Digital Lens Quick Start

There is nothing more frustrating than unpacking your new piece of audio gear and finding out you must read a multi-page document just to operate it.

With that in mind we have prepared a brief set of operating instructions to get you started. After you have listened to the Lens operating successfully in your system, please take the time to read the entire owner's manual and familiarize yourself with the operation and architecture of the world's finest digital interface device, the Genesis Digital Lens.

After you unpack the Lens

There are four items inside the Lens' box; the Digital Lens itself, a remote control, a power cord and this manual.

Plug and Play

Digital Lenses are typically shipped for the voltage of the country they are intended to be used in. In most cases, you will have to do nothing. Your Digital Lens should be ready to plug and play. If, however, you are unsure that your Lens has been properly set to the correct voltage by your dealer, distributor or by the factory itself, open the top cover of the Lens and check or adjust (if necessary) the internal switch to the proper voltage. The switch is located near the power input on the back of the Lens. Replace the top cover.

Plug in the Lens

Set the Lens near the digital playback device (CD transport) and the D to A converter. Using the supplied power cord, plug the Lens into the wall socket. If you typically use a power filter or AC power cleaning device for your digital equipment, we recommend you *do not* utilize one of these devices just yet. First plug the Lens directly into the wall. Later, when you have gained some experience with the Lens, try your AC filter.

Plug in your sources and outputs

The back of the Lens is clearly marked and divided in two; inputs and outputs. Connect your CD player or other digital source to any one of the inputs. We recommend the RCA (coaxial), XLR (AESEBU) or glass inputs. Connect one of the three output selections to your D to A processor.

Turn on the Lens

First, install the batteries for the remote control (the batteries should be taped to the back of the remote). The Lens controls are all located inside the lower left hand block of buttons marked "Digital Lens". Press the red power button and the Lens will turn on.

Select the appropriate input

Using the remote control, select the input that your CD transport is connected to. The display will announce the selection. If you are properly connected, the right hand display will measure the frequency of your CD player (44.1 kHz) and the right hand green lock light will come on. This shows that your CD transport is locked to the input of the Lens.

After the transport's frequency has been displayed, another number will appear on the right hand side. This is the clock error, in parts per million, of your CD transport. The Lens will correct this error automatically.

Your D to A player should be locked to the Lens at this point, regardless of the input you have selected.

Set the Lens options

Without reading all the options available to you with the Lens, we recommend you press the 20 bit button on the remote control. This will almost always give you the best sound regardless of the type of D to A processor you have. The green LED will light on the left hand portion of the display.

You may experiment now with Dither 1 and Dither 2 (on the remote control). Dither 1 is the standard. Dither 2 will yield a slightly softer sound. Experiment for best results.

Attention
Laser Disk Owners

When playing a laser disk it will be necessary to place the Lens in the laser disk mode to avoid having the soundtrack out of synch with the picture.

To activate the laser disk mode, first make sure you are switched to the appropriate input. That is, if the laser disk player is plugged into input 1 (for instance) make sure you are indeed switched to input 1. Press input 1 again (or whatever input you are switched to). Pressing the appropriate input twice, in this manner, will activate the laser disk mode. The front panel's right hand display will show "LD" as long as you are in this mode.

To deactivate the laser disk mode, simply press the same input again (or go to any other input). The right hand display will show "CD" and again display the PPM error on the right hand display.

Full operating Instructions

Congratulations on your choice of the Genesis Technologies Digital Lens. The Lens should provide years of added enjoyment to your stereo system.

Description

The Digital Lens is a full function interface between any digital source (the CD transport for instance) and the D to A processor (DAC). It is remote control operated, has multiple inputs and multiple outputs. It is intended to improve the sound of your transport and DAC in several ways: by eliminating jitter, by increasing isolation between the two machines, by increasing the number of bits from 16 to 20 and by improving the shape of the transmitted signal to your DAC.

Function

Placed between the CD, DAT or Laser Disc transport mechanisms and your DAC, the Digital Lens will eliminate the inherent jitter found in all transports. Jitter rates are reduced from (typically) three hundred to four hundred pico seconds (ps) to near zero pico seconds correlated and well below twenty pico seconds un-correlated.

