.6 Idle Interval for Non-Empty STB Buffer

The idle interval will not exceed 30 ms as long as at least one byte exists in the STB receive buffer, given that the port is "opened."

3.7 Low-Speed Input Characteristics

3.7.1 Input Signaling Characteristics (Pin 3)

The low-speed data port will comply with the input signaling characteristics shown in Table 5.

Table 5: Input Drive Characteristics

Parameter	Specification
Space voltage	+3.0 volts min, +25 volts max
Mark voltage	-25 volts min, -3.0 volts max
Terminating impedance Resistance	6K < R < 7K resistive to ground
Capacitance	C < 150 pf

3.8 Low-Speed Output Characteristics

3.8.1 Output Drive Characteristics (Pin 2)

The STB output drive characteristics are as shown in Table 6.

Table 6: Output Drive Characteristics

Parameter	Specification
Space voltage	+5.3 volts max at Ioh = 0 mA, +3.0 volts min
Mark voltage	-6.0 volts min at Iol = 0 mA, -3.0 volts max,
Terminating impedance Resistance	3k < R < 7k resistive to ground
Capacitance	C < 2500 pF

3.8.2 Passive Outputs (Pins 1, 6, 8, and 9) (Optional)

If the data port optional pins one (1), six (6), eight (8) and nine (9) are provided, the passive outputs will be as shown in Table 7.

Table 7: Passive Drive Characteristics

Parameter	Specification
Output	-2 mA ±20% at + 3 volts and –10 mA ±20% at –5 volts

3.8.3 Low-Speed Signaling Conventions

The data port signaling conventions will be as listed in Table 8.

Table 8: Low-Speed Data Port Signaling Conventions

Interchange voltage	negative or positive
Binary state	1 or 0
Signaling state	mark or space
Function	OFF or ON

The idle state for data port pins two (2) and three (3) will be “mark”.

3.9 USB 2.0 Data Ports

All new DIRECTV Set-top boxes (STB) have USB 2.0 data ports replacing the DB-9F or RJ22 data port connectors. The STB USB port has a host configuration. Serial commands are interfaced through the data port using a USB-Serial adapter. The following RS-232-compatible serial port adapters will be supported:

Manufacturer	Model	USB Vendor ID	USB Product ID
IOGEAR	GUC232A	0x067B	0x2303
ATEN	UC-232A	0x067B	0x2303
BAFO	BF-810	0x067B	0x2303

4 Data Port Commands

4.1 Summary of Useful Data Port Commands

Command Code	Command Label	Description
0x81	Standby[1]	Put STB in Standby
0x82	Active	Turn STB on
0x83	GetPrimaryStatus	Status information on current channel
0x87	GetCurrentChannel	Get the major and minor numbers for the tuned channel
0x90	GetSignalQuality	Signal level for the tuned channel
0x91	GetCurrentTime	Current time in UTC
0x92	GetUserCommand	Get the remote or front panel command input by the user
0x93	EnableUserEntry	Allows direct control of the STB by the remote or front panel buttons
0x94	DisableUserEntry	Disables direct control of the STB by the remote or front panel buttons
0x95	GetReturnValue	Returns the last Return Value issued by a data port command
0x96	Reboot	Commands a reboot
0xA5	SendUserCommand	Send remote control commands through the data port
0xA6	OpenUserChannel	Tune to a channel by inputting a channel number

4.2 Default Data Rate and Format

All STBs have a default data rate of 9600. The data format is 1 start bit, 8 data bits, no parity, 1 stop bit, and no handshaking.

[1] This command holds its value after a warm start. Other commands are terminated.

4.3 Command Protocol

The STB will use the command and data acknowledgment protocol for flow control as specified in Figure 4

