INTERNATIONAL LASER DISPLAY ASSOCIATION

Technical Committee

The ILDA Standard Projector

Revision 003, July 2004

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This document is intended to replace the existing versions of the ISP Standard. It is available for public usage and evaluation for the next year. Please direct any questions or comments concerning this document and your experiences with it to the ILDA Technical Committee

Revision History

Revision 001, December 1996:

- The initial publication of the ILDA Standard Projector.

Revision 002, August 1999:

- Clarified wording on all signal levels within ISP-DB25.
- Clarified wording for the projector interlock within ISP-DB25.
- Changed polarity of blanking signal within ISP-DB25.
- Replaced “USER4” with graphics shutter for Channel 20 of ISP-DMX.
- Added provisions for a sixth color channel to ISP-DB25.
- Added color wavelength and use tables to ISP-DB25.

Revision 003, July 2004:

- Clarified wording within ISP-DB25 regarding differential signaling
- Clarified DB-25 tables/explanations with additional cross-referencing
- Clarified color wavelength and use tables
- Added additional information to ISP-TAPE concerning use of hard-drive based ADAT recorders.

Introduction

As the trade organization for the laser display industry, ILDA's members represent the entire gamut of how laser shows have been produced. There have been almost as many hardware variations, configurations and protocols as there have been people producing laser light shows. The advantage of the association within ILDA is that over time, from the assortment of ideas and procedures amongst its members, gradually the best ideas percolate out and consensus of opinion is formed. From this consensus, standards have been and will continue to be established which will be beneficial to all who use them.

The ultimate goal of these standards is to ensure the compatibility and interchangeability of hardware, software, and artware, in order that the results are predictable and that the artwork is faithfully reproduced from system to system. Additional benefits also arise from standardization, such as cheaper and more reliable hardware, immediate plug-and-play artware, simplified trouble-shooting, to mention just a few.

This document sets forth the general specifications for the manufacture and production of the ILDA Standard Projector, or "ISP". Defining the ISP has been a goal for some time and these specifications represent the culmination of the ILDA's work for the past few years. Utilizing standards already in place, in conjunction with new standards specifically tailored to the ISP, there is now a definition for a standard projector ensuring a platform that can faithfully reproduce artwork within the inherent limitations of the given projector.

The two key concepts here are "faithfully reproduce" and "the inherent limitations of the given projector." To illustrate these concepts, consider television. There are a great variety of television sets, ranging from monochrome, pocket-sized LCD sets to full-color projection TVs, all the way to video walls and Jumbotrons. But each of these operates within a set of standard parameters. They accept the same type of signal source and reproduce it within their inherent limitations.

The ILDA Standard Projector can be compared to a television set. Some would be monochromatic and offer graphics only, while others would be full-color RGB with a full complement of lumia, scan-through effects, and beam rails. Like television sets, each of these would operate from the same signals and reproduce as much as possible the original laser artwork.

To accomplish this, ILDA has defined the key parts of the projectors themselves. These elements, used in conjunction, constitute the ILDA Standard Projector. These parts are:

- Scanner tuning;
- DB-25 connector and signal specifications;
- DMX-512 effects control;
- Effects Specification; and
- ADAT tape playback track assignments.

The designation of a basic, one-scanner pair, graphics-only system, whether monochromatic or RGB, is “ISP Level One”. A single-scanner graphics system which has effects capability such as lumia, beam table, etc., is designated as “ISP Level Two.”

A rudimentary standard essentially already exists for laser graphics largely by virtue of the common base of equipment in use. For example, almost everyone utilizes X-Y scanners and PCAOM color control, and therefore an X-Y-R-G-B standard fundamentally already exists. For graphics-only applications, X-Y-R-G-B is fine. But laser shows may consist of much more than simply laser graphics. Lumia and diffraction effects can be used to punctuate graphics. Actuated beam positions can be used for atmospheric effects and other outboard devices such as fog machines and strobe lights are commonly used to accentuate the drama of a laser show. The specifications for the ISP allow all of these effects to be controlled in a consistent and predictable manner.

With these specifications, projector manufacturers will be able to produce many units of a standard model. They will be buying standard components in high volumes rather than a few non-standard components for a unique projector. They will be able to fine-tune their projector production line for higher quality and faster turn-around times. This will ultimately lead to lower cost in manufacturing, which in turn will be reflected in lower sales prices.

