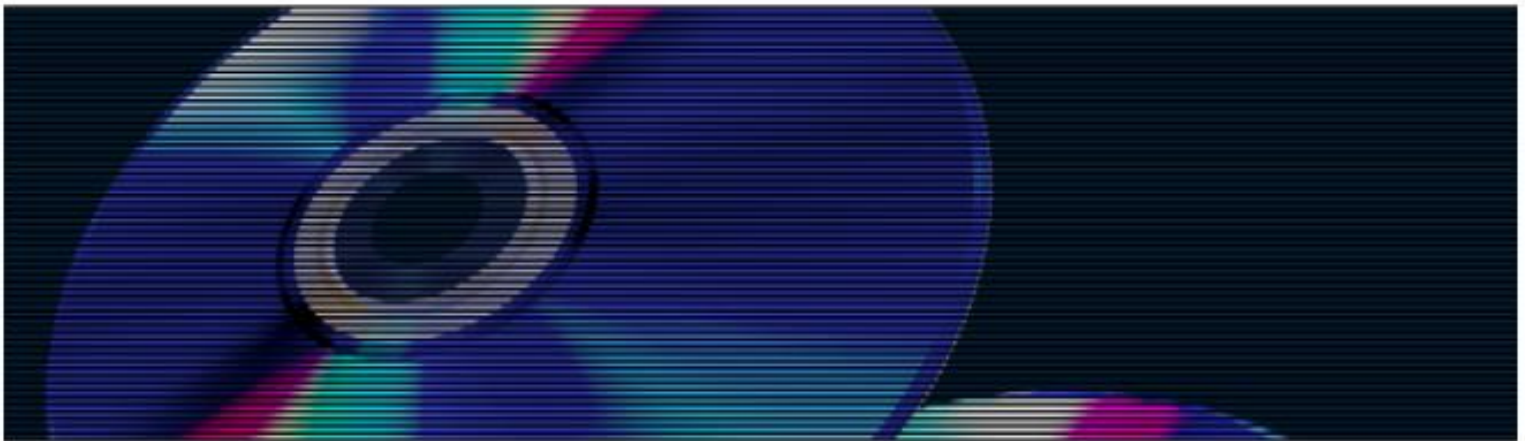


**SONY**



Optical Disc Archive

# Optical Disc Archive Generation 2



Technical Information



1. <u>RELIABILITY</u>	3
2. <u>ACCESSIBILITY</u>	7
3. <u>HIGH SPEED</u>	8
4. <u>FUTURE-PROOF</u>	9

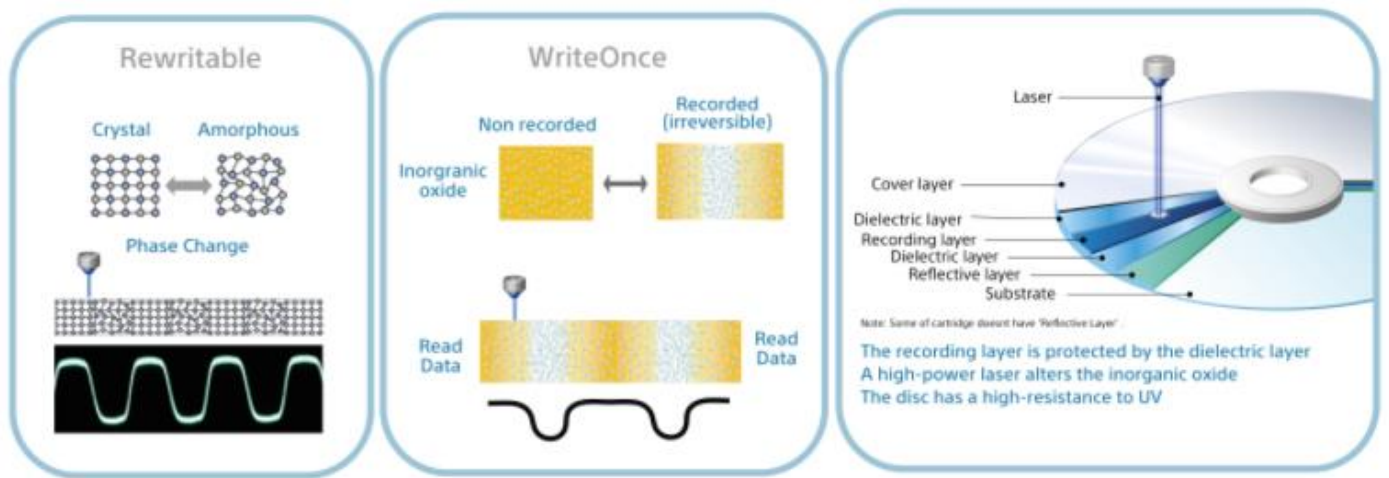
# RELIABILITY

The Sony Optical Disc Archive is the result of more than 30 years of research and development in optical technologies and offers media for the long-term reliable storage of your valuable data.

## RECORDING MECHANISM – PHASE-CHANGE TECHNOLOGY

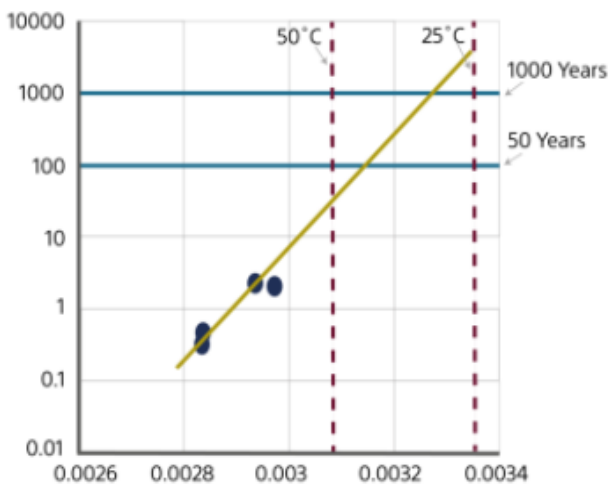
Optical Disc Archive writes data using a system known as “Phase Change.” When the recording surface material is heated above the melting point (600°C) and then rapidly cooled after melting by an optical laser beam, individual elements change from a “crystal state” to an “amorphous state”, in which the individual elements are positioned randomly. In addition to this, the data recording layer is safely covered with a separate film to minimise the effects of external contaminants such as dust or water.

The effect of this is truly outstanding long-term storage performance compared to methods such as recording on magnetic tape and hard disc that record electrical signals directly onto a contact surface.



## PERFECT RELIABILITY

To ensure that customers can store important data for extended periods of time with peace of mind, we’re constantly verifying the reliability of our media by subjecting it to the most stringent tests.



## ACCELERATION TESTS – TEMPERATURE AND HUMIDITY

To demonstrate long life spanning many tens of years, we perform accelerated aging tests defined by ISO standards. We leave the media in extremely harsh environments (with a maximum temperature and humidity of 80% and 85%) for extended periods of time and calculate the degree of degradation by measuring the error rate. From this, we can calculate the lifespan of the media under normal environments.

Looking at the results in the figure to the right, we can see that, when data is stored at 50°C, Optical Disc Archive Gen 2.0 keeps data secure for 100 years - 50 years longer than our first-generation ODA system. This demonstrates that

the media possesses excellent long-term storage performance in ordinary environments and the resilience needed to cope, for example, with a wide range of climates around the world and temporary environmental changes during

transportation. When tape media is exposed to high temperatures such as this, the tape itself stretches, presenting the strong possibility of resulting damage to data.

