



## Houdini Attributes

This page is intended to be kept up to date as new attributes get added and used in Houdini. I've painstakingly gone through every network context to get this Attributes but I'm only human and I've could have missed a few. Please let me know if I did. (Prof. Wiz)

*(note: If you want to use an attribute and it is not a local variable you can access it with the `point()`, `primitive()`, `vertex()` expression)*

### Surface Operator (SOP) local Variables

Name	Description	Nodes Created in
AGE	Number of seconds a particle has been alive.	Point, Attribute Create, Partition, Lattice, Copy, Polywire
ARC	Arc length distance from root in the L-systems.	Attribute Create, Partition, Lattice, Polywire
AREA	The surface area of the primitive.	Attribute Create, Measure, Lattice
BBX, BBY, BBZ	Position of point within bounding box, ranges [0-1].	Point, Attribute Create, Partition, Lattice, Duplicate, Copy, Polywire

## SOPS

CA	Point alpha value.	Point, Vertex, Attribute Create, Lattice, Polywire
Cd	Diffuse/Display Color.	Point, Polywire
CEX, CEY, CEZ	The centroid of the input.	Add, Transform, Vertex, Primitives, Attribute Create, Partition, Lattice, Duplicate, Copy, xformaxis, Twist, Point, Polywire
COMX, COMY, COMZ	Center of mass.	Attribute Create, Partition, Lattice
CR, CG, CB	Diffuse point or vertex color.	Point, Vertex, Attribute Create, Partition, Lattice, Polywire
CREASE	Point or vertex crease weight value. Crease weight for each edge of primitive	vertex, Primitives, Attribute Create, Partition, Lattice
CURLAYER	Stores the currently processed layer for texture/materials.	Attribute Create, Partition, Lattice
CY	The copy number.	Duplicate, Copy
DIST	Distance to intersection from the Ray operation.	Point, Attribute Create, Partition, Lattice, Ray, Polywire
DIV	Number of divisions to build the circle swept with Polywire.	Attribute Create, Partition, Lattice, Polywire
DRAG	Point drag.	Attribute Create, Partition, Lattice
DX, DY, DZ	Direction from the centroid to the primitive centroid.	Primitives
GCX, GCY, GCZ	The centroid of the input group	Transform, Duplicate, Copy, Soft edit, xformaxis

## SOPS

GEN	Generation in the L-systems.	Attribute Create, Partition, Lattice, Polywire
ID	The ID of the particle in the input.	Attribute Create, Partition, Lattice, Copy
LAGE	The age of the point in the L-system computation.	Attribute Create, Partition, Lattice, Polywire
LIFE	Particle age divided by life expectancy (0 to 1).	Point, Attribute Create, Partition, Copy, Polywire
LOD	Level of detail.	Attribute Create, Partition, Lattice
MAPU, MAPV, MAPW	Point texture coordinates.	Point, Vertex, Attribute Create, Lattice, Polywire
MASS, DRAG	Point mass and drag.	Point. Attribute Create, Partition, Lattice, Polywire
MAT	Material name specification.	Attribute Create, Partition, Lattice
MAXLAYER	The number of layers that are considered active for display.	Point, Vertex, Primitives, Polywire
N	Index of the last point in the geometry.	Add, Attribute Create, Delete, Group, Partition, Lattice
NCY	The number of copies.	Duplicate, Copy
NPR	Total number of primitives or profiles.	Primitives, Soft Edit
NPT	Total number of points.	Point, Vertex, Attribute Create, Partition, Lattice, Soft Edit, Sweep, Polywire
NPT	The total number of points in the template geometry.	Copy

## SOPS

NSEG	This is the number of segments which the segments parameter evaluated to for this segment.	Polywire
NVTX	The number of vertices in the primitive.	vertex, Primitives
NX, NY, NZ	Point normal directions.	Point, Vertex, Primitives, Attribute Create, Partition, Lattice, Polywire
PATH	Path primitive number.	Sweep
PCT	Percentage along backbone (path).	Sweep
PERIMETER	The perimeter of the primitive	Attribute Create, Measure
PR, NPR	Primitive or profile number.	Primitives, Attribute Create, Partition, Lattice
PSCALE	Particle Scale	Point, Attribute Create, Partition, Lattice, Polywire
PT	Point number.	Point, Vertex, Primitives, Attribute Create, Partition, Lattice, Sweep, Polywire
PTDIST	When resolving a segment, this is the distance between the end points of the segment.	Polywire
PTn, NPTn	Append n for the second source.	Point, Vertex, Polywire
RESTX, RESTY, RESTZ	The rest position.	Attribute Create, Partition, Lattice
SEGS	Number of segments to divide a curve up into in Polywire.	Attribute Create, Partition, Lattice, Polywire
SIZEX, SIZEY, SIZEZ	The size of the bounding box of the input.	Add, Attribute Create, Partition, Lattice, Duplicate, Copy, xformaxis, Twist