Manufacturers of components, such as scanners, PCAOMs, and board-level devices such as geometric correctors, will benefit as well. Currently many of these manufacturers must concentrate on producing a wide variety of components to meet inconsistent market demands. With the ISP standard in place, these manufacturers will now be able to concentrate on improving a few specific models of their devices. This will result in higher quality, lower cost components, with greater interchangeability.

Software manufacturers will receive similar benefits relating to the consistent market needs that the ISP standards provide. They will now be able to create software which excels with a single projection standard rather than software which works adequately, or marginally, with numerous projector configurations. Now efforts can be focused on improving the usability and functionality of software rather than focusing on providing various interface and control schemes required by different types of projection systems. The resulting software interfaces will afford the end user a greater variety of software titles that offer more creative tools to work with and assure the end user that these programs will function similarly within the constraints of the ISP requirements.

The complexity of artwork creation is also greatly simplified by having predictable performance characteristic afforded by the utilization of standard scanner tuning. Designers will be able to spend more time improving and producing quality shows and less time worrying about the limitations or permutations of end-user equipment.

And the best benefit of all is to the end user. With the changes in projection systems, system components and software interfaces, show production will ultimately become more user friendly, less expensive, more accessible, and more creative than ever.

ILDA Standard Projector

Standard Identifier: ISP

The ILDA Standard Projector - ISP is the hardware configuration which conforms to the following ILDA standards:

ILDA Standard	***Standard Identifier***
30K Scanner Tuning	ISP-30K
DB-25 Connector and Signal Specification*	ISP-DB25*
DMX-512 Effects Control	ISP-DMX
Effects Specification	ISP-EFX
ADAT Tape Playback and Track Assignments	ISP-TAPE

*Note: “The Mechanical and Electrical Interface for Laser Projection Devices,” Revision 001, August 1989, in *The ILDA Handbook and Technical Specifications*, is superseded by ISP-DB25.

30K Scanner Tuning

Standard Identifier: ISP-30K

The ILDA Standard Projector shall have image response as defined by the ILDA Test Pattern properly displayed at 30,000 points per second. See the "ILDA Test Pattern", Revision 002, October, 1995, in the *ILDA Handbook and Technical Standards.*

DB-25 Connector and Signal Specification

Standard Identifier: ISP-DB25

DB-25 Connector

The DB-25 connector connects laser graphics signal sources to laser graphics projectors. The DB-25 pinout is designed so that the signals needed by most users are grouped together. It provides a logical ordering of signals to facilitate easy recollection in the field without a diagram.

Signal sources such as computer or tape playback devices shall use a DB-25 female connector. Projectors and recording devices shall use a DB-25 male connector.

DB-25 Connector Pinout

Pin Number	*Voltage Range*	*Signal Type*
1	+/-10V (diff)	X Axis (+)
2	+/-10V (diff)	Y Axis (+)
3	0 to +5V (diff)	Intensity (+)
4	N/A	Interlock A
5	0 to +5V (diff)	R (+) *[Red]*
6	0 to +5V (diff)	G (+) *[Green]*
7	0 to +5V (diff)	B (+) *[Blue]*
8	0 to +5V (diff)	User-defined signal 1 (+) *[Deep Blue]*
9	0 to +5V (diff)	User-defined signal 2 (+) *[Yellow]*
10	0 to +5V (diff)	User-defined signal 3 (+) *[Cyan / Beam-Brush]*
11	See table	User-defined signal 4 (+) *[X-prime, Z, Field-Change]*
12	See table	Projector return signal
13	0 to +5V (gnd)	Shutter

DB-25 Connector Pinout (continued)

Pin Number	***Voltage Range***	***Signal Type***
14	+/-10V diff	X Axis (-)
15	+/-10V diff	Y Axis (-)
16	0 to +5V diff	Intensity (-)
17	N/A	Interlock B
18	0 to +5V diff	R (-) *[Red]*
19	0 to +5V diff	G (-) *[Green]*
20	0 to +5V diff	B (-) *[Blue]*
21	0 to +5V diff	User-defined signal 1 (-) *[Deep Blue]*
22	0 to +5V diff	User-defined signal 2 (-) *[Yellow]*
23	0 to +5V diff	User-defined signal 3 (-) *[Cyan / Beam-Brush]*
24	See table	User-defined signal 4 (-) *[X-Prime, Z, Field-Change]*
25	N/A	Ground

Important Note:

All signal receivers **must have a true differential input stage!** Unless otherwise indicated, the signal must always to be derived from the difference between the normal signal line and the corresponding inverted signal line. For example:

- A differential voltage of +10V occurs if the normal signal line (+) has a voltage level of +10V with respect to the voltage level of the inverted signal line. (-)
- A differential voltage of -10V occurs if the normal signal line (+) has a voltage level of -10V with respect to the voltage level of the inverted signal line. (-)

Signal transmitters may choose to implement their transmission stage in several ways, provided that the maximum signal voltages are observed at all times. For noise immunity purposes, however, it is highly reccomended to utilize the normal and inverted pairs for each signal transmitted in the standard, symmetrically-differential fashion, providing adequate signal buffering on each pin.

Signal Specification

The DB-25 connector standard sets fourth certain signals. These are:

- Signals required to be present for proper projector operation;
- Signals which are optional; and
- User-defined signals, which are not required but are provided for flexibility.

Required Signals

The required signals are those which would typically be present on tape playback systems and laser graphics computer systems. These required signals are X, Y, R, G, B, Shutter, Ground and Interlock loop.

Required Signals	***Description***
X *Pin 1 = (+) (Normal)* *Pin 14 = (-) (Inverted)*	Controls the horizontal beam position. This is a bipolar analog signal whose voltage range is between +10V and –10V differential. A differential voltage level of -10V shall deflect the laser beam to the left side of the projection area, whereas a differential voltage level of +10V shall deflect the signal to the right. A differential voltage level of 0V shall place the beam in the center of the screen horizontally.
Y *Pin 2 = (+) (Normal)* *Pin 15 = (-) (Inverted)*	Controls the vertical beam position. This is a bipolar analog signal whose voltage range is between +10V and –10V differential. A differential voltage level of -10V shall deflect the laser beam to the bottom of the projection area, whereas differential voltage level of +10V shall deflect the signal to the top. A differential voltage level of 0V shall place the beam in the center of the screen vertically.

R *Pin 5 = (+) (Normal)* *Pin 18 = (-) (Inverted)*	Controls the red intensity. This is a unipolar analog signal whose voltage range is between 0V and +5V differential. A differential voltage level of 0V shall produce no red output. A differential voltage level of +5V shall produce maximum red output.
G *Pin 6 = (+) (Normal)* *Pin 19 = (-) (Inverted)*	Controls the green intensity. This is a unipolar analog signal whose voltage range is between 0V and +5V differential. A differential voltage level of 0V shall produce no green output. A differential voltage level of +5V shall produce maximum green output.
B *Pin 7 = (+) (Normal)* *Pin 20 = (-) (Inverted)*	Controls the blue intensity. This is a unipolar analog signal whose voltage range is between 0V and +5V differential. A differential voltage level of 0V shall produce no blue output. A differential voltage level of +5V shall produce maximum blue output.

See "Color Channel Usage" section below for further details on suggested usage and configuration of these lines.

Shutter *Pin 13 = (+) referenced to ground (pin 25)*	Optical shutter intended to extinguish all light from the graphics scanners. This is a unipolar analog signal whose voltage range is between 0V and 5 volts. The shutter signal is referenced to the Ground pin (#25). A voltage level of 0 volts shall close the shutter so that no light is emitted from the graphics scanners. A voltage level of +5 volts shall fully open the shutter. This is a high-impedance control signal NOT intended to directly drive the shutter device.
Interlock A & Interlock B *(4, 17)*	These signals, tied together at the signal source, are intended to keep the projector from outputting light if inadvertently connected to non-laser signal sources such as SCSI, Parallel or serial connectors. If this loop is broken, it is required that projectors close a shutter, turn off the laser, or take other actions that prevent light from being emitted from the projector. These signals are also a fail-safe should other control measures fail. It is important to note that this portion of the ISP-DB25 is a projector interlock which may be separate from the remote interlock connector on a laser used with the projector.
Ground	0V voltage potential reference and signal shield.

(25)	

Optional Signals

These signals are not required by the ILDA Standard Projector but are provided for flexibility and use of the DB-25 connector by other projectors.