*This is a preliminary calculation based on objective data and Sony offers no guarantee that media are capable of storing data for 100 years irrespective of the environment.*



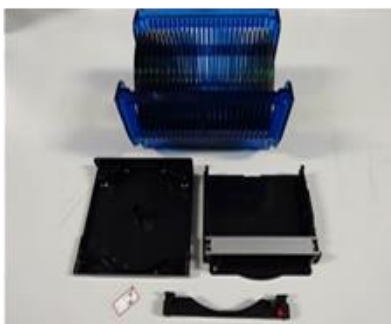
### ACCELERATION TESTS – CORROSIVE GAS

Sony did another acceleration test in order to prove there will be no corrosion under normal environment. This aging is based on the corrosive environmental test conditions specified by the IEC (International Electro-technical Commission) Method-4. As a result, media quality degradation was practically nothing after leaving those media in corrosive gas with 2 weeks.



### SEA WATER TESTS – WATER RESISTANT MEDIA

The last few years have witnessed a great many natural disasters, with tsunamis, hurricanes and flooding creating widespread water damage. Optical Disc Archive is an ideal means of protecting customers' data from such water damage. To prove this, we left the media submerged in seawater for three weeks and, after completely removing the seawater and drying the media, it was confirmed that the data could still be read. Once water penetrates a hard disc, damage to all data on the disc is unavoidable, while water and salt cause degradation of the tape surface of tape media, presenting an extremely high risk of data loss. Third parties have also conducted tests on XDCAM, which uses the same Sony optical disc technologies, in snow and dishwashers.



[WATCH SNOW VIDEO >](#)

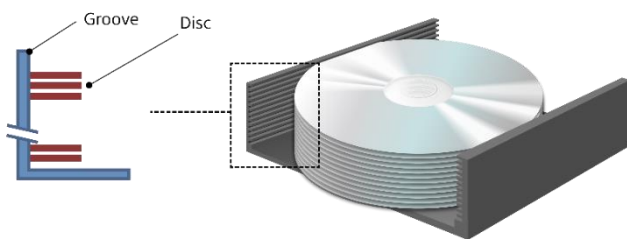
[WATCH DISHWASHER VIDEO >](#)

## ABRASION TESTS – SCRATCH-RESISTANT MEDIA

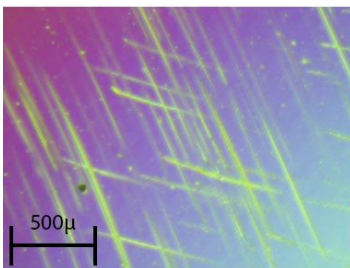
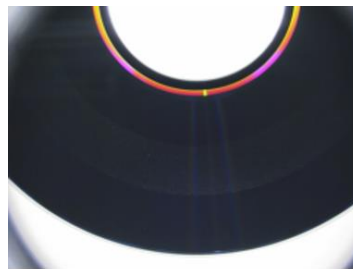
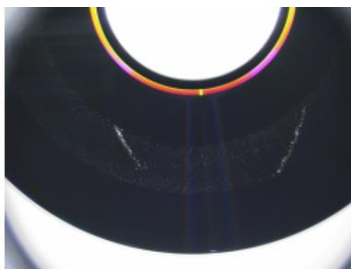
When handling conventional optical media such as CDs, DVDs and Blu-ray Discs, we all have experience of holding the disc by the edges to protect the surface. The reason we do this is because repeated scratching of the disc surface results in destabilisation of the data reading by laser. Each disc used by Optical Disc Archive is protected with a robust coating film, making them resistant to scratching even if exposed to abrasion. The figure to the right shows abrasion testing conducted at Sony, and shows that, although conventional DVDs are scratched, discs used by Optical Disc Archive have almost no scratches at all.



