

DIRECTV Set-Top Box Information for the Installer

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1.1.a	November 17, 2005	J. G.	Fixed 155200 typo and USB 2.0 default data rate in Table 3-1. Deleted duplicate table of Amplifier codes (Table 17)
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2.0	March 2, 2007	W. M.	Added command GetTuner and the multituner commands. Added support for HR20.
2.1	August 6, 2007	J.G. B.S.	Added support for H20.
2.2	March 5, 2008	J.G. B.S.	Added support for D12, R16, H21, HR21 and HR21P



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1 Introduction

1.1 Disclaimer

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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, D11, D12, R15, R16, H10, H20, HR20, H21, HR21 and HR21P. Other models are not supported by this document.

1.3 Notice

Previous “Set-top Information for Installer” documents had a companion document listing various peculiarities of some STBs. This “Peculiarities” document must no longer be used.

1.4 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 2-2 shows which shortcut keys are supported by each model.

Table 2-1: 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 2-2: Supported Shortcut Keys

STB Model	ACTIVE and UP	ACTIVE and RIGHT	ACTIVE and DOWN
D10		Yes	
D11		Yes	
D12		Yes	
H10	Yes	Yes	Yes
R15	Yes	Yes	Yes
R16	Yes	Yes	Yes
H20	Yes	Yes	Yes
H21	Yes	Yes	Yes
HR20	Yes	Yes	Yes
HR21	Yes	Yes	Yes
HR21P	Yes	Yes	Yes



3 Data Port Connectors

Table 3-1 shows what type of connector and data rate the STB data port has.

Table 3-1: Type of Data Port Connector

STB Model	Type of Data Port Connector	Data Rate (baud)
D10	RJ22	9600
D11	USB	9600
D12	USB	9600
H10	RJ22	9600
R15	USB	9600
R16	USB	9600
H20	USB	9600
H21	USB	9600
HR20	USB	9600
HR21	USB	9600
HR21P	USB and DB-9F	9600

3.1 USB 2.0 Data Ports

All new DIRECTV STBs have USB 2.0 data ports. 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:

Table 3-2: USB-Serial Adapter

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

The USB port on most STBs support hot-plug. That means USB ports will work any time when a USB-serial adapter is plugged in. Only the HR20 and HR21 USB ports works differently. The USB-serial adapter must be plugged before the STB is booted. If the USB connector is plugged in when the



STB is running, it must be reset.

3.2 Data Port Interface Default Baud Rate

All 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.



4 Data Port Commands

4.1 Data Port Commands and Supported STB

Table 4-1: Commands and Supported STB

Command Code	Command Label	D10	D11	D12	R15	R16	H10	H20	H21	HR20	HR21 HR21P
0x81	Standby	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
0x82	Active	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
0x83	GetPrimaryStatus	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
0x84	GetCommandVersion	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
0x87	GetCurrentChannel	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
0x90	GetSignalQuality	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
0x91	GetCurrentTime	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
0x92	GetUserCommand	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
0x93	EnableUserEntry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
0x94	DisableUserEntry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
0x95	GetReturnValue	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
0x96	Reboot	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
0xA5	SendUserCommand	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
0xA6	OpenUserChannel	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
0x9A	GetTuner	No	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes
0x8A	GetPrimaryStatusMT	No	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes
0x8B	GetCurrentChannelMT	No	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes
0x9D	GetSignalQualityMT	No	No	No	Yes	Yes	No	Yes	Yes	Yes	Yes
0x9F	OpenUserChannelMT	No	No	No	Yes	Yes	No	Yes	Yes	No	No



4.2 Software Version of Supported STBs

DIRECTV STBs with the software version listed in Table 4-2 and newer software versions support data port commands described in this document.

Table 4-2: Software Version of Supported STB

DIRECTV STB	Software Version
D10-100	0x1040
D10-200	0x1040
D10-300	0x1043
D11-100	0x1040
D12-100	0x1050
D11-300	0x1040
D11-500	0x1040
R15-100	0x1029
R15-300	0x104B
R15-500	0x10FA
R16-300	0x10C2
H10 ⁽¹⁾	0.4.33
H20-100	0x2021
H20-600	0x2024
H21-100, H21-200	0x4048
HR20-100	0x17E
HR20-700	0x134
HR21-100	0x1FE
HR21-200	0x1FE
HR21-700	0x1FE
HR21P-200	0x1FE
⁽¹⁾ All Commands on H10 need a carriage return to be recognized. Therefore, each command string input must be followed by 0x0D (the carriage return hex code).	



