
DesignWorks™ 4.0

*Macintosh® Version
Script Language Reference*

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Part I—Script Language Reference

This manual provides an overview of the script language and then provides reference information on specific Scriptor features and applications. Part II—Script Keyword Reference provides detailed information on individual Scriptor commands. If you are new to writing DesignWorks scripts, you may wish to start by looking at the examples in “Script Examples” on page 46.

A knowledge of the material in this chapter is not necessary in order to use the scripts provided with DesignWorks. See the Chapter entitled “Report Generation and Scripting” in the DesignWorks 4.0 User’s Guide for more information on general operation of the Scriptor from a user’s point of view.

Script Language Changes in DesignWorks 4.0

The report script language that has evolved since the earliest versions of DesignWorks has been greatly enhanced and generalized in 4.0. One of the highest priorities in this version was to maintain compatibility with existing report forms, so there should not be major compatibility problems, however some issues that you may want to be aware of are discussed in “Compatibility with DesignWorks 3.x Report Forms” on page 2.

Overview of New Script Features

Among the many new script language features are the following:

- The interpretation of command keywords has been greatly generalized so that any keyword can be used almost anywhere it makes sense. For example, \$DATE and \$TIME can appear as part of a pin format, or \$DESIGNNAME can be used in generating a device attribute value.
- You can now generate a “break” in a report when a value in a sorted field changes. This can be used to generate reports where a page break

is inserted before each new type of part, for example.

- Reports can be directly generated with line-terminator characters appropriate for a different target system, e.g. generating DOS-compatible text files from a Macintosh.
- Unix-style regular expressions have been implemented. This provides a powerful capability to check the format of attributes and other text data and to extract values from complex fields.
- Attribute values can be calculated and set on any design object using any available information.
- Various conditional operations are implemented, allowing the report format to depend on device types or any other data values.
- A script can open and read any other line-oriented text file and extract values for use in updating the design. This can be used in conjunction with the regular expression features to implement a number of simple file translation or back-annotation capabilities.
- Arbitrary, user-created variables and simple arithmetic operations can be used to accumulate data values in complex ways.
- You can now generate a secondary text output file, referred to as a “transcript” which can contain any arbitrary information. This is intended for use as an error file or log file, allowing you to store a trace of modifications made by a script or errors detected during the generation of a report.
- A script can prompt the user for information to be used in generating a report or setting data values in the design.
- Numerous new keywords have been added to extract and set various kinds of design data and to control the operation of the script.

Compatibility with DesignWorks 3.x Report Forms

In 95% of cases, existing report forms should produce identical results using the new Scriptor tool. The only areas of incompatibility will be:

- Many new keywords have been defined in the new version. If an existing script used an item of the form “\$XXX” on the assumption that an unrecognized keyword would be passed through to the output, this may cause trouble in the new version. This can be fixed by placing a backslash “\” character in front of the dollar sign. This will

prevent it from being interpreted as a command.

- Some existing keywords can now be followed by arguments in parentheses. For example \$DATE and \$TIME can now take an optional format specification. If an existing report form has a keyword followed by an opening parenthesis, this may be interpreted differently in the new version. The solution is the same as the previous item, i.e. place a back-slash escape character in front of the parenthesis.
- Some bugs and inconsistencies in the 3.x Report module were corrected in this version, which may affect generated output. This is mostly in the area of adding pins to a netlist from attribute fields in the device and the handling of duplicate pins. In the event that a specific type of report relied on this behaviour, it will be necessary to change to report form to produce the desired results.

Command Language Introduction

The script language implement by the Scriptor tool was developed originally as a flexible way of specifying netlist formats; an alternative to the hard-coded netlists that are provided by most schematic packages. However, as enterprising users pushed the limits of the original language, we added more features to support more complex report formats, error checking, back annotation and other applications. The script language is still primarily oriented around the concept of generating a text file from design data. However, the new regular expression and file I/O features added in this version make many other applications possible.

Basic Script Structure

A script file is simply a text file containing any number of lines of text with optional commands and comments embedded in them. The default mode of operation for the Scriptor is to read the input (script) file one line at a time, scanning for commands. If no commands are detected, the line is simply written directly to the output file. In fact, the Scriptor will accept any text file as input. If it doesn't recognize any commands, the entire file will be written verbatim to the output without modification (except, possibly, for a change in line terminators - more on this topic later).

When reading the script file, the program scans for any commands, variables or comments. If any of them are found, new data may be generated and substituted at that location in the output, or some other action may be taken.

■ **COMMANDS**—Commands start with the “\$” symbol and are in upper case letters. Commands are used to control the format of the report and perform various actions. Some of the commands need arguments to set certain values (e.g. the number of characters on a line). Any arguments are enclosed in parentheses following the command keyword.

► *See more information on command argument format in “Command Arguments” on page 12*

NOTE: If the desired output file format requires that a word starting with a “\$” be placed in the script, it is best to precede the “\$” with the escape character “\” (backslash) to ensure that it will not be accidentally interpreted as a command.

Commands fall into these general sub-groups:

- ◆ Definition commands are those which set parameters for how data is generated but do not themselves generate any text in the output file. An example is the \$SIGPINFORMAT command, which specifies how pins will be displayed in a signal list.
- ◆ Action commands cause some action to be taken but don’t generate any text data that ends up in the output file. For example the \$SORT command sorts a device or signal list.
- ◆ Function commands perform arithmetic, logical and various conversion operations on data supplied as arguments. For example \$ADD will add two numbers and return the result.
- ◆ Listing commands are those which cause lists of items to be directed to the output file. For example the \$SIGNALS command, which generates a list of the signals in the circuit. All the commands which follow a listing command on a line are item-specific, that is, their exact meaning depends upon the type of item being listed.
- ◆ Object data commands are those whose value derives from the circuit object being listed. These commands can be context-sensitive and may not have meaning in all locations in a script.

For example, the \$SIGNAME command can appear in a \$SIGNALS listing and causes the name of that signal to be substituted. The \$SIGNAME keyword has no meaning standing alone in the script.

- ◆ System data commands cause a specific internal value to be directed to the output file, e.g. the design file name or the system date.

- **ATTRIBUTE OR VARIABLE REFERENCES**—References to script variables or device, pin, signal or design attributes start with the “&” symbol. The reference will be replaced with the actual value of the attribute or variable. More information on variables can be found under “Script Variables” on page 14.

If the desired output file format requires that a “&” be placed in the script, it is best to precede the “&” with the escape character “\” (backslash) to ensure that it will not be accidentally interpreted as an attribute reference.

- **COMMENTS**—Comments are text enclosed between left and right braces “{” and “}”. Comments are intended for internal documentation of the command file. No characters between or including the braces, or a carriage return following the closing brace, will be transmitted to the report. If you need to transmit the character “{” to the output file, you must precede it by the “escape” character “\” (backslash) so that it will not be recognized as a comment.

All other text and special characters (e.g. tabs and form feeds) found in the command file are considered to be raw text and are transmitted to the output file unmodified. The only special processing of control characters that occurs is for carriage return and line feed line terminator characters. This is done to ensure cross-platform compatibility of script files and output files.

► *More information on line termination can be found under “Line Terminators” on page 39.*

Any item starting with a \$ or & but not recognized as a command or variable word will be transmitted to the report file. No error messages are generated for incorrect keywords.

NOTE: It is not recommended that Macintosh “option key” characters be used in reports since they use character codes outside the normal ASCII

character set. This may result in difficulty transmitting the files to other programs and some of the Report format options may not function correctly.

A number of standard script files for report generation and error checking are provided with DesignWorks and some of these are explained in detail in “Script Examples” on page 46. These can be used as guides in creating your own scripts.

DesignWorks Object Types

For report generation purposes, a DesignWorks circuit consists of two major types of objects: devices and signals. The Scriptor tool has two general sets of options allowing information on each of these types of objects to be extracted or written to a file in a variety of forms.

Devices

The device listing features are used to create component lists, bills of materials and types of netlists that are listed by device, such as a SPICE or Pcad format. For each device in a list, any of the following data can be included:

- Device Name—this is the name applied to the device instance, e.g. “U1”, “R23”, “J12”, etc.
- Device Attributes—the contents of any device attribute fields can be included in a listing.
- Device Token—the device token is an integer that is assigned automatically by DesignWorks when the device is first placed on the diagram and not changed as long as that device exists in that circuit. This token number can be used by an external program to determine which devices are new and which are old in a circuit, despite name or parameter changes.
- Device Sequence Number—this is a temporary integer that is assigned by the Report tool as part of its sorting process and may change during a report if multiple sorts are done. This can be used in cases where external programs require objects to be sequentially numbered.
- Device Type information—this refers to information retrieved from the library when the device was created, such as the type name (e.g.

“74LS123”), number and types of pins, etc.

- **Device Graphical Information**—information about the device's page number, position and orientation on the schematic are available to allow transfer of schematic data to other systems, or to create reference listings.
- **Attached signals**—a device listing can also contain a list of the signals attached to each pin of the device. Each signal entry can reference any of the signal data described below. See “\$DEVPINFORMAT” on page 107.

Device listings are created using the \$DEVICES command, described in “\$DEVICES” on page 103.

Signals

Signal listings are used primarily for creating netlists for transfer to external simulators or PCB systems. The following information is available about each signal in the circuit:

- **Signal Name**—this is the name of the signal as it appears on the schematic, or is assigned automatically by the report generator.
- **Signal Attributes**—the contents of any signal attribute field can be included in a signal listing.
- **Signal Token**—this is an integer that is assigned automatically by DesignWorks when the signal is first created and not changed as long as that signal exists in that circuit. Note however, that many common editing operations result in signals being merged or broken apart, which will often result in the signal token changing even though some of the connections in the old signal remain. This token number can be used by an external program to determine which signals are new and which are old in a circuit, despite name or parameter changes.
- **Signal Sequence Number**—this is a temporary integer that is assigned by the Report tool as part of its sorting process and may change during a report if multiple sorts are done. This can be used in cases where external programs require objects to be sequentially numbered.
- **Attached device pins**—any signal list can contain a list of the device pins interconnected by this signal. Pin format options allow almost any of the device parameters mentioned above to be included in each pin entry. See “\$SIGPINFORMAT” on page 169.

Signals listings are created using the \$SIGNALS command described

later in this chapter.

Definition Commands

Definition commands control the general format of the report, for example:

- The number of rows per page.
- The number of columns per row.
- Other report formatting options

Each of these parameters is set by using specific command keywords, the most common of which are summarized in the following table.

► *Complete descriptions of these commands is provided in "Part II—Script Keyword Reference" on page 63.*

\$LINEWIDTH(n)	This command specifies the maximum number of characters that will be placed on a line before an automatic carriage return is inserted.
\$PAGELENGTH(n)	Specifies the action to be taken when a page is full (i.e. when the number of lines specified in \$LINESUSED is exceeded).
\$LINESUSED(n)	Specifies number of lines to use on each report page before moving to the next page.
\$MAXITEMSPERLINE(n)	Restricts the number of entries placed on a line in repeating structures such as a netlist.
\$AUTONUMBER(number of pins)	Any device with less than or equal to the number of pins specified will have pin numbers automatically assigned if none were present in the circuit file. This option is intended to provide pin numbers for discrete components in a circuit, since they do not normally have pin numbers on a diagram. The default number is zero.
\$DEVPINSEQUENCE &attrField	Specifies that the order in which pins appear in a pin listing is to be determined by an attribute specified in the device. This is intended for generating report formats such as SPICE, in which pin order is significant, when some devices in a design may not have their pins defined in the required order.
\$COMBPINSON/ \$COMBPINSOFF	When ON causes multiple pin connections on the same device to be combined. Default is OFF.
\$ALIGNCOLSON/ \$ALIGNCOLSOFF	When ON causes extra blanks to be inserted between netlist or component list entries to force column alignment.

