

# SONY

DVD Recorder

## RDR-GX7

### Technical Notes



**DVD Recorder**

**Dual RW • Compatible**

Recording and playback of both DVD-RW & +RW discs



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# DVD players have become very popular. Now, the era of recordable DVD has finally arrived.

## Chapter 1 The Era of Recordable DVD

DVD-Video disc has now become the standard for enjoying movies and concerts with high quality images and sound. Since the introduction in 1996, its growth in popularity has been phenomenal. Not only are DVD players more mainstream, but also DVD drives can be found in many audio-visual, computer and video game products. With DVD playback now possible from a wide variety of equipment, DVD can now be enjoyed in many different ways and applications.

Thanks to recordable DVD, the high quality images, superior sound quality and remarkably versatile functions provided by DVD can now be applied to home recording on a digital disc. Furthermore, DVD can also be used as a high capacity storage media for personal computers.

### The merits of DVD recording

There are quite a number of advantages to recording television programs and archiving personal video recordings onto optical discs.

#### ■ High quality images –

##### high quality digital sound recording

Recordable DVD digitally records video using the same MPEG-2 format used in DVD-Video disc, while audio is digitally recorded using Dolby Digital, with other possible formats. This ensures extremely high quality video and audio recording, while offering a high degree of playback compatibility with conventional DVD players.

#### Primary recording formats of recordable DVD



#### ■ CD size, but with large recording capacity

One side of a DVD can hold up to 4.7 Gbytes, approximately seven times the capacity of a CD. This high data capacity permits extended video and audio recording. As DVDs are the same size as CDs, just 12 cm in diameter and only 1.2 mm thick, even a large video collection takes up very little space.

#### High data capacity of DVD



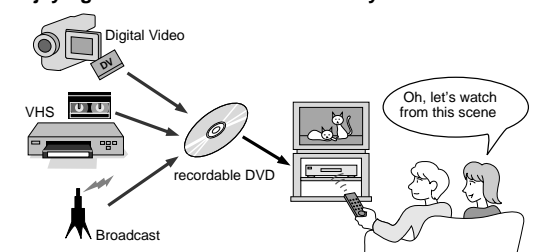
Note: there is also a specification for an 8 cm DVD with 1.46 Gbytes capacity

#### ■ High-speed access for playback and editing

One major feature of disc media is quick random access for superior convenience. For example, during playback, the recorded contents can be confirmed by calling up the on-screen menu. A desired portion can then be selected for quick playback. Even for recording, there is no need to worry about the starting

position like with tape. Just press the Record button and recording operation can quickly begin on available blank space on the disc.

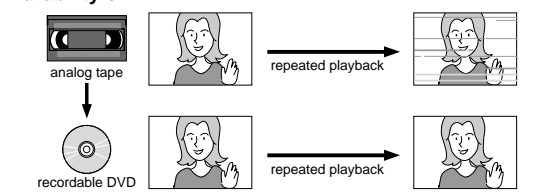
#### Enjoying various sources conveniently on DVD



#### ■ Superior storage characteristics

Since the signal is read by non-contact laser pickup, there is no gradual deterioration in image or sound quality, no matter how many times the disc is played back. In addition, there is no stretching or print-through as with tape, just high quality images and sound, always. Furthermore, as the system is digital, powerful error correction systems can be used to ensure greater resistance against dirt and scratches, for highly reliable playback.

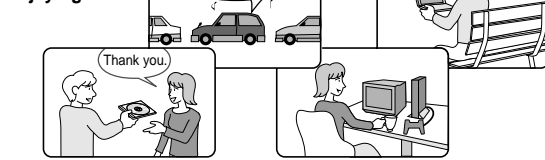
#### Durability of DVD



#### ■ Compatible recording for playback in a wide variety of places

Discs recorded can be played on most conventional DVD players, allowing them to be used in many different ways, such as "video messages" to relatives. Playback is also possible in a car, or on a video game console.

#### Various ways of enjoying DVD



#### ■ Non-linear editing on disc

With tape media, since editing requires dubbing from tape to tape, even simple editing procedures like erasing unwanted scenes requires a lot of time because the entire content must be recorded over again. Moreover, if the result isn't satisfactory, this time consuming process must be repeated again from the start. However, with recordable DVD, editing can be performed on the disc itself. Unwanted scenes can be eliminated almost instantly with a simple operation. In addition, the order of the scenes may be changed, with new titles created for collections of multiple scenes, thereby offering highly versatile editing.

# Chapter 1

## The Era of Recordable DVD

### Recordable DVD specifications

At present, there are five different types of Write-once and Re-writable DVD media, each with their own specifications. These different media include DVD-R, DVD-RW, DVD+RW, DVD+R and DVD-RAM. The following is a brief explanation of their respective development and features.

#### ■ DVD-R

This is a “write-once” format, and as with CD-R, it can only be recorded once. The DVD Forum has formalized this specification as DVD-R (specification name: DVD-Recordable). Since DVD-R was originally developed as a way to create master discs and operation testing discs for DVD-ROM as well as DVD-Video, one of its major features is very high compatibility with DVD-Video. The data capacity was formally set at 4.7 Gbytes with the Version 2.0 specification (for authoring) established in February, 2000, and for the Version 2.0 specification (for general use) established in May, 2000 and its capacity is the same as other recordable DVD media.

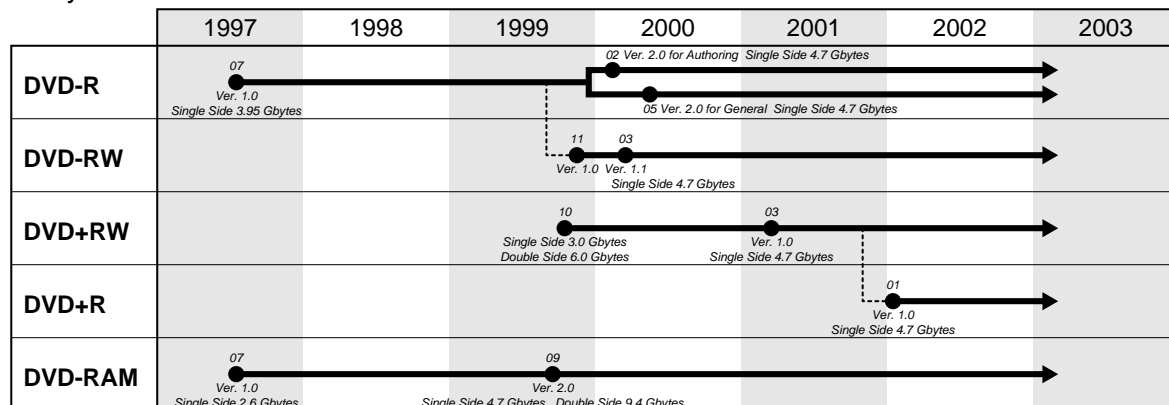
#### ■ DVD-RW

Recordable DVD media that can be “re-written” with new content is called “rewritable.” These include DVD-RW (specification name: DVD Re-recordable), which was formalized as a standard by the DVD Forum. Specifications are very close to those of DVD-ROM and DVD-Video. DVD-RW is compatible with two different recording formats, including Version 1.0 specifications for DVD Video Recording format, plus the Version 1.1 standard for DVD-Video format recording, adopted March 2000, which enables playback on conventional DVD players. The discs can be rewritten approximately 1,000 times.

#### ■ DVD+RW

DVD+RW (specification name: DVD+ReWritable) was announced as a re-writable DVD specification in October 1999. It is being promoted for adoption in CD-R/RW drives and media primarily by a group of eight manufacturers called the DVD+RW Alliance\*. The recording method uses the same phase modulation technology as used in DVD-RAM and DVD-RW.

### History of Recordable DVD



Note: The issue dates of the documents listed above are from the original versions of the copyright owners. However, the DVD+RW 3.0 Gbyte and 6.0 Gbyte versions only are ISO/IEC 16969:1999.

Importance is placed on compatibility with existing DVD-ROM drives and DVD players. Random reading and writing operations are also highlighted, to enable application as a data storage medium for computers. The discs can be rewritten approximately 1,000 times.

\* Dell, Hewlett-Packard, Mitsubishi Chemical Corporation, Philips Electronics, Ricoh Company Ltd., Thompson Multimedia, Yamaha Corporation, and Sony Corporation.

#### ■ DVD+R

In January 2002, the DVD+RW Alliance developed DVD+R (specification name: DVD+Recordable) based on DVD+RW, but since mistaken erasures are not possible, it is ideal as a storage medium. Since the reflection ratio is higher than that of DVD+RW, there is higher playback compatibility with conventional DVD playback equipment.

#### ■ DVD-RAM

DVD-RAM (specification name: DVD Rewritable) is a specification recognized by the DVD Forum. In July 1997, the Version 1.0 specification was announced, featuring the disc in a cartridge and 2.6 Gbytes capacity per disc side. Then, in September 1999 the Version 2.0 specification was announced, with 4.7 Gbytes capacity per disc side for a total of 9.4 Gbytes. DVD-RAM is not compatible with existing DVD-ROM drives and DVD players. However, each side can be re-written approximately 100,000 times, making it a highly functional medium for computer data storage.

*At present, high speed, recordable discs are being developed for each of these formats. In the near future, these discs will become available and are expected to improve data storage capabilities for computers.*

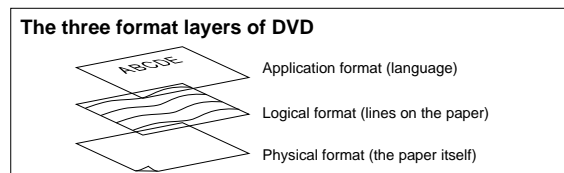
While recordable discs are most commonly distinguished by the five different disc names for their physical formats, they will have different characteristics and capabilities depending upon the recording formats (application formats) used with them. A detailed explanation of formats will be given in Chapter 2.

## Chapter 2

## Features of Recordable DVD Formats

# Recordable DVD operates through a combination of three format layers: the physical format, the logical format and the application format.

DVD specifications are configured with three format layers; the physical format, the logical (sometimes called theoretical) format and the application format.



The physical format can be likened to the sheet of paper on which an essay is written. In this case, the paper is the DVD disc and there are several types, DVD-R DVD+R, DVD-RW, DVD+RW and DVD-RAM. Each is made with different materials, and has different specifications and its own distinct characteristics. For example, an 'essay' written on DVD-RW can be erased and re-written many different times, while an 'essay' on DVD-R, due to the nature of the materials it is made of, can only be written once and cannot be erased.

The logical format can be likened to the way in which letters are written on the essay paper, plus the lines on the paper which are necessary for accurate reading. Moreover, if there are no lines on the paper, then the letters cannot be accurately written down. These lines determine how the letters and words are to be written onto the paper and are used to correctly manage the words themselves. In specific terms, technologies such as UDF and ISO-9660 represent these 'lines' on the paper.

Finally, the application format can be considered the language of the essay. These 'languages' include DVD-Video, DVD Video Recording, DVD-Audio, and DVD+RW Video. For example, if an 'essay' is written in DVD-Video 'language,' it will have different characteristics than exactly the same 'essay' written in DVD-VR 'language.' The DVD-Video 'language' is considered the native 'language' in the world of DVD players. Theoretically, this type of DVD recording should be capable of being read by any DVD player. Alternatively, if the 'essay' is in the 'language' of DVD-VR, it can be freely edited using a variety of inherent editing functions.

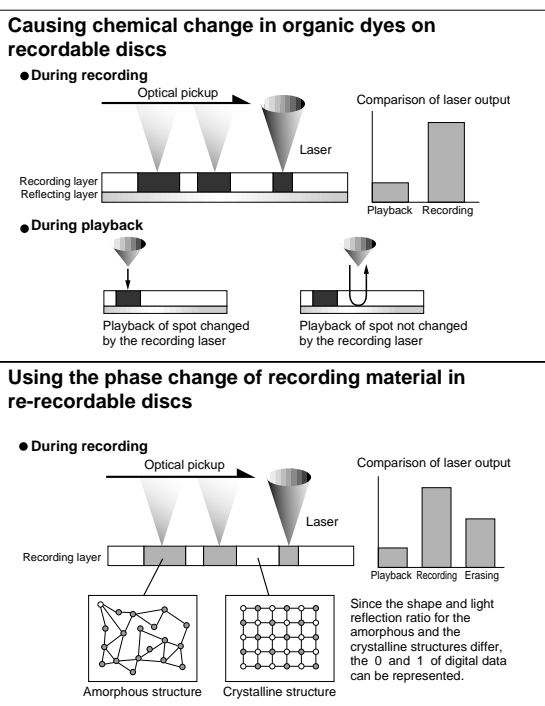
In this chapter we will explain in detail about these three different format layers.

## The Physical Format

The physical format is the specifications of the actual physical dimensions and characteristics of the disc itself. The external dimensions of 4.7 Gbytes DVD disc media are exactly the same as those of a CD, 120 mm in diameter (or 80 mm) and two disc sides of 0.6 mm each, for a total thickness of 1.2 mm. However, the materials in the recordable layer and the configuration of disc sides will vary.

### Playback and recording configuration

Reading the signal from the disc is done in the same way as with other optical disc playback media such as CD and DVD-Video software, with a laser beam reflecting off the surface of the disc.



The modulations of these reflections are read as '0' or '1,' representing the original digital data. Recording onto the disc requires a stronger laser beam than that used for playback, since the laser must heat up the recording material. Write-once discs such as DVD-R and DVD+R use organic dye in the recording layer, which chemically changes when exposed to heat. If a strong laser beam is reflected onto organic dye, it causes a chemical change that changes the light reflection ratio of that spot. During playback, the laser reads these spots to extract the signal from the disc. However, once the chemical change in the organic dye has occurred, it cannot be changed back to its original state.

Re-writable discs such as DVD-RW, DVD+RW and DVD-RAM use a compound which can be phase modulated. In the recording layer, this phase modulation takes the form of either a crystalline structure, or an amorphous non-crystalline structure. If strong laser light rapidly heats up a certain spot on the disc, when it cools its crystalline structure becomes amorphous. When the spot is slowly heated by a weaker laser it changes back to its crystalline structure after it cools. Since the light reflection ratios of the crystalline and amorphous structures are different, the '0' and '1' of digital data can be represented on the disc. Re-writable discs make use of this phase modulation technique to allow re-recording over previously recorded content.