4.3 Basic Data Port Commands

Table 4-3: Basic Commands Summary

Command Code	Command Label	Description
0x81	Standby ⁽¹⁾	Put STB in Standby
0x82	Active	Turn STB on
0x83	GetPrimaryStatus	Status information on current channel
0x84	GetCommandVersion	The STB returns the version of the Data Port Specification that it implements.
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
⁽¹⁾ This command holds its value after a warm start. Other commands are terminated.		



4.4 Multi-Tuner Data Port Commands

A new set of commands are introduced for multi-tuner STBs, such as R15 and HR20. For multi-tuner STBs, the tuner needs to be identified for many of the commands as an input parameter. To maintain backward compatibility, new commands with the suffix “MT”, have been created that have a TunerID parameter added. In the case where an original non TunerID command is issued to a multi-tuner STB, it will be executed as the equivalent “MT” command with TunerID set to 0x01. The [TunerID] shall start at 0x01 and increase in value by one for each additional tuner (i.e. 0x01, 0x02, 0x03...). The [TunerID] can be obtained by issuing the command GetTuner. See Table 4-1 for the list of STBs that support the multi-tuner commands.

Table 4-4: Multi-Tuner Commands Summary

Command Code	Command Label	Description
0x9A	GetTuner	Get the number of tuners and their designations.
0x8A	GetPrimaryStatusMT	Get the status information of current channel.
0x8B	GetCurrentChannelMT	Get the major and minor numbers of the tuned channel.
0x9D	GetSignalQualityMT	Get the signal level for the tuned channel.
0x9F	OpenUserChannelMT	Tune to a channel by inputting a channel number.

4.5 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.

4.6 Command Protocol

The STB will use the command and data acknowledgment protocol for flow control as specified in Figure 4-1.

Any controller that is implemented to control DIRECTV STB, should follow the protocol depicted in Figure 4-1.

