NCL/IGES REFERENCE DOCUMENT
Version 10.0

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NUMERICAL
CONTROL
COMPUTER
SCIENCES

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10 NCL/IGES

The name IGES is an acronym which stands for the Initial Graphics Exchange Specification. This standard has been developed to allow the exchange of geometric and graphic data between dissimilar CAD/CAM systems.

The ***NCL/IGES*** converter imports and exports ASCII IGES files. Imported files are converted to ***NCL*** Unibase files and ***NCL*** Unibase files are exported to IGES files.

NCL/IGES is implemented as a subset of the U.S. Department of Commerce IGES Version 5.0 supporting those entities that allow a direct conversion into ***NCL*** entity types.

10.1 Startup

To start ***NCL/IGES***:

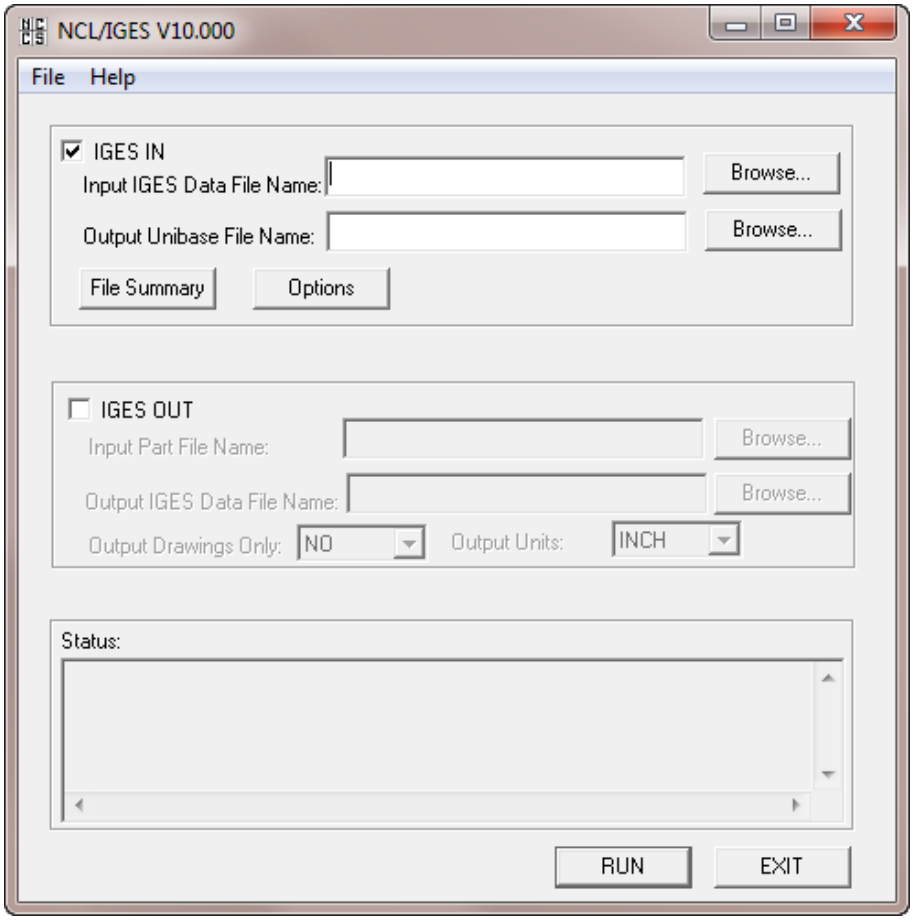
From within ***NCL***, click *FILE* > *IGES*

NCL/IGES can also be started as followed:

Double click the IGES shortcut icon in the ***NCCS*** folder on the Desktop.

10.2 Importing IGES Files

Start ***NCL/IGES*** as previously described. The form on the next page will appear:



10.2.1 IGES IN

This button will be depressed by default. Press this button to switch from "IGES OUT" mode to "IGES IN" mode.

10.2.2 Input IGES Data File Name:

Enter the name of the IGES file you wish to import. Use the *Browse* button to browse for a file.