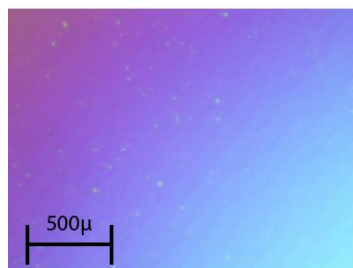
*During ordinary use, the discs do not protrude outside of the cartridge.*



*Discs are partitioned inside the cartridge to ensure that never come into contact with each other.*



A disc without hardcoat  
*(magnified picture)*



Optical Disc Archive  
*(magnified picture)*

**PREVENTION OF DATA FALSIFICATION – TRUE WORM MEDIA**

Storing data over a long period of time presents a significant risk that the stored data may be changed with malicious intent by third parties. The rewriting of data such as video footage that represents national assets or personal data such as medical information must be avoided at all costs. This is why media in general use is provided with a mechanism that makes rewriting impossible once data has been written. Although tape media too is provided with a recording inhibit switch to prevent rewriting, it is impossible to completely prevent third parties with malicious intent from tampering with data. With Optical Disc Archive, on the other hand, data falsification can be prevented by its actual write characteristics. Of the two Optical Disc Archive media, the characteristics of “Write Once Media” make it impossible to rewrite data from the outside. In this way, Optical Disc Archive offers long-term protection of customers’ data as “True WORM (Write Once Read Many)” media.

**CONFIDENTIAL DATA READ – LOW ERROR RATE**

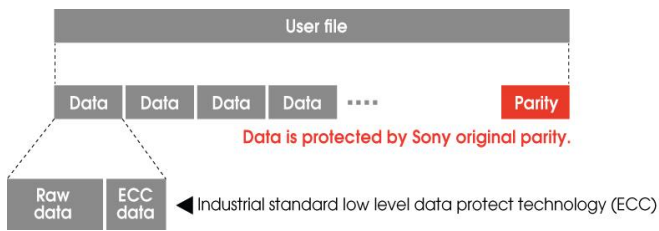
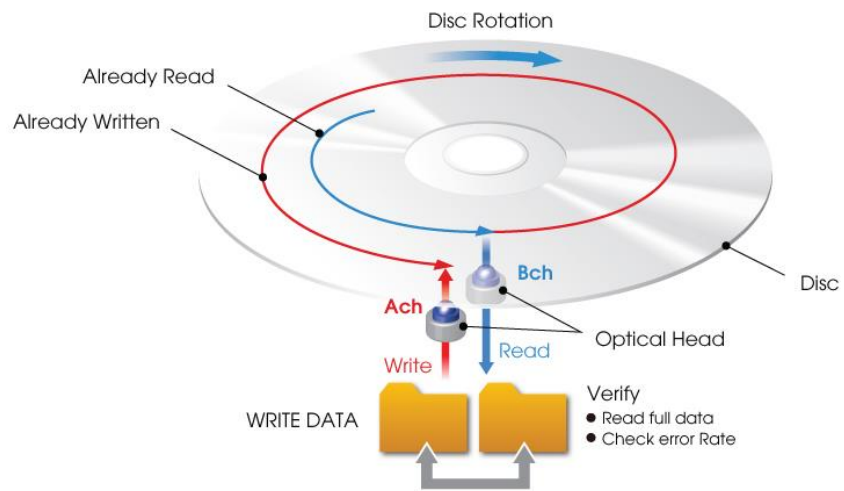
Optical Disc Archive boasts a range of software-based error correcting technologies which, when combined with its proven robust hardware, give it an unsurpassed high data-read quality.

**ON THE FLY VERIFY (DRIVE)**

When data is written in Optical Disc Archive, the data is read internally using a drive and driver developed by Sony, and the read quality is checked according to strict unique standards to ensure that data can be read without fail even after long-term storage.

