ATTENTION! ATTENTION!
All UGC enclosures
now wired to ILDA Standard
wiring specifications. 01/01/2000

UGC

Universal Geometric Corrector

versions 2.0 and 2.0b

Vector Scanning Signal Processor

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UNIVERSAL GEOMETRIC CORRECTOR

INTRODUCTION

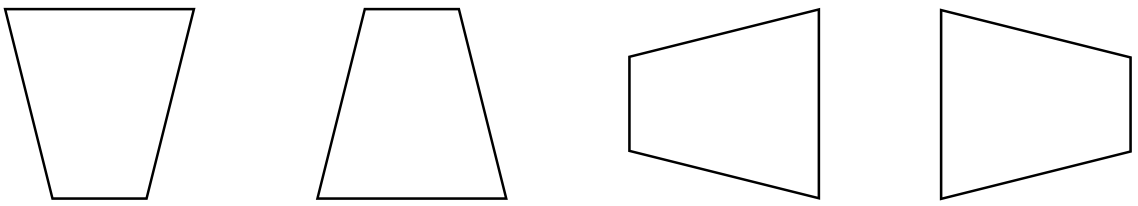
The Universal Geometric Corrector (UGC) is an electronic signal processor that modifies vector scanning signals to compensate for oblique projection angles, non-planar surfaces, and scanner misalignment. Eight adjustments are provided for both the X axis and Y axis.

1. Keystone
2. Shear
3. Linearity
4. Scale
5. Pincushion/Barrel
6. Pincushion Offset
7. DC Offset
8. Bowline

All adjustments are bipolar; no signal correction occurs at the center position of each adjustment. Hence, SCALE can be adjusted from full unity gain at one end to full inverted gain at the other end. Inverting switches are not needed.

Keystone

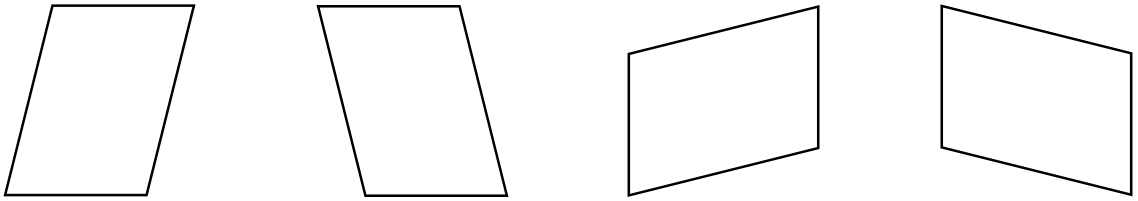
Keystone affects the gain of the opposing axis as a function of the excursion of the adjustment axis. Any off-axis projection will cause some keystone distortion of the image. Keystoning is caused by the difference in path length from one area of the image to another. A longer path means a "wider" image at the part furthest away, and a "narrower" image at the part closest to the projector. Corrections of up to 50% are possible. This function is also known as *trapezoid correction*.



+ Y **- Y** **+ X** **- X**

SHEAR

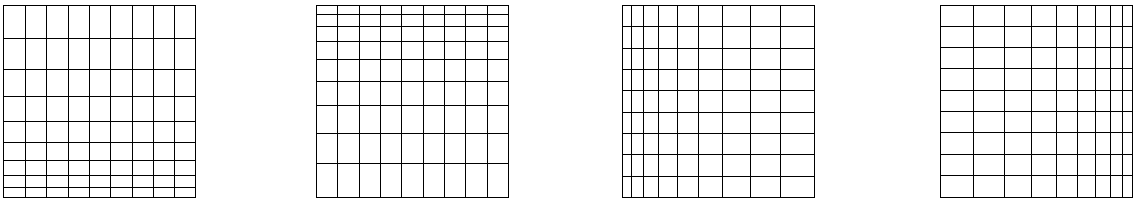
Shear affects the DC position of the opposing axis as a function of the excursion of the adjustment axis. This is primarily used to correct for non-orthogonal orientation of the scanners, scanner mirrors, or input beam. Projectors at other then 90 degree angles may also cause rotation of the image. Shear allows independent controls for shifting the top of the image in one direction while the bottom shifts in the opposite direction. Using both axis of shear correction, it is possible to rotate the image in the Z-axis. Also know as *parallelogram correction*.