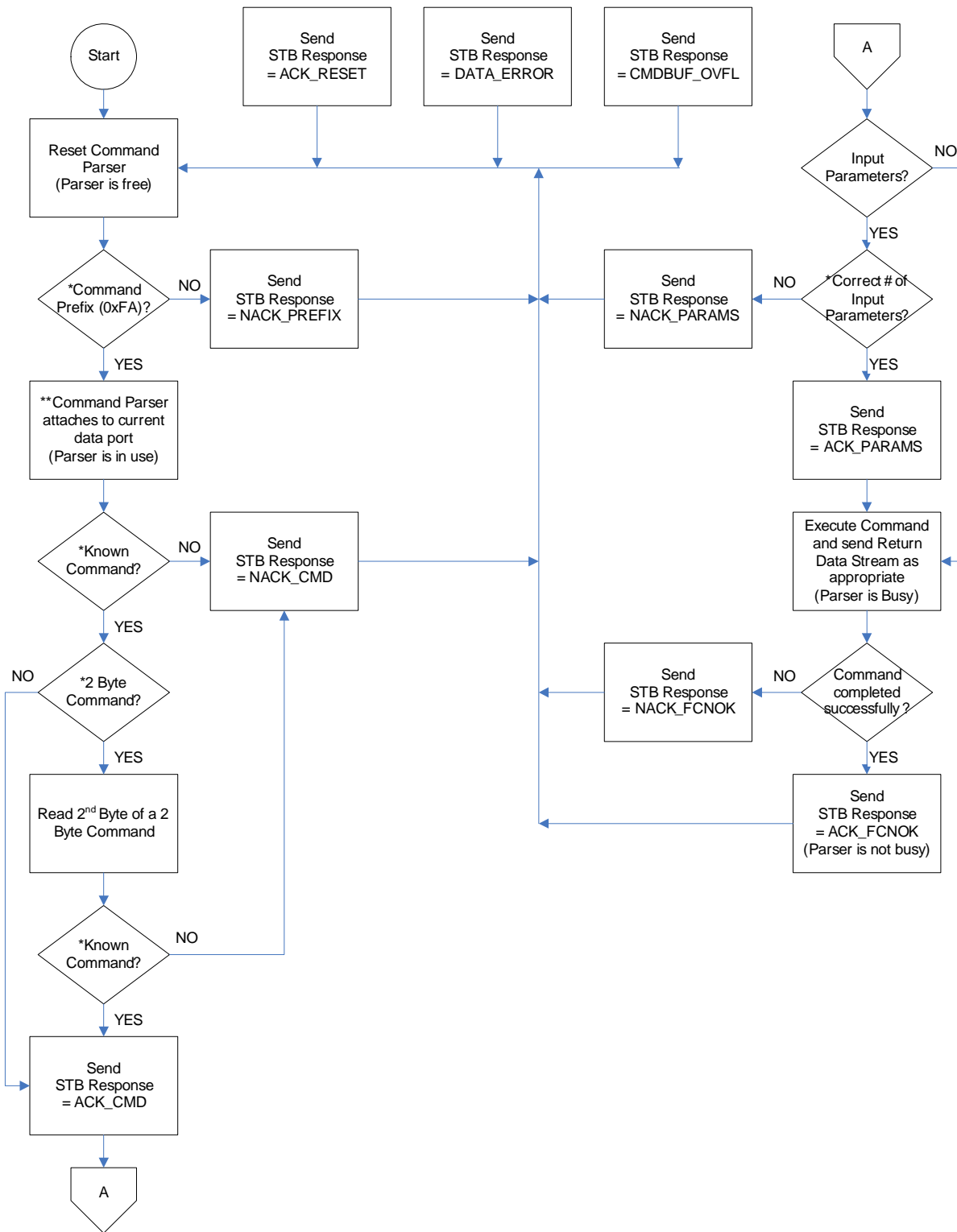


Figure 4-1. Service Command Parser Flowchart



4.7 STB Command Prefix

0xFA Required Command Prefix, precedes all commands

4.8 STB Responses

Table 4-5: STB Responses List

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: Turn off the STB.

Controller -> STB: FA	(Command Prefix)
Controller -> STB: 81	(Command ID)
STB -> Controller: F0	(Command acknowledged)
STB -> Controller: F4	(Command completed successfully)

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 executes this 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	<p>[MajorChnHI] [MajorChnLO] [MinorChnHI] [MinorChnLO] [Primary Type] [Audio Type] [Data Type] [Primary SCIDHI] [Primary SCIDLO] [Audio SCIDHI] [Audio SCIDLO] [Data SCIDHI] [Data SCIDLO] [Network HI] [Network LO] [Xponder] [Year] [Month] [Day] [Hour] [Min] [Sec] [Day Of Week] [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] [Signal Quality] [Rx ID0] [Rx ID1] [RxID2] [RxID3] [RxID4] [RxID5] *****</p> <p>MajorChnHI and MajorChnLO (Major Channel Number): 0x0000 – 0xFFFF</p> <p>MinorChnHI and MinorChnLO (Minor Channel Number): 0x0000 – 0xFFFF</p> <p>Primary Type: 0x0B Data 0x0C Audio 0x0E Retired 0x0F Video - TV 0x10 Video - HDTV 0xFF None</p> <p>Audio Type: 0x00 MPEG In / PCM Out 0x09 AC3 In / AC3 Out 0xFF None</p> <p>Data Type: 0x0B Retired 0x0C Retired 0x0D Retired 0xFF None</p> <p>SCIDs:</p>



	<p>0x0000 – 0xFFFFE 0xFFFF if not required</p> <p>Network: 0x0000 – 0xFFFF</p> <p>Xponder: 0x00 – 0xFF (0 to 255, corresponding to transponders 1 to 256)</p> <p>Year: 0x00 – 0xFF (# of years after 1993)</p> <p>Month: 0x01 – 0x0C</p> <p>Date: 0x01 – 0x1F</p> <p>Hour: 0x00 – 0x17</p> <p>Minute: 0x00 – 0x3B</p> <p>Second: 0x00 – 0x3B</p> <p>Day Of Week: 0x01 to 0x07 (0x01=Monday...0x07=Sunday)</p> <p>Signal Quality: 0x00 – 0x64 (0x00=FEC unlocked and 0x64=max signal strength)</p> <p>CAM and RID are in Hex format.</p>
Return Response	<p>ACK_FCNOK : Success</p> <p>NACK_FCNOK : Failure - STB not tuned to a DIRECTV System channel</p>
Return Value	<p>0x0000 : Success</p> <p>Non-Zero : Failure - STB not tuned to a DIRECTV System channel</p>
Description	<p>The STB will execute a GetPrimaryStatus command by providing the STB's health and status as defined by the Return Data Stream parameters.</p> <p>The STB will provide current time in Universal Time Coordinate (UTC) unconditioned by time zone and daylight savings settings.</p> <p>The fields ROMVer3, ROMVer2, ROMVer1, ROMVer0, STS ID0, STS ID1, STS ID2, STS ID3, STS Ver are private.</p> <p>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. This command would return 00 00 4E 87 C1 19 for the CAM ID.</p> <p>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. This command would return 00 00 0A 27 70 2A for the RID.</p>