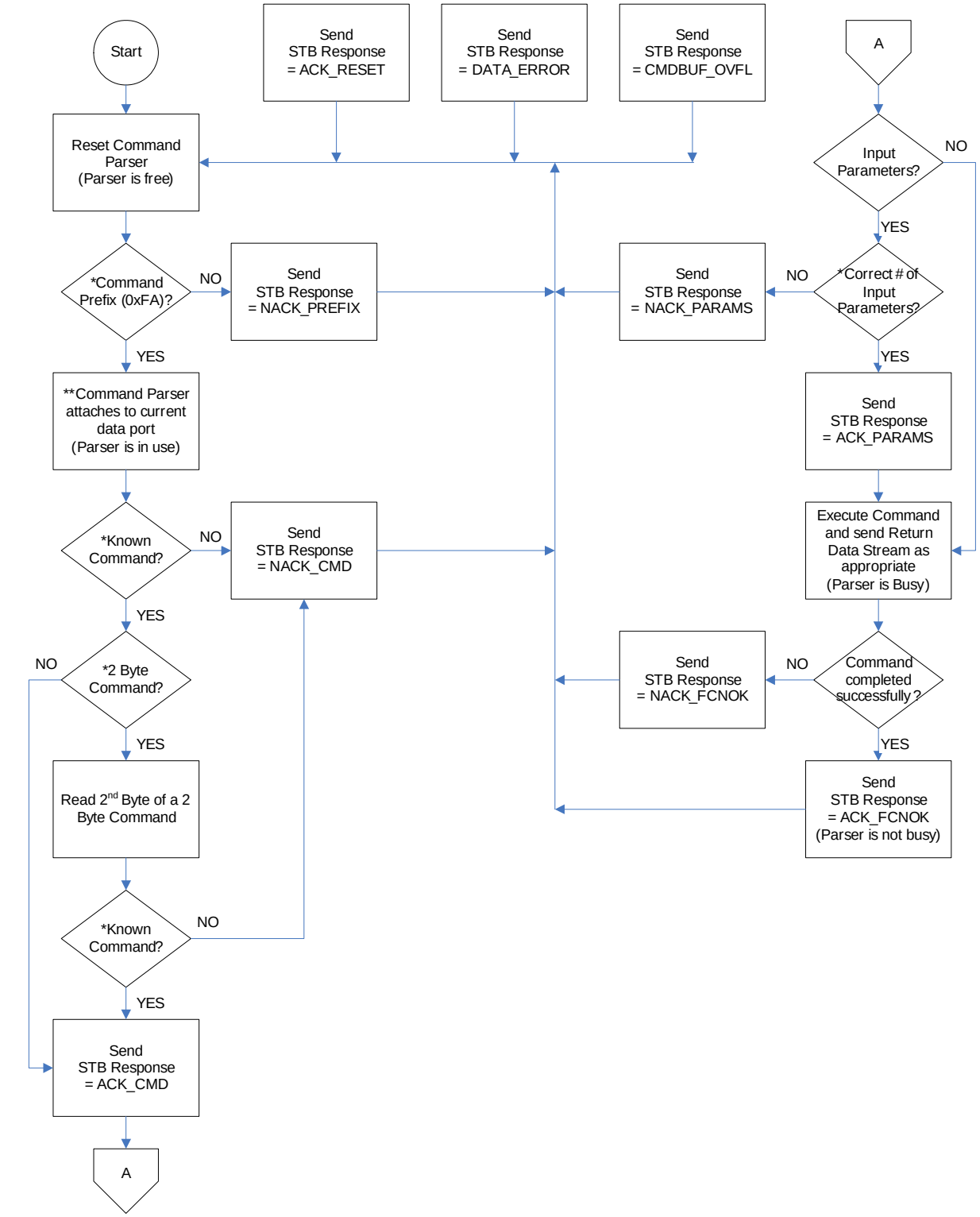

Figure 4. Service Command Parser Flowchart

4.4 STB Command Prefix

0xFA Required Command Prefix, precedes all commands

4.5 STB Responses

Response Code	Response Label	Description
0xF0	ACK_CMD	Command Acknowledge
0xF1	NACK_CMD	Command Unknown
0xF2	ACK_PARAMS	Parser received the correct number of parameters
0xF3	NACK_PARAMS	Parser timed out when receiving parameters
0xF4	ACK_FCNOK	Service command completed successfully
0xF5	NACK_FCNOK	Service command completed unsuccessfully
0xF6	ACK_RESET	Command parser reset - break condition detected
0xF7	NACK_BUSY	A previous service command is pending completion
0xF9	NACK_INUSE	Command parser in use by another device
0xFB	NACK_PREFIX	Expected Prefix, prefix not sent
0xFD	DATA_ERROR	Command parser reset – Communication data error
0xFF	CMDBUF_OVFL	Command parser reset – Command buffer

5 Data Port Command Details

All parameters specified by square brackets "[ ]" are one (1) byte in length.

5.1 Standby (0x81)

Command Label	Standby
Command Byte	0x81
Input Parameter(s)	None
Return Data Stream	None
Return Response	ACK_FCNOK : Always Success
Return Value	0x0000 : Always Success
Description	The STB will execute a Standby command by placing the STB in the "low power" mode where the audio and video processing is disabled. This command has the same effect as turning the box "off" by pressing the front panel power button.

Example #1:

Scenario –Turn off the STB.

Input Standby Command 0xFA 0x81

Input	0xFA	0x87
Description	Command Initializer	Command ID

Return Data – 0xF0 0xF4

Input	0xF0	0xF4
Description	Command acknowledgements	Command successful

5.2 Active (0x82)

Command Label	Active
Command Byte	0x82
Input Parameter(s)	None
Return Data Stream	None
Return Response	ACK_FCNOK : Always Success
Return Value	0x0000 : Always Success

Description	The STB will execute an Active command by placing the STB in the operational mode. This command has the same effect as turning the box "on" by pressing the front panel power button.

5.3 GetPrimaryStatus (0x83)

Command Label	GetPrimaryStatus
Command Byte	0x83
Input Parameter(s)	None
Return Data Stream	[majorchnHI][majorchnLO][minorchnHI][minorchnLO] [PrimaryType][AudioType][DataType] [PrimarySCIDHI][PrimarySCIDLO] [AudioSCIDHI][AudioSCIDLO] [DataSCIDHI][DataSCIDLO] [networkHI][networkLO] [Xponder] [Year][Month][Day][Hour][Min][Sec][DayOfWeek] [ROMVer3][ROMVer2][ROMVer1][ROMVer0] [STS ID0][STS ID1][STS ID2][STS ID3][STS Ver] [CAM ID0][CAM ID1][CAM ID2] [CAM ID3][CAM ID4][CAM ID5] [SignalQuality] [Rx ID0][Rx ID1][RxID2][RxID3][RxID4][RxID5] Major Channel Number: 0x0000 – 0xFFFF Minor Channel Number: 0x0000 – 0xFFFF PrimaryType: 0x0B Data 0x0C Audio 0x0E Retired 0x0F Video - TV 0x10 Video - HDTV 0xFF None AudioType: 0x00 MPEG In / PCM Out 0x09 AC3 In / AC3 Out

	0xFF None DataType: 0x0B Retired 0x0C Retired 0x0D Retired 0xFF None SCIDs: 0x0000 – 0xFFFE 0xFFFF if not required Network: 0x0000 – 0xFFFF Xponder: 0x00 – 0xFF (0 to 255, corresponding to transponders 1 to 256) Year: 0x00 – 0xFF (# of years after 1993) Month: 0x01 – 0x0C Date: 0x01 – 0x1F Hour: 0x00 – 0x17 Minute: 0x00 – 0x3B Second: 0x00 – 0x3B DayOfWeek: 0x01 to 0x07 (0x01=Monday….0x07=Sunday) Signal Quality: 0x00 – 0x64 (0x00=FEC unlocked and 0x64=max signal strength) CAM and RID are in Hex format
Return Response	ACK_FCNOK : Success NACK_FCNOK : Failure - STB not tuned to a DIRECTV System channel
Return Value	0x0000 : Success Non-Zero : Failure - STB not tuned to a DIRECTV System channel
Description	The STB will execute a GetPrimaryStatus command by providing the STB's health and status as defined by the Return Data Stream parameters. The STB will provide current time in Universal Time Coordinate (UTC) unconditioned by time zone and daylight savings settings. The fields ROMVer3, ROMVer2, ROMVer1, ROMVer0, STS ID0, STS ID1, STS ID2, STS ID3, STS Ver are private. The CAM ID is returned in hexadecimal with zeroes stuffed into the most significant positions to fill out the unused bits. For example, a CAM ID = 0013 1751 9641 in hex is 0x4E87C119. The GetPrimaryStatus command would return 00 00 4E 87 C1 19 for the CAM ID. The RID ID is returned in hexadecimal with zeroes stuffed into the most significant positions to fill out the unused bits. For example, a RID = 0001 7035 6778 in hex is 0xA27702A. The GetPrimaryStatus command would return 00 00 0A 27 70 2A for the RID.