+ Y **- Y** **+ X** **- X**

LINEARITY

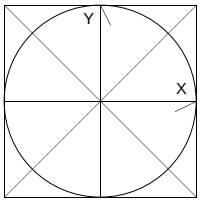
Linearity affects the gain constant of the adjustment axis as a function of the magnitude of the excursion. Basically, a compressor/expander for the signal that will compress in one polarity and expand in the other polarity. This causes one side of the image to become proportionally more squeezed, while the other side stretches. Used in conjunction with keystone to correct for off-axis projection. Linearity causes an offset in the image position that must be corrected with OFFSET. Also known as *proportion*.



+ Y **- Y** **+ X** **- X**

SCALE

Scale affects the overall size of the adjustment axis. A center setting of the control sets the gain to zero; full clockwise fives normal unity gain; full counterclockwise gives inverted unity gain. Also known as *size*, or *gain*.



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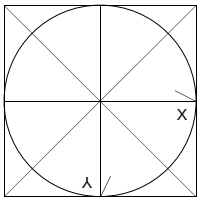

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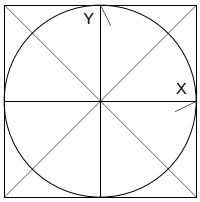

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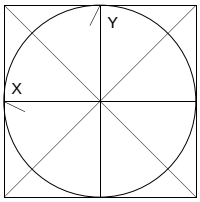
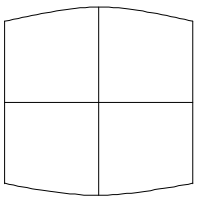


- X

PINCUSHION

Pincushionaffects the gain of the opposing axis as a function of the square of the excursion value of the adjustment axis. The squaring of the value acts as an absolute value function, and provides non-zero correction. Projection on a flat surface, where the scan angle approaches the path length causes pincushion distortion. The corners of a square would extend past the sides of the square, hence the pincushion name. The reverse is barrel distortion, where the sides of the square extend past the corners, giving a rounded appearance. Projection onto curved surfaces, such as planetarium domes, gives rise to barrel distortion.



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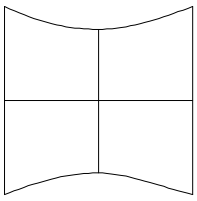

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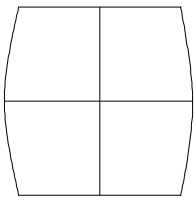

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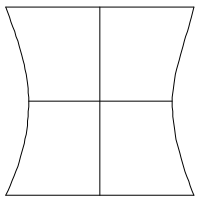

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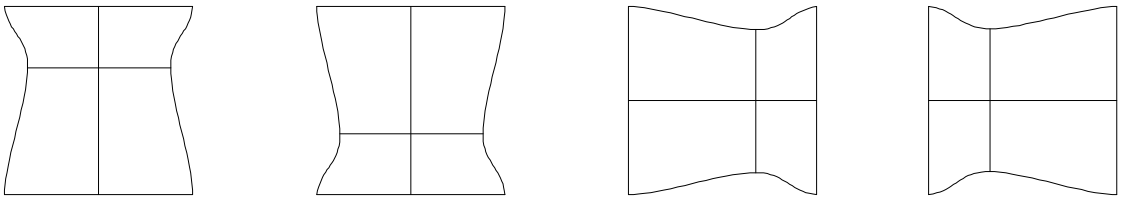
CENTER