Optional Signals	***Description***
Intensity/ Blanking *Pin 3 = (+) (Normal)* *Pin 16 = (-) (Inverted)*	This is intended for use by projectors which use an intensity signal or scanner blanking. This is a unipolar analog signal whose voltage range is between 0V and +5V differential. A differential voltage level of 0V indicates zero intensity and that the beam is fully blanked. A differential voltage level of +5V indicates full intensity and that the beam is not blanked.
Projector Return Signal *(12)*	Return signal from the projector. This is intended as a photo-diode output so that the projector light output can be monitored by the signal source. However, this signal can be used for any projector return information as long as the maximum voltage ranges are observed.

User-Defined Signals

These signals are not required by the ILDA Standard Projector but are provided for flexibility when using the DB-25 connector. These are paired as differential analog signals. Although they can be used for any user application which meets the maximum voltage specifications, it is likely that they will be used for semi-standard purposes. The following recommendations are provided for these applications to ensure maximum compatibility between projector manufacturers.

User-Defined Signals	***Description***
User 1 "Deep-blue" *Pin 8 = (+) (Normal)* *Pin 21 = (-) (Inverted)*	Where it is desired to have a separate signal which controls the deep-blue intensity, this signal shall be supplied on the "User-defined signal 1" pair. When used this way, this is a unipolar analog voltage whose range is between 0V and +5V differential. A differential voltage level of 0 volts shall produce no deep-blue output. A differential voltage level of +5 volts shall produce maximum blue output.
User 2 "Yellow" *Pin 9 = (+) (Normal)* *Pin 22 = (-) (Inverted)*	Where it is desired to have a separate signal which controls the yellow intensity, this shall be supplied on the "User-defined signal 2" pair. When used this way, this is a unipolar analog voltage whose range is between 0V and +5V differential. A differential voltage level of 0 volts shall produce no yellow output. A differential voltage level of +5 volts shall produce maximum yellow output.
User 3 "Cyan" *Pin 10 = (+) (Normal)* *Pin 23 = (-) (Inverted)*	Where it is desired to have a separate signal which controls the cyan intensity, and where beam brush is not used, this shall be supplied on the "User-defined signal 3" pair. When used this way, this is a unipolar analog voltage whose range is between 0V and +5V differential. A differential voltage level of 0 volts shall produce no cyan output. A differential voltage level of +5 volts shall produce maximum cyan output.

See "Color Channel Usage" section below for further details on suggested usage and configuration of these lines.

User-Defined Signals (alternate uses)

User 3 **"Beam-Brush"** *Pin 10 = (+)* *(Normal)* *Pin 23 = (-)* *(Inverted)*	Where it is desired to have a separate signal which controls the beam diameter, and where cyan on User3 is not used, this shall be supplied on the "User-defined signal 3" pair. When used this way, this is a unipolar analog voltage whose range is between 0V and +5V differential. A differential voltage level of 0 volts shall produce the smallest beam diameter. A differential voltage level of +5 volts shall produce the maximum beam diameter.
Stereoscopic & Depth Signals:	
User 4 **"X-Prime"** *Pin 11 = (+)* *(Normal)* *Pin 24 = (-)* *(Inverted)*	For stereoscopic applications where it is desired to have a separate signal for a second X scanner, this shall be supplied on the "User-defined signal 4" pair. When used this way, this signal shall represent the right-eye view and the standard "X" signal (pins 1, 14) shall represent the left-eye view. The analog voltage range and polarity are identical to the "X" signal.
User 4 **"Z Axis"** *Pin 11 = (+)* *(Normal)* *Pin 24 = (-)* *(Inverted)*	For volumetric or stereoscopic applications where it is desired to have a separate signal which indicates depth, this shall be supplied on the "User-defined signal 4" pair. When used this way, this is a bipolar analog voltage whose range is between –10V and +10V differential. A differential voltage level of -10V shall represent "rear" or "far from the viewer". A differential voltage level of +10V shall represent "front" or "toward the viewer". A differential voltage level of 0V shall represent a neutral distance such as the plane of the screen.

User 4 **"Field Change"** *Pin 11 = (+)* *(Normal)* *Pin 24 = (-)* *(Inverted)*	For applications using sequential-field stereoscopic techniques, the field (selected polarization) shall be supplied on the "User-defined signal 4" pair. When used this way, this is a bipolar analog voltage whose range is between –5V and +5V differential. A differential voltage level of 0 volts shall produce no image polarization; the image shall be visible to both eyes. In cases where a non-polarized image is not possible a differential voltage level of 0 volts shall produce image polarization visible to the left eye and invisible to the right eye. A differential voltage level of –5 volts shall produce image polarization visible to the left eye and invisible to the right eye. A differential voltage level of +5 volts shall produce image polarization visible to the right eye and invisible to the left eye.

