



MOTOHANDBOOK

The A-B-Cs of HDTV



MOTOROLA

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SECTION 1

HDTV: WHAT'S THE BIG DEAL?

All the great things you've heard about High-Definition Television (HDTV) are true. The sharper, crisper picture. The vivid, almost living, color. The amazing details. In fact, HDTV is better than any TV you've ever seen. What remains a little fuzzy, though is this: what, exactly, is HDTV? Not to mention, what do all those terms like "16:9" and "progressive scan" mean?

Throughout the following pages, we'll try to make this all as clear as a high-definition picture. Bring it all into focus, so to speak.



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SECTION 2

HIGH-DEFINITION, DEFINED

HDTV, or High-Definition Television, is a subset of the 18 DTV (Digital Television) formats currently available to various broadcasters and media players (like DVD players). HDTV's color resolution is far superior to that of a regular television, and its picture is many times sharper. Plus, HDTV audio is broadcast with full Dolby® Digital audio, with many programs in 5.1 Dolby® Digital surround sound. All of which adds up to a truly incredible television experience.

DTV and HDTV broadcasts are offered in a variety of vertical resolutions, aspect ratios, and scan modes. Several formats have emerged as the clear leaders: 1080i, 720p, 480p and 480i.

<i>FORMAT</i>	<i>Horizontal Pixels</i>	<i>Vertical Pixels</i>	<i>Aspect Ratio</i>	<i>Scan Mode</i>	<i>Frame Rates</i>
<i>1080p</i>	<i>1920</i>	<i>1080</i>	<i>16:9</i>	<i>Progressive</i>	<i>24, 30</i>
<i>1080i</i>	<i>1920</i>	<i>1080</i>	<i>16:9</i>	<i>Interlaced</i>	<i>30</i>
<i>720p</i>	<i>1280</i>	<i>720</i>	<i>16:9</i>	<i>Progressive</i>	<i>24, 30, 60</i>
<i>720i</i>	<i>1280</i>	<i>720</i>	<i>16:9</i>	<i>Interlaced</i>	<i>30</i>
<i>480p</i>	<i>704</i>	<i>480</i>	<i>16:9</i>	<i>Progressive</i>	<i>24, 30, 60</i>
<i>480i</i>	<i>704</i>	<i>480</i>	<i>16:9</i>	<i>Interlaced</i>	<i>30</i>

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TOUGH TERMS, EASY EXPLANATIONS

Scan modes? Aspect ratios? Relax, this isn't rocket science. Here's some of the key terminology needed to better understand the basics of HDTV:

Pixel: Tiny dots that convey light and combine to form a video picture. Short for "picture element."

Resolution: The number of vertical pixels viewable onscreen. The higher the better.

Aspect Ratio: The relationship of a screen's width to its height. For example, a 16:9 aspect ratio means there are 16 inches of screen width for every 9 inches of height.

Component Video: High-bandwidth video signals that separate the Luminance and Chrominance of a video picture for enhanced resolution and color fidelity. A set of three physical connectors (typically red, green and blue RCA jacks) are used to transmit or receive component video signals.

Composite Video: Video signals that combine the Luminance and Chrominance of a video picture.

Downscaling: A process that converts a program to a lower resolution than its native format, or between progressive and interlaced scan formats, for display on television. Downscaled content is typically less crisp and clear than its native resolution.

Upscaling: A process that converts a program to a higher resolution than its native format, or between progressive and interlaced scan formats, for display on television. Upscaled content can look fuzzy or distorted compared to its native resolution.



Digital Visual Interface (DVI): A high-bandwidth video connection that carries digitized RGB (Red, Green & Blue) picture information and can support copy-protection methods. The DVI specification allows for the presentation device and display device to agree on an optimal picture size and resolution to automatically ensure the highest quality picture.

Scan Modes: Defines how often, and how much of, the video picture is redrawn when displaying moving images on the screen.

Interlaced Scan: Every other line of the picture is redrawn 60 times a second. This mode is prone to more "flicker" at larger screen sizes.

Progressive Scan: Every line of the picture is redrawn 30 times a second. Less "flicker," but requires greater bandwidth from service providers.

NTSC: National Television Systems Committee. Created the standard used on U.S. televisions almost exclusively until a few years ago. Defined the basic resolution of television video as 720 pixels wide, with 525 scan lines, with a 4:3 aspect ratio. All NTSC video uses interlaced scan mode.