\$SPACE(number)	Sets the column spacing used when ALIGNCOLSON is set. Default is 16.
\$ITEMSEPARATOR(string)	Specifies a string that will be inserted between successive items in an item list.
\$UNNAMEDDEVS(string)	Specifies a string that will be output whenever a device name is called for and the device in question is unnamed.
\$UNNAMEDSIGS(string)	Specifies a string that will be output whenever a signal name is called for and the signal in question is unnamed. The default value is “unnamed”. For example:
\$ONEPINSON/ \$ONEPINSOFF	When ON suppresses the pin number from being printed in netlist entries for devices with only one pin. This will cause entries such as test points to appear as TP1 instead of TP1-1. Default is OFF.
\$CONTSTART(string)	Specifies a string of characters that will be inserted at the beginning of each line that is a continuation from a previous line (i.e. whenever \$MAXITEMSPERLINE or \$LINEWIDTH is exceeded while writing a list).
\$CONTEND(string)	Specifies a string of characters that will be inserted at the end of each line that is being continued onto the next line (i.e. whenever \$MAXITEMSPERLINE or \$LINEWIDTH is exceeded).
\$BLANKREPLACE(string)	Specifies a string of characters that will be substituted for a blank in any device or signal name. This is done to accommodate systems which cannot accept blanks in names.
\$UNCONNPINSON/ \$UNCONNPINSOFF	When ON, allows device pins that have no signal lines attached to them and are not connected to any other signals by name to appear in the netlist, otherwise they are suppressed. Default is ON.
\$REPEATITEMON/ \$REPEATITEMOFF	This option, when ON, forces the last item in any list to be repeated at the start of any continuation line. This is used by some systems to recognize continuations.
\$CONTREPEATON/ \$CONTREPEATOFF	This option, when ON, forces the first part (up to the start of the first pin item) of the first line in a signal list to be repeated at the start of any continuation line. This is used by some systems to recognize continuations by repeating the signal name or other parameters on each successive netlist line for the same signal.

Command Language Concepts

This section provides information on a number of concepts that are

important to the operation of scripts.

Current Design or Current Object

A script can be invoked under many different circumstances in addition to the simple “Scripter” command in the Tools menu. A script can sometimes be executed in response to an action on a specific object, such as a device. Similarly, one part of a script may cause another part of a script to be invoked to generate data for a specific object.

For these reasons, it is important to be aware of what the “current object” is at any point in a script. In fact, normally there is a sort of hierarchy of objects that may be involved in evaluating a given command. For example, suppose you are generating a listing for a pin in a netlist. The pin is associated with a parent device and an attached signal, which are in turn associated with the parent circuit, which is in turn contained in some design. Data from any of these objects can be used in generating a pin listing.

It is important that a script not attempt to access data for a “smaller” object than the current one. E.g. If the current object is a device, you cannot use the \$PINNUM keyword because it requires access to a specific pin. In general, a device has many pins and the Scripter cannot assume that it knows which one you mean. On the other hand, if the current object is a pin, you *can* use \$DEVNAME to get the attached device’s name, because there is an unequivocal device associated with a pin.

The following points summarize how the current object is determined:

- If a script is executed by a user command from a menu, the current object at the start is the current circuit (i.e. the topmost circuit window).
- If a script is invoked as a result of some operation on an object (e.g. placing a device), then the current object will be the one just edited (i.e. the device just placed).
- Any part of a script that is executed as part of an iterating command (like \$DEVICES) will have as its current object the current one in the iterating sequence.

Data Types

The script language only really implements one type of data: the character string. The internal representation of character strings limits their length to 32,767 characters. This does not limit the total length of an output file, but no single line, variable value, or attribute value can exceed that length. Any commands that require other types of data (e.g. numeric or Boolean) will convert the arguments from the character string format to the required internal format, then convert the results back to a character string again.

Integers

Some of the keywords expect values that would be considered to be an “integer” data type in a regular programming language. For commands such as \$ADD, the arguments will be assumed to be the string representation of decimal integers and will be converted to signed 32-bit internal values for the operation. The result is then converted back to a decimal integer string.

No errors are reported during this conversion process. Conversion of a string to an integer stops as soon as any non-decimal character is encountered. Thus, an empty string, or any string starting with a non-numeric character, will be treated as zero.

Booleans

Some of the commands operate on or return “Boolean” (i.e. TRUE or FALSE) values. Again, the internal representation is a character string. For commands such as \$IF that evaluate the “truth” or “falseness” of the data, an argument will be taken as TRUE if it contains any non-zero-length value. Note that the contents of the string are not examined, so even a blank character will count as TRUE. An argument will count as FALSE only if it is zero length. (Note that there is a \$NONBLANK function which can be used if you want to count a “blank” string as FALSE.)

For commands that return a “boolean” value, such as \$AND, TRUE is represented by a string consisting of a single character “1”. FALSE is represented by an empty string.

Blocks

A number of script commands refer to a *block*. A block is simply a set of lines in the script file that start with a \$DEFINEBLOCK command and end with an \$END. Once defined, a block is treated internally as if it was a separate file. When the script is executed, everything between the \$DEFINEBLOCK and corresponding \$END is skipped until some other part of the script makes explicit reference to it.

Blocks have a number of uses, including:

- They can be used as a kind of “subroutine” which can be invoked from elsewhere in the script using the \$INCLUDE command. This can be useful if several parts of a script need to make use of the same sequence of lines.
- They can be used simply to delimit a block of text to define a value mapping table for the \$TABLE, \$MAP or \$VERIFY commands.
- They can be used to define a set of script lines to be executed under specific circumstances, e.g. to define the format of an internal circuit in a hierarchical netlist, as in the \$INTERNAL command.

For DesignWorks 3.x users, the \$DEFINEBLOCK command is an extension of the \$DEFINECIRCUIT command used in hierarchical report forms.

Command Arguments

Many \$ commands can be followed by argument strings contained in parentheses. These arguments can pass information used in performing the requested operation. In some cases the arguments are optional and the command will perform a default function with no arguments. For example the \$DATE command, when used without following argument in parentheses, returns a string containing the date of the report in a standard format. If you want to control the format, you can add a string argument containing format control characters.

Argument Data Types

As discussed in “Data Types” on page 11, there is really only one kind of data in the Scripter, the character string, but it may be interpreted in various ways by different commands. Various kinds of arguments are used,

depending on the command:

- **String**—Everything is a string.
- **Integer**—This is the string representation of a decimal integer.
- **Boolean**—This is a string in which any non-null value will be taken as TRUE and an empty string is taken as FALSE.
- **Block**—Some commands refer to another block of text elsewhere in the command file. Such a block starts with a \$DEFINEBLOCK command (which specifies the name of the block) and ends with an \$END. The block can then be referred to by name by various commands. Blocks are used to specify value mapping tables, sets of commands to execute under specific circumstances, and other uses.

Argument Syntax

For any command that takes arguments, the argument list is enclosed in parentheses and the individual arguments are separated by commas. Because the arguments are literal strings where every character is potentially significant, several special cautions should be observed:

- **Leading and trailing white space** is removed from argument strings. If you want to pass a leading or trailing blank or tab in an argument string, or a single blank by itself, you must escape it with a backslash. For example, the following sets the variable to a string consisting of one blank:

```
$SETVAR(Blank, \ )
```

- **If you need to pass a comma or closing parenthesis** in an argument string, these should also be escaped, as in:

```
$TABLE(ValueList, \, , \))
```

Note that this is passing three arguments. The first is a block name, the second is a string containing a comma and the third is a string containing a closing parenthesis.

Control and Escape Characters

Anywhere in a script file where literal text is allowed (i.e. anywhere not inside a \$ command structure or comment), the following two format options can be used to insert special characters in the output stream:

- **Control characters** (i.e. ASCII codes less than 20 hex) can be inserted

in the file using the ^ (shift 6) character. The character following the ^ will be inserted in the file with 40 hex subtracted from its ASCII code. This means that ^@ will generate a null (code 00) character, ^A will generate code 01, ^M will generate 0D (carriage return), etc. Note that the letter following ^ must be upper case.

- Special characters that may have specific meanings in the report command language can be included in the output using the \ escape character. For example, the brace character { is used to open a comment block in the command language. To include this character in the output stream, it should be preceded by the escape character, as in “\{”. In addition, the escape character can be used to terminate keywords or attribute field names that might otherwise run into the following literal text. For example:

```
&ExtraText\ENDMODULE;
```

In this case the \ is used to separate the field name “ExtraText” from the literal text “ENDMODULE;”. Without the \ escape character, the command language interpreter would consider the text ExtraTextENDMODULE to be an attribute field name.

Script Variables

A script can create, modify and refer to string variables. The following notes outline the rules for string variables:

- A variable is defined and set by the \$SETVAR command, which is described in “Part II—Script Keyword Reference” on page 63.
- A variable is referred to (i.e. its value is extracted) by using the variable name prefixed by an ampersand “&”. Note that this is the same way that an attribute field in the design is referred to, so it is the user’s responsibility to ensure that there is no accidental name overlap. If you create a variable with the same name as an attribute field, the variable will take precedence. I.e. A reference to &name will return the value of the variable.
- A variable is “global” throughout the script. I.e. Once a variable of a given name is set anywhere, its value remains set and it can be referred to in any part of the script executed later.
- Variable values disappear when the script finishes executing, i.e. if you run the same or another script later, the same variable will not retain its old value.

- Variable names can be 1 to 16 characters long and can consist of letters, numbers, dots “.”, and underscores “_”. Variable names consisting entirely of decimal digits are reserved, as discussed below.

The following simple example shows how a variable is set and referenced:

```
$SETVAR(MyVar, This stuff becomes the value)  
The value of the variable is: &MyVar
```

Special Variables &1—&9

Variable names consisting entirely of decimal digits are reserved for use as regular expression “match” variables. When a regular expression is executed, these are automatically set to the values matched by parts of the expression. A complete description of this facility is given in the section “Regular Expressions”.

Predefined Variables

You can predefine variables and set them a a certain value by using the SCRIPTVAR setup file keyword described in the Appendix “Setup File Format” in the DesignWorks 4.0 User’s Guide. This can be useful to allow you to make a script that uses variables for items that may change from user to user, such as directory pathnames. A path variable can be defined once in a setup file and a setup of scripts can then refer to them. The variable can then be changed by changing only one reference in the Setup file and all scripts will then use the new value.

Note that these variables are not “global” in that they are reset to their defined values at the beginning of each of each script. You can modify them using the \$SETVAR command, but they do not retain the modified value when the same or any other script is executed. If this type of behavior is needed, it can be implemented by storing values in attribute fields associated with the design.

Attribute Field References

The ability to easily extract the values of device, signal, pin or design attributes in a report is one of the most important features of the script language. An attribute field is referred to (that is, its value is extracted) simply by using the attribute field name prefixed by an ampersand “&”. For example, the following single line script will list all the devices in a

circuit, showing the name followed by the contents of the Part and Value fields:

```
SDEVICES$DEVNAME &Part &Value
```

The object type that is being referred to by a given attribute reference depends on its position in the file and on how the script was invoked. With the exception of pins (described in the next section), an attribute reference always refers to the current object. In most circumstances, this means that a field reference that appears in a \$DEVICES line refers to a device attribute, a reference that appears in a \$SIGNALS line refers to a signal attribute and a reference that appears in a top-level line (i.e. not in \$DEVICES or \$SIGNALS) refers to a design attribute.

