**BUFFER ISSUE RESOLUTION DOCUMENT (BIRD)**

**BIRD NUMBER:** 172.2

**ISSUE TITLE:** Extend Multilingual Parameter and Converter\_Parameter Rules

**REQUESTOR:**  Bob Ross, Teraspeed Consulting Group

**DATE SUBMITTED:** July 11, 2014

**DATE REVISED:** August 6, 2014, August 22, 2014

**DATE ACCEPTED BY IBIS OPEN FORUM: August 22, 2014**

**STATEMENT OF THE ISSUE:**

More clarification statements are added to paragraphs describing Parameter and Converter\_Parameter rules under [External Model] and [External Circuit]. These clarifications include:

1. parameter file names can include the .ami extension or any extension that is not .ibs, .pkg or .ebd, or can have no extension,
2. the parameters syntax for parameter file references may include embedded spaces, and
3. AMI Formats Table, Gaussian, Dual-Dirac, and DjRj are illegal for parameters referenced in a parameter file

**ANALYSIS PATH/DATA THAT LED TO SPECIFICATION:**

During the ibischk6, Version 6.0.0 parser development, the list of legal file name extensions for parameters (other than .ami) was extended to include no extension or an extension with just the dot (for example, xyz or xyz.). A statement is proposed to clarify these cases.

During the ibischk6 parser development, the question arose whether spaces could be embedded in the parameter reference line. An example of a parameter reference line in the Version 6.0 Specification is:

Parameters R1\_value = paramfile.par(TreeRootName(Model\_Specific(R1)))

To avoid extra parsing difficulty, embedded spaces are not allowed in ibischk6, Version 6.0.0. For example, the following statement would not be allowed:

Parameters R1\_value = paramfile.par ( TreeRootName (Model\_Specific ( R1 ) ) )

An explicit restriction exists in the current ibischk6, Version 6.0.0 parser and earlier ibischk parser operation.

Based on discussions at the August 1, 2014 IBIS Teleconference meeting, the second format with spaces is explicitly allowed in BIRD172.1. This may require a BUG report and parser change.

When referencing a parameter in a file, only those Formats that have a default value (the first value) such as Value, List, Steps, etc. are permitted. They also permit Default (or Value or Default). Format Table supports multiple values and is prohibited. Statistical Formats Gaussian, Dual-Dirac, and DjRj rely on two or more entries and are prohibited. Note, Format Gaussian could have been allowed based on its first value (the mean). However, it would have been the only legal statistical Format. Also, Default is not permitted with Table, Gaussian, Dual-Dirac, and DjRj, so the proposal is not permit any of these Formats for syntactical and functional consistency.

**ANY OTHER BACKGROUND INFORMATION:**

The proposed rules conform to ibischk6, Version 6.0.0 operation. If any of the proposed rules are revised, then a BUG report can be filed to modify the parser.

This BIRD was approved at the August 22, 2014 IBIS Open Forum teleconference as BIRD172.2, with the addition of a single colon (:) character in the “Analysis Path/Data” section.

Under [External Model], Parameters and Converter\_Parameters starting on page 99 (changes are shown in red):

Parameters:

Lists names of parameters that can be passed into an external model file. Each Parameters entry must match a name or keyword in the external file or language. The list of Parameters may span several lines by using the word Parameters at the start of each line. The Parameters subparameter is optional, and the external model must operate with default settings without any Parameters assignments.

Parameter passing is not supported in SPICE. VHDL-AMS and VHDL-A(MS) parameters are supported using “generic” names, and Verilog-AMS and Verilog-A(MS) parameters are supported using “parameter” names. IBIS-ISS parameters are supported for all IBIS-ISS parameters which are defined on the subcircuit definition line.

Parameters are locally scoped under each [External Model] keyword, i.e., the same parameter under two different [External Model] will have independent values.

The parameter(s) listed under the Parameters subparameter may optionally be followed by an equal sign and a numeric, Boolean or string literal or a reference to a parameter name which is located in a parameter tree. The reference must begin with a file name, followed by an open parentheses and a the tree root name, a new open parentheses for any branch names (including the Reserved\_Parameters or Model\_Specific branch names if present in the tree) and the parameter name, and a matching set of closing parentheses. Spaces are allowed in the reference following the file name.