5.4 GetCommandVersion (0x84)

Command Label	GetCommandVersion
Command Byte	0x84
Input Parameter(s)	None
Return Data Stream	[VerMajor] [VerMinor] [Reserved1] [Reserved2] As defined in this document in Section 1.5 VerMajor: 0x00 – 0xFF; VerMinor: 0x00 – 0xFF Reserved1, Reserved2: 0x00
Return Response	ACK_FCNOK : Always Success
Return Value	0x0000 : Always Success
Description	This command displays the version of the Data Port Service Command ICD specification the software was coded to.

5.5 GetCurrentChannel (0x87)

Command Label	GetCurrentChannel
Command Byte	0x87
Input Parameter(s)	None
Return Data Stream	[majorchnHI][majorchnLO][minorchnHI][minorchnLO]
Return Response	ACK_FCNOK : Success NACK_FCNOK : Failure – STB not tuned to a DIRECTV System channel
Return Value	0x0000 : Success Non-Zero : Failure – STB not tuned to a DIRECTV System channel
Description	The STB will execute a GetCurrentChannel command by providing the major/minor channel number (i.e., for the DIRECTV system channel the STB is tuned to) in the Return Data Stream.

Example #1:

Scenario –Find out what channel a single tuner STB is tuned to (STB is tuned to channel 276 which in hexadecimal notation is 0x114).

Input GetCurrentChannel Command 0xFA 0x87

Input	0xFA	0x87

Description	Command Initializer	Command ID

Return Data – 0xF0 0xF2 0x1 0x14 0xFF 0xFF 0xF4

Input	0xF0 0xF2	0x114	0xF4
Description	Command acknowledgements	Channel	Command successful

5.6 GetSignalQuality (0x90)

Command Label	GetSignalQuality
Command Byte	0x90
Input Parameter(s)	None
Return Data Stream	[SignalQuality] Signal Quality: 0x00 – 0x64 (0x00=FEC unlocked and 0x64=max signal strength)
Return Response	ACK_FCNOK : Success NACK_FCNOK : Failure – STB not tuned to a DIRECTV System channel
Return Value	0x0000 : Success Non-Zero : Failure – STB not tuned to a DIRECTV System channel
Description	The STB will execute a GetSignalQuality command by providing the signal quality in the Return Data Stream.

5.7 GetCurrentTime (0x91)

Command Label	GetCurrentTime
Command Byte	0x91
Input Parameter(s)	None
Return Data Stream	[Year][Month][Date][Hour][Minute][Second][DayOfWeek] Year: 0x00 – 0xFF (# of years after 1993) Month: 0x01 – 0x0C Date: 0x01 – 0x1F Hour: 0x00 – 0x17 Minute: 0x00 – 0x3B

	Second: 0x00 – 0x3B DayOfWeek: 0x01 to 0x07 (0x01=Monday….0x07=Sunday).
Return Response	ACK_FCNOK : Always Success
Return Value	0x0000 : Always Success
Description	The STB will execute a GetCurrentTime command by providing the current time in Universal Time Coordinate (UTC) conditioned by time zone and daylight savings settings.

5.8 GetUserCommand (0x92)

Command Label	GetUserCommand
Command Byte	0x92
Input Parameter(s)	None
Return Data Stream	[Type][Device][Command] Type: 0x00 Key Toggle 0x01 Key Down 0x03 Key Up Device: 0x00 Front Panel 0x01 Remote Key: 0xA0 Enter (key #38) 0xA1 Info (key #26) 0xA2 Active (key #27) 0xA3 List (key #29) 0xA4 Back (key #31) 0xA5 (-) (key #37) 0xC3 Select (key #36) 0xC5 Power ON (key #1) 0x9A Right Arrow (key #35) 0x9B Left Arrow (key #34) 0x9C Up Arrow (key #32) 0x9D Down Arrow (key #33) 0xFA Retired (TV/STB) 0xD0 Power OFF (key #2) 0xB0 Pause (key #43) 0xB1 Rewind (key #44) 0xB2 Play (key #45) 0xB3 Stop (key #46) 0xB4 FFWD (key #47) 0xB5 Record (key #48) 0xB6 Replay (key #49) 0xB7 Advance (key #50) 0xE0 Digit 0 (key #9) 0xE1 Digit 1 (key #10) 0xE2 Digit 2 (key #11) 0xE3 Digit 3 (key #12) 0xE4 Digit 4 (key #13) 0xE5 Digit 5 (key #14) 0xE6 Digit 6 (key #15) 0xE7 Digit 7 (key #16) 0xE8 Digit 8 (key #17)

	0xD1 CH + (key #19) 0xE9 Digit 9 (key #18) 0xD2 CH – (key #20) 0xEA Red (key #39) 0xD3 Guide (key #25) 0xEB Yellow (key #40) 0xD4 Exit (key #30) 0xEC Green (key #41) 0xD5 Power (key #7) 0xED Blue (key #42) 0xD6 Previous Channel (key #21) 0xF7 Menu (key #28) Note: All keys not otherwise identified above will be considered RESERVED.
Return Response	ACK_FCNOK : Success NACK_FCNOK : Failure – No User Command available since last request
Return Value	0x0000 : Success Non-Zero : Failure – No User Command available since last request
Description	The STB will execute a GetUserCommand command by providing the remote control or front panel key presses via the Return Data Stream. The DisableUserEntry command will be called prior to calling the GetUserCommand command. If a user command has transpired since the last GetUserCommand request, the user command Type, Device, and Contents are placed in the return data stream. If a user command has not been made since the last request, the NACK_FCNOK is returned instead. The GetUserCommand is used to identify the type, device and key. For example, if the user pressed and released the Select (0xC3) key then one GetUserCommand is required. The GetUserCommand provides a Type of 0x00 (Key Toggle), Device of 0x01 (Remote) and Key of 0xC3 (Select key). On the other hand, if the user pressed the Select (0xC3) key, held it so that the remote repeats the command, and then released it on the remote control, two (2) GetUserCommands are required. The first GetUserCommand provides a Type of 0x01 (Key Down), Device of 0x01 (Remote) and Key of 0xC3 (Select key). The second GetUserCommand provides a Type of 0x03 (Key Up), Device of 0x01 (Remote) and Key of 0xC3 (Select).