Color Channel Usage

The ILDA Standard Projector assumes that the color device will be a polychromatic acousto-optic deflector (PCAOM) or a device with similar color-control and fast speed characteristics (example: direct modulation of laser diodes). Today's PCAOMs can control four or more laser wavelengths (colors) simultaneously. This can be used to give a wider color gamut (range) than if only three wavelengths -- red, green and blue -- are controlled.

Here's how this is done:

Most full-color laser displays at present are ion lasers strong in red and green, but deficient in deep blue. The strongest "blue" line is actually blue-green (cyan) at 488 nm. Because of the desire to often have a "brighter" display, as opposed to a more vibrantly "colorful" display, especially in large venues, the cyan line often fills in for most or all of the blue content in the show.

When there are only three color signals and the cyan (488 nm) line of the laser is controlled by the blue color signal, it is impossible to get dark blues (476 nm) or vibrant violets (457 nm) alone. This is because the stronger cyan line predominates. Dark blues and violets will usually look washed out.

In some situations, this is unavoidable. One example is with the ILDA ISP-ADAT standard, where there are only three color channels available on the ADAT tape. Depending on the laser wavelengths used, shows played from ADAT may be weak in dark blue and violet (without special hardware "tricks" on the projector).

If you would prefer to have a larger color gamut (i.e more vibrant colors) at the expense of slightly less output color, it is recommended to leave the cyan line disconnected, and to connect only the dark blue and/or violet to the blue signal line. What this arrangement lacks in power from the high-gain cyan line, it often makes up for in the improved vibrancy and saturation of the colors projected, giving a far less “pastel” look to the laser imagery.

Fortunately, many computer systems or custom playback systems (e.g. CD or DVD discs) can provide more than three color channels. For example, a digitizer can draw a shape using a "deep blue" color; when the show is played back, color channel 4 is used to display the shape. The Color Channel Usage chart below insures consistency when systems and projectors use more than three colors. In the example, it would not be good if each projector used color channel 4 to control a different laser wavelength.

- System designers: If you are designing a computer or custom playback system, ensure that your color output signals control the proper pins. Remember that the projector may have any number of channels (even just one if it does not have a color laser), so there should be an output option for each choice (e.g., 1-, 3-, 4-, 5- or 6-channel color).

- Projector manufacturers: Use a label next to the ILDA connector, or other means to clearly mark how many channels the projector can control. Think about "plug and play": a laserist should be able to plug their system into your projector, and instantly know how to set up the system to run your ILDA compatible projector.

  Note: Some advanced projectors may use circuits that map three color inputs (red, green and blue) into more than three color channels. (For example, 50% red and 50% blue might be displayed by a single violet line.) If so, add a switch or other means so this could be turned off or so the user can directly control more than three color channels.

- Laserists: Ensure that you have selected the proper number of channels for the particular projector/laser combination you are using. If your laser projection has missing colors, or the colors are mapped incorrectly, recheck your settings.

The Color Channel Usage chart below shows the wavelengths to be used for 3-, 4-, 5- and 6-channel color systems. Here is how to use it.

Color Channels	***Laser Color***
"Standard RGB" 3 Channel Color	Red (610nm to 690nm) Green (510nm to 550nm) Blue (450nm to 490nm)
"Enhanced RGBV" 4 Channel Color *(Deep Blue/Violet on User 1)*	Red (610nm to 690nm) Green (510nm to 550nm) Blue (470nm to 490nm) Deep Blue (450nm to 470nm)
"Enhanced RGBCV" 5 Channel Color *(Deep Blue/Violet on User 1)* *(Cyan on User 3)*	Red (610nm to 690nm) Green (510nm to 550nm) Cyan (480nm to 490nm) Blue (470nm to 490nm) Deep Blue (450nm to 470nm)
"Enhanced RGBCYV" 6 Channel Color *(Deep Blue/Violet on User 1)* *(Yellow on User 2)* *(Cyan on User 3)*	Red (610nm to 690nm) Yellow (550nm to 570nm) Green (510nm to 550nm) Cyan (480nm to 490nm) Blue (470nm to 480nm) Deep Blue (450nm to 470nm)

Additional Notes About Signals:

The absolute maximum voltage on any pin with respect to ground shall be positive or negative 25 volts. Signal inputs shall be designed to accept this voltage without any damaging results.