10.2.3 Output Unibase File Name:

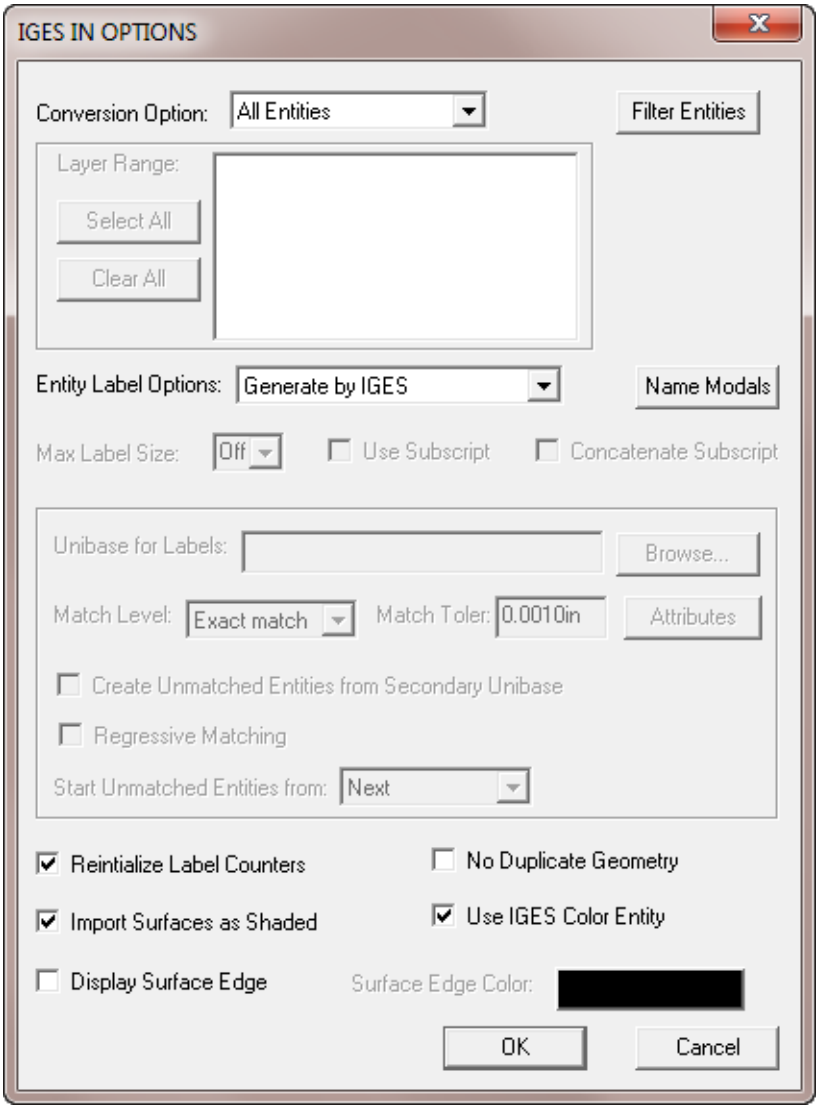
Enter the desired name of the Unibase file which will contain the converted entities. If an existing file is specified it will be overwritten. If an output file is not specified the input file name will be used with a *.u* extension.

10.2.4 File Summary

Click this button to obtain a summary of the entities contained in the IGES file. The summary data will be displayed in the Status Window. This data will also be written to a file named *input.lst*, where *input* is the name of the input IGES file.

10.2.5 Options

Click this button to set various conversion options. The following "IGES IN" Options form will appear:



Conversion Option

All entities

Select this option to convert all IGES entities (accept the DRAWING entity) regardless of which layer the entities are on.