► See the rules for determining the current object in “Current Design or Current Object” on page 10.

Precedence of Field References in Pin Listings

Some ambiguity can arise in attribute references when the current object is a pin, that is, inside a \$PINS command. In order to allow reference to attributes belonging to the pin itself or the associated device or signal, the Scripter searches for values in the following order:

- If the named field has a non-null value in the current pin, it is used.
- Otherwise, if the field has a non-null value in the device associated with the current pin, it is used.
- Otherwise, if the field has a non-null value in the signal associated with the current pin, it is used.

This allows you to specify a default value for an attribute in a device or signal and then override it for selected pins. For example, the following script refers to an attribute field “ConnType” that has been defined for both pins and devices:

```
SDEVPI NFORMAT($PINNAME=&ConnType)  
SDEVICES$DEVNAME $PINS
```

If the field ConnType has a value of “Normal” in the device, a value of “Special” in the third pin and a null value in all other pins, you will see a listing like the following:

```
DEV1 PIN1=Normal PIN2=Normal PIN3=Special PIN4=Normal
```

Attribute vs. Variable References

Note that attributes are extracted the same way as script variables, so it is the user's responsibility to ensure that there is no accidental name overlap. If you create a variable with the same name as an attribute field, the variable will take precedence. That is, a reference to &name will return the value of the variable.

NOTE: When the script language parser is scanning for commands, it takes any contiguous group of identifier characters as a single identifier. This can be a problem if you wish to append some fixed text to the extracted value from a field. For example, if you wished to append "_000" to every part number (from a field called PartNum) in a bill of materials, it might be tempting to put this in a script:

```
&PartNum_000
```

However, the script language will interpret this as a reference to a field called PartNum_000, since all these characters are valid in an identifier. The solution is to insert an escape character after the identifier to clearly delimit it, as in:

```
&PartNum\_000
```

Controlling Report Page Layout

A number of Scriptor keywords and features are design to assist in creating neat, human-readable reports. This section will cover the setting of page height and width, page and value breaks and column alignment.

► *Specific details on each of the keywords used here are provided in "Part II—Script Keyword Reference" on page 63.*

Setting Page Height and Width

Three keywords control the number of lines of text output on each page and the numbers of characters on each line: \$LINEWIDTH, \$LINESUSED and \$PAGELENGTH.

NOTE: The Scripter is generating a pure text file and has no direct control over the fonts, tab settings, margins and other page layout parameters used when printing the report output. It is the user's responsibility to understand the relationship between these settings and the actual line and character counts used in generating the reports.

A typical usage of these commands would appear as:

```
SLI NEWIDTH(60)  
$LINESUSED(56)  
$PAGELENGTH(66)
```

This indicates to the program that the maximum number of characters to be output on a line is 60 and the maximum numbers of lines of text on a page is to be 56. Note that the Scripter does not break individual text items on output. The line width is only used to decide whether or not to put out the next item generated by a repeating data command. If the fixed contents of a line (i.e. outside of repeating data items) is greater than the specified width, it will be output regardless.

The \$PAGELENGTH command indicates the total number of lines on a page, including the \$LINESUSED, the page header and any blank lines generated to fill out the page. In this example, the total page length is 66 lines. If no header has been specified, once the 56 lines specified by \$LINESUSED have been generated, the program will generate 10 empty lines to meet the specified total. Obviously, the number of lines that will fit on a page depend on the font and line spacing settings. It may be necessary to experiment to choose an appropriate \$PAGELENGTH setting for your output medium.

A special \$PAGELENGTH value of zero can be used to indicate that an ASCII form feed character should be output to indicate a page eject. Many word processing packages accept this character as a page break.

Defining a Page Header

Any block of text can be defined as a page header to be inserted at the top of each generated page. This text is defined in a section that starts with a \$HEADER keyword and ends with an \$END keyword. The contents of this section is passed to the output file immediately to create the header for the first page, then each time a page feed occurs.

The header section is scanned for any commands or variables to substitute

before it is output. Any command keywords that are shown in the keyword reference as valid in “Script” or “Script - Design” can be used in the header section. These allow you to insert the page number (\$PAGE), date (\$DATE/\$TIME), design name (\$DESIGNNAME/\$FILENAME), contents of design attributes (&field) and other values in the header section.

Here is a simple example of a page header specification:

```
SHEADER
XYZ Industries of Smithville, Inc.
Bill of Materials Report
File: $FILENAME Date: $DATE
SEND
```

Setting Column Alignment

Since the Scripiter is generating a text file and does not print directly, the actual column alignment that is obtained on output depends on the mechanism used to print the final report. There are two general ways of ensuring alignment of columns of text in reports generated by the Scripiter:

- You can use the \$COL command for fixed items or the \$ALIGNCOLSON command for repeating items. This inserts extra blank characters in the output to ensure column alignment. This only provides correct alignment on output when used with a fixed-space font such as Courier.
- You can insert tab characters using the \$TAB and \$ITEMSEPARATOR commands and then set the tab spacing as desired in the word processor you use to print the results.

Defining a Value Break

The Scripiter allows you to define a block of text to be output each time a computed value changes while generating a sorted \$DEVICES or \$SIGNALS listing. This allows you to insert a new heading or simply a blank line for extra readability between sections of a report. For a complete description of this feature, see “\$BREAK” on page 70.

Date and Time References

The script language provides a methods for displaying and manipulating date and time values in a variety of formats. In addition to the current date and time provided by the operating system, date and time values are used in a number DesignWorks operations, including:

- The *created* and *last modified* dates of the current design file are available for use in reports. Note that “last modified” refers to the disk file associated with the design, not the design itself. Schematic editing operations do not change this value. For designs that have not yet been saved to a file, these will be the date the file was created.
- The *last modified* date of the source device library is stored in a device attribute called LibDate when a device is placed in a design. This can be used later to determine if the design is up to date with respect to the symbol library.
- The *last modified* date of the external circuit file is stored in a device attribute ExtCctDate when the external circuit is attached as a subcircuit.
- When a device is placed in a schematic, the current time is stored in the DateStamp.Dev field of the device. This can be used in back- and forward-annotation processes that need to uniquely identify devices even if the name has been changed.

► See more information on date stamps in the chapter entitled “Device Naming and Packaging” in the DesignWorks 4.0 User’s Guide.

Raw Date and Time Format

In DesignWorks, whenever a date is stored automatically in an attribute field, for example in the LibDate field, it is stored in the raw Macintosh internal format. This is an integer value that represents the number of seconds since January 1, 1904. When this value is stored in an attribute, it is converted to an unsigned decimal character string. The \$DATE and \$TIME commands provide formatting operations to convert these values to human-readable form.

Date and Time Formatting Commands

The \$DATE and \$TIME commands can be used in a number of different forms to display the current system time or any stored time value used in DesignWorks time-stamping functions. The \$DATE and \$TIME commands are described in detail in “Part II—Script Keyword Reference” on page 63.

Sorting and Merging

The script language provides the ability to sort device and signal listings on any data field. In addition to the obvious application of producing sorted listings for improved readability, sorting provides the basis for these additional functions:

- A merging function allows all devices or signals with the same sort value to be combined into a single line in the output. This can be used, for example, to create a “bill of materials” style listing in which a single line is devoted to one part number and lists all instances of that part number. This is described in more detail in “Enabling Merging” on page 24.
- A value break function allows the insertion of a header or page break when some field or computed value changes. This is described in “\$BREAK” on page 70.

The \$SORT Command

The \$SORT command provides the ability to sort device and signal listings on any data field. Items with the same value in any field can be optionally merged into a single line. This allows listings to be organized to suit various applications, for example:

- Device or signal lists can be sorted by name to enhance readability.
- Device lists can be sorted by type so that each line lists one device type with all information common to that type and a list of instances of the type.
- A device list can be sorted by page number to show the devices used

on each page.

- Signals can be sorted by an attribute field, for example to give priority to certain nets so they are listed first for autorouting purposes.
- Devices can be sorted by any attribute field, for example by component value, stock number, cost, etc.

The \$SORT command has the following form:

```
$SORT objectType field1 field2 ...
```

Where:

- *objectType* must be either “\$DEVICES” or “\$SIGNALS”.
- *field1*, *field2*, etc. are identifiers indicating which fields to sort on. The list is sorted first on the first field. If any items in the list have identical values in that field, then the groups of like-valued items are sorted on the next specified field, etc.

Once a sort has been done, it remains in effect for all subsequent listings on that object type until the next \$SORT or \$FIND command. Each \$SORT clears the previous \$SORT. Sorting can be in ascending or descending order, as described below.

The following field specifications are valid in all \$SORT commands:

- \$ASCENDING** This specifies that all following fields specified should be sorted in ascending order. This is the default direction, so ASCENDING will normally only be required after a DESCENDING to reset the sort direction for subsequent fields on the same line.
- \$DESCENDING** This specifies that all following fields will be used to sort in descending order.

If *objectType* is \$DEVICES, the following field specifications can be used:

- \$DEVNAME** Sort on the device name. If no name exists in the circuit, and no name has been assigned using ASSIGNNAMES, then the item will be placed at the end of the list. If the device name contains a numeric portion (e.g. U12), then the numeric part of the name is sorted on its integer value, instead of its character value. E.g. the name U12 will appear before U110, instead of after, as it would in a purely lexical sort.

\$DEVHIERNAME	Sort on the device hierarchical name, i.e. a name generated by prefixing the device name with the names of all parent devices in the hierarchy. This is normally only used in flattened netlists.
\$DEVINSTNAME	Sort on the contents of the InstName field. This is normally only used in flattened netlists.
.\$POSX	Sort on the horizontal position of the top left corner of the device symbol on the diagram.
.\$POSY	Sort on the vertical position of the top left corner of the device symbol on the diagram.
.\$TYPENAME	Sort on the device's type name, i.e. as it appears in the Parts palette.
\$ORIENT	Sort on the device orientation.
\$PAGE	Sort on the page number that the device appears on.
\$NUMPINS	Sort on the number of device pins.
\$DEPTH	Sort on the contents of the Depth attribute field. NOTE: This field will only be valid if the mode is enabled.
.&attrField	Sort on the contents of the attribute field named attrField in each device. If that field is empty or does not exist in a given device, then that device will be placed at the end of the list.

If *objectType* is \$SIGNALS, the following field specifications can be used:

\$SIGNAME	Sort on the signal name. If no name exists in the circuit, and no name has been assigned using ASSIGNNAMES, then the name “unnamed” will be assumed. See the note under “DEVNAME” above regarding sorting numeric portions of the name.
\$SIGHIERNAME	Sort on the signal hierarchical name, i.e. the name of the signal prefixed by the names of all parent devices in the hierarchy. This is normally only used in flattened netlists.
\$NUMPINS	Sort on the number of device pins attached to this signal.
\$SIGSOURCE	Sort on the order of appearance of this signal in a SIGSOURCE command. If the signal does not appear in a SIGSOURCE command (as most won't), it will appear after the SIGSOURCE signals. This is used to place all power and ground nets at the front of a netlist.
.&attrField	Sort on the contents of the attribute field named “attrField” in each signal. If that field is empty or does not exist in a given signal, then that signal will be placed at the end of the list.

► See the examples in “Script Examples” on page 46 for more information on how to use the sorting capability.

Enabling Merging

The combination options \$COMBSIGSON/OFF and \$COMBDEVSON/OFF instruct the Scriptor to combine items with the same sort value into a single line in the listing. This can be used to produce a variety of useful listing formats, for example listings of all devices having a certain type name.