## SOPS

SPRINGK	Elasticity of a point.	Attribute Create, Partition, Lattice
TENSION, SPRINGK	Spring tension of an edge, and elasticity of a point.	Point, Attribute Create, Partition, Lattice, Polywire
TPT	The actual point number of the currently processed template point, independent of any template groups. See PT above.	Copy
TW	See WEIGHT.	Attribute Create, Partition, Lattice
TX, TY, TZ	Point (Vertex/Primitives)position.	Point, Vertex, Primitives, Attribute Create, Partition, Lattice
UPX, UPY, UPZ	Point up vector values.	Point, Attribute Create, Partition, Lattice
V	If the input geometry contains volume primitives, this is the total value of those volume primitives at the current point.	Iso Surface
VTX, NVTX	Vertex number & total number of vertices.	vertex, Attribute Create, Partition, Lattice
VX, VY, VZ	Velocity direction.	Attribute Create, Partition, Lattice
WEIGHT	Point spline weight, Weight of meta-primitive (0 for non-meta-primitive)	Point, Primitives, Attribute Create, Partition, Lattice, Polywire
WIDTH	The width of the curve. Used by mantra for rendering curves & polywire for generating trees.	Attribute Create, Partition, Lattice, Polywire

SOPS

X, Y, Z	Variables in the implicit function equation.	Iso Surface
XMIN, XMAX	The X extents of the bounding box of the input.	Add, Attribute Create, Partition, Lattice,Duplicate, Copy, xformaxis, Twist
YMIN,YMAX	The Y extents of the bounding box of the input.	Add, Attribute Create, Partition, Lattice,Duplicate, Copy, xformaxis, Twist
ZMIN, ZMAX	The Z extents of the bounding box of the input.	Add, Attribute Create, Partition, Lattice,Duplicate, Copy, xformaxis, Twist

## Fur Attributes

Name	Source	Class	Type	Description
area	Skin	Primitive	Float	This attribute describes the area of each polygon in the skin geometry. This affects the number of curves generated by the primitive. This attribute is optional, if missing the area of each primitive will be computed.
clumporigin	Clumps	Primitive	Float[3]	describes where each clump originates on the rest skin
clumpradius	Clumps	Primitive	Float	maximum distance from the clump origin hairs may originate and still be a member of the clump
furdensity	Skin	Any	Float	This attribute is used as a scalar multiplier to the "Density" parameter and affects the number of generated curves. If this value is reduced by a CVEX skin shader, some curves will be removed to reflect the lowered density value. This attribute is optional, if missing a value of 1 is used.

Fur Attributes

furlength	Skin	Any	Float	This attribute is used as a scalar multiplier to the “Length” parameter and affects the length of the generated curves. This attribute is optional, if missing a value of 1 is used.
rest	Skin	Point or Vertex	Float[3]	This attribute describes the rest position of each point in the skin geometry. This affects the calculation of each polygon’s area when determining the number of generated curves. This value is also used to map each generated curve to a clump. This attribute is optional, if missing the point’s position is used.

## Instancing point attributes

When you copy or instance geometry onto points, Houdini looks for specific attributes on the destination points to customize each copy/instance.

Attribute name	Data type	Description
orient	float4 (quaternion)	Orientation of the copy*
pscale	float	Uniform scale
scale	float3	Non-uniform scale
N	vector	*
up	vector	Up vector of the copy*
v	vector	Velocity of the copy (for orientation and/or motion blur)*
rot	float4 (quaternion)	
trans	vector	

Houdini will try to find orientation attributes in the following order:

If an orient attribute exists, use it as the orientation.

Otherwise, If N exists, make the copy's +Z axis point in that direction.

Otherwise, if v exists, make the copy's +Z axis point in that direction.

Otherwise, if up exists, make the copy's +Y axis point in that direction.