ATSC: Advanced Television Systems Committee. Formed in 1994 to develop technical standards for DTV and HDTV. Specifies MPEG2 for video compression and AC-3 (Dolby Digital) for audio. Provides up to 10 times more picture detail than NTSC.

SDTV: Standard Definition Television. Any picture with 480 vertical pixels, running in interlaced scan modes only. SDTV can be 16:9 or 4:3 aspect ratio.

EDTV: Enhanced Definition Television. Also 480 vertical pixels, but in progressive scan mode only. This format's aspect ratio can be either 16:9 or 4:3, just like SDTV.

HDTV: High-Definition Television. Can contain 720 or 1080 vertical pixels in progressive or interlaced scan modes. HDTV signals are 16:9 only.



SECTION 4

HDTV: WHAT'S DIFFERENT ABOUT IT?

The difference between HDTV and standard TV are like night and day. But to fully understand why, you need to understand how. Let's start with one of the biggest, most important differences: Resolution.

Resolution

Television images are divided into horizontal lines. The more lines, the better the picture quality. Regular televisions display a maximum of 480 interlaced lines at a time. HDTV sets, on the other hand, display up to 720-1080 active, viewable lines of resolution.

That's a big difference. Which is why HDTV displays in such crisp detail.



Standard TV



HDTV

Resolution comparison

Scan Modes

How those lines are redrawn on the TV screen is called scanning mode. Some HDTV systems use interlaced scanning, others use progressive scanning.

Interlaced (denoted with an "i" – 1080i, for example) means the screen shows a picture using two fields with each field redrawn every 60th of a second. One field contains all of the odd lines of the picture, the other field contains all the even lines. Thus, the entire picture is "redrawn" every 30th of a second. As screens get larger, interlaced images flicker more and picture quality can deteriorate.

Progressive scanning (denoted with a “p” – 720p, for example) displays all lines at once, with a single picture “redraw” every 60th of a second. Less flicker, and smoother motion on the screen, but requiring greater bandwidth from broadcasters and service providers.

Aspect Ratios

Another way HDTV can differ from standard television programming is what’s called “aspect ratio.” Aspect ratio describes the relationship of a screen’s width to its height. HDTV uses a widescreen format of 16:9 – just like in a movie theater. Which means your HDTV picture captures everything the filmmakers intended. By comparison, NTSC aspect ratio (Standard TV and some Enhanced TV) is 4:3.



Comparison of Widescreen (16:9) and Standard Screen (4:3) Aspect Ratios

Widescreen images naturally convey greater visual interest, because they more closely mimic our natural field of vision. Widescreen format also creates a panoramic effect for the viewer, conveying more scenery and action.

Aspect Ratio Mismatches

By now, we’re all familiar with **Letterboxing**—the black horizontal bars that preserve the original 16:9 aspect ratio when watching a widescreen-formatted movie on a standard 4:3 television.



Letter Box Display
(16:9 Picture on 4:3 Screen)

Pillarboxing, on the other hand, is the term for vertical black bars on either side of a 4:3 program shown on a widescreen 16:9 television screen. Since the majority of television content is 4:3, these bars allow the original program to be seen in its intended format without distortion or stretching.



Pillar Box Display
(4:3 Picture on 16:9 Screen)

Widescreen Stretch Modes

Some viewers dislike black bars, no matter what. Plus, since widescreen HDTV manufacturers recognize that most programming remains 4:3, most 16:9 HDTVs are able to stretch 4:3 programs to a full screen display with no black bars. These programs will appear distorted from their original presentation.



Widescreen Stretch
(4:3 Picture on 16:9 Screen)

Hybrid Aspect Ratios

DTV-HD broadcasters must transmit 16:9 video, yet not all HD broadcasts contain full 16:9 video. The most common hybrids are 14:9 and 15:9, with thin black bars used to make up the difference. This can be confusing for consumers, who question why their HD-broadcast channel contains black bars.

SECTION 5

WHAT'S ON HDTV?

These days, all of the major broadcast networks and a growing number of cable networks offer high-definition programming. Consumers now can view their favorite prime time sitcoms, major sporting events, local news and movies all with crystal clear picture, vivid color and amazing sound.

Digital cable networks also dedicate a range of channels to high-definition programming. Sports, nature shows, history and current events all come to life like never before in high-definition. Plus, premium channels like HBO®, SHOWTIME® and Starz® all deliver movies in high-definition for a true theater-like experience at home.

These new industry standards are ensuring that high-definition programming is here to stay and will continue to grow in months to come.



