DICOM Correction Proposal

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Date of Last Update	2014/09/08
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Correction Number CP-1365
Log Summary: Support of more than 16 bit in point index lists
Name of Standard PS3.3, PS3.6,
Rationale for Correction: The following attributes are encoded with an OW VR: - Primitive Point Index List (0066,0029) - Triangle Point Index List (0066,0023) - Edge Point Index List (0066,0024) - Vertex Point Index List (0066,0025). This limits the number of usable points within the Surface Segmentation IOD to 65536 within one surface. However, surfaces can contain more than 65536 points in many use cases. This correction replaces them with alternative index lists that extends the limitation to 32 bit per point, which is practical for all use cases.
Correction Wording:

Amend PS 3.3:

C.27.2 Points Macro

Table C.27-2 specifies the Attributes of the Points Macro.

Table C.27-2
POINTS MACRO ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Number Of Surface Points	(0066,0015)	1	Specifies the number of points in the point set. ~~**Shall be less than or equal to 65535, if there are indexes into Points Coordinates Data (0066,0016) that are limit in length.**~~ **See C.27.2.1.1.**
Point Coordinates Data	(0066,0016)	1	See C.27.2.1.1
…	…	…	…

C.27.2.1 Points Macro Attribute Descriptions

All Attributes within this module containing points or vectors are in x-y-z order. If multiple elements are encoded, the ordering is $x_1,y_1,z_1,\ldots,x_n,y_n,z_n$.

The points are in the coordinate system identified by the Frame of Reference UID (0020,0052). To map these points into the coordinate system of another SOP Instance a Spatial Registration Instance can be used.

C.27.2.1.1 Point Coordinates Data

When referencing individual points the index of the first point shall be 1.

~~Note: For the Attributes (defined in C.27.4 Surface Mesh Primitives Macro) that index the coordinates, the OW VR imposes the limitation to 65535 coordinates.~~

C.27.3 Vectors Macro

Table C.27-3 specifies the attributes of the Vectors Macro.

Table C.27-3
VECTORS MACRO ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
Number of Vectors	(0066,001E)	1	The number of vectors in the Vector Coordinate Data (0066,0021). See C.27.3.1.
Vector Dimensionality	(0066,001F)	1	The dimensionality of the underlying vector field. See C.27.3.1.
Vector Accuracy	(0066,0020)	3	A single standard deviation for all the vectors' coordinates. The units shall be the same as the units of the coordinate system in which the vector coordinates are specified. See C.27.3.1.
Vector Coordinate Data	(0066,0021)	1	A data stream of coordinates encoded as floats. See C.27.3.1.

C.27.3.1 Vectors Macro Attribute Descriptions

All Attributes within this module containing points or vectors are encoded as multi-valued floats in an x-y-z ordering. If multiple elements are encoded, the ordering is $x_1,y_1,z_1,\ldots,x_n,y_n,z_n$.

The vectors encoded in this macro can be anything from 1D to nD objects. The vectors are encoded as a stream of values in the Vector Coordinate Data (0066,0021) Attribute. Vector Dimensionality (0066,001F) defines how many subsequent entries in Vector Coordinate Data (0066,0021) describe one element. Vector Coordinate Data (0066,0021) shall have (Number of Vectors) x (Vector Dimensionality) values.

For measured vectors, the Vector Accuracy Attribute (0066,0020) describes the error per dimension in a multi-valued float attribute.

Note**s**: ~~**1.**~~ The vectors are located at the points specified by the table including this macro.

~~2. Though not explicitly limited, so that the macro may be of general use, the Number of Vectors (0066,001E) is implicitly limited by the number of points specified by the table including this macro, which in the case of C.27.1 Surface Mesh Module, is the Number of Surface Points (0066,0015), which is limited to 65535, because of the limit on the number of index values.~~

C.27.4 Surface Mesh Primitives Macro

Table C.27-4 specifies the attributes of the Surface Mesh Primitives Macro.