5.9 EnableUserEntry (0x93)

Command Label	EnableUserEntry
Command Byte	0x93
Input Parameter(s)	None
Return Data Stream	None
Return Response	ACK_FCNOK : Always Success
Return Value	0x0000 : Always Success
Description	The STB executes an EnableUserEntry command by allowing remote control and front panel key presses to reach the user interface handler.

5.10 DisableUserEntry (0x94)

Command Label	DisableUserEntry
Command Byte	0x94
Input Parameter(s)	None
Return Data Stream	None
Return Response	ACK_FCNOK : Always Success
Return Value	0x0000 : Always Success
Description	The STB executes a DisableUserEntry command by blocking remote control and front panel key presses from reaching the user interface handler. Instead user commands (front panel entries and IR remote control entries) may be obtained using the GetUserCommand service command.

5.11 GetReturnValue (0x95)

Command Label	GetReturnValue
Command Byte	0x95
Input Parameter(s)	None
Return Data Stream	[RVal3][RVal2][RVal1][RVal0]
Return Response	ACK_FCNOK : Always Success
Return Value	None : Preserves the previous return value
Description	The STB will execute a GetReturnValue command by returning the Return Value from the last issued Command that generated a return value.

5.12 Reboot (0x96)

Command Label	Reboot
Command Byte	0x96
Input Parameter(s)	None
Return Data Stream	None
Return Response	None[2]
Return Value	None
Description	The STB will execute a Reboot command by performing a hard reset of the STB. This command has the same effect as pressing the red reset button on the STB.

[2] Since a hard-reset is performed, no return value or return response can be provided.

5.13 SendUserCommand (0xA5)

Command Label	SendUserCommand
Command Byte	0xA5
Input Parameter(s)	[type][device][command]

type:

0x00	Key Toggle
0x01	Key Up
0x02	Key Down

device:

0x00	Front Panel
0x01	Remote

key:

0XA0	Enter (key #38)	0xB0	Pause (key #43)
0XA1	Info (key #26)	0xB1	Rewind (key #44)
0XA2	Active (key #27)	0xB2	Play (key #45)
0XA3	List (key #29)	0xB3	Stop (key #46)
0XA4	Back (key #31)	0xB4	FFWD (key #47)
0XA5	(-) (key #37)	0xB5	Record (key #48)
0xB6	Replay (key #49)		
0xC3	Select (key #36)	0xB7	Advance (key #50)
0xC5	Power ON (key #1)		
0xE0	Digit 0 (key #9)		
0x9A	Right Arrow (key #35)	0xE1	Digit 1 (key #10)
0x9B	Left Arrow (key #34)	0xE2	Digit 2 (key #11)
0x9C	Up Arrow (key #32)	0xE3	Digit 3 (key #12)
0x9D	Down Arrow (key #33)	0xE4	Digit 4 (key #13)
		0xE5	Digit 5 (key #14)
0xFA	Retired (TV/STB)	0xE6	Digit 6 (key #15)
		0xE7	Digit 7 (key #16)
0xD0	Power OFF (key #2)	0xE8	Digit 8 (key #17)
0xD1	CH + (key #19)	0xE9	Digit 9 (key #18)
0xD2	CH – (key #20)	0xEA	Red (key #39)
0xD3	Guide (key #25)	0xEB	Yellow (key #40)

	0xD4 Exit (key #30) 0xEC Green (key #41) 0xD5 Power (key #7) 0xED Blue (key #42) 0xD6 Previous Channel (key #21) 0xF7 Menu (key #28) 0xF8 Format (key #51) Note: All keys not otherwise identified above will be considered RESERVED.
Return Data Stream	None
Return Response	ACK_FCNOK : Success NACK_FCNOK : Failure – Undefined command
Return Value	0x0000 : Success 0x0001 : Failure – Command not supported for specified device Others : Failure – Bad command
Description	The STB will execute a SendUserCommand command by sending the defined user command to the user interface task. This operation can take place whether command DisableUserEntry (0x13) is active or not. The STB will respond to the user command as though a user button on the keypad or remote control were pressed. Most commands require both a down and an up key press. The type Key Toggle will take 60 ms. Note: There is a chance for command conflict if DisableUserEntry is not active, particularly from stray IR remote control signals.

Example #1:

Scenario – Change to channel 278.

Input SendUserCommand 0xFA 0xA5 0x00 0x01 0xE2 0xFA 0xA5 0x00 0x01 0xE7 0xFA 0xA5 0x00 0x01 0xE8

Each digit in 278 is input separately. Below is the input for the first digit “2”.

Input	0xFA	0xA5	0x00	0x01	0xE2
Description	Command Initializer	Command ID	Key toggle	Remote	Digit 2

Return Data – 0xF0 0xF2 0xF4

Output	0xF0 0xF2 0xF4
Description	Successful command acknowledgements

5.14 OpenUserChannel (0xA6)

Command Label	OpenUserChannel
Command Byte	0xA6
Input Parameter(s)	[majorchnHI][majorchnLO][minorchnHI][minorchnLO]
Return Data Stream	None
Return Response	ACK_FCNOK : Success NACK_FCNOK : Failure – Not a DIRECTV System channel
Return Value	0x0000 : Success 0xFFFF : Channel not found in Program Guide 0xFFFE : Channel is not a DIRECTV System channel 0x0002 : NoVideoControl Word 0x0004 : No Audio Control Word 0x0008 : No HS Data Control Word 0x0010 : No Low-Speed Data Control Word 0x0020 : No System Clock Reference 0x0040 : No Presentation Time Stamp 0x0080 : Tuning Error 0x0100 : Video Error 0x0200 : Access Error 0x0400 : Buffer Overflow 0x0800 : Acquisition Not Complete 0x1000 : Audio Error 0x2000 : Video Timeout 0x4000 : Inactive Transponder 0x1001 : Failure – Channel not found in program guide 0x1002 : Failure – Channel not a DIRECTV system channel 0x1003 : Failure – Channel not authorized 0x1004 : Failure – Channel blocked by viewer 0x1005 : Failure – Channel rating limit exceeded 0x1006 : Failure – Channel spending limit exceeded Others : Failure – Bad command
Description	The STB will execute an OpenUserChannel command by tuning to and decoding streams for the specified guide major/minor channel number.