TYPES OF HDTV SETS

Flat screen TVs have grown larger and rear projection models have slimmed down. Thanks to a host of continually developing display technologies taking picture quality beyond the traditional CRT, or Cathode Ray Tube we're all familiar with.

Consumers shopping for High-Definition need to consider several factors.

First, DTV sets vary widely in their support for the range of new formats. Most, though not all, HDTVs accept the 1080i format, and support for 720p, 480p, and 480i differ from model to model. HDTVs have "native" display formats as well. Newer sets support all of the aforementioned plus 1080p. An HDTV might accept 1080i but convert it to 720p or vice versa.

Most sets today are "HD-ready" requiring only a set-top receiver to decode high-definition content. TV manufacturers are exploring new digital display technologies, including Plasma, Liquid Crystal, and Digital Light Processing. Plasma and DLP provide crisp & brilliant pictures, although plasma displays seem to command the most attention due to their cost.

Widescreen HDTVs

Widescreen High-Definition televisions offer several attractive features:

First, true 16:9 high-definition programs can be displayed full screen, without letterboxing. Also, most movies today on DVD are enhanced for widescreen TVs. Second, widescreen sets



display more resolution and detail than is possible on a standard screen TV. In time, more and more broadcasts will be in 16:9 format, where panoramic viewing will give rise to the true "home theater."

Not all of today's programming is broadcast in high-definition. So some shows and movies will display in letterbox format, or in standard resolution. Plus, widescreen sets are typically more expensive than standard 4:3 sets, though the pricing gap is shrinking as the technology becomes more available.

Standard Screen HDTVs

As previously mentioned, much of today's programming is still broadcast in the original 4:3 NTSC aspect ratio. Thus, standard screen high-definition sets have several advantages. Aside from being able to display most of today's programming without black bars, standard screen HD sets are less expensive, and a better fit with people's existing entertainment center furniture.



Still, standard screen HDTVs do have a few drawbacks. First, "less expensive" is a relative term; any HDTV set will cost more than a standard definition set. And once broadcasters catch up with the widescreen format, programming on these sets will appear in letterbox format. As public awareness and interest in the benefits of widescreen TV grows, 4:3 digital displays will become less and less desirable just as color television eventually replaced black and white television in most homes.



CONSUMER EQUIPMENT

What does the average consumer require for HD? That depends on budget and space restrictions.

To enjoy the full benefits of DTV broadcasting, you should consider investing in the following:

- » An "HD-Ready" TV, or an HDTV set with integrated ATSC tuner
- » A set-top HD receiver capable of at least 720p, and up to 1080i, resolution.
- » An off-air antenna or subscription to digital cable or satellite service
- » A Dolby® Digital home theater receiver with speakers. Surround sound (5.1) will give you the fullest audio experience, but isn't necessary.

HD Set-Top Receivers

DCT6200 High-Definition Set-top

The DCT6200 set-tops deliver High-Definition Television (HDTV) and other processing intensive and interactive applications.

Key feature:

- Decodes both standard analog and high definition digital cable signals.



DCH6400 Series High-Definition Dual-Tuner DVR Set-top

The DCH6400 Series set-tops provide all the features of the DCH6200 set-tops plus a built-in dual-tuner DVR.

Key features:

- Decodes high-definition video.
- Acts as a home media server for a whole home media network – moving content such as recorded shows, photos, or music to other connected devices in the home.
- Built-in hard drive for storing recordings.
- DCH6416 capacity is 160Gb.
- Can store multiple HD programs.
- Can record two HD programs at one time using the dual tuner capacity.





SECTION 8

AUDIO/VIDEO CONNECTIONS

Digital Television receivers provide several video outputs, enabling connectivity to a wide range of devices. Component video connections are most common, with RCA type coaxial connectors carrying the video as carried as three components: Y, Pr and Pb. (Note: YPrPb is not the same as RGB.)

DTV formats use Dolby® Digital audio, which does not always mean surround sound. Some programs are broadcast in

original stereo Dolby® Digital 2.0; True HD programs and films use Dolby® Digital 5.1 surround sound audio.

DTV receivers output audio in coaxial or optical formats, using standard baseband stereo analog audio (left and right channels). Most HDTVs provide baseband audio inputs only, as well.

SPDIF



The orange coaxial SPDIF connector is a digital output connection that carries Dolby Digital 5.1 audio or PCM audio. It is used to connect the DCT6208 to a stereo tuner or A/V receiver to provide surround-sound, theater-style audio.