5.4 GetCommandVersion (0x84)

Command Label	GetCommandVersion
Command Byte	0x84
Input Parameter(s)	None



Return Data Stream	[Version Major] [Version Minor] [Reserved1] [Reserved2] ***** Version Major: 0x00 – 0xFF; Version Minor: 0x00 – 0xFF Reserved1: 0x00 Reserved2: 0x00
Return Response	ACK_FCNOK : Always Success
Return Value	0x0000 : Always Success
Description	This command displays the version of the Data Port specification the STB software was coded to. For example: Ver 1.4 will return a [Version Major]: 0x01 and [Version Minor]: 0x04. Note: STBs supported by this document will return a version number of 1.4 or higher.

5.5 GetCurrentChannel (0x87)

Command Label	GetCurrentChannel
Command Byte	0x87
Input Parameter(s)	None
Return Data Stream	[MajorChnHI] [MajorChnLO] [MinorChnHI] [MinorChnLO] ***** MajorChnHI : 0x00 – 0xFF MajorChnLO : 0x00 – 0xFF MinorChnHI : 0x00 – 0xFF MinorChnLO : 0x00 – 0xFF
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 executes this command by providing the major and minor channel number (i.e., for the DIRECTV system channel the STB is tuned to) in the Return Data Stream.

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

Controller -> STB: FA (Command Prefix)

Controller -> STB: 87 (Command ID)



- STB -> Controller: F0 (Command acknowledged)
- STB -> Controller: 01 14 FF FF (Major and minor^[1] channel number)
- STB -> Controller: F4 (Command completed successfully)

^[1]Note: For most of DIRECTV channels, the minor channel number is 0xFFFF.

5.6 GetSignalQuality (0x90)

Command Label	GetSignalQuality
Command Byte	0x90
Input Parameter(s)	None
Return Data Stream	[Signal Quality] ***** 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 executes this 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] [Day Of Week] ***** Year: 0x00 – 0xFF (# of years after 1993) Month: 0x01 – 0x0C Date: 0x01 – 0x1F Hour: 0x00 – 0x17 Minute: 0x00 – 0x3B Second: 0x00 – 0x3B



	Day Of Week: 0x01 to 0x07 (0x01=Monday....0x07=Sunday).
Return Response	ACK_FCNOK : Always Success
Return Value	0x0000 : Always Success
Description	The STB executes this 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	<p>[Type] [Device] [Key]</p> <p>*****</p> <p>Type:</p> <p> 0x00 Key Toggle</p> <p> 0x01 Key Down</p> <p> 0x03 Key Up</p> <p>Device:</p> <p> 0x00 Front Panel</p> <p> 0x01 Remote</p> <p>Key:</p> <table border="0"> <tr> <td>0xA0 Enter (key #38)</td> <td>0xB0 Pause (key #43)</td> </tr> <tr> <td>0xA1 Info (key #26)</td> <td>0xB1 Rewind (key #44)</td> </tr> <tr> <td>0xA2 Active (key #27)</td> <td>0xB2 Play (key #45)</td> </tr> <tr> <td>0xA3 List (key #29)</td> <td>0xB3 Stop (key #46)</td> </tr> <tr> <td>0xA4 Back (key #31)</td> <td>0xB4 FFWD (key #47)</td> </tr> <tr> <td>0xA5 (-) (key #37)</td> <td>0xB5 Record (key #48)</td> </tr> <tr> <td></td> <td>0xB6 Replay (key #49)</td> </tr> <tr> <td>0xC3 Select (key #36)</td> <td>0xB7 Advance (key #50)</td> </tr> <tr> <td>0xC5 Power ON (key #1)</td> <td></td> </tr> <tr> <td></td> <td>0xE0 Digit 0 (key #9)</td> </tr> <tr> <td>0x9A Right Arrow (key #35)</td> <td>0xE1 Digit 1 (key #10)</td> </tr> <tr> <td>0x9B Left Arrow (key #34)</td> <td>0xE2 Digit 2 (key #11)</td> </tr> <tr> <td>0x9C Up Arrow (key #32)</td> <td>0xE3 Digit 3 (key #12)</td> </tr> <tr> <td>0x9D Down Arrow (key #33)</td> <td>0xE4 Digit 4 (key #13)</td> </tr> <tr> <td></td> <td>0xE5 Digit 5 (key #14)</td> </tr> <tr> <td></td> <td>0xE6 Digit 6 (key #15)</td> </tr> <tr> <td></td> <td>0xE7 Digit 7 (key #16)</td> </tr> <tr> <td>0xD0 Power OFF (key #2)</td> <td>0xE8 Digit 8 (key #17)</td> </tr> <tr> <td>0xD1 CH + (key #19)</td> <td>0xE9 Digit 9 (key #18)</td> </tr> <tr> <td>0xD2 CH - (key #20)</td> <td>0xEA Red (key #39)</td> </tr> </table>		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)		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)
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0xD2 CH - (key #20)	0xEA Red (key #39)																																									