IMPORTANT: The "COMB" options will have no effect if no sort has been specified since they only operate on sorted values.

\$COMBSIGSON/\$COMBSIGSOFF

When ON causes signals with the same sort value to be combined into a single net in the netlist. Default is OFF.

NOTE: COMBSIGSON should not be used in most normal netlisting applications. Any like-named signals have already been logically connected by DesignWorks and will be listed in one entry even if COMBSIGS is OFF. COMBSIGSON will have the additional effect of merging like-named signals, even if they appeared on different pages of the schematic.

\$COMBDEVSON/\$COMBDEVSOFF

When ON causes devices with the same sort value to be merged into a single entry in the component list. Default is OFF.

Display of Multiple Values in Merged Lines

Whenever merging is enabled (that is, \$COMBSIGSON or \$COMBDEVSON is active), a single line in a listing can represent an arbitrary number of circuit objects. All objects on that line have the same sort value but will generally differ in other values.

For example, this simple script:

```
SSORT $DEVICES &Part
$COMBDEVSON
$DEVICES&Part $DEVNAME
```

will produce a sorted list with one line per Part value, sorted by Part. When the Scriptor encounters \$DEVNAME it actually puts out the names

of all the devices merged on that line, so a typical line will look like:

```
74ALS00 U23 U34 U125
```

Items with multiple values will always be sorted by value and are always merged, i.e. only unique values are displayed. In the example above, if multiple device symbols have the same name, that name will only appear once in the list.

Disabling Multiple Value Display

There may be cases where the display of multiple values on merged lines would not be desirable. An example is the use of date stamps in PCB netlist output. If multiple gate symbols are merged into a single package in the netlist, the date stamp value will be different on each of the device symbols being combined into one package. However, the PCB package only wants to see a single value since it only considers it to be one object. There are two ways of creating a single value for use in the report:

- The `$$SINGLE` keyword disables multiple value display for the next command that generates any object-derived data. When this is used the value that will be displayed in the first one encountered in the internal circuit structure. There are no guarantees that this value will be the first one in any sort sequence.
- You can use a function call to derive a value from the list of object values. There are three built-in functions that may be useful for this: `$$COUNT` (a count of the number of items), `$$MIN` (the item with the lowest numeric value) and `$$MAX` (the item with the highest numeric value).

Multiple Value Items in Function Arguments

When a data item that represents multiple values is used as an argument to a function command, the question arises of whether the value is expanded before or after the function is called. The Scriptor's default behaviour is to expand multiple values *after* a function is evaluated. Put another way, data items that are passed as arguments to a function are not expanded to multiple values. It is assumed that the function will be called once for each object being merged and that the data item in the argument will take on its appropriate value for that single object.

This default behaviour can be overridden using the `$$MERGE` keyword, which can be thought of as the opposite of `$$SINGLE`. If `$$MERGE` is

placed before a data item, its value will be the expanded value of all objects that it represents even if it is an argument to a function.

We will illustrate this by a simple example. Suppose we have a circuit with two devices having the same value in the Part attribute, but different values, “1” and “2” respectively, in the Value attribute. We then execute this script:

```
SSORT $DEVICES &Part
$SETVAR(Test1, )
$SETVAR(Test2, )
$DEVICES&Part $SETVAR(Test1, &Value) $SETVAR(Test2,
$MERGE&Value)
The value of Test1 is &Test1
The value of Test2 is &Test2
```

This script will generate the following output:

```
The value of Test1 is 2
The value of Test2 is 1 2
```

In this case the first \$SETVAR command is executed twice, once with Value equal to “1” and once with Value equal to “2”. The second call overwrites the value of Test1 set by the first call. Note that there is no guarantee of the order of execution, so the value output might be “1”.

The second \$SETVAR has a \$MERGE command, indicating that we want the &Value item to be substituted with all the values of the merged objects, in this case “1 2”.

NOTE: The second \$SETVAR is still executed twice, even though it produces that same value both times. This could be overridden by placing a \$SINGLE in front of \$SETVAR. In this case, the result would not be affected, but it would be a minor inefficiency.

Implementing Mark as OK in Error Checking Scripts

A number of Scriptor commands are provided to assist in creating a “Mark as OK” function in error checking scripts. This is primarily intended for use with the ErrorScript tool, although it could be used elsewhere. The ErrorScript tool has a “Mark as OK” button which the user clicks to indicate that the current object found by the error checking script

should be considered to be not in error and not be located again by future runs of the same error check. It is the error checking script's responsibility to implement this function and to provide the necessary data to the ErrorScript tool.

► *More information on working with the ErrorScript tool is provided in the chapter entitled "Tools for Searching, Browsing and Error Checking" in the DesignWorks 4.0 User's Guide.*

How the Mark as OK Function Works

In order to allow a "Mark as OK" setting to be specific to a certain test, a value is stored in the OKErrors attribute field which represents a bit set numbered from 0 to 31. In designing a set of error checks for a design kit, a bit number is assigned to each error check. When it is scanning circuit objects looking for errors, the script should check its assigned error bit. If the bit is on, then this error check has been masked out for this object and the object should not be considered to be in error.

NOTE: In order to reduce duplicate usage of error bits, bit number 0 to 15 are reserved for use in scripts provided with DesignWorks. Users are encourage to use bits 16 to 31 for their own scripts.

Error Bit Functions

This table summarizes the functions available to operate on the contents of the OKErrors field:

\$ERRORBITON(num)	This returns a TRUE value if the given bit number is 1 in OKErrors, that is, if the corresponding error check should be skipped for this object.
\$ERRORBITOFF(num)	This returns a TRUE value if the given bit number is 0 in OKErrors.
\$SETERRORBIT(num)	This sets the given bit number in OKErrors, i.e. marks this error as OK.
\$CLEARERRORBIT(num)	This clears the given bit number in OKErrors.
\$CLEARERRORS	This sets the OKErrors field to a null value, i.e. re-enabling all error checks for this object.

NOTE: There is no absolute requirement that you use the OKErrors attribute field or any of the functions described here in creating an error

checking script. You are free to use any other attribute fields or script functions in implementing error checks. However, unless there is a good reason for doing otherwise, we suggest using these functions so that the user of your scripts sees a consistent implementation.

How the Mark as OK Value is Stored

The “Mark as OK” bits are stored as an unsigned 32-bit integer represented in hexadecimal form in the OKErrors attribute field. This field is predefined as a secondary field for devices, pins and signals in all designs created in DesignWorks.

Reporting Power and Ground Nets

The “signal source” facility in the Scriptor allows you to name certain signals to be treated as power and ground nets. This has the following two effects:

- It allows you to create common connections in a circuit using attribute entries in devices. This can be used to create power and ground entries in the netlist without having to show all these connections explicitly on the diagram.
- It informs the Scriptor that the given signals should be merged across hierarchy levels.

► For an overview of the methods of creating power and ground connections, see the chapter “Making Signal Connections” in the DesignWorks 4.0 User’s Guide.

Specifying Signal Sources

Any device attribute field may be specified as a signal source by the command:

```
SSIGSOURCE(signalName) &fieldName
```

signalName is the name of the signal to attach pins to in the netlist. *fieldName* is the name of the attribute field to search for in each device to look for pin numbers to attach to the named signal. If *fieldName* is omit-

ted, the signal name is taken to be the name of the attribute field to search.

The named device attribute field is assumed to contain a list of pin numbers to attach to the signal. This can consist of a single pin entry, such as “7”, or a list, such as “5,6,9,14”, separated by commas.

IMPORTANT: In this version of DesignWorks, pin numbers are limited to 4 characters. If you omit the comma in a list like the one above, the entire text string will be taken as a single item and the Scriptor will report a string overflow error.

For example “Ground” connections can be created as follows:

- Using the Get Info command on a selected device, create an entry such as “7” in the Ground attribute for a device, in this case connecting pin 7 to the Ground net.
- Place the command \$SIGSOURCE(Ground) in the script file. This causes Scriptor to search all device attributes for fields named Ground and use the field value as a pin number.

There is no fixed limit to the number of SIGSOURCE entries that can be created.

NOTE: The predefined fields Ground and Power are normally used for standard power and ground connections. These pin connections are prespecified for all digital components in the standard DesignWorks libraries. Corresponding \$SIGSOURCE statements are included, where appropriate, in all standard netlisting scripts. You can create your own special-purpose power nets by using the \$DESIGNSIGSOURCE facility described in the following section.

Creating Design-Specific Signal Source Fields

Including a \$SIGSOURCE command in a script creates a signal source that will be searched for all designs that use that script for output. In some cases it is desirable to specify a special power or ground net that applies only to a single design. For this purpose, most of the standard report scripts included with DesignWorks have a line like this:

```
$DESIGNSIGSOURCE(Si gSources)
```

This command provides a more indirect and flexible way of specifying signal source fields independently for a single design.

NOTE: The SigSources design attribute field is predefined in all designs for this purpose.

This command causes the Scriptor to take the following steps:

- The attribute field named as an argument of the \$DESIGNSIGSOURCE command is taken to be a *design* attribute field. This field is retrieved and scanned for a list of signal source names like this example:

Minus5V, Plus3V

- Each of the items in this list is treated as a signal source. That is the named field is checked in each device for a list of pin numbers and any found are added to a net with the same name.

In this case, placing “Minus5V, Plus3V” in the design field SigSources is equivalent to placing the following lines in the script, for this design only:

```
SSIGSOURCE(Minus5V)  
SSIGSOURCE(Plus3V)
```

NOTE: The \$DESIGNSIGSOURCE mechanism does not provide any way of specifying a field name that is different from the target net name, as can be done with the \$SIGSOURCE command.

To summarize, here are the steps you need to take to use this feature:

- Check that a \$DESIGNSIGSOURCE command exists in the netlist script you are using, or add one. The SigSources design attribute field is predefined for this purpose. If you are using a design kit provided with DesignWorks, check the ReadMe file that came with it for more information.
- Place a list of the special signal source fields that you will need in the design attribute field specified above. These items must be separated by commas and each must be a valid attribute field name.
- Place the desired pin connections for each of these nets in the corresponding attribute field in each device in your design.

When you produce a netlist from this design, you should see new nets with the names specified in the design attribute and with the pin connections derived from the values in each device.

► Also see “*\$DESIGNPINSIGSOURCE/\$DESIGNSIGSOURCE*” on page 99.

Script Hierarchy Issues

The Scriptor has the ability to produce a hierarchical netlist of a circuit, i.e. a list including the internals of hierarchical blocks. The listing can proceed into nested blocks to any desired depth to provide the required detail. For the following discussions, this facility is referred to as “hierarchical netlisting”. Without hierarchical netlisting enabled, only objects in the current circuit level (i.e. that displayed in the topmost window) will appear in a netlist.

Types of Hierarchical Netlists

Two types of netlists can be produced from a hierarchical design:

- **Flattened Netlist:** A flattened netlist is generated by substituting each hierarchical block symbol with its internal circuit. All information about the hierarchical blocks themselves, nesting levels, etc. is lost. The resulting output appears to have been generated from a flat design. This format is most commonly used for printed circuit board netlists.
- **Pure Hierarchical Netlist:** A Pure Hierarchical Netlist consists of a netlist of the master circuit for the design, and then separate netlists of the internals of each type of hierarchical block used. Each internal circuit can be written into a separate file, or all netlists may be concatenated in a single file in either top-down or bottom-up order. This format is commonly used for simulators (e.g. SPICE) and FPGA tools.

IMPORTANT: Since a Pure Hierarchical Netlist contains only a single copy of the definition of each internal circuit, it cannot contain any instance data.