*Complete data comparison using multiple optical eyes.*

*Proprietary parity mechanism by file system driver, on top of standard ECC (error check & correction).*



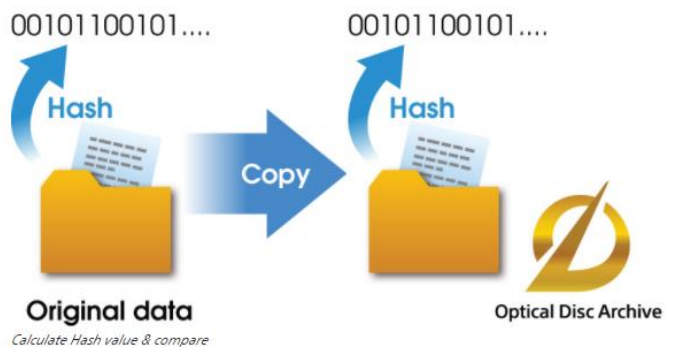
**OPTICAL DISC ARCHIVE PARITY (FILE SYSTEM DRIVER)**

In addition to using the basic optical disc Error Check & Correction (ECC) technology also employed by Blu-Ray, Optical Disc Archive realises an unrivalled error rate by allocating parity (technology that protects data in the event of an error through data redundancy) for each fixed size in individual file system layers.

**HASH VALUE CHECK (APPLICATION)**

The Content Manager and File Manager perform hash-value comparison of the original data with data written in Optical Disc Archive. (Hash Value Check is a general technology and its mechanism is used in many applications.)

*Calculate Hash value & compare*



## 100 YEARS OF ARCHIVAL LIFE

The Optical Disc Archive system stores data onto cartridge-encased optical discs. Each cartridge holds multiple discs, enabling high-capacity storage. Because optical disc writes and reads are non-contact, they offer extremely reliable and long-lasting storage. The cartridge, in turn, is durable and dust-resistant, and can be expected to keep data safe for more than 100 years – twice as long as our previous Optical Disc Archive system.

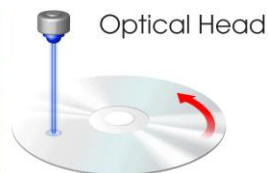


When the recording surface material is heated above the melting point of 600°C and then rapidly cooled after melting, its substances solidify in an amorphous state. Unlike data tape, the Optical Disc Archive system doesn't need media migration to copy all data onto the latest media. The system's drive software treats each 12-disc cartridge as a single volume, while the drive itself incorporates a small changer mechanism that automatically changes the discs so that users don't recognise they are using multiple discs. Six media types are available, with cartridge capacities ranging from 300 GB (at the low end) to 3.3 TB (high end), so users are free to choose the capacity that best meets their application.

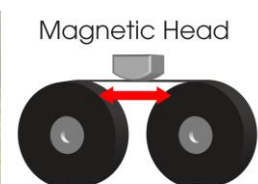
## ACCESSIBILITY

Optical Disc Archive features outstanding random read access, making it possible to access the data you need quickly. You can play parts of a video file you wish to view and quickly retrieve a document from a large number of files, eliminating the hassle that comes with using tape storage.

Capitalising on the characteristics of random access, Optical Disc Archive offers the ability to play videos without stress or frustration.



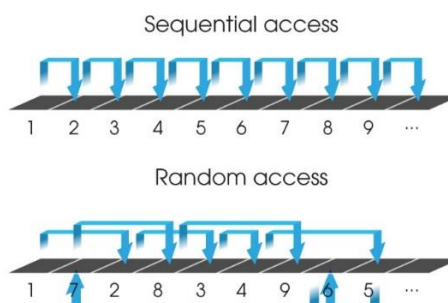
*The head can be moved freely on the disc.*



*The tape needs to be fast-forwarded/rewound to the position where the required data is*

## SEQUENTIAL ACCESS AND RANDOM ACCESS

"Sequential access" refers to the process of accessing a series of data on media in regulated order from the first datum while "random access" refers to the process of accessing data in random order.