### Differences in disc side construction

The physical format of commercial DVD-Video software and other playback-only DVD discs has a continuous line of recorded pits on the disc, just like CD-ROM. By reading these pits optically, the disc can be played back.

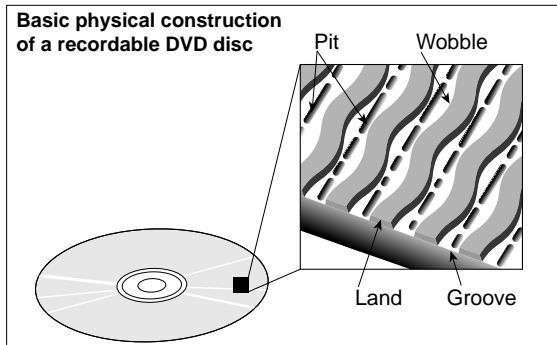
## Chapter 2

### Features of Recordable DVD Formats

#### Different types of physical formats

The physical formats of all recordable DVD can be roughly divided into two categories: the “wobble groove” type which includes DVD-RW, DVD-R, DVD+RW and DVD+R; and “wobble land groove” type of DVD-RAM. The disc surface can be configured with the following types of features: lands (protrusions), grooves, pits (the recorded points) and wobbles (snake-like patterns). Lands and grooves are like guides which enable correct tracking of the laser light beam during recording, with wobbles used within the land grooves as markers to indicate the circumference direction.

**Basic physical construction of a recordable DVD disc**



#### ■ DVD-RW and DVD-R physical format

The physical format of DVD-RW and DVD-R discs uses wobbled grooves, just like CD-RW and CD-R. Wobbles in the grooves and breaks in the land areas called land pre-pits (LPP) are used to perform addressing. Recording pits are only located in the groove areas. Track pitch is 0.74 microns, the same as DVD-ROM, with the light reflection ratio of DVD-R roughly the same as that of DVD-ROM single layer, and the light reflection ratio of DVD-RW roughly the same as that of DVD-ROM dual layer. For both discs, physical construction is very close to that of a playback-only DVD-Video disc.

#### ■ DVD+RW and DVD+R physical format

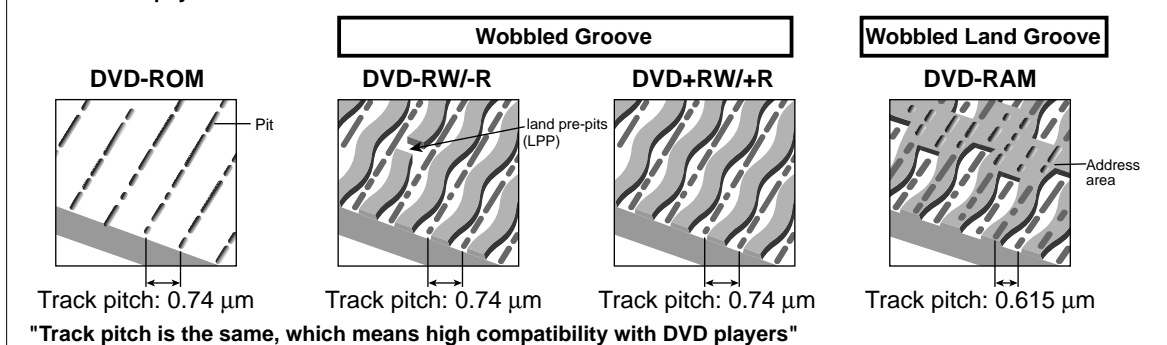
The physical format of DVD+RW and DVD+R uses wobbled grooves, just like DVD-RW and DVD-R. Track pitch is also the same at 0.74 microns. The biggest difference between DVD+RW/+R and DVD-RW/-R is that the wobbles of

DVD+RW/+R are much finer. This is called a “high frequency wobble.” The fineness of the wobble is some 37.1 times that of CD-RW/-R to enable addressing control with much higher precision since the recording density of DVD is much higher than that of CD-RW/-R. The use of this high frequency wobble enables a form of additional data recording technology without breaks called “loss-less linking.” For random writing common in PC data recording, loss-less linking reduces the data error generation ratio. While loss-less linking is specified as a requirement for the DVD+RW format, it is an option on the DVD-RW format.

#### ■ DVD-RAM physical format

The physical format of DVD-RAM uses wobbled land and grooves. Recorded pits are formed on both the land and groove tracks, while track pitch is slightly smaller at 0.615 microns. These features differentiate it from the other types of discs explained in this section. In addition, DVD-RAM also employs Zoned CLV (Constant Linear Velocity) and an address information area in the breaks between recorded tracks, making data distribution completely different from that of playback-only DVD. Accordingly, special playback equipment is required for DVD-RAM. For this reason, DVD-RAM is considered a format in which priority is placed on having a higher number of re-write cycles, rather than on playback compatibility.

**Differences in physical construction**



## Chapter 2

### Features of Recordable DVD Formats

#### The Logical Format

The logical format is essentially the 'file system' used when making a DVD recording. Data on hard discs, floppy discs, CD-ROM, and DVD-ROM is recorded as '0' and '1' bit stream data. This bit stream data is grouped in meaningful collections called files, allowing the user to perform such operations as reading and editing of this data by managing it through some type of file system. The file system will vary depending upon the recording media and the application. The following is an explanation of some examples of specified file systems (file formats) used in DVD.

##### ■ UDF (Universal Disk Format)

This is a universally adopted file format proposed by OSTA\*. UDF is primarily intended for DVD, the specifications were based on the concept of allowing the exchange of data between other operating systems, including the common use of data among various types of optical storage.

##### ◆ UDF Version 1.02

This is a file format used for the DVD-Video format. It is used to enable playback compatibility of re-recordable DVD.

##### ◆ UDF Version 2.00

This is used in the DVD Video Recording format, a real-time video recording application format established by the DVD Forum. It enables random write and read, as well as swapping processing, so that the media can be used just like a floppy or MO disc.

\*The Optical Storage Technology Association is a group that has established a worldwide standard file format for optical storage applications.

##### ■ ISO-9660

This universal file format is used in almost all CD-ROM discs. Its original form was the High Sierra format proposed by Apple, DEC, Microsoft, Philips, Sony and other companies in 1986. Later, ISO recognized this as a worldwide standard specification.

##### ■ UDF Bridge

This format provides the access procedure for both ISO-9660 and the UDF Version 1.02, which is a logical format, created for playback-only discs. By adopting the access procedure for ISO-9660, a widely used file format for CD-ROM, DVD discs can even be used on systems, which do not support UDF.

#### The Application Format

DVD stands for "Digital Versatile Disc," and as its name implies, it can be used not only for moving video and sound, but also for storing digital data. The various application formats have been given detailed specifications to enable their respective applications. For example, the DVD-Video format was originally established as an application format to record movies for playback only. In addition, for music there is also the DVD-Audio format. DVD functions – what you can actually do and what you can't do – vary greatly according to the application format. The following is an explanation of three application formats, which are presently used in DVD recording.

##### ■ DVD-Video format

The DVD-Video format was the first application format established for ROM use in the DVD family. The objective of establishing this format was to enable a single movie to be recorded on a disc with high quality images and sound. Thus, this format was used to enable commercial DVD-Video software, which could be played back on DVD players and other DVD associated equipment. The MPEG2 digital coding format is used to compress the video images, thereby achieving a resolution of approximately 500 horizontal TV lines for a superior quality image. In addition to linear PCM audio, other formats are also used, such as the Dolby Digital format, which can offer up to 5.1 channels of surround sound. This enables the playback of powerful soundtracks with a realistic soundstage and imaging. Along with high quality images and sound there are a number of interactive functions possible, for example, multi-lingual, multi-story and multi-angle features.

While this DVD-Video format was originally established for playback-only discs, it is now also used as an application format for DVD-RW and DVD-R recording in home-use DVD recorders. In this case, the biggest advantage is high compatibility with legacy DVD players. This comes as no surprise since this is the original playback format for DVD players. However, it should be noted that at the stage during recording (i.e. the un-finalized condition), the data writing required for playback of the DVD-Video format may not be complete. Therefore, in order to assure playback on other DVD players, the finalization operation must then be performed.

##### ■ DVD+RW Video format

The DVD+RW Video format, was established by Philips for recording moving video content. Primarily in the PC application field, this format is also called the "+VR" format. Essentially, the DVD+RW format enables playback compatibility between existing DVD players and DVD drives in personal computers. Its biggest advantages are real-time recording, additional recording and re-recording capabilities. Moreover, finalization, which records a lead-out to indicate the end of the data on the disc, has been specified as automatic, so it does not need to be performed by the user. Thanks to this feature, the disc taken directly out of

## Chapter 2

### Features of Recordable DVD Formats

the recorder can be played back as-is on another player, with the added flexibility of allowing the disc to be put back into the recorder for additional recording. Furthermore, recorded contents can easily be edited on the disc itself.

#### ■ DVD Video Recording format

Known simply as the VR format, the DVD Video Recording format was established by the DVD Forum for recording moving video content in real time. This format is used on both DVD-RW, plus DVD-RAM and together with the random writing capability of UDF Version 2.00 (explained in the logical format section), it offers the ability to divide and change the arrangement of recorded data. Using this capability, it is possible to perform various editing operations on the recorded contents. Unlike a conventional disc editing function, which processes the original recorded data, a virtual editing function, a 'playlist,' is provided. This enables various editing operations without altering the original recording. In addition, various functions are provided for recording, for instance, to allow the two languages in a broadcast multiplex soundtrack to be recorded. It should be noted that many parts of the recording and editing functions differ from the intended DVD-Video format, so as a result there is no compatibility with existing DVD players. However, Sony and other manufacturers have recently released DVD players which can play back discs recorded in this VR format. From now on, Sony plans to equip its DVD players with VR format playback capability. This will improve the overall playback environment available for the VR format.

Note: The above mentioned functions can be performed in this format. However, the functions actually provided on each recorder will differ.

#### Sony's High Quality Blank Disc Products

Sony has already released blank disc media for DVD-R, DVD-RW, DVD+R and DVD+RW. The DVD-R and DVD+R discs use a highly sensitive recording dye material, while the DVD-RW and DVD+RW discs are manufactured with a high performance phase change recording material, for superior image recording characteristics and highly stable playback.



Disc Media Products for 2002.

## Chapter 2

### Features of Recordable DVD Formats

#### Summary of Chapter 2

The following is a graphical summary of the various features and characteristics explained in this chapter.

At present, these are the physical, logical and application combinations mainly used in home-use DVD recorders.

Ordinary name		DVD-Video	DVD-R	DVD-RW		DVD+R	DVD+RW	DVD-RAM
Physical format	Format name	DVD-ROM	DVD-R	DVD-RW		DVD+R	DVD+RW	DVD-RAM
	Number of recording cycles	Not possible	Write once (additional rec. possible)	Re-writable (approx. 1,000 times)		Write once (additional rec. possible)	Re-writable (approx. 1,000 times)	Re-writable (approx. 100,000 times)
	Recording material		Organic dye	Phase changing material		Organic dye	Phase changing material	Phase changing material
	Capacity (12 cm disc)	Single side Single layer: 4.7 Gbytes Single side Dual layer: 8.54 Gbytes	Single side: 4.7 Gbytes	Single side: 4.7 Gbytes		Single side: 4.7 Gbytes	Single side: 4.7 Gbytes	Single side: 4.7 Gbytes Double side: 9.4 Gbytes
	Playback laser wavelength	645 - 655 nm	650 nm / 635 nm	650 nm / 635 nm		650 - 665 nm	650 - 665 nm	650 nm
	Recording laser wavelength		650 nm	650 nm / 635 nm		650 - 665 nm	650 - 665 nm	650 nm
	Lens aperture value (NA value)	0.6	0.6	0.6		0.65	0.65	0.6
	Recording tracks	Pit	Groove	Groove		Groove	Groove	Land & Groove
	Track pitch	0.74 $\mu$ m	0.74 $\mu$ m	0.74 $\mu$ m		0.74 $\mu$ m	0.74 $\mu$ m	0.615 $\mu$ m
	Shortest mark length	0.4 $\mu$ m	0.4 $\mu$ m	0.4 $\mu$ m		0.4 $\mu$ m	0.4 $\mu$ m	0.42 $\mu$ m
	Sector placement	CLV	CLV	CLV		CLV	CLV	Zoned CLV
	Addressing	Pit	Wobble Land Pre Pit	Wobble Land Pre Pit		Wobble ADIP (Wobble)	Wobble ADIP (Wobble)	PID (Pit)
	Reflection ratio	Single layer: 45 to 85% Dual layer: 18 to 30%	45 to 85%	18 to 30%		45 to 85%	18 to 30%	15 to 25%
	Maximum transmission rate (speed)*1 *2	11.08 Mbps	11.08 Mbps (x1) 44.32 Mbps (x4)	11.08 Mbps (x1) 22.16 Mbps (x2)		26.8 Mbps (x2.4)	26.8 Mbps (x2.4)	22.16 Mbps (x2)
	Cartridge	None	None	None		None	None	Type 1: Yes Type 2: No
Logical format	Format name	UDF Bridge	UDF Bridge	UDF Bridge	UDF Ver. 2.00	UDF Bridge	UDF Bridge	UDF Ver. 2.00
Application format	Format name	DVD-Video	DVD-Video	DVD-Video	DVD Video Recording (VR)	DVD+RW Video	DVD+RW Video	DVD Video Recording (VR)
Features*2	DVD player playback compatibility		Good	Good	Fair Only machines with VR playback	Good	Good	Fair Only machines with RAM playback
	Finalization		Required	Required	Not required	Required	Not required (Auto Finalizing)	Not required
	On-disc editing		Low	Low	High	Low	Mid	High
	Simultaneous recording of bilingual broadcasts in one stream		No	No	Yes	No	No	Yes
	Copy-once content recording		Not available	Not available	Yes	Not available yet	Not available yet	Yes

\*1: The maximum data transmission rate will vary depending upon the specific combination of media and hardware.