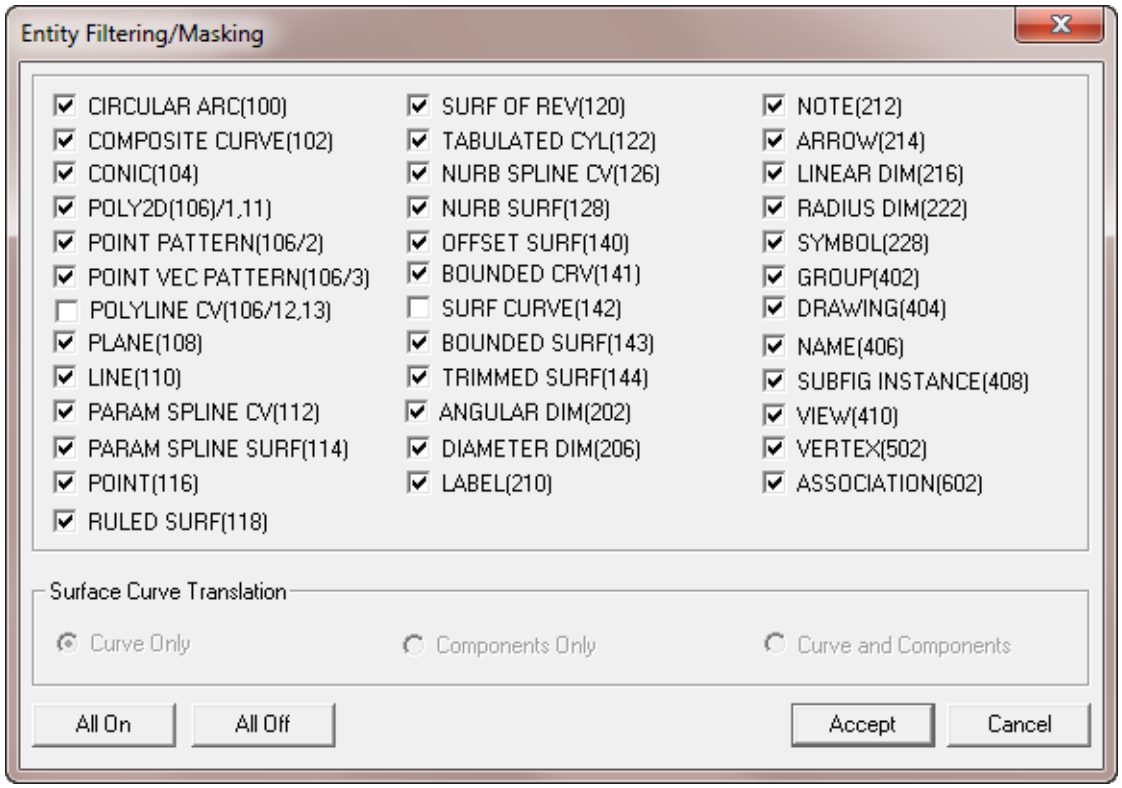
By layer

Select this option to convert entities by layer. When this option is selected the Layer Range list box will be activated and list of layers that exist in the input IGES file will be displayed.

Click on the layers you wish to convert. Click *Select All* to select all layers. Click *Clear All* to clear previously selected layers.

Filter Entities

Click this button to filter out specific entity types from the conversion. The form shown on next page will appear.



Depress or check the box next to the entity types you want to translate.

Check item “POLYLINE CV (106/12,13)” will cause IGES to translate the corresponding data as a Rational B-Spline curve, otherwise it will be translated as a pattern.

Check item “SURF CURVE (142) will activate the Surface Curve Translation Section with the following options.

Curve Only

The surface curve is translated, but the components are not translated independently.

Components Only

The components of the surface curve are translated but the surface curve is not.

Curve and Components

The surface curve and its components are translated.

All On

Press this button to translate all entities.

All Off

Press this button to filter out all entities.

See the Imported Entity Mapping and Exported Entity Mapping sections for detail of the entity types. Also see the View Entity (Type 410) and the Drawing Entity (Type 404) for details of these two entities.

ACCEPT

Click this button to accept the filter settings and exit the form.

CANCEL

Click this button to exit the form without saving the filter settings.

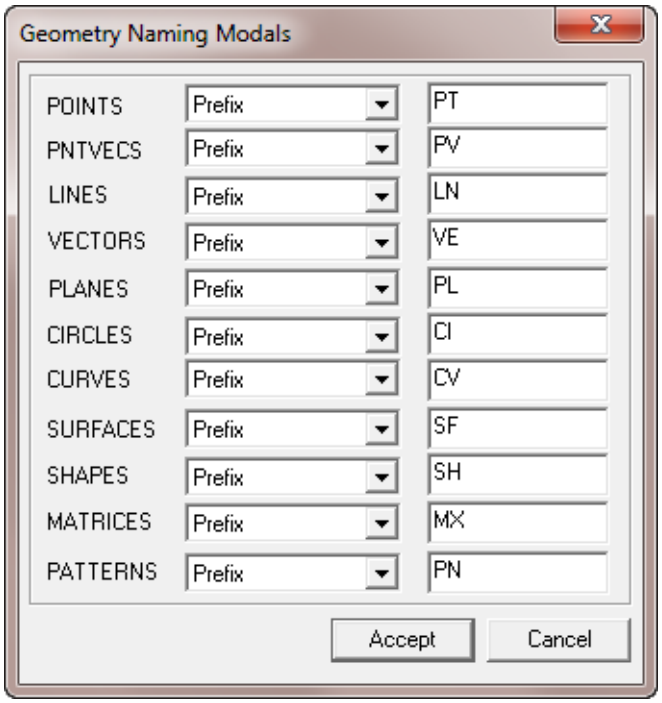
Entity Label Option

The entity label options are used to determine how the converted entities will be labeled (named). Click this button to produce the form shown on next page.

Generate by IGES

Click this option if you want ***NCL/IGES*** to automatically assign a name to the imported entities according to the "Name Modals" setup. This is the default option.

Click the "**Name Modals**" button to open the following form.



Choose the desired naming convention (prefix or subscript) by clicking the toggle button next to the entity type.

When Prefix is used entities will be named using the 2 character prefix shown in the box to the right of each entity type and a number, starting at 1.

The default setting of this form uses the conventional ***NCL*** autonaming convention.

For example:

Points	PT1, PT2,...PTn
Lines	LN1,LN2,...LNn
Circles	CI1,CI2,...CIn
Planes	PL1,PL2,...PLn
Curves	CV1,CV2,...CVn
Surfaces	SF1,SF2,...SFn
Paterns	PN1,PN2,...PNn

When Subscript is used entities will be named using the characters (up to six characters can be entered) shown in the box to the right of each entity type and a subscript number, starting at 1.