Example #1:

Scenario –Change to channel 276 (hex 0x114) on a single tuner STB.

Input OpenUserChannel Command – 0xFA 0xA6 0x01 0x14 0xFF 0xFF

Input	0xFA	0xA6	0x01	0x14	0xFF	0xFF
Description	Command Initializer	Command ID	1st part of hex 0x114	2nd part of hex 0x114	No minor #	No minor #

Return Data – 0xF0 0xF2 0xF4

Output	0xF0 0xF2 0xF4
Description	Successful command acknowledgements

6 Remote Control

6.1 Introduction

There are two universal remotes designed by UEI for use with the D10 and H10 STBs. One is the standard IR universal remote, model RC 23, which comes with each D10. The D10 only accepts IR commands. The other is the IR/RF universal remote, model RC24, which comes with the H10. The H10 accepts both IR and RF signals. Both remotes look the same as shown in Figure 5 with the exception of the FORMAT key which is only found on the RC24.

The following sections list the DIRECTV remote control key codes for IR emitters used to control the STB. Also included are the brand setup code list used for setting up the remote to control the TV and auxiliary devices. It is the same code list found within the STB user interface.

Figure 5: DIRECTV Universal Remote

6.2 Remote Control Key Codes

All DIRECTV Set-top box IR and RF commands are modulated on a 38 kHz carrier.

Key Label	Hex Code Assignment
STB Power ON	80h
STB Power OFF	81h
TV Power ON	5Bh(1)
TV Power OFF	5Bh(1)
POWER	10h
TV Input	5Bh(1)
Digit 0	11h
Digit 1	01h
Digit 2	02h
Digit 3	03h
Digit 4	04h
Digit 5	05h
Digit 6	06h
Digit 7	07h
Digit 8	08h
Digit 9	09h
CH +	0Dh
CH -	0Eh
Prev. Channel	0Fh
Volume UP	5Bh(1)
Volume Down	5Bh(1)
Mute	5Bh(1)
Guide	28h
Info	2Eh
Q. Menu	20h

Active	29h
List	2Ah
Exit	26h
Back	27h
Up	21h
Down	22h
Left	23h
Right	24h
Select	25h
(-)	12h
Enter	13h
Red	41h
Yellow	42h
Green	43h
Blue	44h
Pause	32h
Rewind	33h
Play	30h
Stop	31h
FFWD	34h
Record	35h
Replay	36h
Advance	37h
Format	73h
(1) Default value when the remote control has not been programmed	

6.3 Target Device Mode Mapping

The universal remote control can control multiple DIRECTV STBs or other auxiliary devices as shown in Table 9. To control multiple DIRECTV STBs, each remote can use up to four separate code assignments as listed in Table 10.

Table 9: Remote Control Device Mapping

Mode	Load/ Device Assignment
SAT	Satellite, Universal SAT
TV	TV
AV 1	TV, SAT, AMP, TUN, VCR, DVD
AV 2	TV, SAT, AMP, TUN, VCR, DVD

Table 10: DIRECTV STB Device Codes

SYSTEM CODE (in HEX)	Description
0C	DIRECTV 1 S0001 (S1377) default
0D	DIRECTV 2 S0002 (S1378)
02	DIRECTV 3 S0003 (S1388)
03	DIRECTV 4 S0004 (S1389)

6.4 Brand Setup Code List

The following list contains the setup codes for auxiliary devices to be controlled by the DIRECTV universal remote.

Table 11 Setup Codes for Audio Amplifiers (A)

Brand	Codes
Aiwa	30406
Bose	30674
Carver	30269
Curtis Mathes	30300
Denon	30160

Durabrand	31561
GE	30078
Harman/Kardon	30892
JVC	30331
Left Coast	30892
Lenoxx	31561
Linn	30269
Luxman	30165
Magnavox	30269
Marantz	30892, 30321, 30269
Nakamichi	30321
NEC	30264
Optimus	30395, 30300
Panasonic	30308, 30521
Parasound	30246
Philips	30892, 30269
Pioneer	30300, 30013
Polk Audio	30892, 30269
RCA	30300
Realistic	30395
Sansui	30321
Shure	30264
Sony	30689, 30815, 30220
Soundesign	30078, 30211
Technics	30521, 30308
Victor	30331
Wards	30078, 30013, 30211
Yamaha	30354, 30143, 30133

Table 12 Setup Codes for Audio Amp/Tuners (R)

Brand	Codes
ADC	30531
Aiwa	31405, 30158, 30189, 31388, 30121, 30405, 31641
Akai	31512
Alco	31390
Amphion Media Works	31615, 31563
AMW	31615, 31563
Anam	31609, 31074
Apex Digital	31430, 31257
Arcam	31120
Audiotronic	31189

Audiovox	31390
Bose	31229, 30639
Brix	31602
Cambridge Soundworks	31370
Capetronic	30531
Carver	31189, 30189, 30042
Casio	30195
Clarinette	30195
Classic	31352
Coby	31389
Criterion	31420
Curtis Mathes	30080
Daewoo	31250
Dell	31383
Denon	31360, 30004
Fisher	31801, 30042
Garrard	30463
Gateway	31517
Go Video	31532
Harman/Kardon	30110, 30189, 30891
Hewlett Packard	31181
Hitachi	31801
Initial	31426
Integra	31298, 30135
JBL	30110, 31306
JVC	30074, 31495, 31374
Kenwood	31313, 31570, 31569, 30027, 30186, 30042, 30239
KLH	31412, 31390, 31428
Koss	31366
Lasonic	31798
Lenoxx	31437
Linn	30189
Liquid Video	31497
Lloyd's	30195
LXI	30181
Magnavox	31189, 31269, 30189, 30195, 30531, 31514, 30391
Marantz	31189, 31269, 30039, 30189, 31289
MCS	30039
Mitsubishi	31393
Modulaire	30195
Nakamichi	30097
Norcent	31389
Onkyo	30135, 31531, 31298, 30842