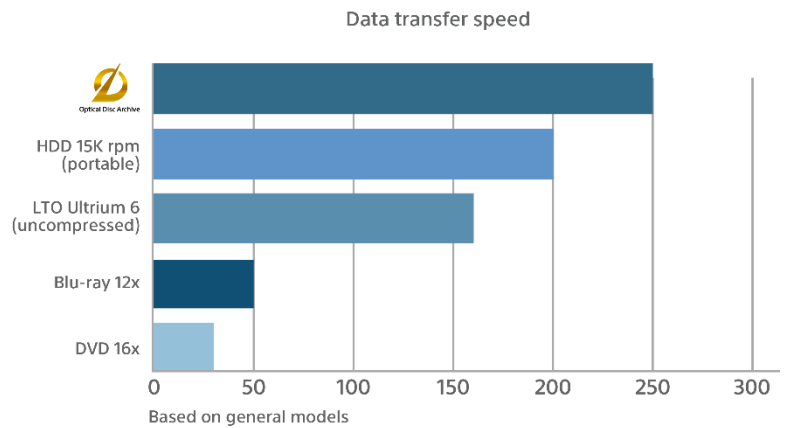
## MAXIMUM DATA ACCESS SPEED

Although necessitating disc exchanges when the required data is on a different disc, Optical Disc Archive offers the ability to access data with remarkable speed compared to tape data that necessitates the physical fast-forwarding and rewinding of a tape 800 meters or more in length until the location of the required data is reached.

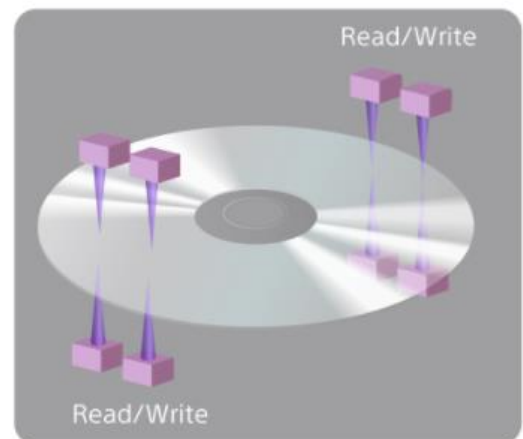
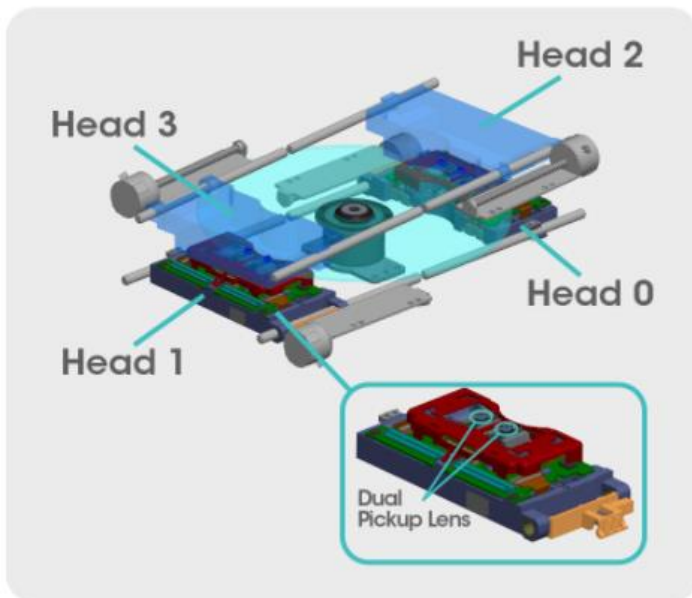
- Time taken for one disc exchange on Optical Disc Archive: Approximately 30 seconds
- Time taken to move the head on a data tape with a total length of 800 meters: Approximately 2 minutes 30 seconds

## HIGH SPEED

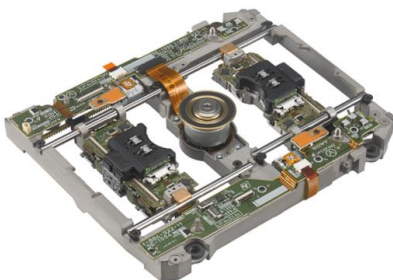
In data archiving, as volumes of data have increased, so too has the need for high-speed data writing and reading. When equipped with a 4ch pickup, an original development by Sony, Optical Disc Archive users benefit from a maximum read speed of 1.1Gbps. With an 8ch pickup, the maximum read speed is 2Gbps.