The Genesis Digital lens, in addition to jitter elimination, can be programmed to increase the apparent resolution of the digital signal by the addition of triangulated dither. Bits 17, through 20 can be activated with the 20 bit feature and bits 14 and 15 can be modified, by choosing one of two dither options on the remote control to create a more analog sound. The standard CD format is limited to 16 bits. Bit 16 is left alone in order to preserve the HDCD format.

The Digital Lens will measure, display and correct transport clock speed anomalies, a problem common to virtually all CD players, DAT's and laser disc mechanisms.

Available inputs on the lens include XLR (AESEBU), RCA (coaxial), BNC (coaxial) TOSLINK (optical), ST (optical). Outputs include XLR (AESEBU), ST (optical) and RCA (coaxial).

Jitter elimination, the simple story

Jitter is a problem common to every CD transport on the market. Although it is not limited to the CD transport, it is the most common source (jitter can be caused by the cables connecting the DAC to the transport, the receiver in the DAC, power supplies etc.).

Simply stated, jitter is a phenomenon characteristic of the digital audio bits appearing (in time) where you do not expect them to appear.

Digital music systems require a high degree of timing accuracy. Each bit (a bit is a single on or off transition) must begin and end at a prescribed place in time. The digital bits occur at these precise time interval because of a crystal controlled oscillator known as a clock. This clock is similar to the one in a digital wristwatch which is also controlled by a crystal. The clock in a wristwatch is used as a timing reference and the circuitry in your wristwatch simply counts the number of "beats" produced by this crystal. *Where* the beginning and the end of each beat occurs within a group of beats (a digital word) is unimportant (unlike a digital audio system) as long as their repetition rate is accurate.

A digital playback system has exactly the same crystal oscillator as your wristwatch uses to keep the time. Unlike a wristwatch, however, this accurate "beat" or "clock" is mixed together with the music signal when your CD was recorded. The clock is in effect "buried" inside the "music".

The act of retrieving the information off of the CD, synchronizing the internal clock of your CD transport with the recorded clock on the CD all conspire to cause jitter in the transport's output signal. When the DAC receives this jittered signal, it causes more jitter when it tries to separate the clock from the music.

There are two types of jitter distortion. Correlated and un-correlated.

Simply stated, correlated jitter is the increase or decrease of jitter in direct proportion to a specific musical note or group of notes (frequencies). This is the worst form of jitter because it follows the music and is frequency selective, a phenomenon the ear is quite sensitive to.

Uncorrelated jitter has no bearing on the music or the particular notes that are being played. It is a form of jitter that is hard to hear, relatively benign and more closely approximates simple white noise.

Correlated jitter is the most common form, unfortunately, and is a factor in what many people have referred to as "digital sound" or a harsh sound that lacks many of the spatial cues (depth, width, space) necessary to a believable stereo performance.

(1. Refer to Stereophile Magazine, October '92, Remy Fourre "Jitter and the digital interface" page 80)

A brief history of jitter reduction.

A few years ago, several high end audio companies introduced jitter reduction devices to help correct some of these problems. To a great extent the Audiophile and "Musicphile" community has benefited from these early efforts because of the sonic improvements they brought as well as the increase in awareness of the jitter phenomenon.

There are several drawbacks to these original devices: they only reduce the level of jitter (not eliminate) and the reduction is only within a limited frequency band. We have found it critical to reduce correlated jitter, over the entire audio band, to a level below audibility.

In order to accomplish this goal the engineering team at Genesis developed an entirely unique process of dealing with the digital signal which also yielded additional advantages, beyond jitter elimination.

These advantages include correcting primary timing errors in the transport itself (too fast or too slow) and the ability to employ DSP technology (digital signal processing) which extends the number of bits from 16 to 20.

How the Lens works

The job of the Lens is to first separate the clock and the music and then "throw away" the original jittered clock signal leaving only the music. The pure musical information is then recombined, jitter free, with a perfect clock and then passed on to your D to A processor.