The file reference may point to any file which contains one or more parameter trees. The files referenced must be located in the same directory as the .ibs file containing the reference. The file names of parameter files must follow the rules for file names given in Section 3, “GENERAL SYNTAX RULES AND GUIDELINES”. In addition, files with no extensions (e.g, xyz) or with just a dot (e.g., xyz.) are permitted. IBIS file formats except .ami (e.g., .ibs, .pkg, and .ebd) do not contain parameter trees and are not permitted as parameter files. Parameter files may only contain parameter trees using the tree syntax described in IBIS in Section 10.3 with the following exceptions and additions:

When the extension of the external parameter’s file name ends with “.ami”:

a) only Usage In or Usage Info are allowed for parameters which are to be passed into models instantiated by the [External Model] or the [External Circuit] keywords

When the extension of the external parameter’s file name does not end with “.ami”:

a) the parameter tree must not contain the Reserved\_Parameters branch but must contain the Model\_Specific branch

b) only Usage Info is allowed

Note that in the case when a parameter is located in an .ami file and it is of Usage In, the parameter value will be passed into the AMI executable model but this does not mean that the same parameter couldn’t be used by other model(s) which are instantiated through [External Model] or [External Circuit]. Parameters described in parameter trees cannot be of AMI Format Table, Gaussian, Dual-Dirac or DjRj.

Multiple parameters may only be listed on a single line if no value assignments are made. When the Parameters line includes a parameter value assignment, each parameter must be listed on a new line. String literals must be enclosed in double quotes.

The EDA tool may provide additional means to the user to assign values to Parameters. This may include the option to override the values provided in the .ibs file, to allow the user to make selections for multi-valued parameters in the parameter tree, or to provide values for uninitialized Parameters.

Converter\_Parameters:

This optional subparameter lists and initializes parameter names to be used as arguments for the A\_to\_D and/or D\_to\_A converter(s) of the [External Model] keyword under which it appears. The list of Converter\_Parameters may span several lines by using the word Converter\_Parameters at the start of each line. Any A\_to\_D or D\_to\_A argument which is entered as a parameter must be declared and initialized with the Converter\_Parameters subparameter.

Converter\_Parameters are locally scoped under each [External Model] keyword, i.e., the same converter parameter under two different [External Model]s will have independent values.

The Converter\_Parameters subparameter must contain one parameter name per line, which must be followed by an equal sign and a constant numeric literal or a reference to a parameter name which is located in a parameter tree. The reference must begin with a file name, followed by an open parentheses and a the tree root name, a new open parentheses for any branch names (including the Reserved\_Parameters or Model\_Specific branch names if present in the tree) and the parameter name, and a matching set of closing parentheses. Spaces are allowed in the reference following the file name.

The file reference may point to any file which contains one or more parameter trees. The files referenced must be located in the same directory as the .ibs file containing the reference. The file names of parameter files must follow the rules for file names given in Section 3, “GENERAL SYNTAX RULES AND GUIDELINES”. In addition, files with no extensions (e.g, xyz) or with just a dot (e.g., xyz.) are permitted. IBIS file formats except .ami (e.g., .ibs, .pkg, and .ebd) do not contain parameter trees and are not permitted as parameter files. Parameter files may only contain parameter trees using the tree syntax described in IBIS in Section 10.3 with the following exceptions and additions:

When the extension of the external parameter’s file name ends with “.ami”:

a) only Usage In or Usage Info are allowed for parameters which are to be passed into models instantiated by the [External Model] or the [External Circuit] keywords

When the extension of the external parameter’s file name does not end with “.ami”:

a) the parameter tree must not contain the Reserved\_Parameters branch but must contain the Model\_Specific branch

b) only Usage Info is allowed

Note that in the case when a parameter is located in an .ami file and it is of Usage In, the parameter value will be passed into the AMI executable model but this does not mean that the same parameter couldn’t be used by other model(s) which are instantiated through [External Model] or [External Circuit]. Converter\_Parameters described in parameter trees cannot be of AMI Format Table, Gaussian, Dual-Dirac or DjRj.

The EDA tool may provide additional means to the user to make assignments to Converter\_Parameters. This may include the option to override the values provided in the .ibs file, or to allow the user to make selections for multi-valued parameters in the parameter tree.

Under [External Circuit], Parameters and Converter\_Parameters starting on page 119 (changes are shown in red):

Parameters:

Lists names of parameters that may be passed into an external circuit file. Each Parameters entry must match a name or keyword in the external file or language. The list of Parameters can span several lines by using the word Parameters at the start of each line. The Parameters subparameter is optional, and the external circuit must operate with default settings without any Parameters assignments.

Parameter passing is not supported in SPICE. VHDL-AMS and VHDL-A(MS) parameters are supported using “generic” names, and Verilog-AMS and Verilog-A(MS) parameters are supported using “parameter” names. IBIS-ISS parameters are supported for all IBIS-ISS parameters which are defined on the subcircuit definition line.

Parameters are locally scoped under each [External Circuit] keyword, i.e., the same parameter under two different [External Circuit] will have independent values.