OPTICAL SPDIF



The OPTICAL SPDIF connector is an optical digital output connection that carries Dolby Digital 5.1 audio or PCM audio. It is used to connect the DCT6208 to a stereo tuner or A/V receiver to provide surround-sound, theater style audio.

TO TV/VCR



This coaxial output connector is used to connect the DCT High-Definition Receiver to a TV or VCR operating on channel 3 or 4.

S-VIDEO



This connector is used to deliver high quality, standard definition video to external devices that accept S-Video inputs, such as a high-end VCR or TV.

AUDIO IN L/R



These connectors are used to connect a set-top between a peripheral audio device such as a CD player and a stereo tuner or A/V receiver. In the current DCT6208 release, the audio from the peripheral device will pass through the DCT6208 when it is turned off.

VIDEO IN/OUT



The VIDEO IN connector accepts a baseband video input from a VCR, camcorder or other video device. The VIDEO OUT connector is used to deliver baseband video to an external device such as a VCR or TV.

HDMI



combines both digital video and audio in one convenient connection.

IEEE1394

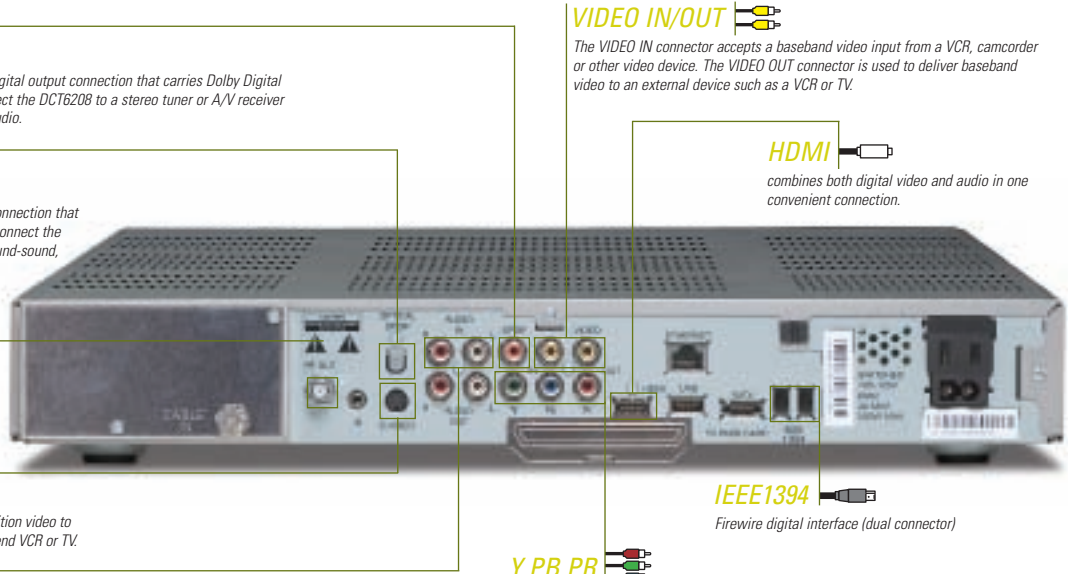


Firewire digital interface (dual connector)

Y PB PR



These connectors are used to deliver component video to an HD-ready TV or monitor. Though capable of delivering standard definition video to your TV or monitor, these cables are necessary to deliver High Definition video.





SECTION 9

MOTOROLA DELIVERS THE BIG PICTURE

The First –And Latest –HDTV!

In 1990, General Instrument Corporation (which later merged with Motorola) became the first to propose an all-digital high-definition television (HDTV) technical standard.

These long roots in the development of HDTV—along with the most current and advanced products for receiving HDTV programming—are why Motorola is a leading technology provider in high-definition today.

We hope this handbook has helped you gain a better understand of HDTV. For further exploration of this exciting new technology, the Resource Directory in the following section offers additional sources of information.



Motorola is a leading technology provider in high-definition.

HDTV

YOUR HDTV DECISION

HDTV is becoming the next TV choice for more and more homes. There's a wide range of HDTV information to be found through Internet searches, but the final word on which HDTV looks the best and will work for you comes from your own perceptions. The best way to determine what will look best to you is to compare them in person to see them side by side.

When you've made your decision as to which one is best for you, Motorola is here providing the digital video technology you need to receive HDTV channels you want to watch .

Compatible Video Service Provider network support is required.

For more information, ask your local video service provider .





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