Simple in concept but difficult in execution, the Lens actually strips more than just the jitter laden clock signal from the music. The computer inside the Lens also discards the digital information that identifies whether the music eventually goes to the left channel or the right channel, discards the front panel timing information, discards the track number information, discards the copy protection flags and so on. Many of these eliminated bits are not only unnecessary to your DAC but will cause sonic degradation if presented to the DAC to decode. The few that are important (left and right information for instance) are regenerated anew by the Lens just before the output.

Once the Lens has cleared away the original clock and the unnecessary bits, the remaining digital music signal is sent to a memory section, identical to your home computer's RAM memory, for storage. The Lens is capable of a half megabyte of storage.

Once in memory, it is a relatively simple matter for the Lens to modify the information in an important way. Through the use of DSP we can, at your discretion, add more bits of information than there were in the beginning. This is accomplished through the addition of triangulated dither (see the section on resolution enhancement).

Now that the music has been transformed from 16 bits to 20 bits, it is taken out of memory, put into the proper format for transmission to the DAC, and is then transmitted with an ultra stable reference (clock) controlling the music signal in a jitter free environment.

It is easy to see that what comes out of the Lens has been cleaned up, improved upon and sent to the DAC in much better shape than the original signal. The music itself is, however, untouched and remains in its original form. No processing or signal manipulation has occurred to violate the purity of the original musical information.

Transport speed accuracy

Similar to a phono turntable that is running too slow or too fast, all digital transports have some degree of speed error. This speed error, in a phono turntable, manifests itself in slower tempo and lower pitch in the music (if it is going too slow). In a digital system, the tempo is slower but the pitch will remain exact (same example). While the typical speed error in a CD transport is relatively low, on the order of 30 to 100 parts per million (PPM) which equates to approximately one half second over a seventy minute recording (we have measured as high as three seconds error over a seventy minute recording) the effect is none the less undesirable.

The Digital Lens is capable of correcting timing errors (fast or slow) of up to 1,000 PPM. Timing errors are reduced to a guaranteed accuracy of 5 PPM.

Although there are several devices on the market that accept inaccurate timing frequencies in and produce accurate timing frequencies out, they do so at the expense of data accuracy. The Digital Lens is unique in its ability to correct timing errors without data corruption.

The Digital Lens will display your transport's timing error

When the data are first clocked in to the lens, its internal computer determines the error of the transport. Once that error has been determined, two things happen: first, the length of the memory is adjusted to be as conservative as possible, decreasing the delay in data transmission to a minimum (if your transport is slow) and second, the front panel display of the Lens will provide an analysis, in parts per million, of your transport's timing error. This analysis is updated on the front panel every time you change an input or play a new CD.

This feature can be valuable in determining the accuracy and quality of your CD or DAT transport.

Resolution enhancement

Between the output of the Lens' RAM memory section and the master output clock, there is a sophisticated DSP circuit that allows the user to enhance the apparent

resolution of the system by removing some of the signal degrading subcode data, by adding more bits to the data stream and by dithering existing low level bits.

Users can select 16 or 20 bit performance options from the lens. Those DAC's with digital filters capable of accepting 18 or 20 bit information (most can) will benefit sonically from adding these previously unavailable bits. Even 1 bit DAC's will benefit from the dithering of bits. The standard number of bits of information found on a CD is 16.

While it is true that the Lens can activate bits 17, 18, 19 and 20 (four more bits of resolution than is available on any CD) it cannot add *musical* information because the bits are being added after the fact (of the recording). New information, however, that is musically unrelated to the original 16 bits can be added.

The effect of adding this new information can be rather dramatic, sonically, due to changes in operation of the DAC's digital filter and D to A processor required when presented the expanded number of bits. Similar (in concept) to class A biasing of a power amplifier, using the resolution enhancement function insures that the D to A processor and digital filter never cease operation when the musical information has fallen below the threshold of the original digital recorder. More apparent space, depth and openness are the most obvious benefits.