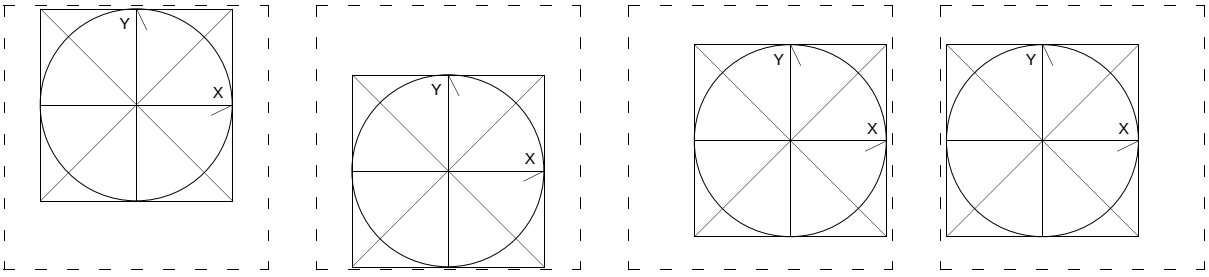
Center affect s the zero position of the pincushion and barrel adjustment. Projection onto a curved surface from an off-axis or non-central location may require this adjustment.



+ Y **- Y** **+ X** **- X**

OFFSET

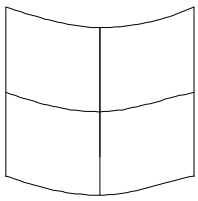
Offset affect the DC position of the image in the adjustment axis. It us used to fine tune the image for registration purposes.



+ Y **- Y** **+ X** **- X**

BOWLINE

Bowline affects the DC position of the opposing axis as a function of the square of the excursion of the adjustment axis. The squaring of the excursion value acts as an absolute value function, and provides non-zero correction. Projection on an angled surface leads to three distortions; Keystone, Linearity, and Bowline. These distortions are a function of the difference in path length from scanner to surface. Bowline distortion also may occur when projecting on a cured surface.



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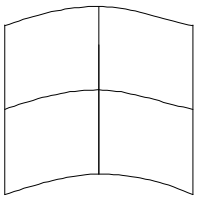

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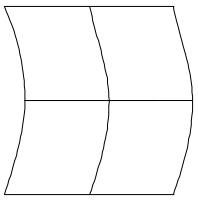

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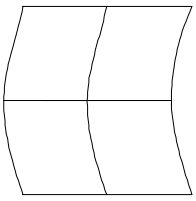


- X

ADJUSTING UGC

For X and Y:

PIN = Pincushion/Barrel

BOW = Bowline

KEY = Keystone

SHR = Shear

LIN = Linearity

SIZ = Scale (Size)

POF = Pincushion Offset

OFF = Offset

Rack-mount version:

FRONT PANEL SWITCH

"NORMAL" (UP) GOES THROUGH CIRCUIT

"BYPASS" (DOWN) BYPASSES CIRCUIT

1. Initial adjustments: when the system is first connected between the computer and the laser projector, put the signal switch in "BYPASS" mode in order to verify system operation. Power up the UGC and switch to "NORMAL" on the front panel. If the image is severely distorted (I.e. twisted or off-center), switch back to "BYPASS" and roughly center ALL potentiometers in their travel range. Switching back to "NORMAL", you should see a dot of a very small image approximately in the center of your screen. Use the SIZ controls to adjust to about full-size; clockwise for a normal image, counterclockwise for an inverted image (if you are doing rear-screen projection).

2. Use the SHR controls to make the axis perpendicular to you screen surface. This is best done by looking at the axis in the center of the image.

3. Use KEY controls to get opposing sides of the image to become equal in size.

4. Switching to a grid test pattern, use the LIN controls to equalize the size of the squares on the opposite sides of the image.

5. Turn the PIN controls fully counterclockwise, and then adjust the POF controls to where the image is roughly centered in the pincushion curve, Turn the PIN controls clockwise until the edges appear to be straight.