► See the Chapter entitled “Hierarchical Design” in the DesignWorks 4.0 User’s Guide for more information on instance vs. definition data.

The \$HIERARCHY Command

The \$HIERARCHY command in a script file sets the type of netlist output to be generated.

NOTE: The hierarchy mode of the netlist does not have to match that of the design. For example, you can generate a PURE netlist from a PHYSICAL mode design. The following table indicates which design modes are appropriate for the various netlist types.

Report Mode	Design Mode	Description
\$CIRCUIT	FLAT PHYSICAL	Generate a normal netlist for the single current circuit only. This is the default mode.
\$TOPCIRCUIT	FLAT PHYSICAL PURE	Generate a normal netlist for the master circuit of the current design only.
\$FLAT	FLAT PHYSICAL	Generate a flattened netlist for the entire design.
\$FLATDOWN	FLAT PHYSICAL	Generate a flattened netlist for the current circuit and all nested blocks.
\$PURE	FLAT PHYSICAL PURE	Generate a pure netlist for the entire design. In particular, this causes a \$DEVICES listing to list each unique type of device only once.
\$PUREDOWN	FLAT PHYSICAL PURE	Generate a pure netlist for the current circuit and all nested blocks.

Note these points on hierarchical format:

- A flattened netlist will normally make reference to *instance* attributes in the design. Instance attributes are not normally used in a Flat mode design, so this combination is not recommended.
- PURE netlist mode can be used with a FLAT design but no internal circuits will be listed.
- In PURE netlist mode, the internal circuit for each block type is listed only once, regardless of how many times it is used in the design. Therefore, instance data is not normally included in a PURE netlist.

- All hierarchical netlists are affected by the Report Options settings that restrict entry into subcircuits. These are described below.

► See the Chapter entitled “Hierarchical Design” in the DesignWorks 4.0 User’s Guide for more information on instance vs. definition data.

Restricting Reporting of Internal Circuits

The listing of internal circuits of individual blocks can be controlled using the Report Options button in the Get Info command for a device. The option “Report this device” will cause this device or block to appear in the netlist as if it has no internal circuit. The option “Report subcircuit” will cause the internal circuit of this device will appear in the netlist. I.e. in a PURE netlist, the internal circuit will be defined, in a FLATTENED netlist, the internal circuit will be substituted and this device will not appear at all.

NOTE: The “restriction” status is stored in the Restrict device attribute field. Information on the values stored in this field can be found in the appendix “Predefined Attribute Fields” in the DesignWorks 4.0 User’s Guide.

Listing Format for Internal Circuits

For flattened netlists, the output format is usually the same as would be generated from a flat design, except that hierarchical or instance names (see next section) are sometimes substituted for definition names.

For Pure Hierarchical Netlists, formatting is more complex since the format of the master circuit is usually different from the internal circuit definitions. For this reason, the Report tool treats these two types of circuits as two separate format definitions.

The general outline of a Pure Hierarchical Netlist format is as follows:

```
{
  SPURE mode lists each device type once
  so the next $DEVICES listing will only
  list unique type definitions.
}
$HIERARCHY SPURE
{
  The DEFINECIRCUIT section gives the listing
  format for the internal circuits
}
```

```
$DEFINECIRCUIT
{ Listing commands for internal circuit }
$END
{
  Use FIND command to locate all devices that
  have a non-empty Depth attribute, i.e.
  they have an internal circuit. The Depth
  attribute field contains an integer indicating
  the number of circuit levels below this device
}
$FIND $DEVICES &Depth
{
  Sort by the Depth field to list from the
  bottom up. The $DESCENDING option could
  be used to sort from the top down.
}
$SORT $DEVICES &Depth
{
  The following $DEVICES listing will list
  each unique type of device only once because
  we are in $PURE mode. $INTERNAL causes the
  internal circuit to be output for each device
  in the format defined in $DEFINECIRCUIT.
  Other text or commands could be included in
  the $DEVICES line to output a circuit block
  header or terminator.
}
$DEVICES$INTERNAL
{
  Now switch to TOPCIRCUIT mode and do a
  separate listing for the master circuit
}
$HIERARCHY $STOPCIRCUIT
{ Commands to list master circuit }
```

Depth Ordering in Pure Netlists

The Depth attribute field is used to select device types that have internal circuits and to sort by depth for top-down or bottom-up listings.

NOTE: The Depth field is not maintained by the Schematic module during normal editing operations. The Depth value is calculated by the Report tool only when a PURE netlist is generated.

The Depth field will be empty for devices with no internal circuit or those with the “Report This Device” option selected in the device Report Options. For devices with an accessible internal circuit, the Depth field will contain an integer indicating the number circuit levels below the device. E.g. if the device's internal circuit contains only bottom-level

devices, the value will be 1.

The Depth field can therefore be used with the \$FIND command to perform separate listing operations on devices with or without internal circuits. For example:

```
$FIND $DEVICES &Depth
```

will select all devices having an internal circuit, whereas:

```
$FIND $DEVICES $NOT &Depth
```

will select devices having no internal circuit. Similarly, the \$SORT command can be used to determine whether internal circuits are defined from the lowest level up or vice-versa.

```
$SORT $DEVICES &Depth
```

will cause the lowest level devices to be listed first, i.e. bottom up. This is the preferred order for most formats because it ensures that each type of internal circuit is defined before it is referred to in any other circuit.

Instance vs. Definition vs. Hierarchical Names

Devices and signals have three different types of “names” that are significant in producing netlists from hierarchical designs. These are summarized in the following table.

Report Keyword	Attribute	Field Description
\$DEVNAME/ \$SIGNAME	Name	Normally used in Flat mode designs. Not guaranteed to be unique across a hierarchical design.
\$DEVINSTNAME/ \$SIGINSTNAME	InstName	Not normally used in Flat mode designs. InstName is used for package assignment in Physical mode designs. Should be unique across design.
\$DEVHIERNAME/ \$SIGHIERNAME	Temporary generated Scripter	A generated name consisting of the device byor signal Name field prefixed by the names of all containing hierarchical blocks.

Note these rules when selecting which type of name to use in a report format:

- \$DEVNAME/\$SIGNAME should not be used in a flattened netlist

unless you intend to manually guarantee that it is unique across the entire design and each type of hierarchical block is only used once.

- In Physical mode designs, \$DEVINSTNAME should be used as the device “name” in netlists intended for PCB-layout use, since it normally contains the package assignment.
- In flattened netlists, \$SIGHIERNAME should be used for the signal “name” since it ensures a unique name that is easily located in the schematic. \$SIGINSTNAME can be used but must be assigned manually to each signal.

Power and Ground Connections in Hierarchy

Power and ground symbols (i.e. Signal Connector devices) do not make an immediate logical connection across hierarchy levels. For this reason, power and ground connections in different circuit levels will be considered separate nets in a flattened netlist, unless you do one of the following:

- Specify the name of each power and ground net in a \$SIGSOURCE statement in the script. This instructs the Report tool to look for those named nets and integrate them into a single entity.
- Create individual ports for the power and ground connections on each hierarchical block symbol and treat them as regular nets.

File Input and Output

The Scripter is essentially a text file processing module, so issues of directories, file naming, line terminators, etc. are important considerations in writing scripts. This section discusses some of these issues.

File Names and Paths

Whenever a file name is specified in a script, the issue of which directory the file is going to be found in must be considered. Generally, there are two different kinds of files dealt with by the Scripter:

- Design-specific files: These include the design itself, netlists or reports generated from it, back-annotation files and possibly "include" files that need to be copied into output of some kind. These files are modified as the design is created and edited by the user.
- System files: These include the scripts used for netlisting and report generation, Prompter setup tables, etc. These files are normally fixed and may be shared by a number of users.

This division of files raises the following issues:

- Most users will tend to keep these two sets of files in different areas. In fact, in network systems or workgroups, the two sets of files might be on quite separate machines.
- When creating scripts and other system files, it is desirable to make them as portable as possible, so that they don't need to be modified to run on a variety of systems. For this reason it is undesirable to include any absolute pathnames in a script.

In order to handle these situations, the Scriptor keeps track of two directories at any one time:

- The "current directory" for design-specific files.
- The "root directory" for system files.

These are described in the following sections.

Current Directory

While a script is executing, there is always a "current directory", which is the place where output files will be generated. When a script starts, the current directory will be the one containing the design file associated with the current design. If the current design has not been saved, then the current directory will be the location of the DesignWorks program.

During the execution of a script, the current directory can be changed by several things:

- Explicitly selecting a directory with the \$FOLDER/\$DIRECTORY command.
- Creating a new directory with the \$CREATEFOLDER/\$CREATEDIRECTORY command. This sets the current directory to be the new one.
- Opening a new design. This sets the current directory to be the new

design's directory.

Root Directory

The *root directory* is the starting point for locating system files such as scripts and Prompter tables. For larger installations where the program and common files may be shared over a network, DesignWorks also permits multiple root directories. The following points should be noted about root directories:

- If not otherwise specified in the Setup or .INI file, the root directory is the one containing the DesignWorks program.
- The root directory cannot be changed by any script or user commands. It is determined by settings in the Setup or .INI file.
- Names of include files or script names are always given relative to the root directory. The Scriptor does not search recursively insided directories. Therefore, any script name must be specified either with an absolute path name (i.e. starting with the disk name), or must be relative to the root directory.
- If there are multiple root directories, the Scriptor determines of the "current" directory (described above) is in any of the specified root directories, then it searches first in that one. The purpose of this is to allow users on network systems to have a directory on their local disk which contains their designs and local scripts. If this directory is specified as a root, it will be searched first, before looking in the program location.

Platform Compatibility Issues

Although the almost universal use of the ASCII character set makes moving text files between systems relatively painless, there are still some issues that should be considered.

File and Path Names

In this version, the Scriptor does not provide any portable method of specifying file and path names. Any path names given literally in a script will make it platform-specific. This can be overcome by specifying path names as pre-defined variables in the Setup or .INI file. A script (or many scripts) can then refer to this variable without requiring changes.

Line Terminators

One aspect of the ASCII character set that has had varying interpretation is the choice of characters to terminate a line of text. Various systems use different combinations of the line feed (0A hex) and carriage return (0D hex) characters.

On input, i.e. when reading script and include files, the Scriptor accepts any combination of carriage return and line feed as a line terminator. A script file can be passed between Macintosh and Windows systems without changing its functionality and without passing unacceptable characters through to the output. Even though a script file from another system may not display correctly when viewed in a text editor, it should be interpreted correctly as script input.

On output, i.e. when generating report files, the Scriptor by default generates line terminators appropriate for the platform it is running on. The `$LINETERMINATOR` command can be used to explicitly specify output for Macintosh-, Windows- or Unix-compatible systems, or to customize the line terminators to any string. Note that this command affects only the normal report output file. Transcript files, if requested are only ever generated with line terminators appropriate to the host system. See more information on transcript files in “Transcript Output” on page 40.

Special Characters

Both Macintosh and Windows systems allow you to insert special non-ASCII characters in text for international punctuation, accents and special symbols. However, the two systems are not compatible and such characters will generally not be acceptable as input in PCB netlist files, etc. The Scriptor does not check for these characters and will pass them through as literal data if desired. It is recommended that you avoid using these characters unless there is a very specific requirement for them.

Types of Output

Output to File

The most common usage of the Scriptor is to generate text reports, netlists, etc. For this reason, the default behavior is to write all text generated by a script to a text output file. If the script does not explicitly create an output file, the user will be prompted to create one with a standard

"Save" box as soon as the scripted generates its first character of output. If the script generates absolutely no output, then it will run without this prompt. This behavior can be changed by using the \$REPORTON/OFF, \$CREATEREPORT and \$CLOSEREPORT commands, described below.