Enhanced resolution is achieved by the addition of triangular density dither (TDD). Dither is random noise (called rectangular dither), and TDD denotes the particular spectral density of triangulated noise. Adding two digital rectangular dither samples together creates a TDD waveform.

Audible TDD

The addition of TDD in the resolution enhancement mode will result in audible sonic improvements but will not add audible background noise to the signal.

The addition of audible TDD to the 15th bit (Dither setting number 2) will create a slight amount of background noise (6 dB more) audible by putting your ear close to the speaker. Using the remote control, this function can be activated and will be displayed on the front panel as "D2".

This feature was included in the design of the Digital Lens in an effort to more closely approximate the sound of live music. Analog recordings and live music itself all have a degree of background noise not found in digital systems. We believe that this lack of noise is unnatural to the ear. Listen to your surroundings as you read this paper. No matter how quiet a room you are in, there is still audible background noise of some type.

The audible TDD function can accomplish the task of adding a small amount of background noise to the digital signal in an effort to more closely approximate the way music is reproduced in a live fashion.

The output stage

Finally, after all the preceding refinements and enhancements, there is the output stage. Using a high current, high speed dedicated driver to produce the final waveforms to be presented to your D to A processor, the output stage of the Digital Lens is optically isolated from all other circuitry and is fed by its own separate power supply and power transformer, immune to interference from circuitry in the rest of the unit.

Great care has been taken to insure that no jitter or external clock noise is introduced into the final output stage of the Digital Lens. The digital signal presented to your DAC will be as perfect as current technology is capable of.

Conclusion

The Digital Lens is a unique and essential part of any high end digital reproduction system. As its name implies, the Lens will accept any digital signal from any source, no matter how flawed that source may be, and focus it to perfection so that your D to A processor can truly demonstrate its strengths.

Preliminary instructions

Voltage change.

The Digital Lens is shipped from the factory at the correct voltage for your country. Should it become necessary to change that voltage, use the following instructions:

To change the voltage to 115 volt operation (primarily North America, Taiwan and Japan) or to 220V (the rest of the world), remove the top cover of the Lens and set the voltage change switch to 115 volts or 220V. Replace the top cover. The Lens will work properly from as low as 80 volts to as high as 260 volts providing the switch is set properly.

We highly recommend the use of an "Audiophile quality" power cord for the Lens. The one included with the Lens is a special heavy duty 14 gauge cord and will work fine. However, there are numerous other after market power cables made by high end cable manufacturers that can offer additional sonic benefits.

Hook up instructions

Inputs

The Digital Lens has five digital inputs. Hook up any or all of these inputs to your digital sources.

1: **Coax**. This input employs an RCA connector and will be the most common input you use.

2: **BNC**. This input uses the electronic industry's standard for high frequency transmission.

3: **AESEBU**. This input uses a balanced or XLR connector.

4: **TOSLINK**. This input is an optical coupling that uses the standard plastic optical fiber. It will be necessary if you wish to connect up an inexpensive deck that has no other alternative output.

5: **Glass**. This input is an optical coupling sometimes referred to as ATT. This is an excellent high frequency input and has the greatest bandwidth capability of any of the Lens' inputs.

The Digital Lens has three digital outputs. Connect one of these outputs to your DAC.

1: **Coax.** This output employs and RCA type connector and is considered by most to be the defacto standard.

2: **AESEBU**. This output uses a balanced or XLR connector and is considered by most to be the preferred standard.

3: **Glass**. This output is an optical coupling sometimes referred to as ATT. This is an excellent high frequency output and has the greatest bandwidth capability of any of the Lens' outputs.

Controls

All controls functions are handled by the remote control. Power, input selection, dither choices etc. are handled by the hand held remote control unit.

There are a number of functions on the Genesis remote control. Those specific to the Digital Lens are separated in the box in the lower left hand corner. Those functions not in the box are for the Genesis Technologies servo controlled bass unit, found on most Genesis loudspeaker products.

Power
The red button in the Digital Lens section of the remote marked "power" is used to turn on and turn off the Digital Lens.

