INTERNATIONAL LASER DISPLAY ASSOCIATION

Technical Committee

Mechanical and Electrical Interface for Laser Projection Devices

Revision 001, August 1989

Scope

This Laser Projector Interface Standard provides the cable, mechanical and electrical requirements for interfacing with laser projection systems.

The primary objective of this standard is to define a mechanical and electrical interface for laser projection devices so as to provide laser graphic playback systems, within a certain class of laser projectors, with device independence. A secondary objective is to allow for remote projector operation over a single cable at distances of several hundred feet. Thus, laser projectors with either single or dual scanner sets, full-color or monocolor outputs, differential or single-ended wiring, local or remote operation can all be easily accommodated by this standard.

Provisions have been made for future asynchronous digital communications between laser projection devices and laser graphics playback systems.

A laser safety provision has been included by defining a Master Shutter control line for each scanner set within a projection device.

To accommodate precise long distance remote operation, we have defined a differential driver/receiver configuration for the projector interface standard. For applications where single-ended driver configurations are currently used, we have incorporated a single-ended driver option into this standard.

Although individually shielded twisted pair wire has been specified for the interfacing standard, readers should understand that cabling trade-offs may be required to achieve satisfactory system operation and cost.

Glossary and Conventions

Glossary

- Noninverting Signal (+). The "true" sense of a signal definition. This signal will be denoted by a (+) symbol placed immediately after a signal name.
- Inverting Signal (-). A signal which is a mirror-image of a noninverting signal. This signal will be denoted by a (-) symbol placed immediately after a signal name.
- Differential Voltage. The potential difference measured between the noninverting and inverting signal lines as defined by the following equation.
- Single-ended Voltage. VDIF = V(+) - V(-)
  The potential difference as measured between a signal and its reference ground potential.
- Common-mode Voltage. VCOM = V(+) + V(-)
  The average potential difference measured between the noninverting and inverting signal lines.

Conventions

- The word "shall" indicates a requirement that must be met to comply with the standard.
- The word "recommended" marks specifications which, while not mandatory, will provide the best performance.
- The word "suggestion" denotes specifications which will ensure full compatibility and stay within the spirit of the standard.
- The term "reserved" is used for signals that are set aside for future standardization.

Physical Characteristics

Connector Requirements

The interface connection at each projection device shall be a 37 Pin Circular Plastic Connector (CPC) type, Reverse Sex (with Socket Contacts), Square Flange Receptacle with a Series 1 Contact Arrangement. See Table 2 for recommended manufacturers.

Cable Requirements

The recommended connecting cable between the projection devices and the graphic playback systems is individually shielded twisted wire pairs; however, this may vary depending upon projector design and cable length required. See Table 1 for Recommended Cable Types. Implementations may require trade-offs between shielding effectiveness, cable length and the number of conductors to achieve satisfactory system operation. For short cable lengths, unshielded twisted pair wires may be acceptable.

Single/Dual Scanner Sets

For projection devices having only a single scanner set, the top portion of the standard receptacle shall be used. The lower portion of this receptacle shall be reserved for the second set of a dual scanner set device.

Connector Pinouts

The interfacing connector pinouts have been defined for single-ended or differential sources, driving single or dual scanner set projection devices.

Electrical Characteristics

Five differential analog signals (Red, Green, Blue, X-Axis, Y-Axis) and one single-ended digital signal (Master Shutter) have been defined for a full color, single scanner set laser graphic image. The differential analog signals are defined in terms of a noninverting (+) and the inverting (-) signal lines. Additional signals, TX and RX, have been defined for future digital control options.

Signal Definitions

Red (+)(-)

Used in full color RGB projection systems, this signal controls the Red intensity of the color mix. In monochrome projection systems, it shall control the beam blanking and intensity levels. This signal shall be a Unipolar analog signal whose differential voltage ranges from 0 volts to +10 volts. 0 volts shall denote maximum black level (full OFF) and +10 volts shall denote maximum white level (full ON).

Green (+)(-)

Used in full color RGB projection systems only. This signal controls the Green intensity of the color mix. It is a Unipolar signal whose differential voltage ranges from 0 volts to +10 volts. 0 volts shall denote maximum black level (full OFF) and +10 volts shall denote maximum white level (full ON).

Blue (+)(-)

Used in full color RGB projection systems only. This signal controls the Blue intensity of the color mix. It is a Unipolar signal whose differential voltage ranges from 0 volts to +10 volts. 0 volts shall denote maximum black level (full OFF) and +10 volts shall denote maximum white level (full ON).

X-Axis (+)(-)

Controls the X axis beam position. It is a Bipolar signal whose differential voltage ranges from +10 volts to -10 volts. A +10 volt level shall

correspond to a maximum positive X-Axis deflection and a -10 volt level shall be a maximum negative deflection. A 0 volt level corresponds to the image's X-Axis center point. A positive X-axis deflection is defined for front projection viewing and shall be defined as beam movement to the right.