For example:

Entity Type	Right Column Entry	Entity Names
Points	PTT	PTT(1),PTT(2),...PTT(n)
Lines	LNN	LNN(1),LNN(2),...LNN(n)
Circles	CII	CII(1),CII(2),...CII(n)
Planes	PLL	PLL(1),PLL(2),...PLL(n)
Curves	CVV	CVV(1),CVV(2),...CVV(n)
Surfaces	SFF	SFF(1),SFF(2),...SFF(n)
Paterns	PNN	PNN(1),PNN(2),...PNN(n)

Click the ACCEPT button to accept the current settings and exit the form.

Click the CANCEL button to exit the form without saving any changes.

From IGES Label Field or From IGES Property

Click either one of this option will activate the following buttons:

Max Label Size

This specifies the maximum size of the labels allowed.

Use Subscript

This specifies labels as subscripted name.

Concatenate Subscript

This specifies labels created by concatenating the label and subscript fields of the IGES file. This is usually for IGES files generated by UG-II.

Using Existing Unibase

Click this option if an IGES file which contains a model that is theoretically the same as an existing unibase with some minor differences. In this case, ***NCL/IGES*** will compare the entities in the input IGES file with entities in the specified unibase. If the compared entities are exactly the same, then the names used in the existing unibase will be used for the same entities in the IGES file, otherwise a new name will be used.

There are four levels of matching with this option. All entities with an exact match will be translated first. Once all matching entities are translated, ***NCL/IGES*** will compare the unmatched entities searching for the closest match. Depending on the entity type there are up to four levels to determine the closest match:

Point:

Level 1 - Searches all remaining unmatched points for the closest point.
Level 2:4 - Not used.

Lines:

Level 1 - The closest line that has the same length and direction.
Level 2 - The closest line that has the same direction.
Level 3 - The line with the closest start point.
Level 4 - Not used.

Circles:

Level 1 - Circle with the same center point, radius and central angle but with reversed normal vector.
Level 2 - Circle with the same center point, central angle and normal vector but with different radius.
Level 3 - Circle with the same radius, central angle and normal vector.
Level 4 - Closest circle with the same central angle and normal vector.

Planes:

Level 1 - Plane with the same normal vector and the closest point.
Level 2:4 - Not used.

Polylines and Patterns:

Level 1 - Polyline or pattern with all points translated.
Level 2 - Polyline or pattern with the same number of points.
Level 3:4 - Not used.

Point-vectors:

Level 1 - Point-vector with the same length, direction and closest point.
Level 2 - Point-vector with the same direction and the closest point.
Level 3:4 - Not used

Curves:

Level 1 - Closest curve that is an exact match but has been translated.
Level 2 - Closest curve with same sized bounding box and with end points translated along a vector to a different position.
Level 3 - Closest curve with end points translated along a vector to a different position.
Level 4 - Not used.

Rational B-spline Surfaces and Mesh Surfaces:

Planar Surface:

Level 1 - Planar surface with same normal, same distance and the closest boundary.
Level 2 - Planar surface with same normal and with the closest boundary.
Level 3:4 - Not used.

Spherical Surfaces:

Level 1 - Spherical surface with same center and radius.
Level 2 - Spherical surface with same center point, but different radius.
Level 3 - Spherical surface with the closest center point.
Level 4 - Not used.

Cylindrical Surfaces:

Level 1 - Closest cylindrical surface with the same radius, axis vector and height.
Level 2 - Cylindrical surface with the same start point, radius and axis vector but with a different height.
Level 3 - Cylindrical surface with the same start point and axis vector but with a different height and radius.
Level 4 - Cylindrical surface with the same axis vector, closest radius.

Cone Surfaces:

Level 1 - Closest cone surface with the same radius, angle, axis vector and height.
Level 2 - Cone surface with the same start point, radius, angle and axis vector but with a different height.
Level 3 - Cone surface with the same start point, angle and axis vector but with a different height and radius.
Level 4 - Not used.

Freeform Surface:

Level 1 - Same surface but reversed in U and/or V.
Level 2 - Closest surface with same shape.
Level 3 - Surface with same corner points.
Level 4 - Surface with same corner points to within 5 times tolerance

Trimmed Surfaces:

Base surface goes through the same qualifications as untrimmed surfaces. If the base surface match for the level being tested, then

Level 1 - Surface with the same number of trimming curves and a bounding box that intersects the bounding box of the surface being matched.
Level 2 - Surface with a bounding box that intersects the bounding box of the surface being matched.
Level 3:4 - Not used.

All the remaining unmatched entities will be labeled with the standard prefix for that type of entity, and the number will start one higher than the highest number used for that type of entity. The label of any entity not used in the existing unibase will be displayed in the "*Status*" area of the main form. This information will also be placed into the "*.lst*" file.

Unibase for Labels

This feature is only activated when the "Using Existing Unibase" option is selected. Enter the file name of the secondary unibase or use the *Browse* button to browse for a secondary unibase file

Match Level

This feature is only activated when the "Using Existing Unibase" option is selected. There are five choices for this toggle button, they are: Exact Match, Level 1, Level 2, Level 3, and Level 4.