You may notice that the lock light on your DAC remains lit even if the Lens is not connected to a digital source. This is due to the fact that the Lens does not use the clock in your CD transport (or digital source) to synchronize and "lock" your DAC. Rather, the Lens is now the controlling device in your system.

Coax, AESEBU, TOSLINK, Glass, BNC.
Pressing any of the above marked buttons will activate that input. Inputs are marked as above on the rear of the Digital Lens.

Display
This button will disable the front panel display so that it goes dark. Using this feature, or not, is simply a matter of personal preference. To reinstate the display, press any function on the remote control or press the display button again.

16 Bit
This is the default mode. Only the standard word size of 16 bits will be allowed. Dither 1 will not activate in this mode. Dither 2 will activate (dithering bit 15). Experiment between 16 bit and 20 bit modes for best sound. The 16 bit position will typically be the least used position. The green indicator on the left side of the front panel will be turned off when in the 16 bit mode.

20 Bit (recommended)
Pressing this button will activate bits 17, 18, 19 and 20. Activation will more closely approximate 20 bit performance than the 16 bit mode and is the recommended setting for almost all DAC's. The left hand green LED, on the front panel, will turn on when this feature has been activated. Dither 1 will automatically be activated when you go into the 20 bit mode (unless you are in the Dither 2 mode).

Dither 1
This is part of the resolution enhancement selection. Pressing this button will allow you to toggle between Dither 1 and Dither 2. **This function will not activate if you are in the 16 bit mode**. Dither 1 is automatically activated when the 20 bit function has been selected (unless you are in the Dither 2 mode). The front panel will momentarily display "D1" when the Dither 1 button is depressed. Once you are in the 20 bit mode, Dither 1 will have been activated and it is then possible to listen to the difference between Dither 1 and Dither 2. Dither 1 is the recommended setting for most applications.

Dither 2
This is part of the resolution enhancement selection. Pressing this button will dither bit 15 in either the 16 bit or the 20 bit mode. Experiment with this feature for best sound. The display, on the front panel, will momentarily flash "D2" to indicate activation. Press Dither 1 to deactivate Dither 2. In our listening experience, Dither 2 will yield a softer sound while still maintaining full dynamic range and stunning bass.

Adding dither (triangulated noise) to the digital data stream typically has rather major sonic benefits such as added depth, soundstage width and smoother and more articulated high frequency response.

By activating either of the dither functions, Dither 1 (in 20 bit mode) and Dither 2 (in either the 20 or the 16 bit modes), you are adding a triangular density spectrum to the digital data stream. Dither 1 (20 bit mode) adds this triangulated noise spectrum to bits 17, 18, 19 and 20 which are not normally activated at all (CD based systems only use 16 bits, not 20). Dither 2 adds the spectrum only to bit 15, unless the 20 bit mode has been activated, in which case bits 15, 17, 18, 19 and 20 are all active with triangulated noise.

In our listening experience, leaving the 20 bit mode activated (with the Dither 1 spectral density as opposed to the Dither 2 spectral density) is the best position. Please feel free to experiment and find the best sonic position in your particular system.

The Lens is HDCD compatible.

Front Panel display

There are two alpha numeric displays on the lens. One display is on the right side and the other is on the left side. In addition to the two alpha numeric displays, there are two green LED indicators located in the middle of the display panel, one on the middle right and one on the middle left.

Right hand alpha numeric display

The right hand display will indicate one of two pieces of information: load status of the memory and parts per million error of the transport or source.

The default mode of the right hand display shows the parts per million (PPM) clock error of your source. This error will either be a positive number (too fast) or a negative number (too slow). Negative numbers will have the arithmetic minus symbol displayed. The figure displayed is a measurement of the clock speed of your transport as compared to the precision temperature controlled clock (TCO) at the output of the Lens, displayed in parts per million. The Lens can and will correct any speed error displayed on the front panel, providing the number is less than 1000 PPM.

Typical errors are between 10 and 50 PPM. A non typical reading (several hundred PPM error) is not necessarily an indication of poor sonic performance on the part of your transport. Some excellent sounding transports have been observed with unusually high PPM error. Genesis has not established a correlation between PPM error and sonic performance, providing the PPM error has first been corrected by the Lens.