\*2: High-speed recording is now being considered for each recording format.

Note: The above mentioned functions can be performed in this format. However, the functions actually provided on each recorder will differ.

## Chapter 3

### Sony is Dual RW Compatible

#### Sony's Format Compatibility Considerations and "Dual RW Compatible."

Among the various DVD formats with their respective features, which format is best for use in a home AV-use DVD recorder? In this chapter we will explain in detail Sony's format compatibility considerations, and the compatibility offered by the new RDR-GX7 DVD recorder.

#### DVD Recorder Format Compatibility at Present

How are the five DVD formats explained in the previous chapter used in their respective DVD recording machines? Practically all DVD recorders are compatible with both write-once and re-writable formats. In home AV-use DVD recorders, for re-writing, each manufacturer has adopted one format from among DVD-RW, DVD+RW and DVD-RAM. For a write-once format, in DVD-RW or DVD-RAM compatible recorders, DVD-R has been selected, while for DVD+RW compatible recorders, DVD+R has been selected. The same is true for drives in PCs, though some products are compatible with multiple formats. In the PC field, DVD+RW is highly evaluated for its random writing and high-speed recording compatibility. Needless to say, each format has its strong and weak points, so the each format differs in appeal depending upon the importance placed on each point.

#### Compatibility With Over 100 Million DVD Players Now In Use

On which points should importance be placed? In the development of its DVD recorder, Sony placed primary importance on playback compatibility; that is, being able to play the recorded disc on the greatest number of playback devices, including DVD players and DVD drives in personal computers. This compatibility is clearly the most important point of a recording device. For example, a DVD disc recorded on the recorder in your living room should be able to be played back on the DVD player in your bedroom, as well as on players owned by your friends. You should also be able to record videos on DVD, which can be sent to distant relatives and played on their players. This is part of the whole appeal of DVD recording. Just like the many different types of CD playback equipment in use around the world, when a CD-R or CD-RW is recorded, it should be able to be played anywhere, on any player, because playback compatibility is the most important point of recording. If a recorded disc cannot be played back, it is useless as a recording. Since DVD players were released onto the market, some 100 million have now been sold worldwide. These players have become popular because they offer high quality images and superior sound quality, as well as random access and other convenient operation features unavailable from any other type of player. What's more, in the future, even more types of devices are predicted to have DVD playback capability. Consequently, this will increase the market opportunities for DVD usage and the overall requirement for DVD hardware compatibility.

#### The Concept Called Dual RW Compatible

When considering the features and usage for each format, the most desirable feature of a DVD recorder is to offer a high level of playback compatibility through a wide range of formats. This is the idea behind Sony's format compatibility concept of "Dual RW Compatible." Home AV-use DVD recorders will primarily be used for re-writable discs, so they are compatible with DVD-RW and DVD+RW, which feature a high degree of playback compatibility. For high playback compatibility, you can record in DVD-Video format on DVD-RW discs (in Video mode) or record on DVD+RW discs. On the other hand, to create discs with high level disc editing functions, you can record on DVD-RW discs in DVD Video Recording mode. Essentially, Dual RW Compatible assures high playback compatibility, while also incorporating functions to meet various needs, so consumers will feel greater confidence in selecting equipment that is Dual RW Compatible.




#### The Dual RW Compatible logo



#### DVD Recorder based on the Dual RW Compatible concept – Sony RDR-GX7

Sony is proud to announce the release of the new RDR-GX7 DVD Recorder. Based on the Dual RW Compatible concept previously explained, it has been designed for compatibility with both DVD-RW and DVD+RW formats, as well as the DVD-R format for archiving.

#### Recordable discs (Recordable discs are 12 cm only.)

Disc types	Application Format	
<b>DVD-RW</b> <sup>*1</sup> Ver. 1.1 Ver. 1.1 with CPRM <sup>*2</sup>		DVD Video Recording Format (VR mode) DVD-Video Format (Video mode)
<b>DVD+RW</b> <sup>*1</sup>		DVD+RW Video Format
<b>DVD-R</b> <sup>*1</sup> Ver. 2.0		DVD-Video Format

<sup>\*1</sup> "DVD-RW", "DVD+RW", and "DVD-R" are trademarks.

<sup>\*2</sup> CPRM (Content Protection for Recordable Media) is a coding technology that protects copyrights for images.

## Chapter 3

### Sony is Dual RW Compatible


#### Compatible Playback Formats of the Sony RDR-GX7 DVD Recorder

Although the RDR-GX7 was developed as a DVD recorder, it is also a DVD player that delivers high image quality and high fidelity sound, making it ideal for home theater use. What's more, it can also play back the wide variety of discs indicated in the chart.

#### Playable discs

Playable discs are available in 12 cm and 8 cm sizes. )

Disc types

DVD VIDEO <sup>*1</sup>	
DVD-RW <sup>*1</sup> Ver. 1.0 Ver. 1.1 Ver. 1.1 with CPRM	
DVD+RW <sup>*1</sup>	
DVD-R <sup>*1</sup>	
DVD+R <sup>*1</sup>	
Music CD	
CD-R/CD-RW (Music CD format only)	

<sup>\*1</sup> "DVD VIDEO", "DVD-RW", "DVD+R", "DVD+RW", and "DVD-R" are trademarks.

• DVD-RW/-Rs, DVD+RWs/+Rs, or CD-RW/-Rs recorded on another recording device cannot be played on this recorder if they have not been correctly finalized. Some discs cannot be played due to the recording quality or physical condition of the disc, or the characteristics of the recording device and authoring software.

#### Dual RW Compatible Is Also Gaining Popularity in the PC Field

Even before the advent of DVD Video Recorders for AV use, Sony was manufacturing and selling DVD and CD rewritable drives for use as PC peripherals which are both DVD-RW and DVD+RW compatible. Sony's Dual RW drives have been very well received by PC users due to their broad compatibility with various formats, including DVD-RW, DVD+RW, DVD-R, DVD+R, DVD-ROM (read only), CD-R, CD-RW, CD-ROM (read only), as well as their high-speed writing capability and support of two high-speed interfaces; i.LINK and USB 2.0 (external model).



Product released in fall 2002

DVD Recorder  
**RDR-GX7**



## Chapter 4-1

### Product Summary

#### Now you can make your own DVD recordings at home

In the six years since the release of Sony's first DVD player, the DVP-S7000, Sony has continued to perfect the quality and performance of its players. Now Sony is pleased to announce the introduction of its first DVD recorder, the RDR-GX7. Compatible with a wide range of media to ensure playback compatibility with standard DVD players, this is the world's first Dual RW recorder in a home deck style. Unlike recording DVDs on a personal computer, this model can record TV programs with the same ease of operation as with a conventional video recorder. In addition, complete recordings made with a DV camcorder, or only desired scenes, can easily be recorded onto DVD discs. Of course, the new recorder incorporates high quality Sony technology for superior image reproduction and high sound quality. More than simply a time-shift recorder for TV programs, the Sony RDR-GX7 DVD Recorder opens up a whole new world of versatility and enjoyment for the user.

#### Dual RW Compatible

The RDR-GX7 is the only home DVD recorder\* that currently supports the recording of DVD-RW, DVD+RW and DVD-R formats, thus eliminating the need for consumers to choose one format over another and ensuring the best possible playback compatibility. This unique format freedom gives the user more choice of media and greater compatibility among home entertainment hardware.

\* As of February, 2003.

#### One-touch DVD recording from camcorder tapes

The highly advanced dubbing function of the Sony DVD recorder simplifies all operations. Through the i.LINK (DV) IN terminal on the RDR-GX7, comprehensive control of DV and Digital 8 camcorders is possible. Tape rewind, playback, DVD recording start and all other dubbing operations can be automatically started and stopped with the press of a single button. In this way, the RDR-GX7 makes it easier than ever to store those unique moments recorded on your camcorder onto DVD discs. Of course, only the desired portions of your tapes can be edited or saved, as you wish, via simple remote control operation.

#### Convenient recording and playback functions

When recording a television program on a disc, one scene from the program is automatically saved as a still video image, and can be displayed on the title thumbnail with the title.

Then, during playback, the contents can be displayed, and desired titles can be selected for viewing. For contents recorded on DVD-RW discs in VR mode, a "virtual" edit list can be created, which makes combining, dividing, moving titles and scenes virtually, such an easy operation. In addition, for rewritable media, unwanted areas on the disc can be efficiently used again.

#### High image quality design, from input to output

Before recording, various circuits operate to clean the video signal to be recorded, and to suit the image characteristics to match your taste. For recording to disc, a VBR (Variable Bit Rate) system is employed which assures MPEG encoding with extremely high image quality. Even during playback, the use of high quality digital image technology assures performance on par with top class DVD players.

#### New GUI for easy operation

A disc format provides sophisticated functions with unparalleled versatility. Thanks to a new "intelligent" GUI (Graphic User Interface), this recorder is easy for anyone to operate and control. Also, careful attention was given when designing the GUI image in order to convey a feeling of warmth and comfort in the viewing room.

#### Newly developed drive improves reliability

The RDR-GX7 incorporates a new high performance Dual Drive developed and manufactured by Sony. Since it optimizes the conditions required for the many different types of discs, highly stable recording with a low error rate has been achieved. As a result, it assures the highest possible level of playback compatibility, which is a fundamental factor in DVD recording.

## Chapter 4-2

## DV Edit

## Camcorder recordings are easily archived on DVD

**Record from DV or Digital 8 tape to DVD - i.LINK makes it simple**

Many people have accumulated a lot of unique and treasured recordings on video tape. The ideal way to archive them is on DVD. The RDR-GX7 has been designed to make it easy to do just that, with operation simple enough for anyone to master. Through its i.LINK (DV) IN terminal, the RDR-GX7 can completely control a DV or Digital 8 camcorder. This allows remarkably simple dubbing operations using the One Touch Dubbing feature, with other functions also provided that enable anyone to accomplish high level editing tasks. Using these editing functions, it is possible to record on any type of DVD disc compatible with this recorder. By saving your precious video moments on discs with high playback compatibility, you can enjoy watching them on other DVD players.

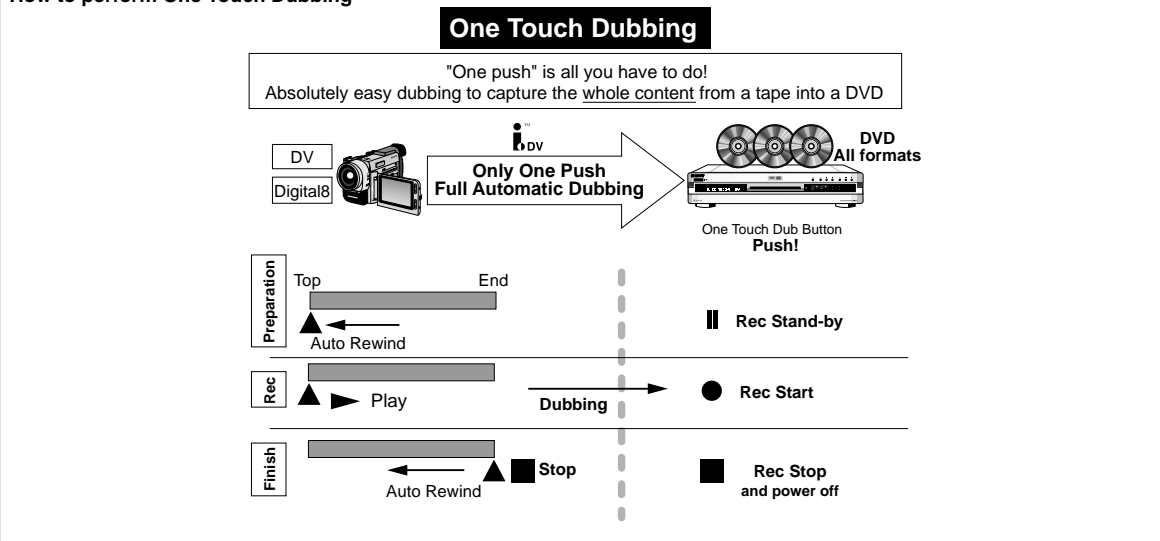


An i.LINK (DV) IN terminal is provided on the front panel.

■ **One Touch Dubbing offers extremely simple operation**

When you want to save the entire contents of a video tape onto a DVD, this mode is the one to choose. All troublesome operation steps have been eliminated with the One Touch Dubbing feature. Just connect your DV or Digital 8 camcorder to the RDR-GX7 using a single i.LINK cable, which plugs into the i.LINK (DV) IN terminal on the front panel. Next, press the ONE TOUCH DUB button to start; you don't even have to turn on the power of your TV or monitor. The i.LINK connection not only transmits the video and audio as a digital signal, it also functions as a high-speed serial interface for sending and receiving control data between the camcorder and the RDR-GX7. The RDR-GX7 uses

i.LINK to completely control the dubbing operation by synchronizing its operation with the camcorder – all you have to do is push the button, and the RDR-GX7 starts controlling the playback of the camcorder. The tape in the camcorder is automatically rewound to the beginning, and dubbing onto a DVD disc begins. When the recorded portion of the tape finishes, recording to the DVD disc stops. The tape is then rewound automatically, and the power of the RDR-GX7 is turned off. Just as its name implies, One Touch Dubbing is the easiest way to dub from a video tape to a DVD disc.