6. Use the BOW controls as a asymmetrical pincushion adjustment. If you observe the center axis lines on a test pattern, you will see the bowline correction take effect most clearly. This is usually used in conjunction with pincushion for off-axis projection. Pincushion and Bowline can be "played" against each other to obtain off-axis pincushion correction.

UGC EDGE CONNECTOR PINOUT

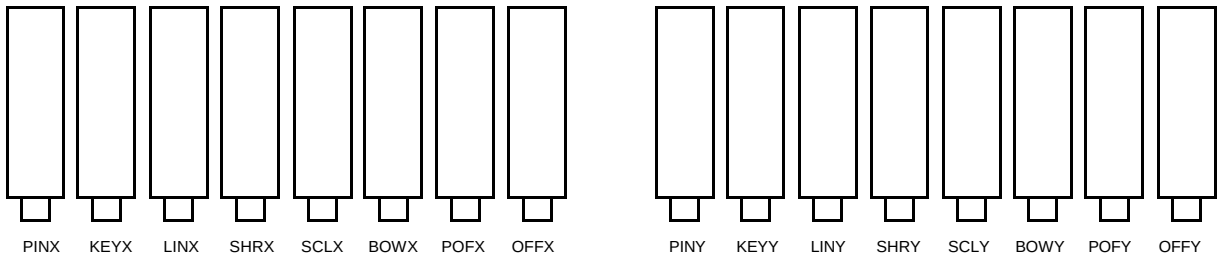
The recommended edge connector for the UGC Card is:

CINCH connector Part Number 50-22SN-7

PINs 1-9	No Connection
PIN 10	X Input +
PIN 11	X Input -
PIN 12	Y Input +
PIN 13	Y Input -
PIN 14	No Connection
PIN 15	X Output +
PIN 16	X Output -
PIN 17	Y Output +
PIN 18	Y Output -
PIN 19	No Connection
PIN 20	V +
PIN 21	V -
PIN 22	Ground

Notes: Supply rails are typically +15 VDC and –15 VDC Regulated. For single-ended operation, Input Grounds are tied to both inverting Input lines. Output Ground is Supply Ground. Inverted Outputs (-) must not be tied to Ground.

Stand-alone UGC Card
Trimmer Potentiometers Layout



PIN is Pincushion	SCL is Scale (or Size)
KEY is Keystone	BOW is Bowline
LIN is Linearity	POF is Pincushion Offset
SHR is Shear	OFF is Offset

UGC OPTIONS

The Universal Geometric Corrector has differential inputs and outputs on the card. This means that there is an X positive and an X negative input and also output. (Y axis is the same)

Differential signals, also known as Balanced Line, are well suited for any long haul transmission of signals, Differential transmission consist of two equal and opposite signals, basically mirror images of each other, and a signal ground. The differential receiver compares the positive and negative signals, effectively rejecting (canceling) any noise that is introduced along the line.

Single Ended, or Unbalanced line, is more akin to the familiar RCA connectors used for consumer audio. A signal and a ground wire are all that is provided for signal transmission. This works fine for short connections, but provides little noise immunity.

The UGC box can be wired for either differential or single ended inputs or outputs, and can convert one type to the other. With a single ended input, both positive inputs are connected to the input signals and both negative inputs are connected to signal ground. Signal ground must also be connected to system ground. With differential input, positive and negative signals are connected to their respective inputs, along with signal ground.

With single ended outputs, the positive outputs are used along with the system ground. The negative outputs are not connected. With differential outputs, the positive and negative outputs are provided, along with the system ground.

UGC BOX PINOUTS

Input Connector DB-25 Male

1	X + (positive) signal
2	Y + (positive) signal
14	X - (negative) signal
15	Y - (negative) signal
25	Ground

Output Connector DB-25 Female

1	X + (positive) signal
2	Y + (positive) signal
14	X - (negative) signal
15	Y - (negative) signal
25	Ground

All other lines are passed through direct from the Input Connector to the Output Connector (i.e. color, shutter, and interlock signals per the ILDA ISP standard).

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