Optimus	31023, 30738, 31074, 30181, 30670, 30080, 30531, 30801, 30042,30186
Oritron	31497, 31366
Panasonic	31518, 30039, 31288, 31763, 30367, 30309, 31316, 31764
Penney	30195
Philco	31390
Philips	31189, 31269, 30189, 31120, 30391, 31266
Pioneer	31023, 30014, 30244, 30150, 30630, 30080, 30531, 31384
Polaroid	31508
Polk Audio	30189, 31289
Proscan	31254
Quasar	30039
RCA	31023, 31609, 31254, 30080, 31074, 31511, 31390, 30531
Realistic	30195, 30181
Regent	31437
Rio	31869, 31383
Saba	31519
Samsung	31500, 31295
Sansui	30189
Sanyo	31469, 31251, 30801
Sharp	31286, 30186
Sharper Image	31556
Sherwood	31653, 30502, 30491
Shinsonic	31426
Sonic Blue	31869, 31532, 31383
Sony	31058, 31441, 31258, 31759, 30158, 31658, 31858, 30474, 31349, 31558, 31442, 31758
Soundesign	30670
Stereophonics	31023
Sunfire	31313
Teac	30463, 31528, 31390, 31074
Technics	31308, 31518, 30039, 30309
Thorens	31189
Venturer	31390
Victor	30074
Wards	30158, 30189, 30080, 30014
Yamaha	30176, 30186, 31375, 31331, 31176
Yorx	30195
Zenith	31293, 30857, 31869

Table 13 Setup Codes for Satellite Receivers (S)

Brand	Codes
Crossdigital	01109
DIRECTV	00001, 00002, 00003, 00004, 00392, 00566, 00639,01639, 01142, 00247, 00749, 01749, 00724,00819, 01856, 01076, 01109, 00099, 01414,01640, 01108, 01392, 01442, 01609
GE	00566
General Instrument	00869
Hitachi	00819
Hughes Network Systems	01142, 00749, 01749, 01442
LG	01414
Magnavox	00724
Memorex	00724
Mitsubishi	00749
Motorola	00869
Next Level	00869
Panasonic	00247, 00701
Paysat	00724
Philips	01142, 00749, 01749, 00724, 01076, 00099, 01442
Proscan	00392, 00566
RadioShack	00869
RCA	00392, 00566, 00855, 00143, 01392
Samsung	01276, 01109, 01108, 01609; 01708
SKY	00856
Sony	00639, 01639, 01640
Star Choice	00869
Tivo	01142, 01442
Toshiba	00749, 01749, 00790, 01285
UltimateTV	01392, 01640
Uniden	00724
Voom	00869
Zenith	00856, 01856

Table 14 Setup Codes for TVs (T)

Brand	Codes
Admiral	10093, 10463
Advent	10761, 10817, 10815, 10783, 10842
Aiko	10092
Akai	10812, 10702, 10030, 10672
Alaron	10179

Albatron	10843, 10700
Ambassador	10177
America	Action 10180
Ampro	10751
Anam	10180
AOC	10030, 10019
Apex	Digital 10748, 10765, 10767
Audiovox	10451, 10180, 10092, 10623
Belcor	10019
Bell& Howell	10154, 10016
Bradford	10180
Brockwood	10019
Broksonic	10236, 10463
Candle	10030, 10056
Carnivale	10030
Carver	10054
Celebrity	10000
Celera	10765
Changhong	10765
Citizen	10060, 10030, 10056, 10092
Clarion	10180
Concerto	10056
Contec	10180
Craig	10180
Crosley	10054
Crown	10180
Curtis Mathes	10047, 10054, 10154, 10451, 10093, 10060, 10702, 10030, 10145,10166, 10056, 11147, 10016, 10466, 11347
CXC	10180
Daewoo	10451, 11661, 10092, 10672, 10019, 10623
Daytron	10019
Denon	10145
Dumont	10017, 10019
Durabrand	10463, 10180, 10178, 10171
Dwin	10774, 10720
Electroband	10000
Elektra	10017, 11661
Emerson	10154, 10236, 10463, 10180, 10178, 10171, 10019, 10177, 10623,10179
Envision	10030
Fisher	10154
Fujitsu	10809, 10683, 10179, 10853

Funai	10180, 10171, 10179
Futuretech	10180
Gateway	11755, 11756
GE	11447, 10047, 10051, 10451, 10178, 10021, 11347, 11147
Gibralter	10017, 10030, 10019
GoldStar	10030, 10178, 10019
Grunpy	10180, 10179
Hallmark	10178
Harley Davidson	10179
Harman/Kardon	10054
Harvard	10180
Havermy	10093
Hello Kitty	10451
Himitsu	10180
Hisense	10748
Hitachi	11145, 10145, 10016, 10151, 10056
Hyundai	10849
Infinity	10054
Inteq	10017
JBL	10054
JCB	10000
Jensen	10761, 10817, 10815
JVC	10053
KEC	10180
Kenwood	10030, 10019
KLH	10765, 10767
KTV	10180, 10030
LG	10856
Logik	10016
Luxman	10056
LXI	10047, 10054, 10154, 10156, 10178
Magnavox	11454, 10054, 10030, 10706, 10179, 11254
Majestic	10016
Marantz	10054, 10030, 10704
Matsushita	10250, 10650
Megapower	10700
Megatron	10178, 10145
Memorex	10154, 10463, 10150, 10178, 10179, 10016
MGA	10150, 10030, 10178, 10019
Midland	10047, 10017, 10051
Minutz	10021
Mitsubishi	10093, 11250, 10150, 10178, 10836, 10019