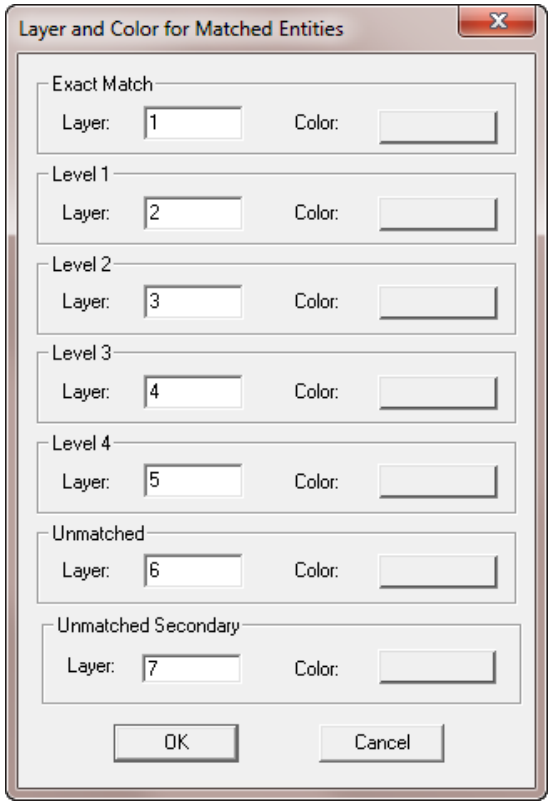
Matching Toler

This feature is only activated when the "Using Existing Unibase" or "No Duplicate Geometry" option is selected. This specifies the tolerance under which two entities are considered to be matched or duplicated. This value will be used as is in "Exact" matching or "No Duplicate Geometry". This value will be expanded by different internal specified factors for the other levels of matching.

Attribute

This feature is only activated when the "Using Existing Unibase" option is selected. Click this button to open the form as shown on next page.

This form is used to assign the matching/unmatching entities put in different layers and colors according to the matching levels



Create Unmatched Entities from Secondary Unibase

This feature is only activated when the "Using Existing Unibase" option is selected. Check this item to create unmatched entities from the secondary unibase, i.e. the existing unibase.

Regressive Matching

This feature is only activated when the "Using Existing Unibase" option is selected. Check this item to initialize regressive matching. Regressive matching matches each IGES entity with both the available (unmatch) unibase entities and the other entities of the same type that were previously matched on this level. If this option is not checked IGES would search an entity in the secondary unibase that matches the entity from the IGES file per the rules base on the current level of matching. As soon as a match is found, the new entity is assigned the label of the corresponding entity from the secondary unibase.

Start Unmatched Entities from

This feature is only activated when the "Using Existing Unibase" option is selected. There are two choices for this toggle button, they are: Next or Secondary. This controls how the unmatched entities labels number in the new unibase started. The unmatched entities label number can be started from the next highest entity count or the entity after the highest matched entity in the secondary unibase.

Re-initialize Label Counters

Check this item to re-initialize the automatic label generation counters when translating multiple files in a single IGES run.

No Duplicate Geometry

Check this item will allow only one copy of duplicate entities to be translated.

Import surfaces as shaded

When this item is checked, imported surfaces will be flagged as shaded. When the resulting Unibase is loaded into ***NCL*** and *View>Modals>Shading* is set to *On*, the imported surfaces will be shaded. Otherwise the imported surfaces must be set to *shaded* while in ***NCL***.

Use IGES Color Entity

When this item is checked, imported entities will be assigned with color specified by the Color Entity (314), otherwise the default ***NCL*** colors will be assigned to the imported entities. If the color specified in the Color Entity is not supported by ***NCL***, the closest matched ***NCL*** color will be used.

Display Surface Edge

When this item is checked, imported surfaces will be rendered with their edges displayed.

Surface Edge Color

Defines the color to display surface edges with. 'Default' uses the same color as the surface is displayed in, while the other choices select an actual color.

OK

Click this button to accept the changes and close the IGES in Options form.

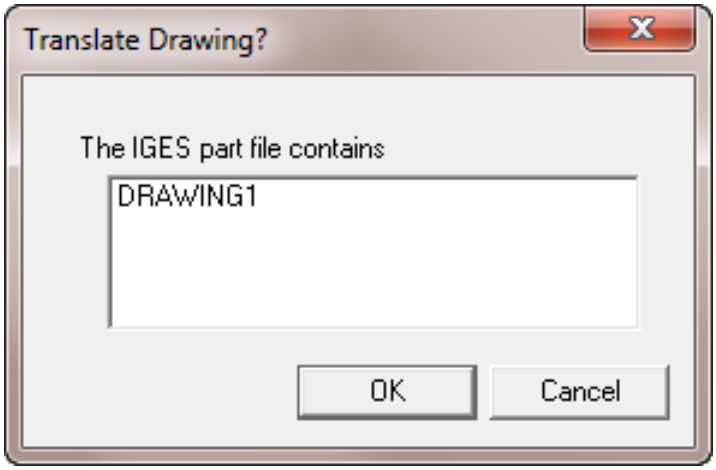
Cancel

Click this button to cancel all the changes and close the IGES in Options form.