### How Houdini calculates the transform matrix

O	Orient matrix
S	Scale matrix (scale * pscale)
L	Alignment matrix, defined by N or v and up
R	Rot matrix
T	Trans matrix (trans + P)

## Instancing Point Attributes

IF N exists AND up exists and isn't {0,0,0}:

L = mlookat(N, 0, up)

ELSE IF N exists:

L = dihedral({0, 0, 1}, N)

ELSE IF v exists AND up exists and isn't {0, 0, 0}:

L = mlookat(v, 0, up)

ELSE IF v exists:

L = dihedral({0, 0, 1}, v)

IF orient exists:

Transform = O \* R \* S \* T

ELSE:

Transform = S \* L \* R \* T

## L- System Attributes

Name	Description
a	The value of the Angle parameter.
b	The value of the b parameter.
c	The value of the c parameter.
d	The value of the d parameter.
g	The age of the current rule, initially 0.
i	The offset into the current L-system string where the rule is being applied.
t	The iteration count, initially 0.
x, y, z	Current turtle position in space.
A	Arclength from the root of the tree to the current point.
L	Current length increment at the point.
T	The value of the Gravity parameter.
U	Color map U value.
V	Color map V value.
W	Width at the current point.

## Particle Summaries

Name	Summary
acceleration	Explicitly sets a particle's acceleration.
age	Sets the ages and/or expected lifespan of particles.
angvelocity	Sets a particle's angular velocity.
attractor	Attracts or repels particles using a referenced Force SOP or Point SOP.
attribtransfer	Transfers point or vertex attributes from reference geometry onto particles.
attribute	Adds custom attributes to particles.
collect	Merges particle streams together so you can act on them collectively.
collision	Sets attributes on and/or groups particles when they collide with geometry.
color	Changes a particle's diffuse color and/or alpha.
creep	Causes particles to stick to geometry.
drag	Applies drag to the velocity of particles.
event	Generates events based on rules.
fan	Applies force on particles like a cone-shaped fan.
fetch	Imports particle streams from other networks.
fireworks	Creates a simple fireworks system.
follow	Makes particles follow a leader.
force	Applies a global directional force, such as gravity.
group	Creates and/or combines named groups of particles.
hitinfo	Manually sets attributes associated with collisions.
instance	Renders instanced geometry on a particle.

Particle Summaries

interact	Make particles attract or repel other particles.
kill	Kills particles based on expressions.
limit	Creates collisions when particles reach a limit boundary.
lineage	Manually sets attributes associated with the particle's family tree.
location	Emits particles at a location in space.
lookat	Rotates particles so they point in a certain direction.
null	Passes inputs through unaffected.
orbit	Makes particles orbit a centerpoint.
position	Explicitly sets a particle's position.
property	Manually set physical attributes.
proximity	Sets attributes on and/or creates groups of particles based on which other particles are nearby.
render	Controls how particles render.
resistance	Calculates air or water resistance on instanced geometry.
rotation	Rotates the particle frame of reference, allowing instanced geometry to point in a different direction from the particle motion.
softbody	Performs soft body deformations similar to the Spring sop.
softlimit	Creates a boundry collisions like Limit, but with spongier bounces.
source	Emits particles from geometry.
speedlimit	Enforces minimum and maximum velocities.
split	Splits (emits) particles from existing particles.
sprite	Changes sprite rendering attributes like texture coordinates, SHOP, rotation, and size.
state	Sets the state information of particles.

Particle Summaries

stream	Emit particles from areas where streams of particles mix.
subnet	Encapsulates the functionality of a POP network inside a node.
suppress	Turns off default rules controlling particle behavior.
switch	Switches between input streams.
torque	Rotates particles around another point.
translation	Moves the particle frame of reference, offsetting instanced geometry from the particle position.
turn	Changes the direction of particles without affecting speed.
upvector	Manually sets a particle's up vector.
v_sprinkler	Simulates a sprinkler.
velocity	Explicitly sets a particle's velocity.
vex	Executes VEX code to modify particles.
wind	Pushes particles up to a maximum speed.

## Particle (POP) Variables

### Standard POP local variables

Name	Description
AGE	The seconds a particle in the template has been alive.
AX AY AZ	Acceleration of the particle.
BBX BBY BBZ	The point's relative position in the bounding box.
DEAD	Point is dead.
ITER	Processing iteration number.
JUSTHIT	A collision for this particle was detected (for example, by the Collision POP) during the processing of this timestep (that is, this iteration of the particle simulation). This variable is cleared at the beginning of each timestep. Note that the collision POP actually detects any collisions which would have occurred the during the previous frame.
LIFE	Percent of total life used (from 0 to 1).
LIFESPAN	Expected lifetime of particle.
MAPU MAPV MAPW	Point or vertex texture coordinates.
NPT	Total number of points.
NGRP	Total number of points in source group.
NX NY NZ	Normal vector.
PT	The point number of the currently processed point.
RESTX RESTY RESTZ	The rest position.