Text output can be generated with line terminator characters suitable for an operating system different than the one the script is running on. The \$LINETERMINATOR command allows you to set the target system, or specify and explicit line terminator string.

Note that output files can be "nested" to any desired depth. I.e. A script can perform multiple \$CREATEREPORT commands without intervening \$CLOSEREPORT commands. Script output is written to the file created by the most recent \$CREATEREPORT until it is closed by a \$CLOSEREPORT. Output will then go to the next most-recently-created file, etc.

Output to Memory Buffer

The Scripter can also be called by other modules within DesignWorks to perform various operations. The calling module can specify that script output should be written to a memory buffer for use by that module when the script is completed. In this case, the user will not be prompted to create a file when output is generated. Note that the script can still explicitly create an output file using \$CREATEREPORT. This will be considered a nested output file, as described above.

Transcript Output

The Scripter can support a secondary text output file which is open simultaneously with the main output file. This is referred to as a "transcript file" and is intended as a method of creating an error report or log file that allows the script user to trace errors that occurred during report generation, changes implemented by the script, etc.

Many of the same formatting commands and information sources can be used in writing to the transcript file. Text is written to the transcript file by means of the \$WRITETRANSSCRIPT keyword. The argument to this command is evaluated and the resulting text is written to the transcript file. Note that it is the callers responsibility to insert line terminators where desired using the \$NEWLINE keyword.

Note that the transcript file is always written with line terminators native

to the machine it is running on. It is not affected by the \$LINETERMINATOR command.

Text File Input

The Scriptor has the ability to read line-oriented text files and extract arbitrary text data items. This can be used compare a design to an external file or perform simple back annotation tasks. The text file input capability is implemented as a special case of the \$INCLUDE command with the \$EXECUTE option.

► For a complete description of this facility and an example of its usage, see "Using an External File as Data" on page 123.

NOTE: We do not recommend using this facility for performing PCB back annotation involving gate or pin swaps. These operations can have complex side effects when used with gate packaging and other DesignWorks features. The BackAnno utility tool is provided for that purpose.

Regular Expressions

The Scriptor allows you to use Unix-style regular expressions to check the format of character strings and extract data fields from strings of a known format. Regular expressions make it possible to perform the following kinds of operations:

- Check a data field (e.g. a device or signal name) for correct format. For example, you can easily create a pattern that says "a letter followed 1 to 9 more letters, numbers or underscores". If any items are found that don't match the pattern, you can warn the user of a possible error.
- Convert the format of a data item. For example, suppose you have a schematic that uses bus names of the form "A[0:7]" and you want to create a netlist for a system that wants to receive a value that looks like "A<7..0>". You can create a regular expression that will extract the parts of the original data item and use them as elements of a new string.

- Extract data from an incoming text file. The scripter has the ability to read a text file one line at a time and execute a script for each line. You can create a regular expression to match the expected contents of the line and extract data items. These can then be used to set values in circuit objects to perform various kinds of back-annotation.

Regular expressions are invoked using the \$REGEXP command.

The \$REGEXP Command

The \$REGEXP function is the only way to invoke a regular expression. It takes the following form:

\$REGEXP(*regularExpression*, *string*)

The *regularExpression* item is a sequence of characters following the syntax described in the next section. The *string* item is any character string, which can be a literal string, like "VALUE", or a sequence of Scripter commands that generate a string value, such as "\$DEVNAME-\$PINNUM".

The \$REGEXP function returns a "false" value (i.e. null string) if the regular expression does not match the string, or a "true" value (i.e. "1") if it does.

IMPORTANT: The syntax of the function call places a restriction on the use of commas and closing parentheses as literal characters in both the regular expression and the string. If either of these are required as a literal character, they should be preceded by the escape (back-slash) character. This does not apply to closing parentheses used for grouping within the regular expression itself. The parser can detect this usage and will not interpret it as closing the \$REGEXP argument list.

Regular Expression Syntax

A regular expression is simply a sequence of characters that will be compared to another sequence of characters. For example, a string of letters or numbers like "Fred" will match only an identical string of letters or numbers. A small set of punctuation characters have special meaning and are referred to as *metacharacters*. The regular expression metacharacters are:

\ ^ \$. [] | () * + ?

When any of these items is encountered in an expression, they impart special meaning to one or more of the characters that follow. These meanings are summarized in the following table::

Regular Expression Metacharacters

Format	Meaning
.	Matches any character except newline
[a- z0- 9]	Matches any single character of set.
[^a- z0- 9]	Matches any single character not in set (in this context ^ means "not").
\d	Matches a digit; same as [0-9]
\D	Matches a non-digit, same as [^0-9]
\w	Matches an alphanumeric (word) character [a-zA-Z0-9_]
\W	Matches a non-word character [^a-zA-Z0-9_]
\s	Matches a whitespace char (space, tab, newline...)
\S	Matches a non-whitespace character
\n	Matches newline
\t	Matches a tab
\nnn	Matches an ASCII character of octal value nnn
\xnn	Matches an ASCII character of hexadecimal value nn
\CX	Matches an ASCII control character
\metachar	Matches the character itself, i.e. overrides normal meaning of special characters. E.g. "[" introduces a set, but "\[" matches "["
(abc)	Provides grouping and remembers the match for later backreferences and match variables. See below
\n	n is a decimal digit from 1 to 9. Matches whatever the nth set of parentheses matched
x?	Matches 0 or 1 x's, where x is any of above
x*	Matches 0 or more x's
x+	Matches 1 or more x's
x{ m, n }	Matches at least m x's but no more than n
abc	Matches all a, b, and c in order
fee fi e foe	Matches any of fee, fie, or foe

The increasing precedence of operators is alternation, concatenation and unary (*, + or ?). The repetition characters (*, + and ?) all match as many characters as possible before proceeding to the right. For example, in the expression:

```
. *. *
```

the first `.*` will always match the entire string and the second `.*` will match the empty string. This can be particularly significant when using match variables as it will affect which portion of the string gets assigned to which match variable.

Match Variables

A powerful feature of regular expressions is the ability to “remember” what string of characters a specific part of the expression matched. Whenever you enclose part of a regular expression in parentheses, you have implicitly created a *match variable*. Because the syntax of regular expressions only allows one decimal character for a match variable name, there are exactly 9 of them, named “1”, “2”, “3”, etc. As a regular expression matching operation proceeds, the string of characters in the subject string that matched the first set of parentheses in the expression is assigned to 1. Whatever matches the second set of parentheses is assigned to 2, etc. If parentheses are nested, the inner set will be the higher number.

Back-references Within an Expression

You can refer back to a match variable within an expression using the format “\n”. This, in effect, has the meaning “match the same stuff that was matched by the nth set of parentheses again”. This can be used to look for repeating patterns. For a simple example:

```
(.+) \1
```

matches any string that has any sequence of characters repeated twice. For example, any of the following would match:

```
XX 123...123... _1_1_ FredAndMaryFredAndMary
```

Match Variable References Outside an Expression

After the `$REGEXP` command has completed execution successfully (i.e. the pattern matched), the values of the match variables are available for use in the script. This is done by referring to the variables “1” through “9” as `&1` through `&9`.

For example, the following can be used to extract the numeric part of a name:

```
The number is $IF($REGEXP(.*(\d+), $DEVNAME)) &1$END
```

In this case, if the name has no numeric part, nothing will be output. An \$ELSE clause on the \$IF could be used to perform some other operation.

Differences From Unix Regular Expressions

For users familiar with Unix regular expressions, there are only a couple of minor differences, imposed by the structure of a Scriptor command file:

- The ^ and \$ operators that match the beginning and end of a line are not implemented. In this implementation, the regular expression must always match the whole subject string, so they are superfluous.
- A comma character “,” must be escaped when used in a regular expression, because it will otherwise terminate the argument string to the \$REGEXP command. I.e. If you need to match a comma, you must put “\,” in the regular expression.

Regular Expression Examples

This section offers a number of examples of using regular expressions for error checking and for extracting or reformatting text data.

Checking for Numeric Data

Regular expression alone:

```
|\.*\D.*
```

Sample script usage:

```
$IF($REGEXP(|\.*\D.*, SPINNUM)) $SETVAR(_Error, 1)$END
```

This expression matches any text string that is either empty (that is, zero length) or contains any non-numeric character. This could be used, for example, to check for invalid pin number data during netlist generation. This example looks a bit strange because it starts with an “|” alternation operator that is supposed to work on two operands. In this case, the left hand operand is nothing, or the empty string. The right hand operand of the “|” is “\.*\D.*”, in other words “any string of zero or more characters, followed by a single, non-decimal character, followed by any string of zero or more characters”.

Checking for Invalid Characters in Names

Regular expression alone:

```
[a-zA-Z_]+
```

Sample script usage:

```
SFIND $DEVICES $NOT($REGEXP([a-zA-Z0-9_]+, $DEVNAME))
```

This example makes use of the "[" operator to list the allowable characters in a device name, in this case letters, numbers and the underscore character.

Extracting Data Fields

Regular expression alone:

```
([A-Za-z0-9_$\ - ]+). *
```

Sample script usage:

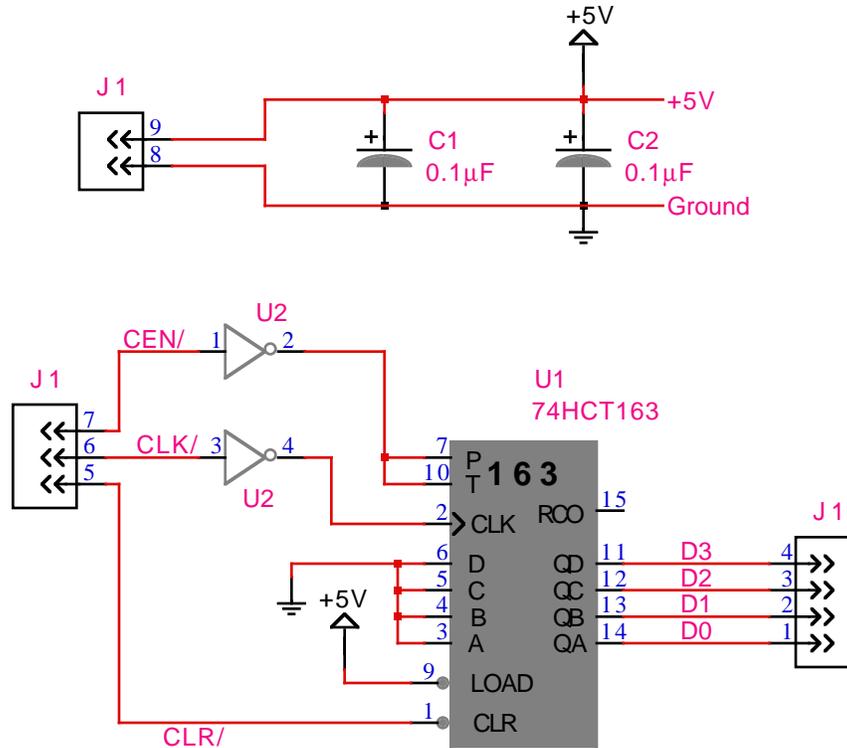
```
SIF($REGEXP(([A-Za-z0-9_$\ - ]+). *, $BUSNAME)) &1$END
```

This example is making use of extra parentheses to assign parts of the matched text to match variables. The "[A-Za-z0-9_\$\ -]+" portion of the expression matches any string of one or more of the characters listed in between "[" and "]". The parentheses around this part of the expression cause the result of this portion of the match to be assigned to match variable number 1. The remaining portion of the expression ".*" will match all remaining characters in the target string.