10.2.6 RUN

Click this button to begin the conversion. IGES header information, percentage of file processed, and translation results will be displayed in the status window. The header and result data is also written to the *output.lst* file, where *output* is the name of the output Unibase file.

If the IGES file contains the IGES DRAWING entity you will be presented with the following form giving you the option to translate the DRAWING data or the 3D model data.



Click *CANCEL* to translate only the 3D model data. This would be the normal course of action.

To translate a *Drawing*, click on the Drawing you want to translate then click *OK*.

See the *Translating the IGES Drawing Entity* section for more details about *Drawings*.

10.2.7 EXIT

Click this button to exit ***NCL/IGES***.

10.3 Viewing The Translated File

From within ***NCL*** click *FILE > LOADU* and click on the ***NCL/IGES*** created Unibase. The Unibase file can also be loaded using the *UBFN* or *LOADU* command within a ***NCL*** part program file.

10.4 Translating The IGES View Entity (Type 410)

The IGES View Entity (type 410) is translated into ***NCL*** views with the name IGES1, IGES2, etc. depending on how many views are present in the IGES file. To determine if the IGES translation program has translated views, read the *File Summary* that appears after an IGES file is translated or review the contents of the .lst file that is created during the translation process.

If you have already loaded the resultant Unibase, click *VIEW > MANAGE > LOAD VW* to list and/or load views.

The intent of the IGES View Entity differs depending on the exporting system. The following are the most common scenarios:

- Each IGES created view would simply display the 3D model in a different spacial orientation, much the same way that ***NCL*** views are displayed. In this case the entire model can be viewed in either the IGES created views and/or any ***NCL*** created view. In such cases the IGES views have no significant intent other than to simply "view" the model.

- Each IGES view, while perhaps representing a different spacial orientation of the model, may contain entities that are not visible in any other view. For example, *drafting* entities may appear in the IGES1 view but not in any other view. Similarly, the IGES2 view may display a fixture base that is not present in any other view. In other cases an IGES view may contain only a few entities, perhaps representing a sectioned view of the model.

When entities appear only in a particular view, such as previously described, they are known as *view dependent* entities. View dependent entities can *only* be displayed in the view on which they are dependent. These entities do, however, exist in model space and can be accessed by ***NCL***'s motion and geometry commands. To see a view dependent entity you must load the view that contains

that entity. In some cases none of the views will contain a complete view of the model. If this is the case you will want to remove the *view dependent* attributes of the model.

10.4.1 Removing View Dependency

There are a couple of ways to work around view dependency. The easiest way is to utilize the "Filter Setup" Form of the "IGES IN" section. First, click the *OPTIONS* button, then *Filter Entities* button. Once the filter set up form opened, undepressed the "*VIEW 410*" button and click *ACCEPT*. In this way, the view dependency will not be translated.

The other way is to retrieve the model from the Unibase using ***NCL***'s *UBFN* and *GET* commands. When entities are retrieved in this manner the model's view attributes are not retrieved. For example:

```
UBFN /iges_created_unibase.u
GET  /ALL
UBFN /CLOSE
SAVEU/new_unibase.u
```

It should be noted that when using this technique drafting entities will not be retrieved.

Another way to remove view dependency is to remove the view dependent flag from the original IGES file. This could be done using the following *gawk* script. For example:

Using a text editor, create a file call view.awk with the following content.

```
# Program to remove view dependency from an IGES file

BEGIN {icol=41; i=icol-1; j=icol+8; k=80-icol-7}
{
if (substr($0,73,1) == "D")
  if (substr($0,74,7)%2 == 1) print substr($0,1,i) "bbbbbbb0" substr($0,j,k)
  else print
else print
}
```

where: "bbbbbbb" represents 7 blank spaces

Next, process the IGES file through awk using the following command:

```
awk -f  view.awk  old.igs > new.igs
```

Where *old.igs* is the name of the original IGES file and *new.igs* is the name of the file being created which does not contain the view dependent attributes.

10.5 Translating The IGES Drawing Entity (Type 404)

During the translation process ***NCL/IGES*** will inform you if one or more *Drawings* exist in the IGES file and will give you the option of translating a *Drawing* or the *model* data (for details see the RUN option above). In the event that a *Drawing* does exist you should process the IGES file once to create a Unibase file containing only *model* data and then again to create a Unibase file (or files) that contain only *Drawing* data.

An IGES Drawing is simply a list of "views" and locations for those views in *drawing space*, the end result being a electronic blueprint which can be plotted and used for reference.

NCL/IGES translates the IGES Drawing entity into a ***NCL*** view. The views are named *DRAWING1*, *DRAWING2*, etc. depending on how many *Drawings* are in the IGES file. Each *Drawing* must be translated into a separate Unibase file.