Signal outputs shall be current limited so that if they are shorted to ground, damage will not result. It is also recommended that the impedance of these outputs be between 100 and 150 ohms so that the cable impedance can be accommodated without ringing or other transmission line effects.

All signal receiving devices **must have a true differential input stage**! Unless otherwise indicated, the signal must always to be derived from the difference between the normal signal line and the corresponding inverted signal line.

DMX-512 Effects Control

Standard Identifier: ISP-DMX

DMX-512 is a lighting communications standard. It was created in 1986 as a standardized method for connecting lighting consoles to dimmer packs and was revised in 1990 to allow more flexibility. Since that time, it has become the most common communication standard used by lighting equipment.

Up to 512 “channels” can be transmitted. Each of these channels were originally intended to control lamp dimmer levels. You can think of it as 512 sliders on a lighting console, connected to 512 light bulbs. The slider position is conveyed as a number between 0 and 255.

To enable laserists to use standard DMX equipment such as lighting consoles and DMX-to-analog converters, this same "single channel controls a single function" philosophy applies.

Examples of things that fit the "single channel controls a single function" philosophy are:

- Beam actuators that can fade beam positions on a beam table (or pop into the beam);
- Shutters and filters that can gradually occlude the beam (or pop into the beam);
- Lumia motor speed; and
- Scan-through device selection and speed.

Even though all 512 channels can be used, it is more common to use fewer channels. The ISP-DMX standard defines the use of 32 channels, and reserves 34 channels for future ILDA standardization.

The DMX-512 specification (also called the USITT DMX512/1990 standard) is available from the following address:

USITT
10 West 19th Street, Suite 5A
New York, NY 10011-4206
Phone: (212) 924-9088
Fax: (212) 924-9343

DMX-512 Channel Assignments

The following channel assignments apply to the ILDA Standard Projector:

Channel Number	***Assigned Effect***
1	Effects fader, (controls beams and non-scan through effects)
2	Effect/beam red fader
3	Effect/beam green fader
4	Effect/beam blue fader
5	Lumia fader
6	Lumia speed
7	Scan through effect #1 engage, diffraction grating
8	Scan through effect #1 coarse speed control
9	Scan through effect #1 fine speed control
10	Scan through effect #2 engage, fuzz
11	Scan through effect #2 coarse speed control
12	Scan through effect #2 fine speed control
13	House lights
14	Fog
15	Strobe
16	Laser control (start or current up)
17	User 1
18	User 2
19	User 3
20	Graphics Shutter -- DMX-512 version of the

	analog shutter signal found on the ISP-DB25
21	Beam diffraction effect 1
22	Beam diffraction effect 2
23	Beam actuator 1
24	Beam actuator 2
25	Beam actuator 3
26	Beam actuator 4
27	Beam actuator 5
28	Beam actuator 6
29	Beam actuator 7
30	Beam actuator 8
31	Beam actuator 9
32	Beam actuator 10
33-66	Reserved for future ILDA assignment

DMX-512 Connector and Pinouts

The DMX-512 connector is a 5-pin XLR with the following pin-out:

Pin	*Signal Name*
1	Cable shield
2	Data complement (-) to projector
3	Data true (+) to projector
4	Optional data complement (-) from projector
5	Optional data true (+) from projector

Signal sources such as computers or tape playback devices shall use a female connector. Projectors shall use a male connector but may also have a female connector for DMX-512 pass-through.

Effects Specification

Standard Identifier: ISP-EFX

Effects have been an important part of laser shows since their beginnings. Many early laser lightshows consisted mostly of effects with little or no scanned imagery. There are many visually stunning patterns and textures that can be produced with laser effects which are not achievable in other mediums. Due to their unique nature, this type of effect will always remain an important tool in the laserist's repertoire.

Effects are anything placed in to a laser beam to produce diffraction, refraction, reflection or diffusion of the beam. Examples of common effects are lumia and diffraction gratings.

This portion of the ISP specification defines default effects for the ILDA Standard Projector and provides mechanical definition of effects to allow interchangeability and control.

Lumia Effect

The ILDA Standard Projector shall have at least one rotating lumia of medium angle and generic texture.

The lumia shall operate independently of image scanning, so as to be used simultaneously with scanning images.

Lumia brightness is controlled by DMX channel 5. A value of zero on DMX channel 5 indicates no light.