The script example shown was created to take bus names like "DATA[0,15]" and extract only the name from the front. In this case, once the expression has matched, the script variable &1 will have the value of the portion of the text that matched the portion of the expression in parentheses.

Script Examples

This section provides some detailed examples of report scripts. To illustrate the use of various options, most of the following examples will refer to this sample circuit:



Take note of some of the characteristics of this circuit:

- Several devices have the same name and are intended to be considered as a single device in the reports.
- The connectors labeled "J1" each have a Part attribute entry "Molex 9-pin".
- The inverters labeled "U2" each have a Part attribute entry "74HCT04".
- The capacitors C1 and C2 each have Part attribute entries "Tantalum" and Value attributes "0.1µF".
- The devices U1 and U2 have Power and Ground attributes specifying the standard power and ground pins.

Basic Netlist Formats

A netlist (i.e. a list of the signal connections in a circuit) can take one of

two general forms:

- A listing of the signals (or nets) making up the circuit with each signal name followed by a list of the device pins connected to the signal.
- A listing of the devices making up the circuit, with each device followed by a list of the signals attached to each pin. This type is discussed in a later section entitled "SPICE-type netlists".

The first form (which we will refer to as a signal list) is generated by the \$SIGNALS listing command, the latter using the \$DEVICES command. Thus, just about the simplest script that will produce a netlist consists of just one line, as follows:

```
$SIGNALS$SIGNAME $PINS
```

The keyword \$SIGNALS specifies that a listing of the signals in the circuit is to be produced, but does not in itself specify the format of the list. The text on the balance of the line determines the format of each signal item. In this example, each line will consist of the signal name (\$SIGNAME), followed by a blank, followed by a list of the pin connections associated with this signal. The format of each pin item will be in the default format "device-pin#". This can be overridden using the \$SIGPIFORMAT definition statement.

The output file generated from this file and the circuit in Fig. 1 will be as follows:

```
unnamed U1-7 U1-10 U2-2
unnamed U1-2 U2-4
D0 J1-1 U1-14
D1 J1-2 U1-13
D2 J1-3 U1-12
D3 J1-4 U1-11
CLR/ J1-5 U1-1
CLK/ J1-6 U2-3
CEN/ J1-7 U2-1
Ground C1-? C2-? J1-8 U1-3 U1-4 U1-5 U1-6
+5V C1-? C2-? J1-9 U1-9
```

Note the following problems in this netlist:

- Several unnamed signals are shown with the same label "unnamed".
- Discrete component pins (e.g. C1, C2) are listed with a "?" for the pin number, since no pin number was given on the diagram.
- Power and ground pins are not appearing.

The following script addresses these problems and implements some additional features:

```

$SIGSOURCE(Ground)
$SIGSOURCE(+5V) &Power
$AUTONUMBER(3)
$ASSIGNNAMES $SIGNALS
$SORT $SIGNALS $SIGNALNAME
$SIGNALS$SIGNALNAME$COL(15) $PINS

```

This produces the following output file:

```

+5V C1-2 C2-2 J1-9 U1-9 U1-16 U2-14
CEN/J1-7 U2-1
CLK/J1-6 U2-3
CLR/J1-5 U1-1
D0 J1-1 U1-14
D1 J1-2 U1-13
D2 J1-3 U1-12
D3 J1-4 U1-11
Ground C1-1 C2-1 J1-8 U1-3 U1-4 U1-5 U1-6 U1-8 U2-7
S00001 U1-7 U1-10 U2-2
S00002 U1-2 U2-4

```

Note the following features of this report:

- The \$SORT line causes the nets to be sorted by signal name.
- The \$ASSIGNNAMES line causes default names of the form S00001 to be assigned to any signals that are unnamed.
- The \$AUTONUMBER format command assigns pin numbers to any device with up to 3 pins.
- The \$SIGSOURCE lines indicate that power and ground connections should be extracted from attribute fields of the given names in each device. Connections for the Ground net are extracted from the attribute field with the same name. Connections for the +5V net are extracted from the Power attribute field.
- The \$COL keyword is used in the \$SIGNALS line to set column alignment and improve readability. Note that this will only appear correctly on the screen if displayed with a fixed-space font such as Courier or Monaco. Another alternative is to put a Tab character in the file at that point (either with a literal tab character or using the \$TAB command), allowing tab settings to be used in a word processor to format the output.

Basic Bills of Materials

The simplest list of the devices making up a circuit is generated by the following single-line script:

```
SDEVI CES$DEVNAME
```

Given the sample circuit in Fig. 1, this will generate the following list:

```
U1
U2
U2
J1
C1
C2
J1
J1
```

Note that there is no particular ordering to this list and like-named devices are not combined. The first problem is fixed by using the \$SORT command, as follows:

```
$SORT $DEVI CES $DEVNAME
SDEVI CES$DEVNAME
```

This generates:

```
C1
C2
J1
J1
J1
U1
U2
U2
```

Like-named devices can be combined into a single report line by inserting the command \$COMBDEVSON. The following script also illustrates how attribute parameters can be displayed on each line in fixed columns:

```
$COMBDEVSON
$SORT $DEVI CES $DEVNAME
SDEVI CES$DEVNAME$COL(20) &Part $COL(40) &Val ue
```

This produces the following output file:

```
C1 Tantal um0. 1μF
C2 Tantal um0. 1μF
J1 Mol ex 9- pi n
U1 74HCT163
U2 74HCT04
```

IMPORTANT: Note that the COMBDEVSON flag does not actually combine devices with the same name, but rather devices with the same sort position. Since we sorted by device name, this has the desired effect. This can be used to combine lines based on the contents of an attribute field such as the "Part" entry. This is demonstrated in the following script, which also adds column titles and a use count for each type.

```

$COMBDEVSON
$SORT $DEVICES &Part
Device Type$COL(20) Num. Used$COL(36) Value$COL(50) Refer-
ences
$DEVICES&Part$COL(25) $COUNT$COL(36) &Val-
ue$COL(50) $DEVNAME

```

Note that we are now sorting by part name, so \$COMBDEVSON means, in effect, "combine devices with the same 'Part' field into one line". The \$DEVNAME entry here may be multi-valued, since we may be combining devices with different device names onto a single line. If this happens, the Scriptor will list all values of DEVNAME associated with the "Part" value on that line, as follows:

```

Device TypeNum. UsedValueReferences
74HCT041 U2
74HCT1631 U1
Mol ex 9- pi n1J1
Tantal um20. 1µFC1 C2

```

IMPORTANT: Since we are sorting by Part value, and not by name, it is important that like-named devices have the same attribute values, otherwise they will appear on different lines.

Exporting to Spreadsheets and Word Processors

DesignWorks reports can readily be exported to spreadsheet programs such as Microsoft Excel or word processors such as Microsoft Word to take advantage of those programs' formatting and data analysis capabilities. Typical applications include:

- Creating formatted copy for presentations or permanent documentation.
- Using spreadsheets to compute pricing, board area, power usage, or other parameters of a design.

Export Format

In general, the important element in exporting data to either type of package is tabs. Spreadsheets typically use tab characters to separate fields when importing text data, and word processors can make use of tabs to provide adjustable column formatting. Use of blanks and the \$COL operator in a script should be avoided, since blanks do not have a fixed width in most Macintosh fonts and will result in inconsistent results.

Inserting Tabs

A tab character can be inserted anywhere in the report script and will be passed directly to the output file. Consider the following sample component list generator (based on the last example in the previous section):

```
SCOMBDEVSON
SSORT $DEVICES &Part
Device Type$TAB\Num. Used$TAB\Value$TAB\References

$DEVICES&Part$TAB$COUNT$TAB&Value$TAB$DEVNAME
```

NOTE: The \$TAB command has been used in this case to clarify where a tab has been used. It is also possible to insert a literal tab character into the file. The "\ " backslash after \$TAB in the title line is not absolutely required in this case, but is good practice, both for readability and to ensure that the following text does not get considered as part of the command by the script parser.

This format allows us to make use of the tab options in the word processor to improve the look of the report, as follows:

```
Device TypeNum. UsedValueReferences
74HCT041 U2
74HCT1631U1
Mol ex 9- pi n1J1
Tantal um20. 1µFC1 C2
```

In cases where a single command causes multiple items to be placed in a report, such as \$PINS, the \$ITEMSEPARATOR specification must be used to insert tabs between items in the list. Thus exporting a netlist with tab separators can be done with the following script (adapted from the preceding section on netlists):

```
SSIGSOURCE(Ground)
SSIGSOURCE(+5V) &Power
$ITEMSEPARATOR( tab)
```

```

$AUTONUMBER(3)
$ASSIGNNAMES $SIGNALS
$SORT $SIGNALS $SIGNALNAME
$SIGNALS$SIGNALNAMEtab$PINS

```

The notation `tab` indicates a tab character.

Page Separators

When exporting data to a spreadsheet, you will normally not want any page breaks to be inserted in the data since they would confuse the importing program. Page breaks can be disabled by setting the `$LINESUSED` and `$PAGELENGTH` format options to large values, as follows:

```

$LINESUSED(32000)
$PAGELENGTH(32000)

```

When exporting to a word processor, you can chose to use either of two methods:

- Use the above settings and generate a continuous list, allowing the word processor to determine the page breaks.
- Set `$PAGELENGTH(0)` and `$LINESUSED(50)` (or whatever number suits your application) to force the Scriptor to insert a form feed character (page break) and a page header on each page.

Error Checking Examples

The Scriptor can be used to check for various kinds of circuit errors such as missing or overlapping names, missing attribute fields, unconnected signals, etc. Making use of the `$ALERTx`, `$PROMPTx` and `$SELECT` commands, it is possible to create a script that checks for these errors without even generating an output file.

Missing Attribute Fields

The following report script will check a circuit for any devices missing the field "SUPPLIER" and write out a list of the offending items:

```

$FIND $DEVICES $NOT(&SUPPLIER)
$SORT $DEVICES $DEVNAME?$DEVICES$DEVNAME

```

By changing the `$DEVICES` command to select the devices instead of reporting them you can have it report the errors immediately instead of writing them to a file:

Script Examples

```
$REPORTOFF
$FIND $DEVICES $NOT(&SUPPLIER)
$DEVICES$SELECT
```

The \$REPORTOFF command is necessary because the \$DEVICES command will generate a line terminator after each device line, even if there is nothing on it. This added command prevents any file output from being generated.

Unconnected Signals

The following script will create a listing of all signals with zero or one pin connections on them:

```
$FIND $SIGNALS $LT($NUMPINS, 2)
$SORT $SIGNALS $SIGNAME
$SIGNALS$SIGNAME
```

Duplicate Pin Numbers

To be added. See \$SAMEPINCOUNT.

Incorrect Name or Attribute Format

to be added. See \$REGEXP.

Using the Scriptor to Assign Names

A report script can be used to assign names to groups of devices in a circuit without actually generating a report. For example, the following script assigns a name of the form "Cn" to all capacitors in the circuit:

```
$FIND $DEVICES $TYPENAME(Cap*) $NOT $DEVNAME
$SORT $DEVICES $PAGE $POSY $POSX
$ASSIGNNAMES $DEVICES $FORMAT(C1)
```

We first find all devices with a library type name beginning with the letters "Cap" and not already named. We then sort the devices by page number and position on the drawing. Then we assign the default names. These names will initially be invisible, but can be made visible by using the Browser tool.