Monivision	10700, 10843
Motorola	10093
MTC	10060, 10030, 10019, 10056
Multitech	10180
NAD	10156, 10178, 10866
NEC	10030, 11704, 10019, 10497, 10056
Nikko	10030, 10178, 10092
Norcent	10748, 10824
NTC	10092
Onwa	10180
Optimus	10154, 10250, 10166, 10650
Optonica	10093
Orion	10236, 10463, 10179
Panasonic	10250, 10051, 10650
Penney	10047, 10156, 10051, 10060, 10030, 10178, 10021, 10019, 11347
Philco	10054, 10030, 10019
Philips	11454, 10054, 10690
Pilot	10030, 10019
Pioneer	10166, 10866, 10679
Portland	10019, 10092
Prima	10761, 10783, 10817, 10815
Princeton	10700, 10717
Prism	10051
Proscan	11447, 10047, 11347
Proton	10178, 10466
Pulsar	10017, 10019
Quasar	10250, 10051, 10650
RadioShack	10047, 10154, 10180, 10030, 10178, 10019, 10056
RCA	11447, 10047, 10019, 10679, 11247, 11547, 10090, 11147, 11047,11347
Realistic	10154, 10180, 10030, 10178, 10056, 10019
Runco	10017, 10030, 10603, 10497
Sampo	10030, 11755
Samsung	10060, 10812, 10702, 10030, 10178, 10019, 10766, 11060, 10056,10814
Sansui	10463
Sanyo	10154
Scimitsu	10019
Scotch	10178
Scott	10236, 10180, 10178, 10179, 10019
Sears	10047, 10054, 10154, 10156, 10178, 10171, 10179, 10056

Sharp	10093, 10689, 10688, 10851, 10818
Sheng Chia	10093
Shogun	10019
Signature	10016
Sony	11100, 10000, 10834
Soundesign	10180, 10178, 10179
Squareview	10171
SSS	10180, 10019
Starlite	10180
Studio Experience	10843
Supreme	10000
SVA	10748
Sylvania	10054, 10030, 10171
Symphonic	10180, 10171
Tandy	10093
Tatung	11756
Technics	10250, 10051
Technol Ace	10179
Techwood	10051, 10056
Teknika	10054, 10180, 10150, 10060, 10019, 10179, 10016, 10056, 10092
Telefunken	10702, 10056
TMK	10178, 10177, 10056
TNCi	10017
Toshiba	10154, 11256, 10156, 10060, 11704, 11656, 10650,
11356	
TVS	10463
V Inc.	11756
Vector Research	10030
Victor	10053
Vidikron	10054
Vidtech	10178, 10019
Viewsonic	11755
Wards	10054, 10030, 10178, 10019, 10179, 10016, 10021, 10056, 10866
Waycon	10156
White Westinghouse	10463, 10623
Yamaha	10030, 10019
Zenith	10017, 10463, 10178, 10016, 10092

Table 15 Setup Codes for VCRs (V)

Brand	Codes
ABS	21972
Admiral	20048, 20209
Adventura	20000
Aiko	20278
Aiwa	20037, 20000
Akai	20041
Alienware	21972
America Action	20278
American High	20035
Asha	20240
Audiovox	20037, 20278
Beaumark	20240
Bell & Howell	20104
Broksonic	20184, 20121, 20209, 20002, 21479, 20479
Calix	20037
Canon	20035
Carver	20081
CCE	20072, 20278
Citizen	20037, 20278, 21278
Colt	20072
Craig	20037, 20047, 20240, 20072
Curtis Mathes	20060, 20035, 20162, 20041, 21035
Cybernex	20240
CyberPower	21972
Daewoo	20045, 20278, 21278
Dell	21972
Denon	20042
Durabrand	20039, 20038
Dynatech	20000
Electrohome	20037
Electrophonic	20037
Emerex	20032
Emerson	20037, 20184, 20000, 20121, 20043, 20209, 20002, 20278, 21278, 20479, 21479
Fisher	20047, 20104
Fuji	20035, 20033
Funai	20000
Garrard	20000
Gateway	21972
GE	20060, 20035, 20240, 21035, 20807, 21060

Go Video	20432
GoldStar	20037, 20038, 21237
Gradiente	20000
Harley Davidson	20000
Harman/Kardon	20081, 20038
Harwood	20072
Hewlett Packard	21972
HI-Q	20047
Hitachi	20000, 20042, 20041
Howard Computers	21972
HP	21972
Hughes Network Systems	20042
iBUYPOWER	21972
Jensen	20041
JVC	20067, 20041
KEC	20037, 20278
Kenwood	20067, 20041, 20038
KLH	20072
Kodak	20035, 20037
Lloyd's	20000
Logik	20072
LXI	20037
Magnasonic	21278
Magnavox	20035, 20039, 20081, 20000, 20149, 21781
Magnin	20240
Marantz	20035, 20081
Marta	20037
Matsushita	20035, 20162
Media Center PC	21972
MEI	20035
Memorex	20035, 20162, 20037, 20048, 20039, 20047, 20240, 20000, 20104, 20209, 21237, 20479
MGA	20240, 20043
MGN Technology	20240
Microsoft	21972
Mind	21972
Minolta	20042
Mitsubishi	20067, 20043, 20807
Motorola	20035, 20048
MTC	20240, 20000
Multitech	20000, 20072
NEC	20104, 20067, 20041, 20038
Nikko	20037

Noblex	20240
Northgate	21972
Olympus	20035
Optimus	21062, 20162, 20037, 20048, 20104, 20432
Orion	20184, 20209, 20002, 20479, 21479
Panasonic	21062, 20035, 20162, 21035, 20616, 20225
Penney	20035, 20037, 20240, 20042, 20038, 21035, 21237
Pentax	20042
Philco	20035, 20479
Philips	20035, 20081, 20618
Pilot	20037
Pioneer	20067
Polk Audio	20081
Profitronic	20240
Proscan	20060, 21060
Protec	20072
Pulsar	20039
Quasar	20035, 20162, 21035
RadioShack	20000
Radix	20037
Randex	20037
RCA	20060, 20240, 20042, 20149, 21035, 20880, 20807, 21060
Realistic	20035, 20037, 20048, 20047, 20000, 20104
ReplayTV	20616, 20614
Runco	20039
Samsung	20240, 20045, 21014
Sanky	20048, 20039
Sansui	20000, 20067, 20209, 20041, 20479, 21479
Sanyo	20047, 20240, 20104
Scott	20184, 20045, 20121, 20043
Sears	20035, 20037, 20047, 20000, 20042, 20104, 21237
Sharp	20048, 20807
Shintom	20072
Shogun	20240
Singer	20072
Sonic Blue	20616, 20614
Sony	20035, 20032, 20033, 20000, 21232, 20636, 21972
STS	20042
Sylvania	20035, 20081, 20000, 20043, 21781
Symphonic	20000
Systemax	21972
Tagar Systems	21972