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] Note: Return data are in Hex format.
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 ⁽¹⁾
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. ⁽¹⁾ 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)	<p>[Type] [Device] [Key]</p> <p>*****</p> <p>Type:</p> <p> 0x00 Key Toggle</p> <p> 0x01 Key Up</p> <p> 0x02 Key Down</p> <p>Device:</p> <p> 0x00 Front Panel</p> <p> 0x01 Remote</p> <p>Key:</p> <table border="0"> <tr> <td>0xA0 Enter (key #38)</td> <td>0xB0 Pause (key #43)</td> </tr> <tr> <td>0xA1 Info (key #26)</td> <td>0xB1 Rewind (key #44)</td> </tr> <tr> <td>0xA2 Active (key #27)</td> <td>0xB2 Play (key #45)</td> </tr> <tr> <td>0xA3 List (key #29)</td> <td>0xB3 Stop (key #46)</td> </tr> <tr> <td>0xA4 Back (key #31)</td> <td>0xB4 FFWD (key #47)</td> </tr> <tr> <td>0xA5 (-) (key #37)</td> <td>0xB5 Record (key #48)</td> </tr> <tr> <td>0xB6 Replay (key #49)</td> <td></td> </tr> <tr> <td>0xC3 Select (key #36)</td> <td>0xB7 Advance (key #50)</td> </tr> <tr> <td>0xC5 Power ON (key #1)</td> <td></td> </tr> <tr> <td></td> <td>0xE0 Digit 0 (key #9)</td> </tr> <tr> <td>0x9A Right Arrow (key #35)</td> <td>0xE1 Digit 1 (key #10)</td> </tr> <tr> <td>0x9B Left Arrow (key #34)</td> <td>0xE2 Digit 2 (key #11)</td> </tr> <tr> <td>0x9C Up Arrow (key #32)</td> <td>0xE3 Digit 3 (key #12)</td> </tr> <tr> <td>0x9D Down Arrow (key #33)</td> <td>0xE4 Digit 4 (key #13)</td> </tr> <tr> <td></td> <td>0xE5 Digit 5 (key #14)</td> </tr> <tr> <td></td> <td>0xE6 Digit 6 (key #15)</td> </tr> <tr> <td></td> <td>0xE7 Digit 7 (key #16)</td> </tr> <tr> <td>0xD0 Power OFF (key #2)</td> <td>0xE8 Digit 8 (key #17)</td> </tr> <tr> <td>0xD1 CH + (key #19)</td> <td>0xE9 Digit 9 (key #18)</td> </tr> <tr> <td>0xD2 CH - (key #20)</td> <td>0xEA Red (key #39)</td> </tr> <tr> <td>0xD3 Guide (key #25)</td> <td>0xEB Yellow (key #40)</td> </tr> </table>	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)		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)
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	MajorChnLO : 0x00 – 0xFF MinorChnHI : 0x00 – 0xFF MinorChnLO : 0x00 – 0xFF
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 : No Video Control 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: Change to channel 276 (hex 0x114) on a single tuner STB.

Controller -> STB: FA (Command Prefix)
 Controller -> STB: A6 (Command ID)
 STB -> Controller: F0 (Command acknowledged)
 Controller -> STB: 01 14 FF FF (Parameters^[1])
 STB -> Controller: F2 (Received the correct number of parameters)



STB -> Controller: F4 (Command completed successfully)

[1]Note: For most DIRECTV channels, the channel minor number is 0xFFFF.