**How to perform One Touch Dubbing**

## Chapter 4-2

## DV Edit

## Auto Scene Chaptering

Although fast random access is a special ability of disc media, when dubbing from a camcorder to a DVD disc, without any marked points in the content, searching and editing cannot be easily performed. However, with the RDR-GX7, when the content is

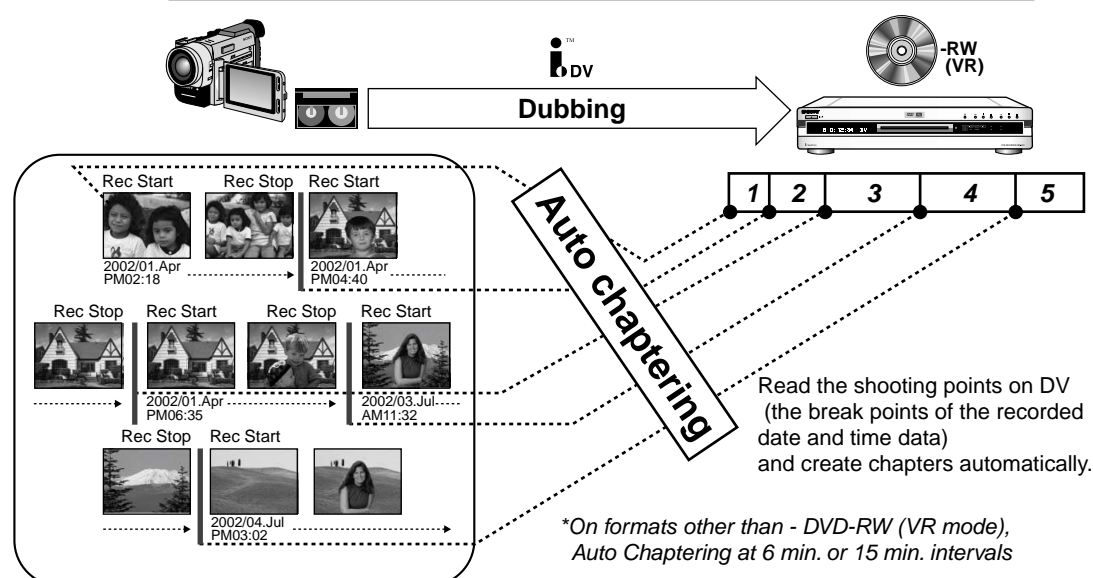
dubbed onto a DVD-RW disc in VR mode, the Auto Scene Chaptering function puts a chapter mark at the beginning of each scene\* of the DV recording. Thanks to this function, after dubbing the DV content onto a disc, it can be played back with

random access capability, and editing operations can be performed. When the content is dubbed onto a DVD-RW (Video mode), +RW or -R disc, chapter marks can be automatically inserted at either 6-minute or 15-minute intervals

## Auto Scene Chaptering

DVD-RW (VR mode) only

Create chapters automatically adapted to shooting points by the camcorder



\*On each video sector of a tape recorded in the DV or Digital 8 format, various forms of data called "auxiliary data" are recorded together with the video images. The recorded date and time is one example. The data for the recorded date and time is automatically recorded together with the image, so at each stop-to-start point, the recorded date and time data is not continuous. The RDR-GX7 takes this time data gap and records it when dubbing to DVD, and at each point a chapter mark is automatically inserted.

## Chapter 4-2

## DV Edit

### Two high level editing functions make it easy to create your own DVD

In saving content on DVD, users usually cut out unwanted sections and edit down the content, but they may later wish to restore some of the original content. In addition, when creating a DVD for personal use, the content is usually rearranged to suit the intended purpose. For this reason, the RDR-GX7 has, in addition to the One Touch Dubbing feature, two different functions which enable a high level of editing operation and versatility.

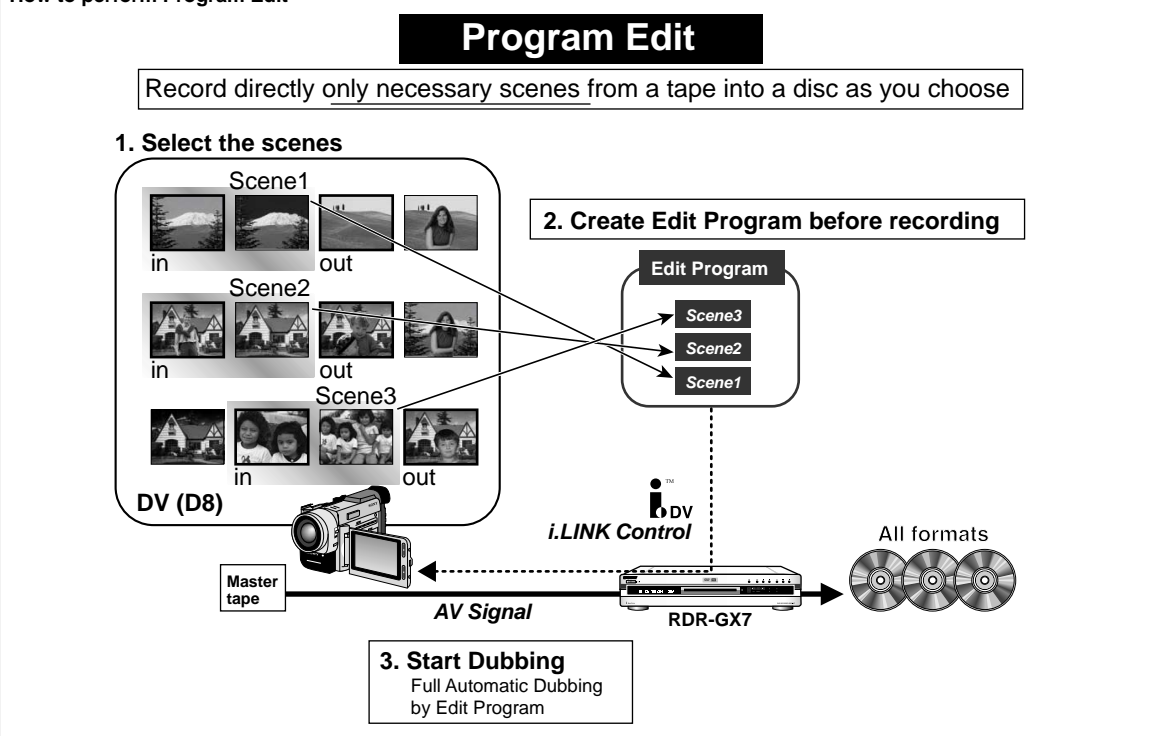
An editing system can be created simply by connecting the RDR-GX7 to a DV or Digital 8 camcorder through a single i.LINK cable. Desired scenes may be selected and these scenes can be put in any desired order through the creation of an editing program. Later, the tape drive of the camcorder can be controlled by the RDR-GX7, with the editing program automatically creating a compilation DVD for personal use.

These operations can be performed using the remote control of the RDR-GX7, with simple operation and a minimum of control steps, for remarkably easy editing. Once this editing program has been created, it can be used again and again to record any number of DVDs for friends and relatives. Since they are recorded directly from the tape as a recording source, the images are clear and crisp. This enables the creation of DVD discs with high image quality.

### ■ Program Edit

This function enables desired scenes from a video tape to be selected and placed in any order for recording onto DVD to create your own original recordings. The camcorder is controlled by the RDR-GX7, with each scene – from the IN point (beginning point of the scene) to the OUT point (end point of the scene) – selectable, in succession. Afterwards, slight adjustments can be made to the IN and OUT points, and the order of the scenes may be changed. As the video scene list is being watched, an Edit Program is created. Once the OK has been given, dubbing can be started, with synchronized operation between the playback side (camcorder) and the recording side (RDR-GX7) to perform the dubbing automatically. Moreover, up to 50 scenes (from one point to another) may be set into one editing program, with a maximum of 20 programs possible, of which all can be stored in the memory of the RDR-GX7. Once a program has been set, it is possible to record any number of DVD discs directly from the original video tape source with automatic operation.

### How to perform Program Edit



## Chapter 4-2

## DV Edit

### ■ Advanced Program Edit

Compared to the Program Edit function, in which the tape is watched and desired scenes are selected, the Advanced Program Edit function copies the entire tape onto a DVD disc. Scenes are selected and edited on the disc itself, taking full advantage of the merits of the disc format. First, the tape is dubbed “as is” onto a DVD-RW in VR mode. In this process, Auto Scene Chaptering (see column) is performed and chapters are automatically created. In addition, since Program Dubbing can take each selected scene and automatically create a scene list based on particular chapters, unwanted scenes may be deleted and the order of scenes can be changed, enabling the creation of a high-level edit program which can also be saved. Then, a new disc can be inserted into the RDR-GX7 and this Edit Program data can be copied onto it to enable the RDR-GX7 to create a copy of the same content onto this disc, directly from the original tape, by controlling the camcorder as the recording source. For all discs

compatible with the RDR-GX7, it is possible to make any number of disc copies containing the high quality image directly from the tape.

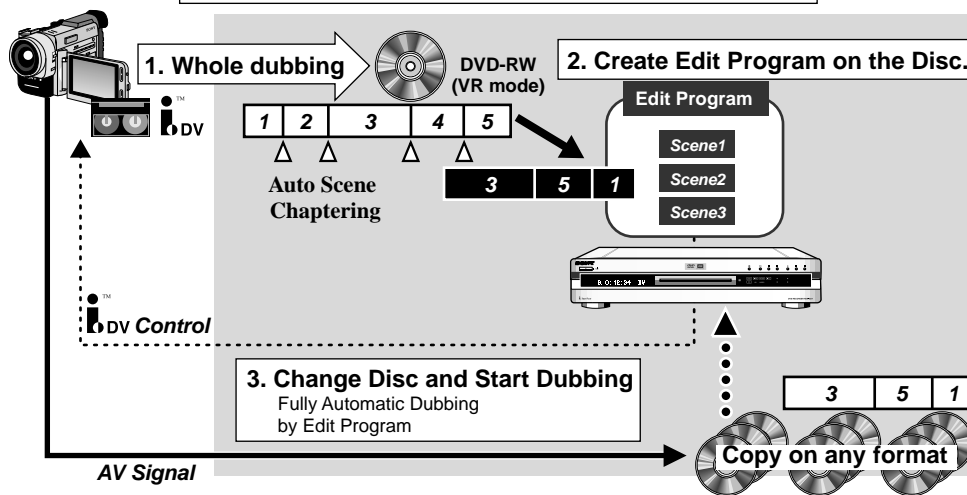
Of course, just as with Program Edit where each scene is selected, selection is possible at the IN and OUT points. Importantly, since this is a disc, chapter selection can be made using high-speed cueing, thus reducing the load on the tape (which serves as the master) during editing processes.

While this type of editing is also possible on an HDD/DVD Combo Recorder, there are many cases where encoding and decoding operations are necessary when accessing the program material. However, with Advanced Program Edit, since the dubbing comes directly from the original video tape, deterioration in image quality is held to the absolute minimum, which presents a distinct advantage over editing on an HDD/DVD Combo Recorder.

#### How to perform Advanced Program Edit

### Advanced Program Edit

- Edit freely with Non-linear Editing
- Make as many copies of the edited disc as you like
- Maintain picture quality by dubbing directly from DV



## Chapter 4-3

### Features

# RDR-GX7's convenient recording and playback features

## Easy DVD recording

When discs recorded using the RDR-GX7 are played back, the contents of the disc are displayed, facilitating rapid search for a particular segment. Previously, making an edited version of a video recording required two video decks to record segments onto a new tape, in a time consuming process. But with the RDR-GX7, it is possible to edit out unwanted portions on a disc and rearrange the playback order. This feature makes it possible to save not only video segments you have shot with a camcorder, but also television programs for time-shift viewing, or for storing on a disc. Compared with conventional video decks, the RDR-GX7 offers far greater versatility and convenience.

## ■ Title List by GUI

When DVD software titles are played back on a DVD player, the menu is displayed on the screen, allowing the user to select the desired content for playback. This convenient feature is made possible because a menu area is provided on a certain portion of the disc. In the RDR-GX7, a Title List function is provided, and via operation of a specific on-screen menu in the GUI, the contents recorded on the disc are displayed. By simply pressing the Title List button on the remote control, the list is shown. Up to eight titles are displayed on the menu at once in either clear, easy-to-read text only, or with the addition of thumbnail images for greater information detail. Switching between these two types of displays is possible using the Zoom +/- button. In addition, since program contents can be sorted by recording date and time, title number or title name, finding a desired title is quick and easy. When a desired title is selected from the Title List, playback, editing, or other operations can be smoothly performed. When the data is to be corrected or changed, the title name can be manually input. This makes it more convenient to

## Title List – on-screen display of content recorded on the DVD



Title List GUI screen (Normal)



Title List GUI screen (Zoom)

manage the recorded titles, to facilitate searching for a specific title in the Title List for playback, or to display the title name for confirmation during playback.

## Editing on disc capability

Editing on the disc is a major feature of rewritable DVD discs, and this is possible with the RDR-GX7. In particular, DVD-RW (VR mode) recordings offer a high degree of editing flexibility. There are two ways of editing DVDs. One is original editing on the disc itself, making changes to both the images and sound actually on the disc. Another way is to leave the images and sound data on the disc without making changes, and edit only the Playlist to rearrange the playback order of the content.

## ■ Original editing

In this type of editing, changes are made to images and sound actually recorded on the disc. With rewritable media, unwanted portions can be erased and these become blank areas, where different images and sound can be subsequently recorded to enable more efficient use of disc capacity.

## Original editing functions

Original editing is possible with DVD-RW (VR mode), -RW (Video mode), +RW and -R\* discs.

**Labeling a title (title name):** This enables a title to be manually input and is performed by using a keyboard on the screen. This title name can also be shown by other DVD players, which can display a DVD menu (except for DVD-RW VR mode).

**Protecting a title (protect):** Unlike erasure protect for an entire tape, this feature allows you to protect a specific title from being inadvertently erased.

**Erasing a title (erase)\*:** This is used to select a title, and erase its contents.

**Erasing a section of a title (A-B erase):** This allows you to erase the content between two specified points within a title. This function can only be used with DVD-RW (VR mode).