Y-Axis (+)(-)

Controls the Y axis beam position. It is a Bipolar input signal whose differential voltage ranges from +10 volts to -10 volts. A +10 volt level shall correspond to a maximum positive Y-Axis deflection, and a -10 volt level shall be a maximum negative deflection. A 0 volt level corresponds to the image's Y-Axis center point. A positive Y-axis deflection shall be defined as a beam movement upward.

Master Shutter

Controls the laser beam output of individual scanner sets. It is a Unipolar single-ended digital signal whose voltage levels are 0 volts and 5 volts. 0 volts shall disable the laser beam output and +5 volts shall enable it. An open-circuit “floating” line condition shall default to 0 volt input level, thus disabling the laser beam output.

Serial TX (+)(-)

An asynchronous serial transmit line used for transmitting digital information to a laser projection device. Currently reserved for future laser projector control functions.

Serial RX (+)(-)

An asynchronous serial receiving line used for receiving digital information from a laser projection device. Currently reserved for future laser projector control functions.

Blanking

For systems which process blanking signals separately from color levels, a blank signal (full beam OFF) shall be defined as the logical OR of color signals Red, Green, and Blue.

Monochrome Projection Systems

A monochrome graphic generator shall drive the Red color lines at least, but it is suggested that all three (R,G,B) color signals be driven to allow playback on a color projection system.

A monochrome laser projector shall receive at least the Red color signal. It is suggested, however, that it respond to all three color signals for compatibility with color graphic generators.

Line Driver Specifications

Analog Differential Line Drivers

Each of the two differential line drivers shall develop +/- 5 volts corresponding to differential voltage levels of 0 volts to +/- 10 volts into a balanced 10k ohm load. The common-mode voltage levels shall be +/- 5 volts maximum.

Note: A common-mode voltage level of 0 volts is recommended.

The source impedance shall be less than 1000 ohms; however, we recommend that the source impedance be between 100 and 150 ohms. The driver circuitry shall be capable of driving a capacitive load of 0.1 microfarads (equivalent to approx. 1000 feet of cable) without instability. The driver circuitry shall be current-limited to 100mA or less and shall tolerate a short, or any potential within +/- 10 volts, to ground.

Analog Single-ended Line Drivers

A single-ended driving source shall be capable of generating voltage levels of +/- 10 volts into a 10k ohm load. This signal shall have no common-mode potential and shall be applied to the noninverting (+) signal lines. The inverting (-) signal lines shall be connected to ground reference at the driver side.

The source impedance shall be less than 1000 ohms; however, we recommend that the source impedance be between 100 and 150 ohms. The driver circuitry shall be capable of driving a capacitive load of 0.1 microfarads (equivalent to approx. 1000 feet of cable) without instability. The driver circuitry shall be current-limited to 100mA or less and shall tolerate a short, or any potential within +/- 10 volts, to ground.

Digital Master Shutter Drivers

The shutter driver shall develop 0 volts and 5 volts as defined in "Signal Definitions: Y-Axis (+)(-)" section.

The driver shall have a source impedance less than 1000 ohms. We recommend that this source impedance be between 100 and 150 ohms. The driver circuitry shall be current-limited to 100mA or less and shall tolerate a short to ground or any potential within +/- 10 volts to ground.

Line Receiver Specifications

Analog Differential Line Receiver Specifications

The line receivers shall be balanced differential input. The noninverting input shall be arranged to drive the output device in the proper true direction as defined in Section 4.1. The inverting input shall drive it in the opposite direction.

The line receiver shall accept a signal of at least +/- 10 volts differential and shall tolerate a common-mode voltage of at least +/- 5 volts. The common-mode rejection of the receiver is not specified, but for noise rejection, it is recommended that the circuit be implemented with 1% or better resistors.

The balanced input impedance shall be no less than 10k ohms due to loading considerations. The maximum input impedance is not specified in this document.

Analog Single-ended Line Receiver Specifications

For short-haul applications and for applications where limited noise immunity is acceptable, the standard will accommodate a single-ended line receiver. We do not recommend a single-ended line receiver for applications using signal cable runs over 25 feet, nor for applications using equipment from multiple vendors.

The single-ended line receiver shall be designed to accommodate a drive voltage of +/- 10 volts. Because the drive circuitry may supply either +/- 5 volts or +/- 10 volts, depending on type, the line receiver must include a means of adjusting the gain to accept +/- 5 and +/- 10 volt full-scale inputs. A variable gain control to compensate for variations in source voltage levels and line loading effects is recommended but not required.

The single-ended line receiver shall be connected to the noninverting signal line, and the inverting signal line shall not be connected. Since the line may be driven by a differential driver, it must not be grounded. The input impedance of the receiver shall be no less than 10k ohms due to loading considerations. The maximum input impedance is not specified in this document.

Digital Line Receiver Specifications

The Master Shutter digital receiver must respond to a digital control signal of 0 and 5 volts. The switching threshold is not specified, but for maximum noise immunity, it should be approximately 2.5 volts with 0.5 volts hystereses. The line receiver shall be able to tolerate a signal swing of at least +/- 10 volts without damage.