5.15 GetTuner (0x9A)

Command Label	GetTuner
Command Byte	0x9A
Input Parameter(s)	None
Return Data Stream	<pre> [Number of DIRECTV Tuners] [DIRECTV Tuner ID 1] [DIRECTV Tuner Type 1] [DIRECTV Tuner ID 2] [DIRECTV Tuner Type 2] ... [DIRECTV Tuner ID 16] [DIRECTV Tuner Type 16] [Number of ATSC Tuners] [ATSC Tuner ID 1] [ATSC Tuner Type 1] [ATSC Tuner ID 2] [ATSC Tuner Type 2] ... [ATSC Tuner ID 16] [ATSC Tuner Type 16] ***** Number of DIRECTV Tuners : 0x00 – 0x10 DIRECTV Tuner Designations (Tuner ID) : 0x01 – 0xFF Number of ATSC Tuners : 0x00 – 0x10 ATSC Tuner Designations (Tuner ID) : 0x01 – 0xFF DIRECTV /ATSC Tuner Type : 0x0A Legacy DIRECTV Ku band 0x0B Legacy DIRECTV Ku band + DVB 0x0C Legacy DIRECTV Ku band + DVB + new Ka band 0x0D ATSC </pre>



	0x0E – 0x1F Reserved
Return Response	ACK_FCNOK : Success NACK_FCNOK : Failure
Return Value	0x0000 : Success 0x0001 : Failure – Command not supported for specified device. Others : Failure – Bad command
Description	The command gives the number of DIRECTV and ATSC tuners. It also lists the tuner type and designations. The STB returns a unique Tuner ID for each tuner regardless if it is a DIRECTV or ATSC tuner. This Tuner ID may be used as input to the multi-tuner commands.

5.16 GetPrimaryStatusMT (0x8A)

Command Label	GetPrimaryStatusMT
Command Byte	0x8A
Input Parameter(s)	[TunerID] ***** TunerID : 0x01 – 0xFF
Return Data Stream	[MajorChnHI] [MajorChnLO] [MinorChnHI] [MinorChnLO] [Primary Type] [Audio Type] [Data Type] [Primary SCIDHI] [Primary SCIDLO] [Audio SCIDHI] [Audio SCIDLO] [Data SCIDHI] [Data SCIDLO] [NetworkHI] [NetworkLO] [Xponder] [Year] [Month] [Day] [Hour] [Min] [Sec] [Day Of Week] [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] [Signal Quality] [Rx ID0] [Rx ID1] [RxID2] [RxID3] [RxID4] [RxID5] ***** MajorChnHI and MajorChnLO (Major Channel Number): 0x0000 – 0xFFFF MinorChnHI and MinorChnLO (Minor Channel Number):



	<p>The fields ROMVer3, ROMVer2, ROMVer1, ROMVer0, STS ID0, STS ID1, STS ID2, STS ID3, STS Ver are private.</p> <p>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. This command would return 00 00 4E 87 C1 19 for the CAM ID.</p> <p>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. This command would return 00 00 0A 27 70 2A for the RID.</p>
--	---

5.17 GetCurrentChannelMT (0x8B)

Command Label	GetCurrentChannelMT
Command Byte	0x8B
Input Parameter(s)	<p>[TunerID]</p> <p>*****</p> <p>TunerID : 0x01 – 0xFF</p>
Return Data Stream	<p>[MajorChnHI] [MajorChnLO] [MinorChnHI] [MinorChnLO]</p> <p>*****</p> <p>MajorChnHI : 0x00 – 0xFF</p> <p>MajorChnLO : 0x00 – 0xFF</p> <p>MinorChnHI : 0x00 – 0xFF</p> <p>MinorChnLO : 0x00 – 0xFF</p>
Return Response	<p>ACK_FCNOK : Success</p> <p>NACK_FCNOK : Failure – STB not tuned to a DIRECTV System channel</p>
Return Value	<p>0x0000 : Success</p> <p>Non-Zero : Failure – STB not tuned to a DIRECTV System channel</p>
Description	<p>The STB will execute a GetCurrentChannelMT 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.</p>

5.18 GetSignalQualityMT (0x9D)

Command Label	GetSignalQualityMT
Command Byte	0x9D
Input Parameter(s)	<p>[TunerID]</p> <p>*****</p>



	TunerID : 0x01 – 0xFF
Return Data Stream	[Signal Quality] ***** 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 GetSignalQualityMT command by providing the signal quality in the Return Data Stream.