The parameter(s) listed under the Parameters subparameter may optionally be followed by an equal sign and a numeric, Boolean or string literal or a reference to a parameter name which is located in a parameter tree. The reference must begin with a file name, followed by an open parentheses and a the tree root name, a new open parentheses for any branch names (including the Reserved\_Parameters or Model\_Specific branch names if present in the tree) and the parameter name, and a matching set of closing parentheses. Spaces are allowed in the reference following the file name.

The file reference may point to any file which contains one or more parameter trees. The files referenced must be located in the same directory as the .ibs file containing the reference. The file names of parameter files must follow the rules for file names given in Section 3, “GENERAL SYNTAX RULES AND GUIDELINES”. In addition, files with no extensions (e.g, xyz) or with just a dot (e.g., xyz.) are permitted. IBIS file formats except .ami (e.g., .ibs, .pkg, and .ebd) do not contain parameter trees and are not permitted as parameter files. Parameter files may only contain parameter trees using the tree syntax described in IBIS in Section 10.3 with the following exceptions and additions:

When the extension of the external parameter’s file name ends with “.ami”:

a) only Usage In or Usage Info are allowed for parameters which are to be passed into models instantiated by the [External Model] or the [External Circuit] keywords

When the extension of the external parameter’s file name does not end with “.ami”:

a) the parameter tree must not contain the Reserved\_Parameters branch but must contain the Model\_Specific branch

b) only Usage Info is allowed

Note that in the case when a parameter is located in an .ami file and it is of Usage In, the parameter value will be passed into the AMI executable model but this does not mean that the same parameter couldn’t be used by other model(s) which are instantiated through [External Model] or [External Circuit]. Parameters described in parameter trees cannot be of AMI Format Table, Gaussian, Dual-Dirac or DjRj.

Multiple parameters may only be listed on a single line if no value assignments are made. When the Parameters line includes a parameter value assignment, each parameter must be listed on a new line. String literals must be enclosed in double quotes.

The EDA tool may provide additional means to the user to assign values to Parameters. This may include the option to override the values provided in the .ibs file, to allow the user to make selections for multi-valued parameters in the parameter tree, or to provide values for uninitialized Parameters.

Converter\_Parameters:

This optional subparameter lists and initializes parameter names to be used as arguments in the A\_to\_D and/or D\_to\_A converter(s) of the [External Circuit] keyword under which it appears. The list of Converter\_Parameters may span several lines by using the word Converter\_Parameters at the start of each line. Any A\_to\_D or D\_to\_A argument which is entered as a parameter must be declared and initialized with the Converter\_Parameters subparameter.

Converter\_Parameters are locally scoped under each [External Circuit] keyword, i.e., the same converter parameter under two different [External Circuit]s will have independent values.

The Converter\_Parameters subparameter must contain one parameter name per line, which must be followed by an equal sign and a constant numeric literal or a reference to a parameter name which is located in a parameter tree. The reference must begin with a file name, followed by an open parentheses and a the tree root name, a new open parentheses for any branch names (including the Reserved\_Parameters or Model\_Specific branch names if present in the tree) and the parameter name, and a matching set of closing parentheses. Spaces are allowed in the reference following the file name.

The file reference may point to any file which contains one or more parameter trees. The files referenced must be located in the same directory as the .ibs file containing the reference. The file names of parameter files must follow the rules for file names given in Section 3, “GENERAL SYNTAX RULES AND GUIDELINES”. In addition, files with no extensions (e.g, xyz) or with just a dot (e.g., xyz.) are permitted. IBIS file formats except .ami (e.g., .ibs, .pkg, and .ebd) do not contain parameter trees and are not permitted as parameter files. Parameter files may only contain parameter trees using the tree syntax described in IBIS in Section 10.3 with the following exceptions and additions:

When the extension of the external parameter’s file name ends with “.ami”:

a) only Usage In or Usage Info are allowed for parameters which are to be passed into models instantiated by the [External Model] or the [External Circuit] keywords

When the extension of the external parameter’s file name does not end with “.ami”:

a) the parameter tree must not contain the Reserved\_Parameters branch but must contain the Model\_Specific branch

b) only Usage Info is allowed

Note that in the case when a parameter is located in an .ami file and it is of Usage In, the parameter value will be passed into the AMI executable model but this does not mean that the same parameter couldn’t be used by other model(s) which are instantiated through [External Model] or [External Circuit]. Converter\_Parameters described in parameter trees cannot be of AMI Format Table, Gaussian, Dual-Dirac or DjRj.

The EDA tool may provide additional means to the user to make assignments to Converter\_Parameters. This may include the option to override the values provided in the .ibs file, or to allow the user to make selections for multi-valued parameters in the parameter tree.