The ODS-D280U/F drive unit (Generation2) is equipped with 8-channel pickup to for high speed data transfer



The ODS-D77U/F drive unit (Generation 1) is equipped with 4-channel pickup

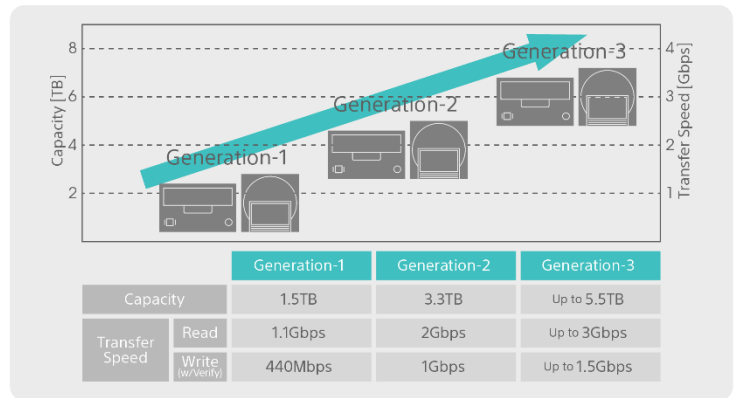




# FUTURE PROOF

## ROADMAP

In order to achieve higher capacity and faster transfer speeds, Sony is establishing a format roadmap of the Optical Disc Archive system. While the first generation had a capacity of up to 1.5TB, a new standard for professional use, the current second generation of the Optical Disc Archive achieves a capacity of 3.3 TB. The third generation will achieve an even higher capacity of 5.5 TB.



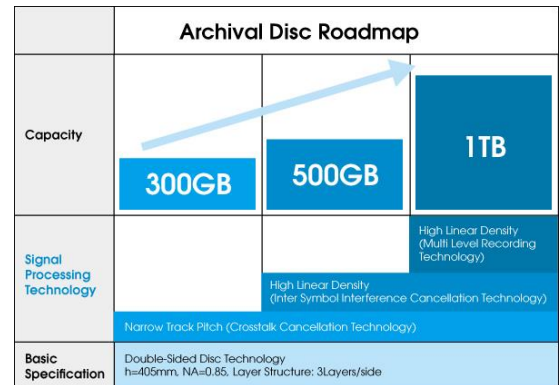
The Archival Disc standard uses proven technology to achieve higher capacity. Double-sided discs (3 layers per side) and land-and-groove format technology will be used. Faster transfer speeds are also planned, due to the development of multi-channel laser heads on the next-generation drive.

For long-term preservation of assets, the Optical Disc Archive guarantees inter-generational compatibility. Now and in future, this system delivers an efficient, secure, and reliable archive solution.

## CAPACITY EXPANSION

Optical Disc Archive Generation 2 will realise capacity expansion up to a maximum of 3.3TB per cartridge by using the “Archival Disc” scheduled to be implemented in 2015 as a bare disc.

The Archival Disc is a next-generation optical disc for professional use formulated by Sony Corporation and Panasonic Corporation in March 2014 with the objective of expanding the market for long-term digital data storage. Archival Disc is a new format with broad compatibility to meet data archive needs that are growing at an ever faster pace as data capacity increases in areas such as long-term archiving in video production that handles large data files, cloud data centres that handle big data and in companies. The site detailing the official Archival Disc roadmap and press release is shown below.