The load impedance shall be at least 5k ohms, but we recommend that the load impedance be between 5k and 10k ohms.

Note: A TTL input circuit will NOT satisfy the requirements of this section. (The input will not be able to withstand input voltages of +/- 10 volts.) Suggested input circuits include CMOS or Op Amp comparator inputs with suitable pull-down and input limiting resistors as well as RS-232 line receiver inputs (1489).

Serial Interface Definitions

The TX and RX Serial Interface wire pairs have been defined for future as asynchronous digital communications between a Host controller and a laser projection device. The electrical characteristics of this interface shall be defined by EIA Standard RS-422-A, December 1978.

These lines are currently reserved (not for use) pending future specification of the data format, control codes and other details of the interface.

Spare Signal Lines

The spare signal lines are undefined and may be used for any analog or digital signal communication in either direction. Since the functionality is undefined and signals may be present, any equipment receiving data from these lines shall have the capability of being disconnected from them.

The spare signal driver may apply any signal not to exceed +/- 10 volts. The driver circuitry shall be current-limited to 100mA or less and shall tolerate a short to ground or any potential within +/- 10 volts of ground.

The spare line receiver shall be able to tolerate a signal swing of a least +/- 10 volts without damage.

Tables

Table 1 — Recommended Cable Types

	Single Scanner Set		Dual Scanner Set	
	6 pair	**9 pair**	**12 pair**	**15 pair**
Belden				
24 AWG	9731	9732	9734	9735
22 AWG	8778	8774	9768	8776
Columbia				
24 AWG	C6066	C6067	C6068	---
22 AWG	C6041	C6042	C6059	C6044
24 AWG	M39252	M39254	M39257	M39259
Manhattan				
22 AWG	M13106	M13109	M13112	M13115

Table 2 — Recommended Connectors

Manufacturer	AMP
Style	CPC Series 1
Shell Size	23
Chassis Receptacle	206306-1
Cable Plug	206305-1
Cable Clamps	
Standard	206138-1
Standard Self-Centering	207774-1
Large Size	206512-1
Back Shell Extender	207055-1
Pins & Socket Contacts (Crimp Ends)	
Wire Size Range	24-20 AWG
Plug Pins	
Tin	66103-2
Gold	66103-4
Receptacle Socket Contacts	
Tin	66105-2
Gold	66105-4

Table 3 — Suggested Cable Color Codes

Definition:

6 pair = 1 head
9 pair = 1 head + spares
12 pair = 2 heads, no spares
15 pair = 2 heads + spares

Pin	Head/Signal	6 pr.	9 pr.	12 pr.	15 pr.
1	1 X-Axis (+)	Red	Red	Red	Red
2	1 X-Axis (-)	Black	Black	Black	Black
6		Shield	Shield	Shield	Shield
5	1 Y-Axis (+)	White	White	White	White
11	1 Y-Axis (-)	Black	Black	Black	Black
6		Shield	Shield	Shield	Shield
3	1 Red (+)	Green	Green	Green	Green
4	1 Red (-)	Black	Black	Black	Black
8		Shield	Shield	Shield	Shield
7	1 Green (+)	Blue	Blue	Blue	Blue
13	1 Green (-)	Black	Black	Black	Black
8		Shield	Shield	Shield	Shield
9	1 Blue (+)	Yellow	Yellow	Yellow	Yellow
14	1 Blue (-)	Black	Black	Black	Black
15		Shield	Shield	Shield	Shield
21	1 Shutter	Brown	Brown	Brown	Brown
22	1 Spare	Black	Black	Black	Black
15		Shield	Shield	Shield	Shield
17	2 Shutter			Orange	Orange
16	2 Spare			Black	Black
23				Shield	Shield
29	2 Blue (+)			White	White

Table 3 — Suggested Cable Color Codes, continued

Pin	Head/Signal	6 pr.	9 pr.	12 pr.	15 pr.
24	2 Blue (-)			Red	Red
23				Shield	Shield
31	2 Green (+)			Green	Green
25	2 Green (-)			Red	Red
30				Shield	Shield
35	2 Red (+)			Blue	Blue
34	2 Red (-)			Red	Red
30				Shield	Shield
33	2 Y-Axis (+)			Yellow	Yellow
27	2 Y-Axis (-)			Red	Red
32				Shield	Shield
37	2 X-Axis (+)			Brown	Brown
36	2 X-Axis (-)			Red	Red
32				Shield	Shield
10	TX+		Orange		Orange
12	TX-		Black		Red
18			Shield		Shield
19	RX+		White		White
26	RX-		Red		Green
18			Shield		Shield
28	Spare		Green		Blue
20	Ground		Red		Green
20			Shield		Shield

Schematics

Figure 1 - Connector Pinouts - ILDA Standard
Projector Interface Standard Differential Inputs
Dual Scanner Set

Figure 2 - Analog Drivers/Receivers

Figure 3 - Digital Drivers/Receivers - ILDA Recommended Standard for Digital Drivers/Receivers