To view the Drawing in ***NCL***, click *VIEW > MANAGE > LOAD VW*, then click on the view named *DRAWING1* (or *DRAWING2*, etc.)

All entities placed on a drawing are projected onto a two-dimensional plane and are located in *drawing space*. Thus, *Drawings* are primarily used to create a hardcopy plot for reference.

10.6 Subfigures And Subfigure Instances

The IGES Subfigure and Subfigure Instance entities are translated into ***NCL/CADD*** *Symbols* and *Symbol Instances*.

The entities within a ***NCL/CADD*** symbol cannot be used for geometry construction or tool path generation unless the symbol is first decomposed.

To decompose a symbol click *TOOLS > CADD > SYMBOLS > DECOMPOSE*, then click on the symbol you want to decompose.

10.7 Translating The IGES Solid Entity (Type 186)

A Solid Entity consists of the dependent shell entity (Type 514), the face entity (Type 510), the loop entity (Type 508), the vertex list entity (Type 502) and the edge list entity (Type 504).

The translation process converts the face entity (Type 510) to "Trimmed Surface", the loop entity (Type 508) to "Boundary Curve" and ignores the rest of the entity types.

10.8 User Definable Maximum Parametric Record Size

In order to help solve translation problems associated with large *Parametric Surfaces*, *Drawings* and *Views*, the default parametric record size is user definable.

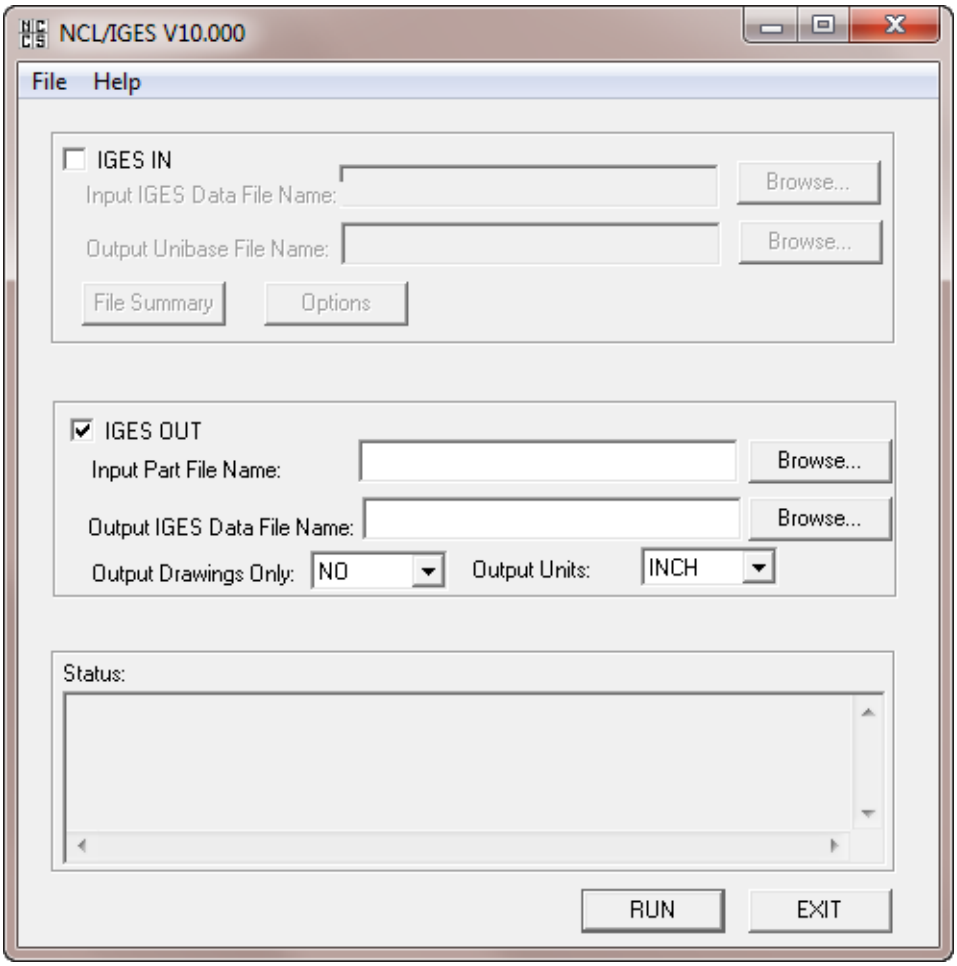
The following environment variable shown with it's default value is located in the *NCCS/NCL100/bin/ncliges* file.

```
MAX_PAR_REC=300000
```

If an error occurs during the processing of an IGES file referring to "parametric record size", simply increase the value shown above and try to process the file again. *MAX_PAR_REC* environment variable can also be defined in the user's *user.init* file.