Particle Variables

SLIDING	The sliding state of the particle.
SPRINGK	Elasticity of a point.
STOPPED	Point is stopped.
STUCK	1 if particle is stuck to a collision object.
TENSION	Spring tension.
TIMEINC	Time increment.
TX TY TZ	Point position.
U V	Surface UV values.
VX VY VZ	Velocity direction.
WEIGHT	Point spline weight.

**Added by Collision POP/Limit POP**

Name	Description
DIST	Distance from particle to last collision.
HCR HCG HCB	Diffuse color at the collision point on the surface the particle collided with.
HITID	ID for last collision. You can control how this attribute is set in the Collision or Limit POP to help distinguish types of collisions.
HITTIME	The time at which the last collision occurred.
HMAPU HMAPV	The texture map UV coordinates for the surface location where the last collision occurred.
HNX HNY HNZ	The normal at the surface location where the last collision occurred.
HTX HTY HTZ	World space position of the last collision.

Particle Variables

HU HV	The UV coordinates for the surface location where the last collision occurred.
NUMHIT	Number of times the particle has collided.

**Added by Color POP**

Name	Description
CA	Point or vertex alpha value.
CR CG CB	Diffuse point or vertex color.

**Added by Property POP**

Name	Description
ATTRACT	Attractor point.
CHARGE	Charge of the particle.
CLING	Point is clinging to geometry.
DRAG	Point drag.
FOLLOW	Leader to follow.
MASS	Point mass.
PSCALE	Particle Scale.
SCALEX SCALEY SCALEZ	Non-uniform scale.

**Added by Proximity POP**

Name	Description
NEAREST	Either the point number or id of the particle nearest to this one.

Particle Variables

NEARESTDIST	The distance to the nearest particle.
NUMPROXIMITY	The number of particles within a specified proximity to this particle.

**Added by Rotation POP**

Name	Description
ROTA	Rotation angle.
ROTX ROTY ROTZ	Rotation axis.

**Added by Source POP**

Name	Description
GEN	Generation.
ID	ID number.
ORIGIN	Original Source point was birthed from.
PARENT	Parent's ID Number.

**Added by Speed Limit POP**

Name	Description
SPEEDMAX	Maximum speed.
SPEEDMIN	Minimum speed.

**Added by Sprite POP**

Name	Description
SROT	Sprite rotation around view axis (in degrees).
STEXU STEXV	Texture coordinate of sprite's lower-left corner.

STEXW STEXH	Size of sprite in texture space.
SX SY	Sprite scale.

**Controlled by Suppress Rule POP**

Name	Description
SUPPPOS	Suppress default position rule.
SUPPVEL	Suppress default velocity rule.
SUPPUP	Suppress default up-vector rule.
SUPPAGE	Suppress default aging rule.
SUPPROT	1 if particle is suppressing its default rotation rule.
SUPPANGVEL	1 if particle is suppressing its default angular velocity rule.

**Added by Up Vector POP**

Name	Description
PVX PVY PVZ	Previous velocity.
UPX UPY UPZ	Up vector.

**Added by Location, Source, Softbody, Split POPs**

Name	Description
SPEED	Absolute speed of particle.

## RIB Attributes

Name	Description
<b>interpolateboundary</b>	An <b>integer</b> primitive or detail attribute which can be set to 1 or 0. This attribute will turn on the interpolate boundary flag for sub-division surfaces in the RIB stream.
<b>ri_curvestep</b>	An <b>integer</b> detail attribute which determines the step value for curve primitives.
<b>ri_curvebasis</b>	A <b>string</b> detail attribute which determines the basis used for cubic curve primitives.
<b>ri_curveinterpolation</b>	A <b>string</b> detail attribute which determines the interpolation (linear or cubic) for curve primitives.
<b>ri_subdivscheme</b>	A <b>string</b> detail attribute which determines the subdivision scheme to be used. Defaults to <code>catmull-clark</code> .
<b>creaseweight</b>	A <b>float</b> primitive or vertex attribute which defines the crease weight for sub-division surfaces.
<b>Pref</b>	A <b>matrix</b> primitive attribute for metaballs. This determines the "rest" position for metaballs.