INTERNATIONAL LASER DISPLAY ASSOCIATION

Technical Committee

The ILDA Grating Standard

Revision 001, July 2004

Revision History

Revision 001, July 2004:

- The initial publication of the ILDA Grating Standard

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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.

To address the issue of classifying the large variety of available grating patterns and types, the ILDA GRATING STANDARD represents a simple code to precisely define all relevant physical parameters of a grating. This supports the industry by making standard gratings available regardless of the source manufacturer or vendor, and aids the artists in precisely defining the parameters of a grating to be used with a specific piece of show material.

Diffraction gratings are holographic optical elements which diffract a single laser beam into various orders, each representing a beam with a specific direction. As the diffractive optical process in a grating is linearly proportional to the wavelength, a multi-wavelength beam is also split into its individual wavelengths, resulting in each order being split into "n" orders, where "n" is the number of wavelengths of the input beam.

ILDA Grating Syntax

Various parameters can vary among diffraction grating styles which necessitates the need for a standardized, easy-to-understand system of classification. The ILDA Grating Standard has adopted the following format for specifying the following parameters: effect type, effect angle, mode, density, size, and form. To provide an easy way to format these parameter specifications, the ILDA Grating Standard uses the following syntax:

[EFFECT TYPE] [ANGLE] [MODE] -- [DENSITY] -- [SIZE] [FORM] -- ([OPTION])

The six parameter categories are required when specifying a grating by the ILDA Standard Grating format code. The **OPTIONAL** item is only used when requiring additional precision optical data for the grating, and can be left out in most cases. This is elaborated on further below in the **OPTIONAL** section.

Examples of the syntax in usage are as follow:

LWR-2-100C
Line, Wide, Reflective, High-density 3°spacing, 100mm dia. Round substrate

GWR-1-50C
Grid, Wide, Reflection, Low density 6° spacing, 50mm dia. Round substrate

LNT-2-100S
Line, Narrow, Transmission, High density 3°spacing, 100mm Square substrate

LWR-1-100x50
Line, Wide, Reflection, Low density 6° spacing, 100 x 50 mm Rectangular substr.

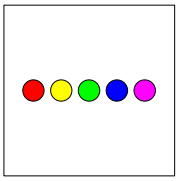
CWT-1-50C
Circle, Wide, Transmission, 16 orders circle, 50mm dia. Round substrate

ILDA Grating Parameters

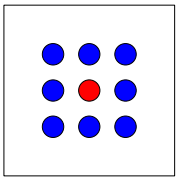
The following is an explanation of each of the parameters and associated codes which make up the ILDA Grating Standard syntax:

EFFECT TYPE

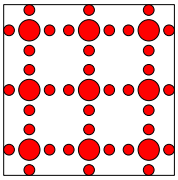
The grating standard includes the most popular effect patterns, each of them represented by an abbreviation of one or two letters:



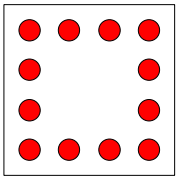
L = "Line"
One dimensional dot array
spacing always equal



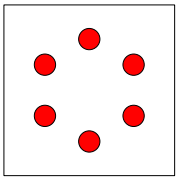
G = "Grid"
Two dimensional dot grid
both dimensions orthogonal
with equal spacing



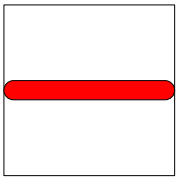
DG = "Double Grid"
Same as Grid, but each
dot in the primary Grid
has a fine spaced secondary
dot grid surrounding them



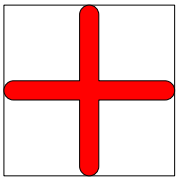
S = "Square"
Two dimensional dot square
both dimensions orthogonal
with equal spacing



C = "Circle"
Two dimensional dot circle
Spacing is normally equal
in both dimensions



SL ="Solid Line"
Solid line, no dots present



SC = "Solid Cross"
Solid cross, no dots present

An effect which appears in a slightly modified form, as per an extended description in the **OPTION** field, will have an "**X**" appended to the effect type. (e.g. "**LX**", "**GX**", "**CX**", etc)

EFFECT ANGLE

The grating standard defines the full angle of the effect pattern. The simple definition is defining two general effect angle types:

N = "Narrow"
Effect full angle less or equal to 45° with 633nm wavelength

W = "Wide"
Effect full angle greater than 45° with 633nm wavelength

If more precision in specification of the effect angle is required, it can be specified in the **OPTION** section. See below for further details.