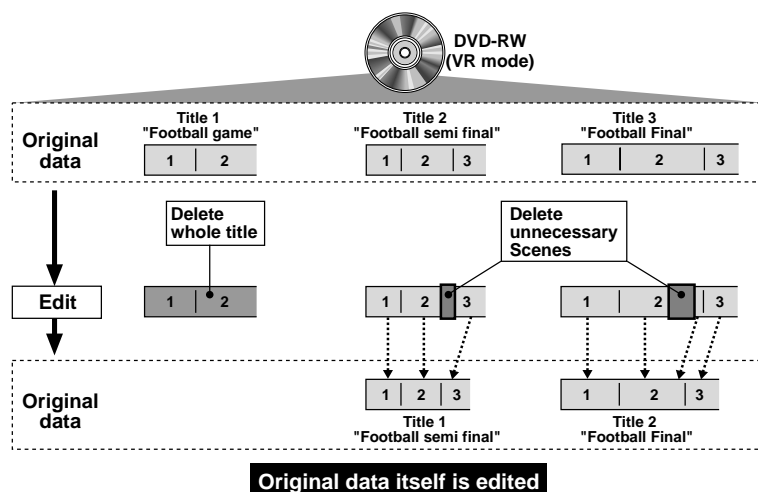
\*With write-once DVD-R discs, the erased areas cannot be recorded over again.

## Chapter 4-3

## Features

## How to perform Original editing

## Disc Edit - Original



## ■ Playlist editing

With this type of editing, the recorded images and sound are not rewritten, but rather a new Playlist is created and the order of playback is changed. The actual video and sound are not altered and editing is only performed “virtually,” so if errors are made in this editing process, it can be performed again from the original material as many times as necessary to achieve the desired result. The Playlist on a disc can hold up to 99 titles, so it is possible to alter the same title in many different ways, or make a new title composed of desired scenes from any number of titles.

## Playlist editing functions

In addition to the original editing functions, the following functions are possible (except the protect function).

**Creating a Playlist title from other titles:** This is the menu used to make a Playlist.

**Moving a Playlist title (move):** This enables the Playlist title playback order to be changed.

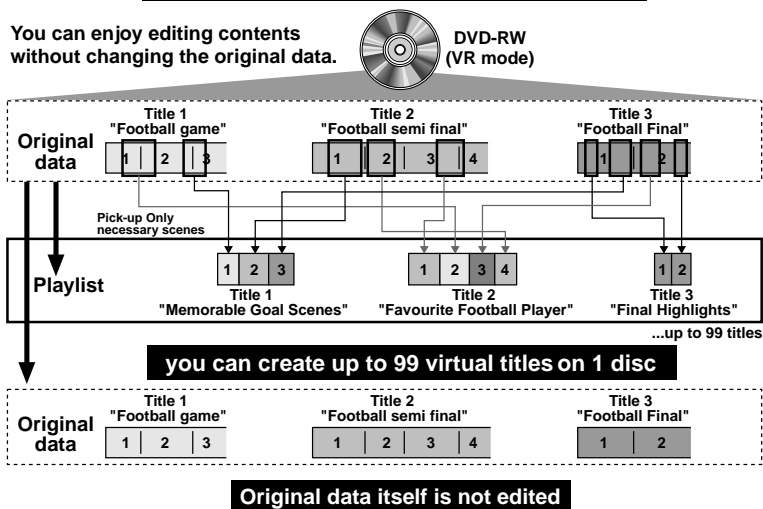
**Dividing a Playlist title (divide):** This enables a single Playlist title to be divided into two titles.

**Combining multiple Playlist titles (combine):** This enables several Playlists to be combined into a single Playlist title.

These Playlist editing functions can only be used with DVD-RW (VR mode).

## How to perform Playlist editing

## Disc Edit - Playlist



## Chapter 4-3

### Features

The RDR-GX7 offers the recording convenience provided by the disc format. At present, there are two basic types of home AV-use DVD recorders in terms of recording operation: tape model recording and disc model recording.

Tape model recording operates in the same way as an ordinary VCR; when the recording button is pressed, recording begins from the current position on the tape and continues recording the contents in a linear fashion, even if there is content already recorded, until the stop button is pressed. For this reason, there is concern about accidentally recording over important content.

Disc model recording, on the other hand, automatically finds blank areas on the disc and records on them. The RDR-GX7 performs disc model recording in all formats, so there is no concern about accidental erasure of previously recorded content.

In addition, while the type of recording in each format differs according to its respective specification, the RDR-GX7 has been designed to perform recording in a manner that efficiently uses blank space on the disc in all formats.

First, with DVD-RW in VR mode, the characteristics of disc recording are taken full advantage of, while all blank areas on the disc are efficiently used. When a single disc is used, during editing, unwanted titles can be erased, and unwanted parts within titles can be erased, leaving blank areas here and there on the disc. Then, DVD-RW VR mode enables those separate blank areas to be recorded again, and played

back as a single title.

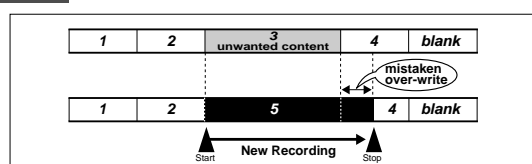
For high playback compatibility with DVD playback equipment, recording in DVD-Video format (DVD-RW Video mode / DVD+RW / DVD-R) can be performed, though editing operations like with VR mode are not possible. Since DVD-R has been designed primarily for playback compatibility, and cannot be re-recorded, new recording can only be performed after recorded titles. Most DVD recorders, even with DVD-RW Video mode recording, perform recording in the same way as with DVD-R. Therefore, even though DVD-RW is a disc that can be re-recorded,

apart from the last portion on the disc, even if previously recorded sections are erased there is no extra capacity for new recording. However, the RDR-GX7, during DVD-RW Video mode recording, enables new recording to be performed on the largest blank area on the disc, regardless of its location on the disc, and this enables more efficient use of disc capacity. In addition, even with re-writable DVD+RW recording, recording is performed in the same way as DVD-RW Video mode, so there is no concern about accidental data erasure, while disc capacity is used more efficiently.

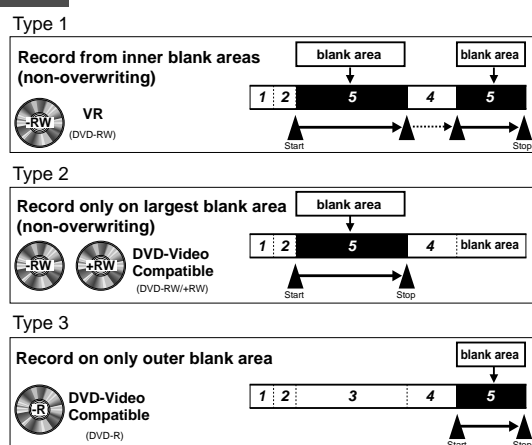
#### Disc model recording

#### Recording Types

##### TAPE MODEL



##### DISC MODEL



# High quality image performance for recording and playback on DVD

## Chapter 4-4

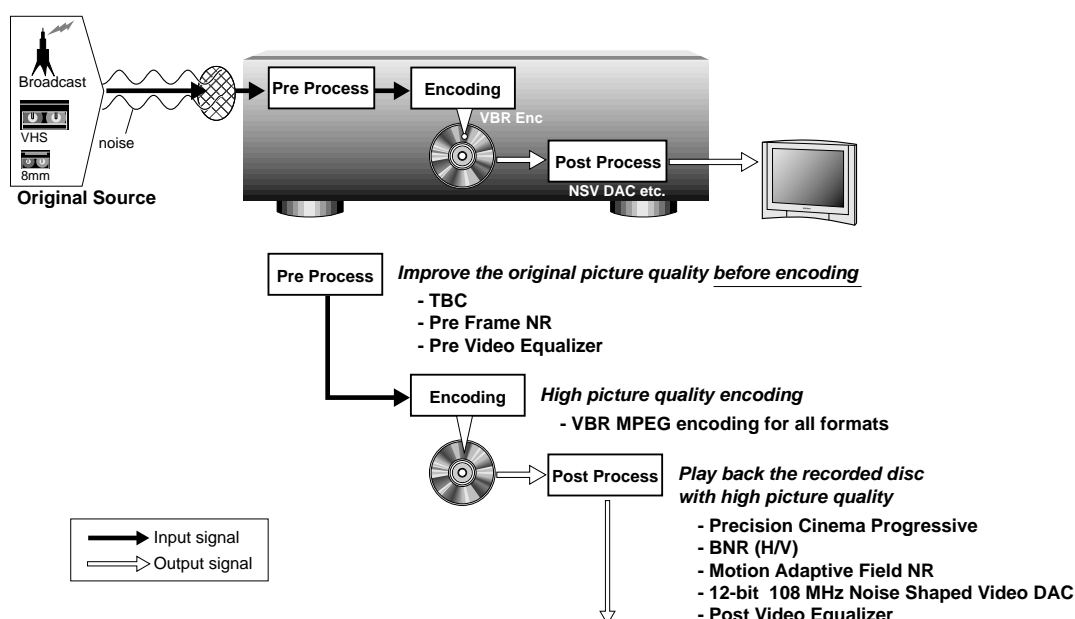
### High quality image & sound

#### High quality image performance from input to output

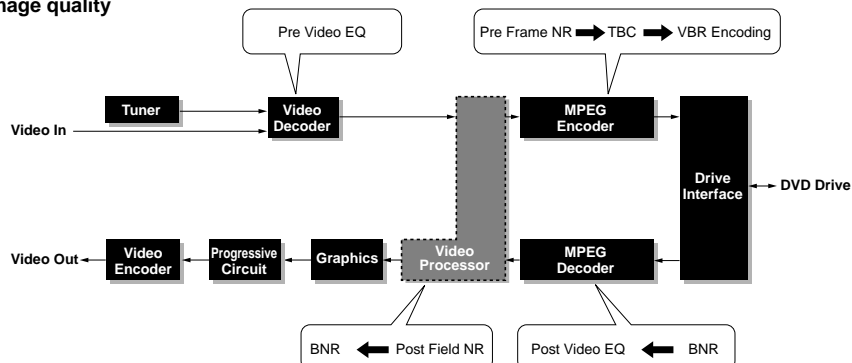
The distinct advantage of a DVD recorder is that the DVD medium exhibits superior durability and performance, making it ideal for the storing of video content. When a video is recorded onto DVD, it's essential to maintain the quality of the original image. For this reason, Sony has designed and engineered the RDR-GX7 to maintain top quality image performance from input to output. DVD recording employs MPEG compression, so if video sources containing noise are encoded, this noise becomes data. This not only reduces the entire data volume available for the video image, but will also emphasize the noise and create new types of noise. Old video tapes, or other sources offer significantly inconsistent picture quality and colour quality. To remedy this, the RDR-GX7 takes a different approach to the conventional practice of simply recording the input signal as is.

Instead, this new advanced approach makes use of various types of pre-processing to clean up the signal before encoding it into a video image, ready for recording. In addition, in the encoding process, regardless of the format to be used for recording, a VBR (Variable Bit Rate) system is employed to ensure recording with the highest possible image quality. Then, during playback, advanced technologies, developed through several generations of Sony DVD players, are employed to assure optimum performance. In this way, the RDR-GX7 handles all image data, in every stage from input to output, in such a way that improved image quality is assured. This approach sets a new standard of high quality image performance for both DVD recording and playback.

#### High performance at each operation stage



#### Multi-stage processing during both input and output assures high image quality



## Chapter 4-4

### High quality image & sound

#### Pre processing to achieve DVD recording with high quality image performance

Achieving “accurate recording for accurate playback” is the basic aim of any recording and playback device. One of the biggest features of the RDR-GX7 is that in the stage before recording, the input video signal is further improved with various forms of pre-processing. Steps are taken to reduce noise, which can have a bad effect on the image during MPEG encoding, while image adjustment through different processing of the input video signal ensures stable performance during subsequent MPEG encoding. In short, pre-processing is responsible for a large improvement in picture quality, while minimizing any deterioration during the encoding process.

##### ■ Pre Video Equalizer

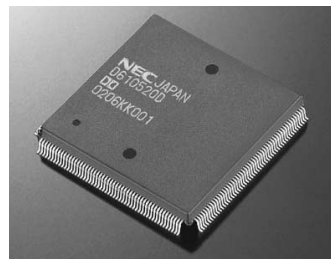
A desire to save video recordings on DVD is invariably accompanied by a large collection of previously recorded video tapes of varying quality and characteristics. To ensure uniform recording quality, the RDR-GX7 features the Pre Video Equalizer, a processing system which adjusts for minute variations in colour in the original video source before recording onto a DVD disc. Brightness, contrast, hue and colour level, are adjusted by this system. By adjusting these four parameters to achieve the desired picture characteristics, there is no need for troublesome picture adjustments when the discs are played back on other DVD players.

##### ■ Frame Noise Reduction before encoding

In the RDR-GX7, the video signal undergoes frame noise reduction processing before MPEG encoding. When comparing the video images before and after this processing, you can notice a distinct reduction in random video noise. Reducing this noise works to minimize wasteful bit allocation on noise during the MPEG encoding process used for DVD recording. As a result, bit allocation is more efficient for a higher level of performance.

##### ■ Time Base Corrector

The RDR-GX7 is equipped with a Time Base Corrector (TBC) circuit. Signals from analogue video decks usually contain time axis fluctuations called “jitter,” which can cause the generation of minute horizontal flickering, or vibrations on the screen. Since this jitter is recorded as movement during MPEG encoding, a large number of bits are wasted during the process. The TBC compensates for this jitter, working to eliminate unwanted flickering and vibrations for a more stable image on the screen. By encoding a more stable signal, higher quality images can be recorded.