10.9 Exporting IGES Files

Start ***NCL/IGES*** as previously described. The form as shown on next page will appear:



10.9.1 IGES OUT

Press this button to switch from IGES IN mode to IGES OUT mode.

10.9.2 Input Part File Name:

Enter the name of the Unibase file you want to export. Use the *Browse* button to browse for a file.

10.9.3 Output IGES Data File Name:

Enter the desired name of the IGES file which will contain the converted entities. If an existing file is specified it will be overwritten. If an output file name is not specified the input file name will be used with a *.igs* extension.

10.9.4 Output Drawings Only

Set this button to *NO* to export only *3D model* data. Set this button to *YES* to export only *2D Drawing* data (if no *Drawings* exist in the Unibase file nothing will be exported).

10.9.5 Output Units

Set this button to *INCHES* if you want the IGES data to be written in inches. Set this button to *MM* if you want the IGES data to be written in millimeters.

10.9.6 RUN

Click this button to begin the translation.

An input form will appear prompting you to *Enter the identification information*. Enter any desired information that would describe the contents of the IGES file. You should always make an entry to this form as some IGES converters will not accept an IGES file that has no identification information.

Click *OK* when you are finished entering the information.

Information about the file being exported will appear in the *Status Window*. When the form becomes active again the exporting process is finished.

10.9.7 EXIT

Click this button to exit ***NCL/IGES***.

10.10 Imported Entity Mapping

Imported entities are mapped from IGES to ***NCL*** as follows. There is no limit to the number of imported entities.

Geometric Entities:

IGES	Type	Form	NCL
Circular Arc	100	0	Circle and Circular Arc
Composite Curve	102	0	Composite Curve
Conic Arc	104	0	Ellipse or Curve
Copious Data	106	1	Separate Lines
		2	***NCL*** Point Pattern
		3	***NCL*** Point-Vector Pattern
		11	Polylines
		12	Polyline Curve represented by points
		13	Polyline Curve represented by point-vectors
Curve on a Parametric Surface	142	0	Surface Spline
Line	110	0	Line
Offset Surface	140	0	Offset Surface
Parametric Spline Curve	112	0	Rational B-Spline Curve
Parametric Spline Surface	114	0	Mesh Surfaces
Plane	108	0	Plane
Point	116	0	Point
Rational B-Spline Curve (up to 99th degree)	126	0	Rational B-Spline Curve
Rational B-Spline Surface (up to 99th degree)	128	0	Rational B-Spline Surface
Ruled Surface	118	0	Ruled Surface
Surface of Revolution	120	0	Surface of Revolution
Tabulated Cylinder	122	0	Tabulated Cylinder
Trimmed Parametric Surface	144	0	Trimmed Surface

Annotation:

IGES	Type	Form	NCL
Angular Dimension	202	0	Angular Dimension
Copious Data	106	20/21	Center line
		31-38	Crosshatch
Diameter Dimension	206	0	Diameter Dimension
General Label	210	0	Label
General Notes	212	0	Notes
General Symbol	228	0	General Symbol
Leader (Arrow)	214	0	Arrow on Curve

Linear Dimension	216	0	Linear Dimension
Radius Dimension	222	0	Radius Dimension

Property:

IGES	Type	Form	*NCL*
Name	406	15	***NCL*** Entity Label

Structure Entities:

IGES	Type	Form	*NCL*
Subfigures	308	0	Symbols
Drawings	404	0	A View called DRAWINGn
Subfigure Instances	408	0	Symbol Instance
Groups	402	7	Individual Entities
Views	410	0	A View called IGESn
Solid	186	0	Trimmed Surfaces and Boundary Loops

Attributes:

IGES	*NCL*
Level	Layer
Pen	Pen
Line Font Pattern	Line Style
Solid	Solid
Dashed	Dashed
Phantom	Phantom
Center Line	Center Line
Line Weight	Line Weight

10.11 Exported Entity Mapping

Exported entities are mapped from ***NCL*** to IGES as follows:

NCL	IGES	Type	Form
Circle	Circular Arc	100	0
Composite Curve	Composite Curve	102	0
Conic	Conic Arc	104	0

Line	Line	110	0
Matrix	Transformation Matrix	124	0
Mesh Surface	Parametric Spline Surface	114	0
NCL Entity Label	Name	406	15
NCL curve	Rational B-Spline Curve	126	0
NCL surface	Rational B-Spline surface	128	0
Pattern	Copious Data	106	2
Plane	Plane	108	0
Point	Point	116	0
Point-Vector	Copious Data	106	3
Rational B-Spline Curve	Rational B-Spline Curve	126	0
Rational B-Spline Surface	Rational B-Spline Surface	128	0
Trimmed Surface	Trimmed Parametric Surface	144	0
Vector	Copious data	106	3

10.12 Miscellanesous

- ***NCL*** entity type SOLID is not output to the generated iges file.
- ***NCL*** entity type ANOTE is output as drafting entity to the generated iges file.