5.19 OpenUserChannelMT (0x9F)

Command Label	OpenUserChannelMT
Command Byte	0x9F
Input Parameter(s)	[MajorChnHI] [MajorChnLO] [MinorChnHI] [MinorChnLO] [TunerID] ***** MajorChnHI : 0x00 – 0xFF MajorChnLO : 0x00 – 0xFF MinorChnHI : 0x00 – 0xFF MinorChnLO : 0x00 – 0xFF TunerID: 0x01 – 0xFF
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 : No Video Control 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 OpenUserChannelMT command by tuning to and decoding streams for the specified guide major/minor channel number using the specified tuner.



6 Remote Control

6.1 Introduction

There are a variety of DIRECTV remote controls available to the consumer. Specific features of DIRECTV remote controls can be found by accessing the on-line manuals at www.directv.com as noted below

The following sections list the DIRECTV remote control key codes for IR emitters used to control the STB. This chapter also provides links pointed to documents that listed the brand setup code 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.

6.2 Brand Setup Code List

The brand setup code used for setting up the remote to control the TV and auxiliary devices can be found on www.directv.com. On directv.com, go to “Customer Service” and click on “System Manuals”. Then click on “Remote Control”. Find the setup code in the appropriate document.



Figure 6-1 RC32 remote control.



6.3 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
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.	



7 Wired IR Input Port

7.1 Introduction

Some DIRECTV set top box models support a wired IR input port. This port permits third party infrared control devices to issue remote control commands to the DIRECTV set top box via a wired interface. This section describes the interface specifications for the wired IR input port

7.2 Interface Specifications

The wired IR input port is designed to accept a 3.5mm stereo plug. The stereo plug must be wired as indicated in Figure 7-1.

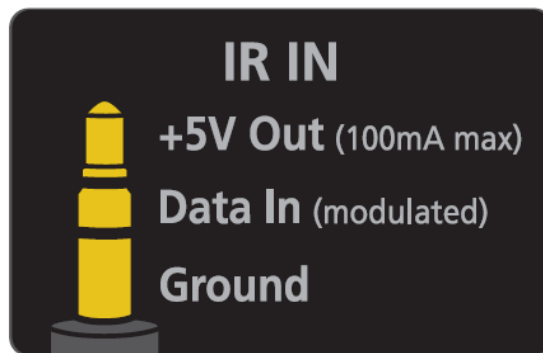


Figure 7-1 Wired IR Input Plug

The DIRECTV set-top box's DATA IN line expects an IR blaster-style signal. The IR signal must be a positive logic IR waveform with a 38kHz carrier (also known as "modulated IR"). The DATA IN line is +3.3V and +5V tolerant.

The DIRECTV set-top box's +5V OUT line can source up to 100mA of current for powering external third party devices. This power is provided out of the DIRECTV set top box. This line may be left unterminated in the stereo plug if external power or voltage sensing by third party devices is not required.



8 Appendix: Low Speed Serial Port Specifications

8.1 Low-Speed Data Port Connector

The connector type on D10, H10 and HR21P is a standard DB-9F or RJ22 (4 way/4 position jack). The pins for the DB-9F are as shown in Figure 8-1. The STB will use three (3) lines (L2-Rx, L3-Tx and L5-Grnd) for bi-directional full-duplex communications.

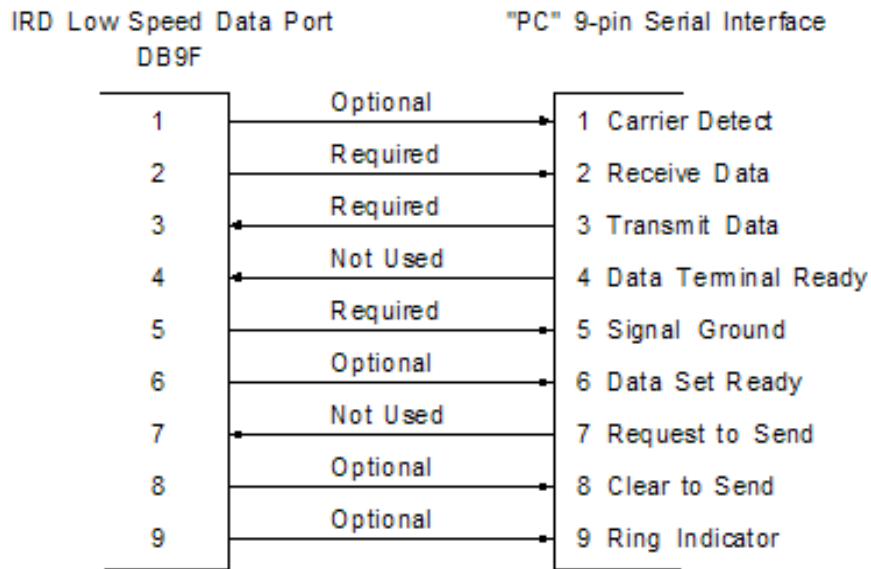


Figure 8-1. Low-Speed Data Port Pin Assignment Diagram

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 8-2 shows the orientation of the RJ22 (4 way/4 position jack).