The encoding LSI contains the Pre Frame Noise Reduction and TBC circuits

## Chapter 4-4

### High quality image & sound

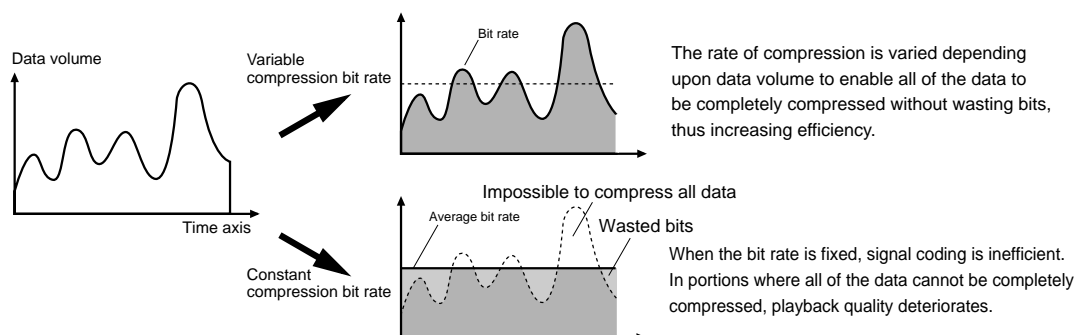
#### VBR encoding using Sony's original algorithms

DVD uses a form of video compression called MPEG-2 to enable the efficient recording of video signals onto a disc with limited capacity. With MPEG-2 technology, if the same scene continues with very little change in the image, previous data is used to portray the image. During SP mode recording, information is compressed to about 1/40th of the original data. There are two major forms of MPEG-2 encoding, Constant Bit Rate (CBR) and Variable Bit Rate (VBR). CBR uses a fixed bit rate and regardless of the content of the image, encoding is performed at the same bit rate. On the other hand, VBR uses a variable bit rate, employing a high bit rate for complex images, which have a lot of movement, or changes. For images with little movement, or changes, a lower bit rate is automatically selected. Therefore, VBR responds to the changes in the video image and adjusts the bit rate to maintain a fixed level of image quality. When comparing the two systems, VBR is obviously superior in

obtaining higher efficiency bit allocation, achieving high image quality without wasting precious bits.

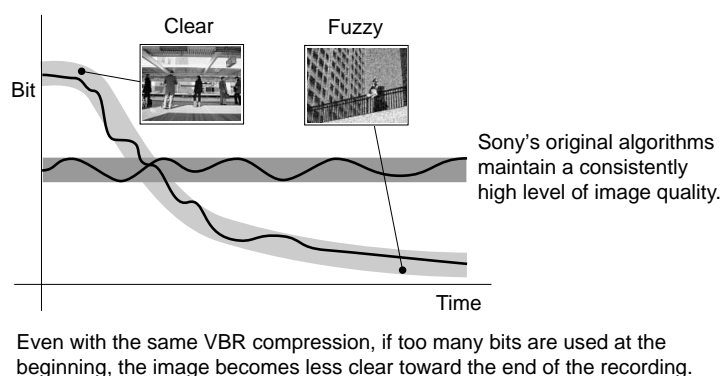
The RDR-GX7 uses VBR, operating via special algorithms developed by Sony. Depending upon the degree of complexity or movement in the source image, VBR compression changes the transmission rate accordingly to maintain optimum recording time in the set recording mode, thus maintaining a consistent level of image quality throughout the recording. The VBR algorithms used in the RDR-GX7 work to maintain a continuously even level of image quality, without any variations by performing VBR encoding in short fixed time units. The amount of bits used for previous time frames are considered during operation to keep track of present bit allocation using high level processing technology. Moreover, high picture quality is assured in all DVD+RW, -RW, and -R formats and recording modes.

#### Comparison of constant bit rate (CBR) compression and variable bit rate (VBR) compression



Recordable DVD discs can be recorded not only using constant bit rate compression, but also using variable bit rate compression, which enables high image quality recording of complex video images at the same average rate as used in constant bit rate compression.

#### VBR compression using Sony's original algorithms



## Chapter 4-4

### High quality image & sound

#### Post processing to obtain the highest possible image quality from the disc

The RDR-GX7 has been designed not only to be a superior DVD recorder, but also to offer a complete array of playback functions. Sony's flagship model DVD player the DVP-S9000ES, released towards the end of 2000, was used as a reference in the planning and design of the RDR-GX7. Accordingly, the DVP-S9000ES contributed much of the high level digital technology adopted in the RDR-GX7 for high quality images, along with other technologies developed specifically for top class performance befitting a flagship model. Both commercially available DVD software, as well as DVD discs recorded by the RDR-GX7, can be played back with the same high level of quality offered by Sony's finest DVD players.

#### ■ Precision Cinema Progressive

Sony's Precision Cinema Progressive system achieves clear and beautiful output from all types of recorded discs, including DVD software titles as well as discs recorded on the RDR-GX7 itself. This system employs several key technologies, including Pixel-by-Pixel I/P Conversion and V-Edge Compensation, along with advanced video D/A converter with high bit rate and sampling rate for enhanced performance. The following explains these technologies in detail.

#### Pixel-by-Pixel Active I/P Conversion

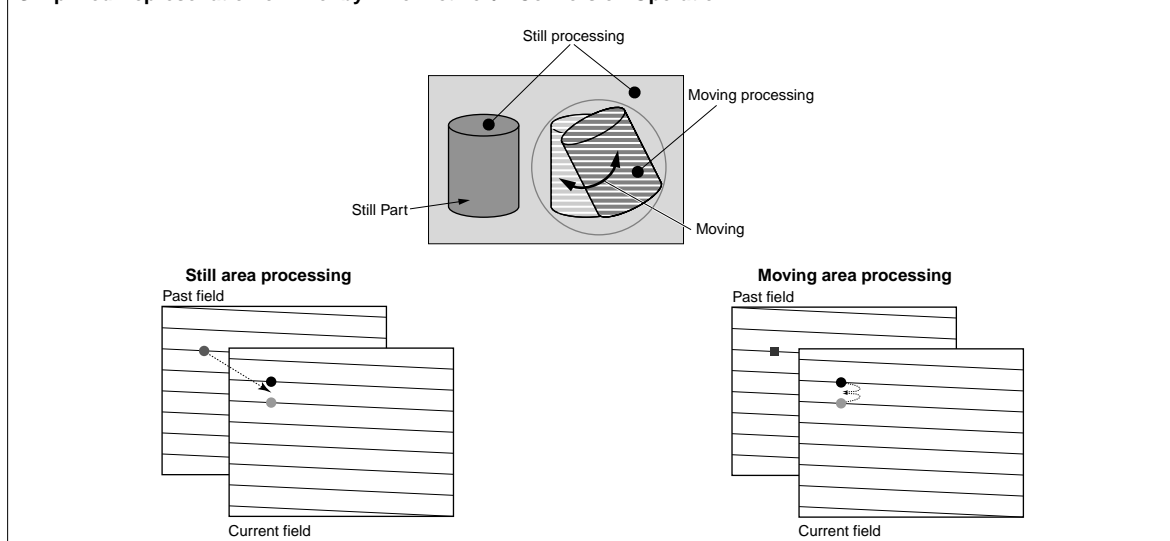
In progressive video, the pairs of video fields of the interlace system are combined (in a process called I/P conversion) to create a single video frame. Since twice the number of horizontal lines result, a more finely detailed video image is obtained. While a pair of fields are combined into an image, depending on whether the original source was originally created on film or was shot with a video camera, this process is performed in an entirely different manner. Sources originally created on film are made up of a series of still images (film frames), so the two fields are

created from the same frame in order to obtain a highly precise image. However, most sources created with a video camera are shot in field units. Time elapses between these fields, so if they are simply combined into a pair, the resulting video image becomes blurred. This is particularly noticeable during sequences with rapid movement.

Since the RGR-GX7 is expected to be used mostly to record programming which originates as video images, Sony has incorporated Pixel-by-Pixel I/P Conversion. This technology assures the highest possible image quality when playing back not only film sources but also non-film sources such as television programs as well as content recorded using various types of camcorders.

Fortunately, all video images in a video sequence or program are not entirely composed of movement. For example, in car chase scenes, while the cars are moving quickly, buildings and the surrounding scenery remain still in relation to them. Therefore, by separating the moving elements in a scene from those which are not moving, separate forms of video processing are possible. This is the concept behind Sony's Pixel-by-Pixel I/P Conversion. The images of the three previous fields are stored in memory, allowing comparison with the current field. In a given image, if the current odd-numbered frame's image is the same as a previous odd-numbered frame's image, there is a high probability that this part is a still image, but if it is different, then this part is judged to be a moving image. Thus, in Pixel-by-Pixel I/P Conversion, for pixels judged to be part of still images, pixels from previous even-numbered frames are selected. For pixels judged to be part of moving images, interpolation data is created based upon the horizontal lines above and below the current odd-numbered field image. In this way, Pixel-by-Pixel I/P Conversion assures clear and beautiful progressive conversion of images originally created on video.

#### Simplified Representation of Pixel-by-Pixel Active I/P Conversion Operation



## Chapter 4-4

### High quality image & sound

#### V-Edge Compensation

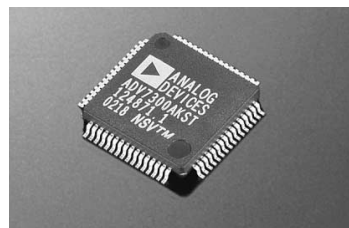
In moving images originally created on video, diagonal edges, depending on the angle, can often appear jagged. In order to smoothly express these diagonal lines, without jagged effects, the RDR-GX7 is equipped with original algorithm-based processing which judges movement at the pixel level, then detects these edges using an original algorithm. When edges are detected, information from a number of surrounding pixels in the field is used to create appropriate pixels to fill and smooth out the edge for a more precisely even representation.

#### 12-bit 108 MHz Noise Shaped Video D/A Converter

The video D/A converter has a high 12-bit resolution, and operates at a high sampling frequency of 108 MHz, and is incorporated onto a single LSI chip. The use of this advanced D/A converter allows any aliasing noise generated to be shifted to a higher frequency, enabling the use of an analog low-pass filter with a gentler sloped cutoff curve and better phase characteristics to assure superior quality image reproduction.

In the video signal, interlaced luminance signals are processed at 8-times oversampling to express the image. With this approach, the D/A converter for playback must have at least 8-bit resolution capability. In the RDR-GX7, however, the D/A converter has a higher 12-bit resolution to assure processing with even greater precision.

Accordingly, if sampling is performed at twice the operation frequency range of the luminance signal, the original waveform,



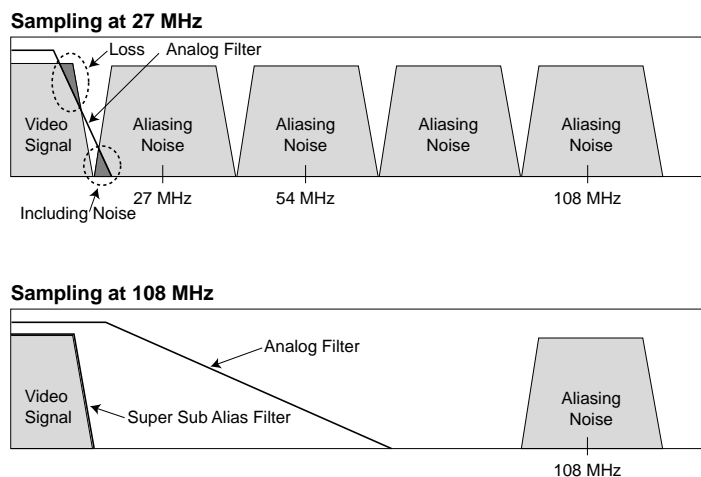
The 12-bit 108 MHz Noise Shaped Video DAC

in theory, can be perfectly reproduced. However, in the process of sampling, unwanted aliasing noise is generated. In order to eliminate this, an analog low-pass filter must be employed. But if the sampling frequency is too low, excess load will be placed upon the filter, adversely affecting its performance. For this reason, a high sampling frequency of 108 MHz has been adopted. This operation frequency represents eight times the necessary sampling frequency of 13.5 MHz for video signals for Standard Definition (SD) content with 525 horizontal lines, and four times the sampling frequency required for Progressive Scan (PS) content with 525 horizontal lines. Any aliasing noise accompanying the video signal can be shifted well away into a higher frequency, where it can be more effectively removed by an analog filter with a more gently sloped cutoff curve. For a digital filter, the Super Sub Alias Filter (SSAF) is also employed. In addition, Noise Shaped Video (NSV) technology is employed in the D/A converter to shift the noise outside of the operation frequency bandwidth. As a result, noise inside the operation bandwidth is greatly reduced, realizing an improvement in the S/N ratio. These double and triple countermeasures work synergistically to assure clearer, more accurate reproduction of video images. These advances assure D/A conversion performance on par with high-end DVD players for beautifully superb image quality.

#### ■ DC-coupled Analog Video Circuitry in All Stages

In order to take full advantage of the performance of the 12-bit 108 MHz video encoder, analog video processing circuits with significantly improved performance have been incorporated into the design of the RDR-GX7. In order to minimize APL shift and assure optimum linearity, a dedicated video amplifier has been adopted. In addition, DC-coupled active LPF and buffer amps are employed in all stages.

#### 108 MHz sampling enables improved noise reduction for better image quality



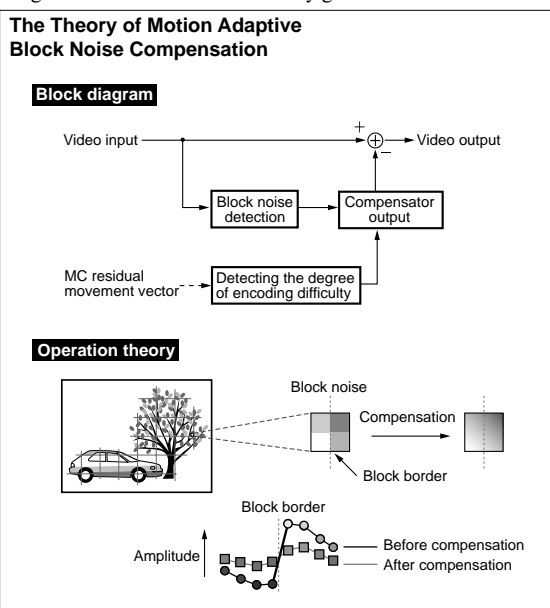
NSV and SSAF (Super Sub Alias Filter) are trademarks of ANALOG DEVICES, Inc.