Lumia rotation speed shall be controlled by DMX channel 6. A value of zero on DMX channel 6 indicates no rotation.

Scan-Through Effect

The ILDA Standard Projector shall have at least two insertable, rotating scan-through effects. These scan-through effects are to be located on the primary image scanners.

Although show designers can install any effect disk into any effect location, the default scan-through effects shall be:

1. Eight-point burst diffraction grating;

2. Small-angle fuzz (2-3 times the normal beam diameter).

Lumia and scan-through effects shall be circular disks with a diameter of 100mm (+0mm, -1mm).

Lumia and scan-through effects devices shall be designed to accept and adequately mount effects disks from less than 1mm to at least 5mm thickness.

Effects disks shall have bare edges without frames or other obstructions which would cause shadowing or interruption of light when inserted into an active image. This is a requirement of the actual effect disks, however this is not required of the effects insertion device. The insertion device may entirely encircle the effect for support and rotation.

Mounting and rotation to be accomplished from the outer edges of the disk. It is intended that the entire area of the disk is available for scanning. (The disk is not mounted from a center hub.)

Effects devices shall be designed to allow regular, quick and easy interchange of effects disks at any time.

Effect #1 insertion is controlled by DMX channel 7.

Effect #1 coarse speed is controlled by DMX channel 8.

Effect #1 fine speed is controlled by DMX channel 9.

Effect #2 insertion is controlled by DMX channel 10.

Effect #2 coarse speed is controlled by DMX channel 11.

Effect #2 fine speed is controlled by DMX channel 12.

A value of zero on DMX insertion channels indicate effect fully removed from the scanning image path.

A value of zero on DMX coarse rotation speed channels indicates no rotation.

Implementation of the fine rotation speed channels is optional. The DMX fine speed control channels, where implemented, shall function as a vernier adjustment of the coarse speed control. It shall provide 255 levels of fine adjustment between each of the coarse speed control's 255 levels. In this manor, systems which do not implement the fine speed control will still reasonably reproduce intended speeds.

Scan-through effect insertion can be accomplished with multiple insertion devices, or by a single ring with multiple effects apertures. If a single ring is used, only one scan-through effect can be inserted into the scanned image at a time. If there is a conflict, where the DMX signal is indicating that both scan-through effects should be inserted, then the lowest numbered scan-through effect indicated shall be used.

Effects devices shall provide visible identification of all effect positions to facilitate proper insertion of effects. i.e., "effect #1", "effect #2" etc.

Additional scan-through effects may be implemented at the projector manufacturer's will. These shall be designated #3, #4, etc. Additional scan-through effects shall utilize insertion and rotation controls in the same fashion as effects #1 and #2.

ADAT Tape Playback and Track Assignments

Standard Identifier: ISP-TAPE

The ADAT is an S-VHS cartridge-based 8-track digital audio recorder. Since the ADAT contains 8 “tracks” of information, all laser show information can be conveniently recorded on a single ADAT tape. Using the ADAT is also very convenient due to its familiar VCR-style control panel.

The ADAT is also a very economical, portable unit. For these reasons, ADAT quickly became the defacto-standard for laser show recording and playback after its introduction in 1992.

At the beginning of 2001, tape-based ADATs have begun to be phased out by several manufacturers, instead replacing them with low-cost hard-drive ADAT recorders which mimic the multitrack standard and functionality of tape-based ADAT devices, whilst seamlessly interchanging with the existing format. Hard-drive ADAT recorders have several distinct advantages over the tape-based ADAT counterpart, such as a much more reliable and durable recording medium, faster cueing, longer record times, and a larger number of tracks stored per deck.

Though many hard drive-based ADAT systems offer 16 or 24 channels per deck, the units will usually split up the tracks into distinct groups of 8, allowing essentially three separate “universes” of ADAT recording to reside on a single unit. This is extremely useful for such applications as shows which employ multiple scan-heads running together in syncronicity.

The ILDA ISP-TAPE 8-channel standard should still be followed for interchange of material. Channels 9-16 (second universe) and 16-24 (third universe) would be considered the same as 1-8 (respectively) for channel assignments.

ADAT Modification

There are several ADAT models available from both Alesis and Fostex. The original Alesis ADAT, introduced in 1992, has a black front. This was discontinued in 1996 in favor of the newer Alesis ADAT xt. The Fostex RD-8 is similar to the original Alesis ADAT, but has some additional capabilities. Fostex also makes a model CX-8 which is identical to the Alesis ADAT xt.