Table C.27-4
SURFACE MESH PRIMITIVES MACRO ATTRIBUTES

Attribute Name	Tag	Type	Attribute Description
~~Vertex Point Index List~~	~~(0066,0025)~~	~~2~~	~~Contains n point indices describing Vertices.~~ ~~See C.27.4.1.~~
Long Vertex Point Index List	**(0066,43)**	**2**	**Contains n point indices describing Vertices.** **See C.27.4.1.**
~~Edge Point Index List~~	~~(0066,0024)~~	~~2~~	~~Contains 2n point indices describing unconnected Edges.~~ ~~See C.27.4.1.~~
Long Edge Point Index List	**(0066,0042)**	**2**	**Contains 2n point indices describing unconnected Edges.** **See C.27.4.1.**
~~Triangle Point Index List~~	~~(0066,0023)~~	~~2~~	~~Contains 3n point indices describing unconnected Triangles.~~ ~~See C.27.4.1.~~
Long Triangle Point Index List	**(0066,0041)**	**2**	**Contains 3n point indices describing unconnected Triangles.** **See C.27.4.1.**
Triangle Strip Sequence	(0066,0026)	2	All Triangle Strips in this Surface. Zero or more Items shall be included in this sequence.
~~>Primitive Point Index List~~	~~(0066,0029)~~	~~1C~~	~~See C.27.4.1.~~
>Long Primitive Point Index List	**(0066,0040)**	**1**	**See C.27.4.1.**
Triangle Fan Sequence	(0066,0027)	2	All Triangle Fans in this Surface. Zero or more Items shall be included in this sequence.
~~>Primitive Point Index List~~	~~(0066,0029)~~	~~1~~	~~See C.27.4.1.~~
>Long Primitive Point Index List	**(0066,0040)**	**1**	**See C.27.4.1.**
Line Sequence	(0066,0028)	2	All Lines in this Surface. Zero or more Items shall be included in this sequence.
~~>Primitive Point Index List~~	~~(0066,0029)~~	~~1~~	~~See C.27.4.1.~~
>Long Primitive Point Index List	**(0066,0040)**	**1**	**See C.27.4.1.**
Facet Sequence	(0066,0034)	2	All Facets in this Surface. Each sequence Item describes one facet. Zero or more Items shall be included in this sequence.
~~>Primitive Point Index List~~	~~(0066,0029)~~	~~1~~	~~See C.27.4.1.~~
>Long Primitive Point Index List	**(0066,0040)**	**1**	**See C.27.4.1.**

C.27.4.1 Surface Mesh Primitives Macro Attribute Descriptions

The Surface Mesh Primitives Macro uses point indices to reference the point rather than repeating point coordinates. All of the point coordinates used are specified within the Surface Points Sequence (0066,0011) of the same Surface Sequence (0066,0002) item. Point indices are described in C.27.2.1.1.

Note: In a previous edition, other Attributes were used that had an OW VR and a limitation to no more than 65535 points per surface. These have been retired and replaced with new Attributes. See PS 3.3 2013.

A Surface Mesh shall contain one or more of the following primitive types:

Vertex	a single Vertex, referencing a single point
Edge	an Edge, referencing two points
Line	a series of connected points describing a path
Triangle	a Triangle, referencing three points:
Triangle Strip	a Triangle Strip with n triangles, referencing n+2 points. The first three referenced points describe the first triangle, the second, third and fourth referenced points describe the second triangle.
Triangle Fan	a Triangle Fan with n triangles, referencing n+2 points. The first referenced point is in the center of the fan. Together with two subsequent referenced points, it describes a complete triangle.
Facet	a closed planar polygon, referencing n points. The final point in the point index list shall be connected to the first point in the point index list to close the facet.

If the Surface Points Normals Sequence (0066,0012) is not present, the default normals can be derived from the Surface Mesh Primitives.

For the Triangle Strip, Triangle Fan, and Facet the Primitive Point Index List (0066,0029) the ordering of the point references implies the direction of the primitive's normal: The normal points in the direction from which the referenced points are specified in a counterclockwise order. For finite volumes this shall be the outward direction.

For the Line primitive, the ordering of the point references defines a directed path, starting with the first point and ending with the last point referenced in each Primitive Point Index List (0066,0029).

For Primitives of type Triangle Strip or Triangle Fan, the orientation of the normals is given by the order of the points in the first triangle.

Note: These points may be used to compute normals to the primitive. (See section C.27.1.1.6.) The order these point references are presented in the Primitive Point Index List (0066,0029) will affect the direction the computed normal points. If the order of the point references is reversed, the direction of the normals will be reversed as well.

Add new Data Elements and flag old ones as retired in data dictionary PS 3.6

Tag	*Name*	*Keyword*	*VR*	*VM*	
(0066,0023)	***Triangle Point Index List***	***TrianglePointIndexList***	***OW***	***1***	***RET***
(0066,0024)	***Edge Point Index List***	***EdgePointIndexList***	***OW***	***1***	***RET***
(0066,0025)	***Vertex Point Index List***	***VertexPointIndexList***	***OW***	***1***	***RET***
(0066,0029)	***Primitive Point Index List***	***PrimitivePointIndexList***	***OW***	***1***	***RET***
(0066,0040)	**Long Primitive Point Index List**	**LongPrimitivePointIndexList**	**UL**	**1-n**	
(0066,0041)	**Long Triangle Point Index List**	**LongTrianglePointIndexList**	**UL**	**3-3n**	
(0066,0042)	**Long Edge Point Index List**	**LongEdgePointIndexList**	**UL**	**2-2n**	
(0066,0043)	**Long Vertex Point Index List**	**LongVertexPointIndexList**	**UL**	**1-n**	