Middle two lights in the display

The right hand green LED is a lock indicator. This shows that the Digital Lens has been connected to an acceptable input and the Lens has successfully locked to your transport of DAT machine.

The left hand green LED is a resolution enhancement indicator. This indicator will illuminate when the 20 bit mode has been activated. When the 20 bit mode is activated bit 17, 18, 19 and 20 will now be active with triangulated dither.

Left hand alpha numeric display

The left hand display has three functions; indicates input selected, indicates Dither 1 or Dither 2 and displays the CD timing information.

When you select an input, the left hand display will show which input has been selected, and that selection will remain displayed until you play a CD or any source containing subcode data.

If you press Dither 1, on the remote control, "D1" will momentarily be displayed on the left hand display. If you press Dither 2, on the remote control, "D2" will momentarily be displayed on the left hand display. Dither 1 is automatically selected for you when you activate the 20 bit mode and "D1" will not be displayed. "D1" will display only if you press the Dither 1 button.

When a CD or any source containing subcode timing information is played, the left hand display will change from its default position (showing the input) to that of displaying the timing information of the track. This timing information should be identical to the timing information on your CD player. If the time display appears to be a bit erratic from time to time, or if the timing information does not appear at all, it is due to a scratched CD or poorly maintained CD and will not affect the sonic abilities of the Lens.

General considerations

The Digital Lens will typically sound better after it has been played for approximately one week.

We recommend you initially use the 20 bit mode setting. Play the unit for one week on this setting before making any *final* evaluations based on experimentation. The sound will change over time.

Interconnection of the Lens to sources and DAC's will, to a large degree, determine how good it sounds. The quality of your interconnects are more important on the output of the Lens, sonically, rather than the input. It does not necessarily hold that the

opposite is true. The quality of cables used on the input is also important, however, to a lesser degree.

Generally speaking, the XLR input (AESEBU) sounds better than RCA (coaxial). This is not always the case and we encourage you to experiment once your unit has broken in.

In almost every case, however, TOSLINK is the least preferable option and should only be used if there is no other choice.

Glass (ATT) inputs and outputs can sound better and worse depending, in part, on the quality of your glass interconnect. As with wire interconnects, the inputs are less critical to this phenomena than the outputs.

There is no harm in leaving the Digital Lens turned on at all times.

Voltage Change

If you need to change the Lens to match the wall voltage, from 120V to 220V or vice versa, it is an easy matter.

Remove the top cover, look to the rear corner that has the plug and you will see a small switch mounted to the PC board. The switch is clearly labeled for the appropriate voltage. Set to the appropriate voltage.

Trouble shooting

1: **Lock light will not come on.** The lock light indicates the proper connection and acceptable format of the device being connected to. The lock light is in the right middle of the display panel on the front of the Lens. Check to make sure the proper input has been selected. Check to make sure the cable is making good connection. Replace the cable with another just to make sure. Switch from the proper input to another and back again.

2: **Timing information flickers or is momentarily inaccurate.** The timing information of your CD is displayed on the left hand side of the front panel's display window. It is derived from the transmitted subcode data provided by your CD transport. If the Lens has trouble reading the subcode data, it may at times display false information. This is due, typically, to a very scratched or poorly kept disc. The computer inside the Lens has a program written to debug some of these problems. If the program detects too many front panel errors, it will begin to use logic to help create the proper response. The algorithm looks at the last accurate number displayed on the front panel and determines the next logical numeric sequence.

3: **Remote control no longer works.** First, check the batteries in the control unit itself. Providing the batteries are good, it may be necessary to reset the internal

computer in the Lens. To reset the computer, you must unplug the unit from the wall for approximately 30 seconds. Re-plug the Lens and reset the desired preferences.

4: **Display goes dark.** This is most likely caused by pushing the "display" button on the remote control. This button will disable the front panel display. Pressing any other button or the display button again will turn the display back on.

Good listening!