## Chapter 4-4

### High quality image & sound

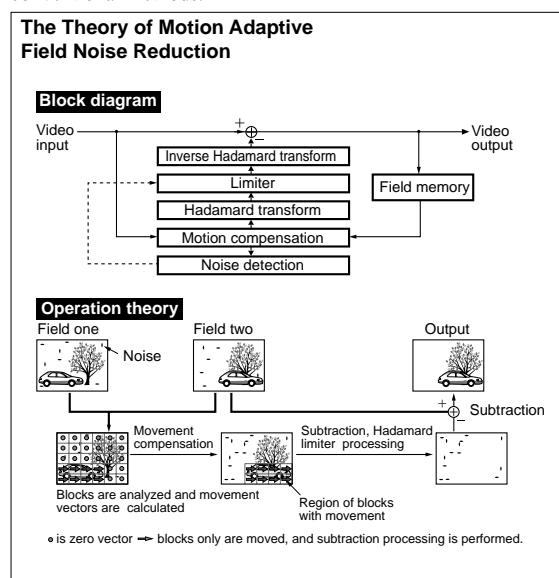
#### ■ Motion Adaptive Block Noise Reduction

Block Noise Reduction is used to effectively reduce both noise and block noise, which are characteristics of MPEG processing. The RDR-GX7 is equipped with a Block Noise Reduction circuit, which detects higher harmonic block noise and works effectively in both horizontal and vertical directions in order to minimize the appearance of block noise borders. It operates in tandem with the Field Noise Reduction circuitry (explained later), in a motion adaptive manner to minimize detection errors, while automatically applying block noise reduction to video images in which block noise is easily generated.

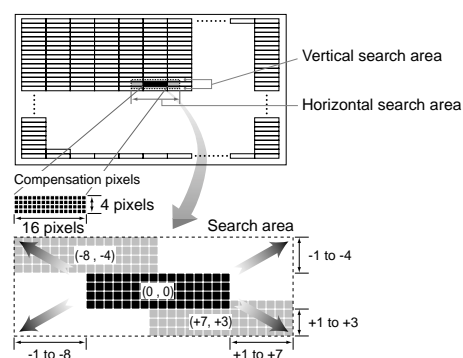


#### ■ Motion Adaptive Field Noise Reduction

The most noticeable drawback of MPEG playback is video background noise. Conventional digital noise reduction (DNR) has the negative effects of residual images and loss of detail, so it is not a thoroughly effective approach. The RDR-GX7, however, employs Motion Adaptive Field Noise Reduction which precisely detects movement and extracts the noise through Hadamard transform, to achieve a highly efficient reduction of noise components. In addition, there are virtually no adverse effects to either movement or detail, making this a much more thorough and effective approach to noise reduction than conventional methods.



#### Representational Diagram of Motion Detection by Block Matching



## Chapter 4-4

### High quality image & sound

#### ■ Post Video Equalizer

The image quality of DVD-Video software varies due to a number of factors, including colour adjustment, local colour preferences, the era it was originally created, preferences of the authors, plus differences among equipment. Consequently, recordable DVDs will also exhibit differences depending upon the quality of the original source and the particular recorder used. Thus, to achieve the best possible playback condition, comprehensive picture adjustments may be required. For this reason the RDR-GX7 is equipped with a video equalizer which enables on-screen adjustment of parameters while the recording is viewed, with control through a menu on the GUI display.

#### ■ Accurate Chroma Up-sampling

It is said that the human eye is very sensitive to color, and for DVD software this is of particular importance. Because of the small size of the disc, data representing color must be compressed to 1/4th of its original volume during the production process before this data is recorded onto the disc. Then, during playback, the original information is restored through a process called chroma up-sampling. In the RDR-GX7, the appropriate form of correction for both video material and for fill-in material images is performed. Since different types of processing are performed depending upon the type of image, color bleed as well as lack of color are both dramatically reduced for superior, natural looking images, even down to outline details. It all adds up to a more enjoyable watching experience.

## Chapter 4-4

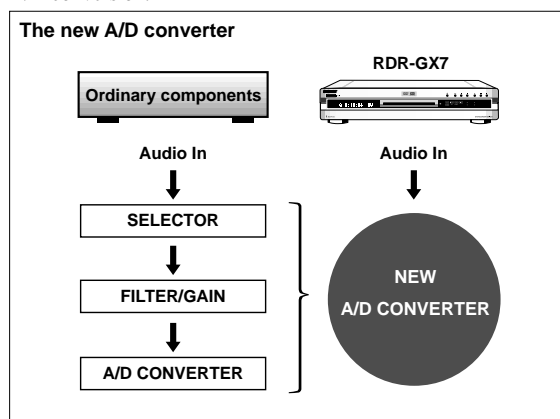
### High quality image & sound

#### High-grade audio circuit design for high sound quality

While video performance is extremely important for quality playback, it's essential to offer the same high level of audio performance. The RDR-GX7 has been designed for connection to high quality amplifiers and speakers, and therefore its design features high-grade audio circuitry, along with new recording circuit technology to facilitate top quality performance, both as a CD player and as a DVD player. In the RDR-GX7, the audio circuitry has been created to assure complete satisfaction in home theater use.

#### ■ Newly developed audio-grade A/D converter (pre-processing)

Analog audio signals input into the RDR-GX7 are converted to digital signals for recording, hence an A/D converter is necessary. For this purpose, a newly developed 96 kHz 24-bit capable A/D converter is incorporated. Since it has an extra margin of performance in terms of both the sampling frequency and the quantization bits, high sound quality is maintained during A/D conversion. In addition, in this A/D converter, the circuitry for all input stages has been integrated onto a single IC chip. Selector circuitry, as well as filter and gain adjustment circuitry, which have conventionally been constructed with many different components along the signal path, are now integrated into an IC, enabling direct input of the audio signal. This approach reduces any negative effects on the audio signal caused by noise generated in the digital and control sections, resulting in accurate A/D conversion.



The Newly Developed 96 kHz 24-bit Capable  
A/D Converter

#### ■ 192 kHz 24-bit high performance D/A converter (post-processing)

A high performance audio output D/A converter has been employed which offers 192 kHz, 24-bit performance. This high quality converter ensures excellent reproduction of DVD-Video soundtracks and audio Compact Discs.

#### ■ High Grade Audio Circuitry for Superior Sound Quality (post-processing)

The analog output of the audio D/A converter is handled as a balanced signal in order to minimize the effects of external noise on the signal, which is sent to the signal amplifier. In addition, the signal amplifier employs a plus-minus power supply for greater dynamic range capability.

#### ■ Wide bandwidth optical output terminal (post-processing)

The RDR-GX7 features two different types of digital outputs, a conventional coaxial output and an optical output, both of which feature extremely wide bandwidth characteristics. Since the optical output is capable of transmission speeds of up to 13.2 Mbps, signal jitter (time axis fluctuations) is minimized, assuring higher sound quality compared with connections to conventional optical outputs when connection is made through this terminal.



Coaxial and optical  
digital audio outputs

#### ■ Television Virtual Surround (TVS) (post-processing)

Using the surround track recorded on DVD-Video software, virtual multi-speaker reproduction is possible through connection to existing television stereo speakers. This function makes it easy to enjoy a soundfield with remarkable presence. Fine sound tuning, such as increasing the level of the “virtual” center channel to reproduce the dialog more clearly, can be easily performed. In addition, four different sound modes (dynamic / wide / night / standard) may be selected to optimize sound reproduction for the software or the listening environment.

# Designed for easy use of all functions

## Chapter 4-5

### Easy use

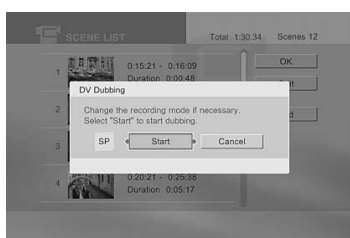
#### Interactive GUI (Graphic User Interface) screen for convenient operation

When you wish to record a video you are watching, just press the REC button. Or, to set a television program for timer recording, just press the Timer button and make your settings. In fact, much of the operation of the RDR-GX7 is similar to operating a conventional VCR. When you wish to view either a recorded DVD or DVD software, simply press the PLAY button just like you would with a DVD player. Moreover, the RDR-GX7 is also equipped with new functions, offering a level of convenience normally unavailable on VCRs and conventional DVD players. Thanks to the new interactive GUI on the RDR-GX7, operation of these functions is simple and foolproof.

#### ■ Interactive operation

The RDR-GX7 is equipped with a new operation system which enables the operation of various convenient functions in an easy, interactive manner which proceeds nearly like a conversation with the unit itself. On the GUI screen, intuitive questions navigate the user through various procedures. For example, it asks what you want to do, and which selections you would like to make, and then provides a list of answers and choices for you to select from to continue your operation sequence. In addition, virtually all choices can be operated using only the cursor button. With this style of operation, sophisticated functions can be operated very simply, with a single thumb on the controls, making DVD recording with the RDR-GX7 both convenient and enjoyable.

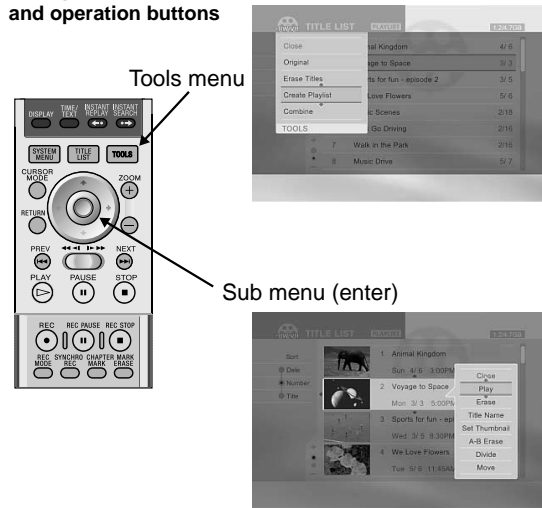
#### Examples of operation dialogs



#### ■ Automatic function call

Although the RDR-GX7 is equipped with a diverse range of functions, the availability of them will differ according to the particular disc and operation mode. Therefore, to assist the user, 'Enter' and 'Tools' buttons are provided which can be used to display currently available functions for operation. From the menu, use the Enter button to call up the Sub menus, and on each of the lists the operable functions for title and program can be

#### Examples of Tools and Sub menu screens, and operation buttons

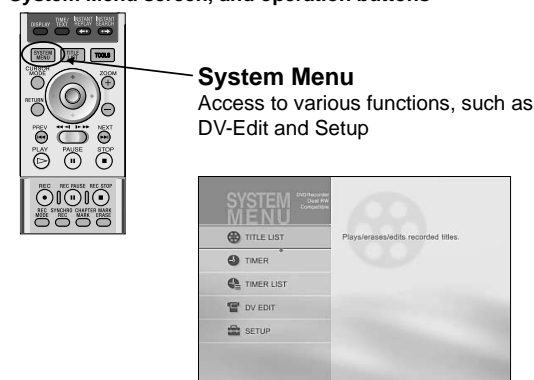


selected. The Tools button supports the operation of each title on the entire disc in response to the screen display. Since these two buttons can be used to call up virtually almost all the functions of the RDR-GX7 on the GUI, there is no need to search for specific control buttons, thus simplifying operation for the user.

#### ■ System Menu

The System Menu is used to call up the main functions of the RDR-GX7. With conventional models, in order to operate a function, it was necessary to find the button for the desired function on the remote commander. The RDR-GX7, however, simplifies this process. First, just press the System Menu button. Then, the System Menu is displayed, allowing the user to select from many operation choices, such as Title List or program display, as well as all the main functions for DV editing. Next, just move the cursor to the desired function, and call it up for operation.

#### System Menu screen, and operation buttons



#### ■ Easy Setup

After purchasing a recorder, it is often quite troublesome to make initial settings such as tuner settings, as well as making sound and other necessary adjustments after connections to other equipment. With the RDR-GX7, these operations are performed

## Chapter 4-5

### Easy use

in an interactive manner. After the necessary connection with other equipment has been made and the power is first turned on, the Easy Setup function starts. Operation proceeds as you are asked a series of simple questions, which lead to the quick completion of the basic setup process. Then you can quickly begin enjoying the recording and playback capabilities of the RDR-GX7. Of course, changes in the setup details for each category can be performed manually by entering them from the Setup menu.

#### ■ New style GUI screen design

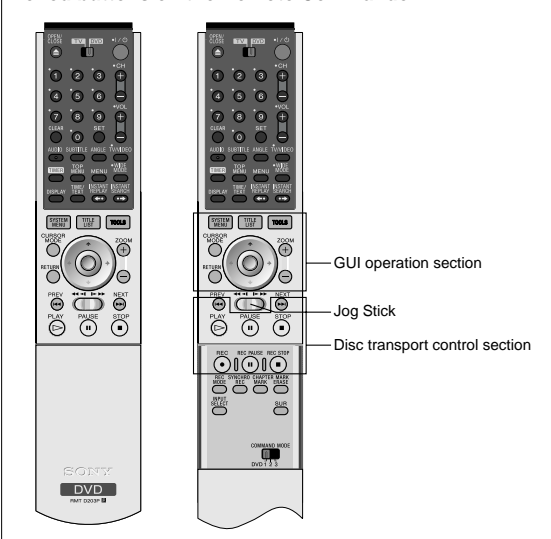
Most conventional GUI designs are invariably done in blue and other basic colors, and have a simple, nondescript image. As the RDR-GX7 is a versatile DVD recorder, the GUI is likely to be used quite frequently. Therefore, great efforts were made to create a new, user-friendly design. In particular, the screen design was created under the concept that the GUI screen is part of the room interior, and should blend harmoniously with it in a stylish, friendly and non-mechanical way. The overall image is one which suggests full drapes. The Menu titles in the upper left corner of the screen are backed by a simple terra cotta color, with an overall feeling of softness that will help set the scene for the video entertainment to follow.

#### ■ Remote Commander designed for easy operation

To ensure that editing and GUI function operations can be easily accessed and controlled, the remote commander has been carefully designed with a logical layout. The buttons are laid out in specific zones for each function. Controls for basic disc transport have been grouped in three rows under the cursor control area. Control of search, slow and frame advance, as used in various editing situations, are integrated to the Jog Stick control for primary editing, thereby creating a new style of operation. In addition, buttons related to GUI operation are placed above, plus to the left and right of the cursor control. The

three buttons placed above the cursor and the cursor itself can be used to control almost all functions. The buttons have been placed close together to minimize the finger movement necessary for their operation. And, by clearly dividing the areas for GUI and disc transport control operation, it is possible to operate either of those groups of functions without changing the position of the hand when holding the Remote Commander.