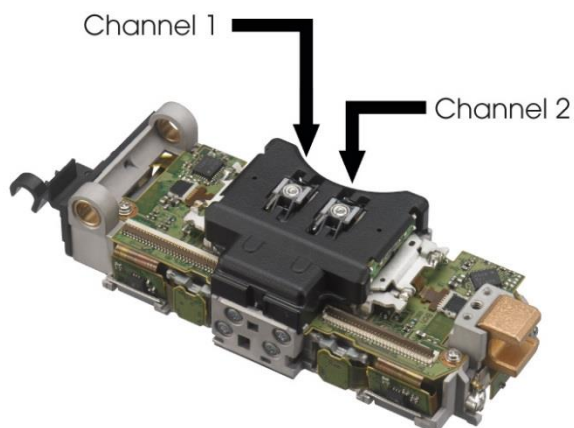
The main technologies for the realisation of a single 300GB Archival Disc scheduled for implementation in 2015 are shown below. To realise a 300GB capacity, 3 layers are mounted on each side and, in addition, a data writing method known as “Land & Groove” is adopted to enable writing of data of greater density.

Disk size (type)	300GB (write-once)
Optical parameters	Wavelength $\lambda=405\text{nm}$ (nanometers), Numerical Aperture NA=0.85
Disc structure	Double-sided disc (3 layers/side), Land & Groove Format
Track pitch	0.225 $\mu\text{m}$ (micrometers)
Data bit length	79.5nm (nanometers)
Error correction method	Reed-Solomon Code

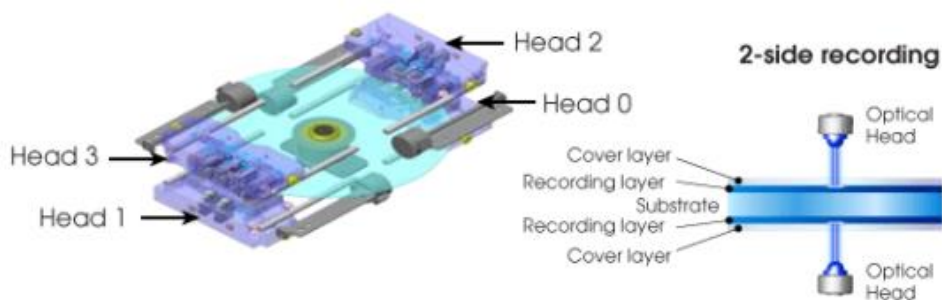
## INCREASED SPEED

Optical Disc Archive Generation 2 uses our original high-speed technology to simultaneously read and write data utilising a total of eight optical lasers deployed on both sides of the disc to realise a maximum high-speed data read speed of 2Gbps and a maximum high-speed data write speed of 1Gbps (with verification) and is capable of astonishing high-speed data processing compared to other archive media.

\*The 2Gbps (= 250MB/sec) transfer rate is a speed at which one hour of video data in Sony's XDCAM HD422 format (50Mbps) can be transferred in just under approximately 2 minutes and 4K material (XAVC 600Mbps) in just under approximately 20 minutes, using the ODC3300R cartridge

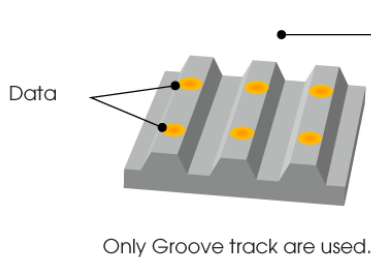


Assembly in the drive with 2 laser heads {2 channels} mounted



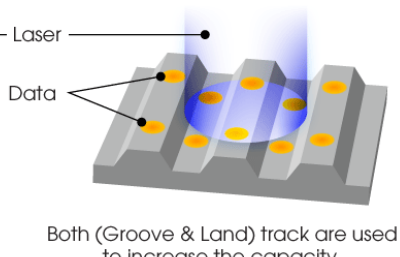
Two head assemblies are mounted in the drive and, a total of 8 laser channels are mounted to handle both sides.

**BD format**



Only Groove track are used.

**Gen.2 & Gen.3 format**



Both (Groove & Land) track are used to increase the capacity.

**BACKWARD COMPATIBILITY**

Archival Disc uses a laser for writing with the same specification as Blu-ray discs, facilitating the maintenance of backward compatibility. Supported by these technological backgrounds, Optical Disc Archive can keep customers' total long-term archive costs to a minimum.