You can purchase specially modified ADATs which are capable of recording laser graphics and DMX-512 control signals from several ILDA members. Alternatively, you can purchase an unmodified unit and perform the modification yourself.

The modification for the original Alesis ADAT and Fostex RD-8 is covered by the "ADAT DC Coupling Modifications for Laser Graphic Recording", Revision 002, October 1995, in the *ILDA Handbook and Technical Specifications*.

The modification for the newer hard-drive based ADATs, Alesis ADAT xt, and Fostex CX-8, are not covered by ILDA documents, but this modification is available commercially through several ILDA members.

In addition, external optical conversion hardware, which eliminates all internal modification of both the tape-based and hard-drive based ADAT decks, whilst providing for additional features such as recording laser graphics, DMX-512 control signals, and shutter information, are available as a separate component commercially through several ILDA members.

ADAT Track Assignments

The ILDA Standard Track Assignments for ADAT recording is:

ADAT Track	***Signal Assignment***
1 (9/17)	X axis
2 (10/18)	Y axis
3 (11/19)	Red
4 (12/20)	Green
5 (13/21)	Blue
6 (14/22)	SPARE USER-DEFINED CHANNEL
7 (15/23)	Left Audio
8 (16/24)	Right Audio

Channel 6 (14/22) is considered to be a spare, used-defined channel. This channel can be used for storing various different signals, at the user's discretion, such as SMPTE time code, DMX projector control, shutter control, or an additional color signal.

Because this channel is considered arbitrary, the user is reminded that not all projection systems have the capability to utilize it. If it is used to record a color signal (for instance) and the playback system is not configured to use this channel for color control, the projected colors may be incorrect or missing. For this reason, when interchanging general material with other ILDA ISP-TAPE users and systems, Channel 6 is NOT recommended to be utilized for any projection-critical items.

Glossary

This Glossary is included to define terms specific to this document. For definitions of other laser display terms, consult the ILDA Laser Glossary, Revision 002, November 1993, in the *ILDA Handbook and Technical Specifications*.

Bipolar Analog Signal

A signal which can go both positive and negative with respect to its reference (e.g. ground for single-ended, non-differential signal)

Differential Voltage

The potential difference measured between the noninverting and inverting signal lines as defined by the following equation: VDIF = V(+) - V(-).

Inverting Signal (-)

A signal which is a mirror-image of a noninverting signal. This signal is denoted by a (-) symbol placed immediately after a signal name.

Lumia

A gauze-like laser effect produced by shining a fixed laser beam through distorting material such as rippled glass. Lumia are often composed of fine parallel lines of light and dark, and they show the characteristic speckle of coherent light. There are many different lumia effects, depending on the type of distorting material.

Noninverting Signal (+)

The “true” sense of a signal definition. This signal is denoted by a (+) symbol placed immediately after a signal name.

Recommended

Marks specifications which, while not mandatory, will provide the best performance.

Reserved

Used for signals that are set aside for future standardization.

Scan-Through Effect

An effect produced by placing a distorting material such as rippled glass after the X-Y graphics scanners. These effects are usually temporary, and only done during certain parts of a laser show.

Shall

Indicates a requirement that must be met to comply with the standard.

Single-ended Voltage

VDIF = V(+) - GND. The potential difference as measured between a signal and its reference ground potential.

Stereoscopic Applications

Sometimes called 3D applications, this is where two images are projected – one for the left eye and one for the right eye. These images may be projected simultaneously, or sequentially, depending on projector hardware.

Symmetrical Signal

A differential signal line is called symmetrical if the voltage of the inverted line is the negative of the voltage of the non-inverted signal line with respect to the 0 Volt potential of the differential driver. The potential of the inverted signal line changes with respect to a fixed potential, in the same way as the potential of the non-inverted signal line changes.

Non-Symmetrical Signal

A differential signal line is called non-symmetrical if the voltage of the inverted line has a fixed potential.

Unipolar Analog Signal

A signal which can go only positive or negative with respect to its reference (e.g. ground for single-ended, non-differential signal). For purposes of this document, all unipolar signals only go positive.

Volumetric Applications

Applications where an image is produced which can be viewed from several locations simultaneously. This is similar to stereoscopic applications but does not require glasses or any other similar viewing apparatus.