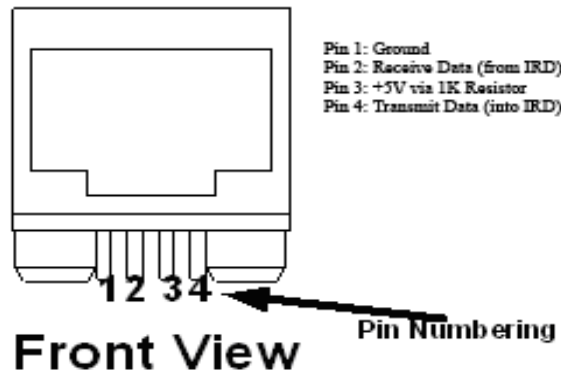


Figure 8-2. Orientation of the RJ22 (4 way/4 position) Jack



8.2 Low-Speed Electrical Performance and Characteristics

The low speed timing characteristics are defined in Table 8-1.

Table 8-1: Timing Characteristics

Parameter	Requirement
Bit Timing	104 μ s \pm 7 μ s
Total Character Interval	1.04 ms \pm 8 μ s

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

The STB complies with the bit timing requirements as shown in Figure 8-3.

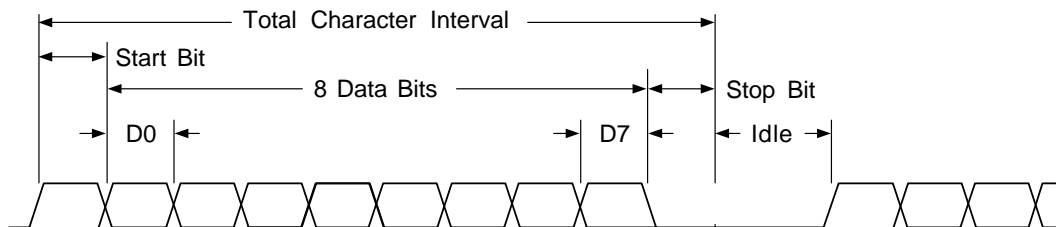


Figure 8-3. Bit Timing Diagram

8.2.2 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.”

8.2.3 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.”

8.3 Low-Speed Input Characteristics

8.3.1 Input Signaling Characteristics (Pin 3)

The low-speed data port will comply with the input signaling characteristics shown in Table 8-2.



Table 8-2: 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

8.4 Low-Speed Output Characteristics

8.4.1 Output Drive Characteristics (Pin 2)

The STB output drive characteristics are as shown in Table 8-3.

Table 8-3: Output Drive Characteristics

Parameter	Specification
Space voltage	+5.3 volts max at $I_{oh} = 0$ mA, +3.0 volts min
Mark voltage	-6.0 volts min at $I_{ol} = 0$ mA, -3.0 volts max,
Terminating impedance resistance	$3k < R < 7k$ resistive to ground
Capacitance	$C < 2500$ pF

8.4.2 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 8-4.



Table 8-4: Passive Drive Characteristics

Parameter	Specification
Output	-2 mA \pm 20% at + 3 volts and -10 mA \pm 20% at -5 volts

8.5 Low-Speed Signaling Conventions

The data port signaling conventions will be as listed in Table 8-5.

Table 8-5: 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”.



9 Appendix: Acronyms

Term	Definition
APG	Advanced Program Guide. DIRECTV's new generation of the electronic program guide.
CAM	Conditial Access Module. Also 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.
DIRECTV®	Trademarked name of the DIRECTV Group.
DVI	Digital Visual Interface.
DVR	Digital Video Recorder.
HDCP	High-bandwidth Digital Content Protection.
IPPV	Impulse Pay Per View. Movie purchases placed using the on-screen displays.
IR	Infrared.
IRD	Integrated Receiver Decoder.
LHCP	Left Hand Circular Polarization.
LNB	Low Noise Block down converter.
NTSC	National Television Systems Committee.
ODU	Outdoor Unit.
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. Commonly used as an optical Dolby Digital connector.
Smart card	See CAM.
STB	Set-top box.
UTC	Universal Time Coordinate.