Tatung	20041
Teac	20000, 20041
Technics	20035, 20162
Teknika	20035, 20037, 20000
Thomas	20000
Tivo	20618, 20636
TMK	20240
Toshiba	20045, 20043, 21145, 20845, 21972
Totevision	20037, 20240
Touch	21972
Unitech	20240
Vector	20045
Vector Research	20038
Video Concepts	20045
Videomagic	20037
Videosonic	20240
Viewsonic	21972
Villain	20000
Wards	20060, 20035, 20048, 20047, 20081, 20240, 20000, 20042, 20072, 20149
White Westinghouse	20209, 20072
XR-1000	20035, 20000, 20072
Yamaha	20038
Zenith	20039, 20033, 20000, 20209, 21479, 20479
ZT Group	21972

Table 16 Setup Codes for Digital Video Disks (Y)

Brand	Codes
Advent	21016
Akai	20899
Allegro	20869
Apex Digital	20672, 20717, 20794, 20830, 21061, 20755, 20797, 21056, 20796, 21020, 21100
Audiovox	21072, 21071
Axion	21072, 21071
Blaupunkt	20717
Blue Parade	20571
Broksonic	20868, 20695
CineVision	20876, 20869
Coby	21086
Curtis Mathes	21087

CyberHome	21024, 21023, 20816
Daewoo	20784, 20869, 20833
Denon	20490
Dual	21085, 21068
DVD2000	20521
Emerson	20591, 20821, 20675
Enterprise	20591
Fisher	20670
Funai	20675
GE	20522, 20815, 20717
Go Video	20744, 20783, 21075, 20869, 20715, 20833
GPX	20699
Greenhill	20717
Hitachi	20573, 20664
Hiteker	20672
Initial	20717
Jensen	21016
JVC	20558, 20623, 20867
Kenwood	20490, 20534
KLH	20717, 21020
Koss	20651
Lasonic	20798
Magnavox	20503, 20821, 20675
Marantz	20539
Memorex	20695
Microsoft	20522
Mintek	20839, 20717
Mitsubishi	21521, 20521
Nesa	20717
Norcent	21003
Onkyo	20503
Oritron	20651
Panasonic	20490, 21762, 20632, 21490, 21462, 21362
Philips	20503, 20539, 20646, 20885, 20854
Pioneer	20525, 20571, 20632
Polaroid	21061, 21086
Polk Audio	20539
Prima	21016
Proscan	20522
Qwestar	20651
RCA	20522, 20571, 20717, 21022, 20822
Rio	20869
Rotel	20623

Rowa	20823
Samsung	20490, 20573, 20820, 21075, 20899
Sansui	20695
Sanyo	20873, 20695, 20670
Sharp	20630
Shinsonic	20533, 20839
Sonic Blue	20869
Sony	20533, 20864, 21033, 22043, 22020
Superscan	20821
Sylvania	20821, 20675
Symphonic	20675
Technics	20490
Theta Digital	20571
Toshiba	20503, 20695, 21045
Tredex	20799
Urban Concepts	20503
US Logic	20839
Xbox	20522
Yamaha	20490, 20539, 20545
Zenith	20503, 20591, 20869

7 Appendix A: Acronyms

Term	Definition
APG	Advanced Program Guide. DIRECTV's new generation of the electronic program guide.
Blackout	An access restricted based on the subscriber IRD location.
CA	Conditional Access
Callback	Data call, transmitted over telecommunications lines from the subscriber IRD to the CAMC. This is a repoting mechanism for impulse pay-per-view purchases.
CAM	Conditial Access Module. Usually referred to as the access card or smart card. A removable, electronic subassembly providing conditional access control of the subscriber terminal. The CA system equipment (smart card) needed in the Integrated Receiver Decoder to control a subscriber's service channel authorization and decryption.
DBS	Direct broadcast satellite. A satellite operating in accordance with International Telecommunications Union and Federal Communications Commission regulations for high power broadcasting from space to individual consumers.
DES	Data Encryption Standard
DIRECTV®	Trademarked name of the DIRECTV Group. The DBS system developed by Hughes that supports digitalf television broadcast and extensive pay-per-view capabilities.
DVI	Digital Visual Interface
DVR	Digital Video Recorder: records a digital signal to a hard disk or similar storage
FEC	Forward Error Correction
HDCP	High-bandwidth Digital Content Protection
IPPV	Impulse Pay-Per-View. A method for ordering service on "impulse" where payments are required for each program or special event independently.
IR	Infrared
IRD	Integrated Receiver Decoder. The indoor portion of the subscriber terminal which performs functions of transmission channel tuning, service channel selection, demodulation, demultiplexing, decryption (under control of the CAM), analog signal output and subscriber interface.
LHCP	Left Hand Circular Polarization
LNB	Low Noise Block down converter. Portion of ODU that receives the satellite signal (12.2-12.7 GHz) and converts the signal into Lband (950-2025 MHz).
NTSC	National Television Systems Committee. Standardization body that developed the Analog Terrestrial formats.

ODU	Outdoor Unit. The system that provides signal reception and down conversion.
OPPV	Order-Ahead pay-per-view. Movie purchases placed by calling a customer service representative rather than using the on-screen displays. Necessary to purchase movies when the subscriber does not connect the phone to the IRD.
OSD	On-Screen Display
PCM	Pulse Code Modulation
PPV	Pay-Per-View
RF	Radio Frequency
RHCP	Right Hand Circular Polarization
RID	Receiver Identification
S/P DIF	Sony Phillips Digital Interface. Interface to transmit digital data to the digital processor. Commonly used as an optical Dolby Digital connector.
Smart card	Credit card sized microcomputer capable of securely storing personal data including financial data such as credit balances. Also known as the CAM.
STB	Set-top box
UTC	Universal Time Coordinate