**Zoned buttons on the Remote Commander**



## Chapter 4-6

### Drive and Deck mechanism

# New technology adopted in the optical pickup, drive and deck mechanism

## Newly developed Dual Drive

The RDR-GX7 is equipped with Sony's newly developed Dual Drive. It represents the heart of dual RW recording capability, assuring precise control for the write strategy (including laser power) of many different kinds of media. The result is highly stable recording with a low error rate. This performance contributes to a large improvement in compatibility, which is the most important fundamental factor in DVD recording. In addition, the drive also assures highly stable reading of the large variety of discs which are compatible with the RDR-GX7, including DVD+R, DVD-Video software, music CDs, and CD-R/RW discs.

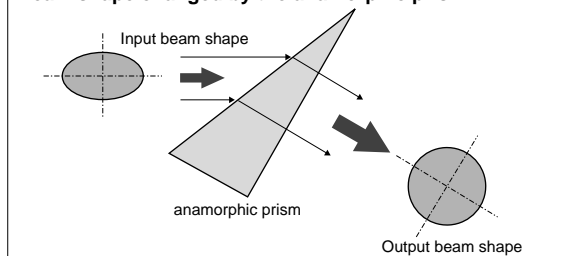
**The Dual Drive Mechanism in the RDR-GX7**



## ■ DVD beam shape adjustment for more stable recording

The light beam emitted from the laser diode, when viewed in cross-section, is actually oval in shape. If light in this oval shape is sent through the lens and projected onto the disc surface, its ability to read and record is reduced. In reality, a light beam that is round in shape provides ideal performance. Therefore, in order to change the shape of the beam from oval to round, it is refracted through an anamorphic prism. This prism has the unique characteristic of enlarging or reducing the beam in only one direction, but does not make any change in other directions. By carefully adjusting the angle of the prism to the input beam, the shape of the beam can be changed. This anamorphic prism system has been adopted in the RDR-GX7 to achieve highly stable recording characteristics.

**Beam shape changed by the anamorphic prism**

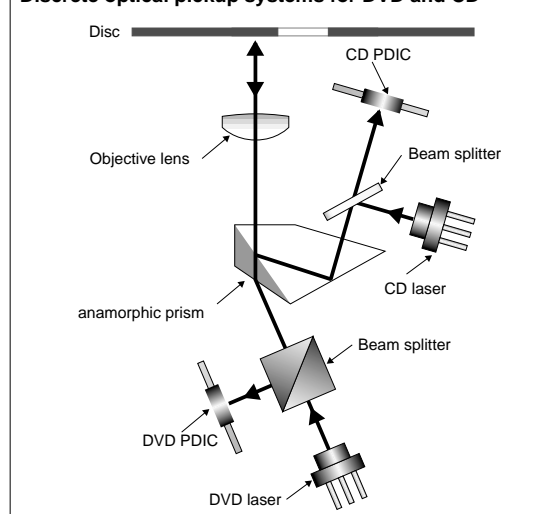


This prism can enlarge or reduce the beam in only one direction, but does not change beam dimensions in any other direction. By changing the angle of the prism in relation to the beam, the shape of the beam can be changed. This enables the shape of the beam to be easily changed from oval to round.

## ■ Discrete optical pickup systems for DVD and CD

In order to handle two different types of disc media, DVD and CD, two different approaches can be taken. Different objective lenses can be used in the optical pickup, or an optical pickup for both applications can be used. In the RDR-GX7, a special objective lens which changes the aperture ratio between DVD and CD operation is employed. Behind the lens, however, discrete optical pathways for DVD and CD are constructed in an optimum, yet extravagant, design execution. As a result, highly stable pickup to suit the characteristics of each type of disc is assured.

**Discrete optical pickup systems for DVD and CD**



## ■ High mount insulators

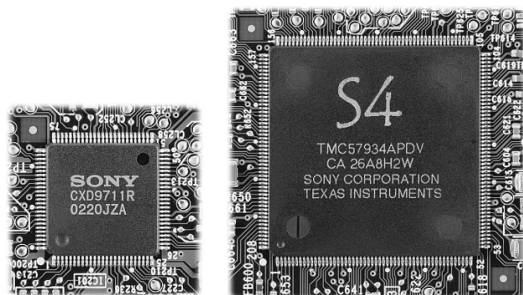
When DVD and CD optical discs are manufactured, they emerge with extremely minute irregularities, which are unavoidable. Even irregularities which are within the DVD specifications of 0.010 g/m can result in the generation of resonance when the disc is rotated at high speeds. This resonance can disturb both tracking and focus operations, causing a deterioration in performance. To minimize this resonance, Base Unit Insulators are normally employed. In the RDR-GX7, base unit insulators are mounted as close as possible to the disc in a high mount insulator design. Special holes have been made in the disc tray to enable the mounting screws for the mechanism to be as thin as possible to assure low resonance. Thus, resonance is minimized as close to the source as possible.

## Chapter 4-6

### Drive and Deck mechanism

#### ■ Functions integrated on two newly developed ICs

In the design of the RDR-GX7, two new ICs were specifically created. The CXD9711R contains the RF amp which is used to read and write signals, while the larger S4 is mainly used for encoding and decoding circuitry. The S4 also contains the servo DSP and ATAPI control circuitry. In addition, the S4 also includes the circuitry for various signal processing functions for DVD recording which are explained in the following sections.



The CXD9711R and the S4 are used in the Dual Drive circuitry

#### ■ Precise signal control for DVD recording

In order to perform highly precise DVD recording in an optimal manner on each form of DVD media, both the write strategy control (that includes DVD laser power control) and address data extraction are important factors. The Dual RW Drive employs a digital PLL to create write strategy, while LPP extraction is performed by digital processing for DVD-R/-RW media and ADIP extraction for DVD+RW media. In particular, for LPP signal processing, an automatic following function is employed to vary the slice level depending upon the hardware. For ADIP signal processing, original detection methods are utilized after A/D conversion. In these ways, various types of media are easily handled, enabling a high level of Dual RW recording capability.

#### Solidly designed mechanism

##### for top performance in all areas

Behind the stylishly flat design, serious considerations were made to the fundamental construction of this DVD recorder. One essential requirement is the need for virtually silent operation in order to minimize any intrusive noise during use. Also, to ensure stable DVD recording, heat generation must also be thoroughly studied. In the planning of the RDR-GX7, these points were carefully considered during the design and construction of the mechanism.

#### ■ Highly rigid chassis and

##### newly developed insulator feet

Resonance from external sources is an extremely important factor in playback quality. In order to ensure the highest possible sound quality from recorded video content and DVD software, newly developed asymmetrical insulator feet are employed. These have been specifically developed for use with the RDR-GX7 and effectively minimize external resonance effects, enabling maximum performance from the Dual Drive. In addition, L-shaped beams are employed in the chassis interior to maintain high rigidity, further limiting the effects of external resonance.

#### ■ Comprehensive measures

##### for heat dissipation and silent operation

Since the pickup section in the drive has a high output, a great deal of heat is generated. In addition, when a large amount of processing is performed by the ICs, high heat generation cannot be avoided. Since this is a recorder which operates at sub-micron precision levels, it is important to find ways of holding down temperature increases in the drive section in order to achieve highly stable DVD recording. When recording in the DVD-R format, it's essential to avoid the effect where high surrounding temperatures cause the laser wavelength to increase. Due to these factors, detailed heat dissipation analysis of the RDR-GX7 was undertaken. Appropriate placement of the parts and the careful placement of heat dissipation hardware has resulted in a design that features highly efficient countermeasures.

Also, quiet operation of the unit is very important for the thorough enjoyment of recorded content and DVD and CD software. For this reason, the back panel of the RDR-GX7 is equipped with a cooling fan with extremely quiet operation. Plus, the fan has a control system to change between two speeds depending upon the internal temperature in order to assure quiet operation.

## Specifications RDR-GX7

### Color system

Recording	NTSC
Playback	NTSC

### Recording

#### Recordable Format

Disc Type		Recording Format
DVD-RW	Ver1.1	DVD Video Recording Format (VR mode)
	Ver1.1 with CPRM	DVD Video Format (Video mode)
DVD+RW		DVD+RW Video Format
DVD-R	Ver2.0	DVD Video Format

\* 12cm Disc only

#### Digital Compression

Video	MPEG
Audio	Dolby Digital / 2ch, 256kbps

#### Recording mode

Mode	Time (at 4.7Gbytes)
HQ	60 min
HSP	90 min
SP (Standard)	120 min
LP	180 min
EP	240 min
SLP	360 min

#### Recording Features

Timer	Number of Events	30 Events /1 Month
	Programming	Manual VCR Plus
Other Features		Quick Timer use REC Key (from 30min up to 6hour by 30min step)  Synchro Rec Synchro Rec goes into standby mode when the power is turned off.  Rec Mode Adjust

### Tuner System

System M	Normal Channel : 2 - 69 CATV Channel : 1 - 125
Audio Reception	Split Carrier System

### AV Connectors

i.LINK(DV) Input	1x (4-pin S100)
S-Video Input	3x
Composite Video Input	3x
Composite Video Out	2x
Component Video Out	1x (Y, Pb, Pr)
S-Video Out	2x
Audio Input	3x
Optical Digital Audio Out	1x
Coaxial Digital Audio Out	1x
Audio Out	2x

### Other Connectors

Control-S Input	1x
VHF / UHF Input	1x
VHF / UHF Out (Pass through only)	1x

### Playback

#### Playable Format

Disc Type	
DVD VIDEO	
DVD-RW	Ver1.0
	Ver1.1
	Ver1.1 with CPRM
DVD+RW	
DVD-R	
DVD+R	
Music CD	
CD-R	(Music CD format only)
CD-RW	(Music CD format only)

\* 12cm and 8cm Disc

\* DVD-RW/-Rs, DVD+RW/+Rs, or CD-RW/-Rs recorded on another recording device cannot be played on this recorder if they have not been correctly finalized. Some discs cannot be played due to the recording quality or physical condition of the disc, or the characteristics of the recording device and authoring software.

#### Audio Format

Dolby Digital
DTS (Digital out only)
PCM (48kHz/96kHz)

#### Audio Specification (Playback)

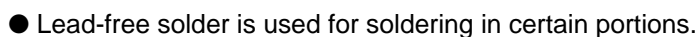
Frequency Response	
DVD (PCM 96kHz)	4Hz to 44kHz (+/-1.0dB)
DVD (PCM 48kHz)	4Hz to 22kHz (+/-0.5dB)
CD	4Hz to 20kHz (+/-0.5dB)
Signal-to-noise ratio	
DVD	115dB
Harmonic distortion	
DVD	0.002%
Dynamic range	
DVD	110dB
CD	100dB
Wow and flutter	
DVD	Less than detected value (0.001% W PEAK)

#### Audio Specification (DVD Recording / Playback)

Frequency Response (Dolby Digital 48kHz)	10Hz to 20kHz (+/-1.0dB)
Signal-to-noise ratio	96dB
Harmonic distortion	0.004%
Dynamic range	96dB

### General

Power Requirements	120V AC, 60Hz
Power Consumption	43W
Dimensions (approx.)	W 430 x H 89 x D 381mm incl. projecting parts
Weight (approx.)	5.6kg
Front Panel	Aluminum
GUI Language	English / French



**VHF/UHF**  
IN

**CERTIFICATION**  
PRODUCT COMPLIES WITH DASH RULES  
"VCR" COMPLIES WITH PART 68 OF THE FCC  
AT THE DISCRESSION OF THE MANUFACTURER  
SAMS CORPORATION  
SAMS ELECTRONICS (CANADA) INC.  
SAMSUNG-DAEWOO TVS-VHS-6000-JAPAN  
REZ. GIBRALTAR JAPAN

**DIGITAL OUT**  
PCMCIA/COAXIAL/DIGITAL  
COAXIAL  
OPTICAL

**LINE IN**  
R-AUDIO-L VIDEO S VIDEO  
1 2 3

**LINE OUT**  
R-AUDIO-L VIDEO S VIDEO  
1 2 3

**COMPONENT VIDEO OUT**  
Y Pb Pr

**~ AC IN**

**CAUTION**  
DO NOT OPEN  
ATTENTION  
NE PAS OUVRIR  
NE PAS OUVRIR

**CAUTION**  
THIS DEVICE COMPLIES WITH PART 68 OF THE FCC RULES. IT IS SUBJECT TO THE FOLLOWING CONDITIONS: (1) THIS DEVICE MUST NOT CAUSE HARMFUL INTERFERENCE, AND (2) IT MUST ACCEPT AND NOT RE-EMIT HARMFUL INTERFERENCE. REPAIRS MUST BE MADE BY QUALIFIED PERSONNEL.

**CAUTION**  
NE PAS OUVRIR  
ATTENTION  
NE PAS OUVRIR

**VCR Plus+ et PlusVideo** sont des marques déposées de Genstar Development Corporation. Le système VCR Plus+ n'est fabriqué que chez Genstar Development Corporation.  
VCR Plus+ and PlusVideo are registered trademarks of Genstar Development Corporation. The VCR Plus+ system is manufactured under license from Genstar Development Corporation.

3-079-459-11

Manufactured under license from Daikin Laboratories.  
"VCR" and the double-V logo are trademarks of Daikin Laboratories.

U.S. Patent Nos.  
5,307,075, 5,332,079, 5,404,712,  
6,725,520 and 5,720,521

"VCR" and "VCR Plus" are trademarks  
of Genstar Development Corporation.

Patented Claims of U.S. Patent Nos. 4,631,033, 4,577,276,  
4,265,088 and 5,007,033 recorded for limited-term only.

Technique d'Innovation, Canada  
Cable Compatible Television Apparatus, Canada

OPEN/CLOSE MENU FOCUS CH + VOICE

1 2 3

4 5 6

7 8 9

CLEAR 0 +SET

AUDIO SUBTITLE ANGLE TV/VIDEO

(TIME) TOP MENU MENU WIRE MODE

DISPLAY

SYSTEM MENU TITLE LIST TOOLS

CURSOR MODE RETURN

PREV PAUSE NEXT

PLAY STOP

SONY DVD

RMT-D203A

- Specifications, photos and related data are intended for design purposes and may be different from those of the actual product.

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