MODE

The grating standard defines with MODE whether the grating operates as transmissive or reflective:

T = "Transmissive"
The grating is transparent - the beam passes through the substrate

R = "Reflective"
The grating has a mirror coating - the beam is reflected from the substrate

X = Not Defined

DENSITY

The grating standard defines with DENSITY the absolute angle spacing between each order. It is defined that each angle spacing between subsequent following orders are equal for each wavelength, and for 2 dimensional gratings the angle spacing is same for both directions.

The simple definition is defining 2 general density types:

1 = "Low Density"
The angle spacing is 6° for 633nm wavelength
When the **EFFECT TYPE** is "**C**" (circle), this represents a 16 orders circle

2 = "High Density"
The angle spacing is 3° for 633nm wavelength
When the **EFFECT TYPE** is "**C**" (circle), this represents a 32 orders circle

X = Not Defined

For other gratings having different angle spacing, the **DENSITY** can be calculated.

For example:

0.5 = 12° or 8 orders circle
4 = 1.5° or 64 orders circle

If more precision is required in a specific application, such as the degree or order numbers varying from the aforementioned item, see **OPTION** for additional specifications regarding the **DENSITY** parameter.

SIZE

Size defines the mechanical dimensions of the physical grating substrate in length, width, or diameter. The thickness of the substrate is independent of these, and thus not recognized in this standardization. All sizes are to be specified in the unit of millimeters.

Square Substrate Form:

For a *square* substrate, the measurement represents the length

Rectangular Substrate Form:

For a *rectangular* substrate, if only one number is present, the measurement represents the longest side length of the substrate.

Optionally, the measurement may appear with two numbers, separated by an "**x**" (e.g. **"100x50"**) to allow exact specification of both the width and height of the substrate. See ***"Rectangular Substrate Form"*** under **FORM** below.

Round Substrate Form:

For a *round* substrate, this number represents the diameter

FORM

Form defines the physical form of the grating substrate.

S = "Square Substrate Form"

Both sides are orthogonal and equal in length

C = "Circular Substrate Form"

The substrate is a circle, measured by diameter

X_ = "Rectangular Substrate Form"

Both sides are orthogonal and *NOT* equal in length. For rectangular substrate forms the **FORM** code is replaced by the short side length in millimeters with a separator "**x**"

OPTION

The **OPTION** parameter definition of a grating is not part of the ILDA Grating Standard, but may be used to provide additional information regarding parameters or parameter types specific to that grating, however not currently defined in the formal specification. This may include such things as higher precision optical data (angles, orders, etc), composition of substrate (glass, plastic, etc) or so forth if required for a particular application.

Even though **OPTION** is not part of the ILDA Grating Standard, it is highly recommended to use these definitions accordingly as described herein when parameters deviate from those described in previous sections. Of particular importance are:

EFFECT ANGLE
This denotes the full angle of diffraction of the grating in degrees when measured with a wavelength of 633nm

DENSITY
This denotes the angle of degrees between subsequent following orders when measures at a wavelength of 633nm

Examples of the **OPTION** syntax in usage are as follow:

LXR-X-50S-(OPTION: Effect angle 10, Density 5)
Line with 5 orders including the zero order, 50mm square reflective substrate

GXR-X-100S-(OPTION: Effect angle 40, Density 20)
Grid w. 5 x 5 orders including the zero order, 100mm square reflective substrate

LXT-X-25S-(OPTION: Effect angle 120, Density 1)
Line with 121 orders including the zero order, 25mm square transmissive substrate

SXT-X-25S-(OPTION: Effect angle 25, Density 3.125)
Square with 32 points, excluding the zero order, 25mm square transmissive substrate

CXT-X-50C-(OPTION: Effect angle 24, Density 0.75)
Circle with 12 points including the zero order, 50mm circular transmissive substrate