Giving Priority to Nets

When a netlist is to be used to drive a PCB layout system, it is frequently

desirable to bring certain nets to the front of the list to give them higher routing priority. This can be done by inserting an attribute field into the highest priority nets and sorting first on this field. Nets will appear in ascending order of the value in this field. Nets without any field specified will appear last.

In the following example, the field PRIORITY with value 0 has been inserted in the attributes for the net Ground in the sample circuit used in the first sections of this chapter. A reference is made to this field in the \$SORT command in the script, as follows:

```

SSIGSOURCE(Ground)
SSIGSOURCE(+5V) &Power
$AUTONUMBER(3)
$ASSIGNNAMES $SIGNALS
$SORT $SIGNALS &PRIORITY $SIGNAME
$SIGNALS$SIGNAME$COL(15) $PINS

```

This gives the following results:

Ground	C1-1 C2-1 J1-8 U1-3 U1-4 U1-5 U1-6 U1-8
+5V	C1-2 C2-2 J1-9 U1-9 U1-16
CEN/	J1-7 U2-1
CLK/	J1-6 U2-3
CLR/	J1-5 U1-1
D0	J1-1 U1-14
D1	J1-2 U1-13
D2	J1-3 U1-12
D3	J1-4 U1-11
S00001	U1-7 U1-10 U2-2
S00002	U1-2 U2-4

Note that the Ground net is now listed before all others and the remaining items are still sorted by name.

Devices by page number

This example uses a sort by attribute fields to make an index to locate types used in a design. This is an extract from a multi-page circuit in which each device has a field called "type" specifying its vendor type number. In addition, discrete components have a field called "Value" with their component value. The following report script is used:

```

$COMBDEVSON
$SORT $DEVICES &Part &Value
TYPEtabVALUEtabPAGES

$DEVICES&Part$TAB&Value$TAB$PAGE

```

This script produces the following results:

```
TYPEVALUEPAGES
```

```
74HC04 1 2 3
```

```
74HC1931 3
```

```
RES 1/4W10K1 2
```

```
RES 1/4W20K1
```

Industry Netlist Formats

In this section we will illustrate how the various Report options can be combined to produce standard netlist formats to interface with outside PCB layout, simulation and other design programs on the Macintosh or other machines.

IMPORTANT: The following examples are provided as illustrations only and may not include all the format information needed to reliably interface with a given external system. We have no control over the specifications for third-party systems and these may change from time to time. The standard scripts provided on disk with DesignWorks may differ from the examples given here. Use a text editor to view these files directly for more complete and up-to-date information.

SPICE-type Netlists

SPICE-based analog simulation programs read all their circuit structure and simulation information from a text file, which must include the following:

- A title line.
- Setup commands which set parameters for the simulation, with one command per line. These usually begin with a ".", such as ".tran" or ".ac".
- One line of information per device in the circuit. Each line starts with the device name (the first letter of which determines its type), a list of the nodes attached to that device, then any parameters required for the device.
- An end marker line.

The order of these lines in the file is not significant, except that the first line is the title line, and the last line must be ".end".

A simplified SPICE report script contains the following commands:

```
$CREATEREPORT($DESIGNNAME.IN)
$DESIGNNAME $DATE $TIME
&Spice
$DEVICES$DEVNAME $PINS &Spice
.end
```

These commands perform the following functions:

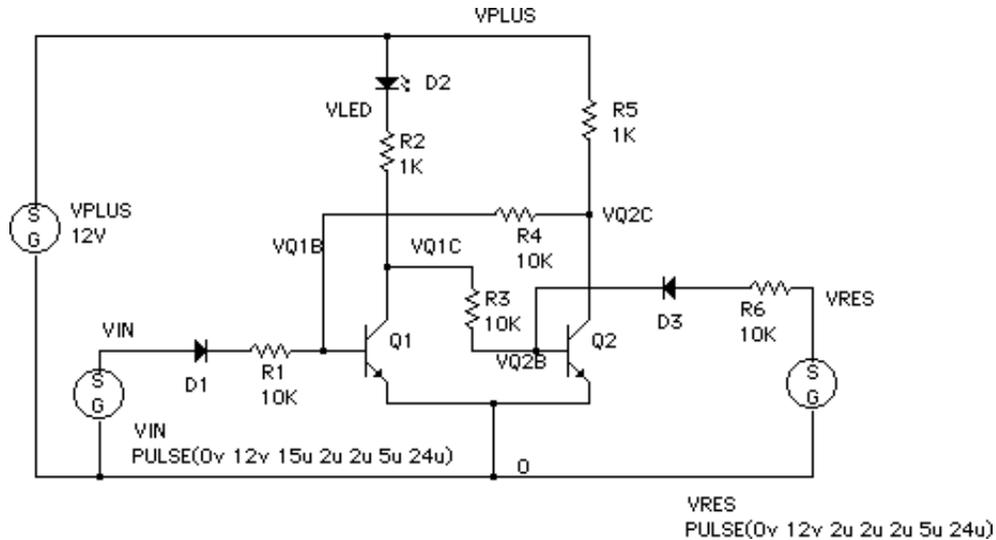
- `$CREATEREPORT($DESIGNNAME.IN)`—causes the string ".IN" to be added to the name of the design file to create the default name for the output file.
- `$DESIGNNAME $DATE $TIME`—create a title line in the output file consisting of the circuit file name and the date and time at which the report was generated.
- `&Spice`—Copies the contents of an attribute field called Spice from the design attributes (set up using Set Design Attributes command in the Options menu). This is used to insert SPICE parameter lines before the actual netlist.
- `$DEVICES$DEVNAME $PINS &Spice`—causes a list of devices to be written into the file. Each line will contain the device name, a list of the attached signals (nodes), followed by the contents of an attribute field called Spice. Note that SPICE uses the first letter of the device name to determine its type. It is up to the user to name each device appropriately.

The \$PINS item lists the pin signals in the order that the device pins were defined in the DevEditor. Therefore it is very important that the device libraries used to create the circuit have a pin order that matches SPICE's requirements. The SPICE Devices library provided with DesignWorks meets this requirement.

`.end`—inserts the actual text ".end" in the output file, which is the SPICE termination marker.

Given this circuit:

Script Examples



the report script shown above generates this output file:

```

SPICE Demo Monday, August 10, 1992 11:05 AM
.TRAN .5US 26US UIC
.model MOD1 npn(bf=80 rb=100 ccs=2pf tf=0.3ns tr=6ns
cj e=3pf cj c=2pf
+ va=50)
.model DIODE1 D
Q1 VQ1C VQ1B 0 MOD1
R1 S00001 VQ1B 10K
R2 VQ1C VLED 1K
R5 VQ2C VPLUS 1K
R3 VQ2B VQ1C 10K
Q2 VQ2C VQ2B 0 MOD1
D2 VLED VPLUS DIODE1
D1 VIN S00001 DIODE1
R4 VQ1B VQ2C 10K
VPLUS VPLUS 0 12V
VIN VIN 0 PULSE(0v 12v 15u 2u 2u 5u 24u)
VRES VRES 0 PULSE(0v 12v 2u 2u 2u 5u 24u)
R6 S00002 VRES 10K
D3 S00002 VQ2B DIODE1
.END

```

Say, for example, you wished to assign arbitrary names to the devices in your circuit without the restriction of using the first letter to determine the device type. This could be done by placing a field in the attributes for each device containing only the type letter, as in the following example:

FieldValue

```
SPTYPEV
SpiceAC 1
```

The script could then be modified as follows to insert this new parameter in the netlist:

```
SDEVICES&SPTYPE$DEVNAME SPINS &Spice
```

The SPICE name would then consist of the concatenation of the contents of the SPTYPE field and the device name. As an alternative to specifying SPTYPE in every device, this field could be entered into the device library entry for this type.

PCAD Format

A PCAD-format (PDIF) netlist for the sample circuit given at the beginning of the Examples section would look like the following:

```
% Project Report Gen Circuit Sunday, March 11, 1992
{COMPONENT Report Gen Circuit.PCB {ENVIRONMENT Report Gen
Circuit} {DETAIL {SUBCOMP
{I Tantalum C1
{CN 1 Ground 2 +5V
}
}
{I Tantalum C2
{CN 1 Ground 2 +5V
}
}
{I Molex 9-pin J1
{CN 1 D0 2 D1 3 D2 4 D3 5 CLR/ 6 CLK/ 7 CEN/ 8 Ground 9 +5V
}
}
{I 74HCT163 U1
{CN 1 CLR/ 2 SIG3 3 Ground 4 Ground 5 Ground 6 Ground 7
SIG1 8 Ground 9 +5V 10 SIG1 11 D3 12 D2 13 D1 14 D0 15
SIG2 16 +5V
}
}
{I 74HCT04 U2
{CN 1 CEN/ 2 SIG1 3 CLK/ 4 SIG3 7 Ground 14 +5V
}
}
}}}
```

Note that this is a listing by device, not by signal, similar to the SPICE script illustrated previously. Each new device is introduced by the "{I" then the type, name, and list of attached signals follows.

This was generated using the following script:

```
$CREATEREPORT($DESIGNNAME.PCAD) $PROMPT
```

```
$LINETERMINATOR $DOS
$SIGSOURCE(Ground)
$SIGSOURCE(P1 us5V) &Power
$DESIGNSIGSOURCE(SigSources)
$AUTONUMBER(3)
$COMBDEVSON
$ASSIGNNAMES $DEVICES $FORMAT(U1)
$ASSIGNNAMES $SIGNALS $FORMAT(SIG1)
$SORT $DEVICES $DEVNAME
$DEVPIFORMAT $PINNUM $SIGNAME
% Project $DESIGNNAME $DATE
\{COMPONENT $DESIGNNAME.PCB \{ENVIRONMENT $DESIGNNAME\}
\{DETAIL \{SUBCOMP
$DEVICES\{I &Part $DEVNAME$NEWLINE\{CN $PIN$NEW-
LINE\} $NEWLINE\}
\}\}\}
```

Note the following important features of this script:

- The \$CREATEREPORT command causes the default report file name to be set to the name of the design with ".PCAD" appended. The user will be prompted to verify or change the name before proceeding.
- The \$LINETERMINATOR command is being used to ensure that the correct line terminator characters are inserted for a DOS- or Windows-based package even if the script is run on a Macintosh.
- The SIGSOURCE commands provide the names of power and ground nets that can be specified in device attribute fields. Note that in the above sample netlist, several power and ground connections are shown that do not appear on the diagram. These are derived from device attributes. Every device in the circuit will be searched for an attribute field with any of the given names. If a field is found, the list of pin numbers it contains will be added to the net with the same name. Note that it is possible to use an attribute field with a different name than the net, if needed. See the SIGSOURCE command for details.
- The DESIGNSIGSOURCE command will allow the user to specify other attribute fields as signal sources by placing the desired names in a design attribute called SigSources.
- The AUTONUMBER command specifies that devices with 3 or less pins will have pin numbers assigned automatically even if they do not appear on the diagram. This is intended to number discrete components which do not have numbers showing on the diagram.
- The COMBDEVSON command specifies that multiple devices with the same sort value (in this case, the same device name) should be combined into a single device entry.

- The ASSIGNNAMES commands cause default names to be created for any unnamed signals or devices. For devices, the names will be of the form "Un" where "n" is an integer. For signals, the names will be of the form "SIGn". The circuit is searched before assigning names to ensure that the new names do not match any existing ones.
- The SORT command sorts the devices by name, for improved readability.
- The DEVPINFORMAT command sets the format for each device pin in the following \$DEVICES listing. In this case, each entry will show the pin number followed by a blank and the signal name.
- The "% Project" text is not a command, so it is transmitted directly to the output file. The \$DESIGNNAME command is replaced by the name of the design being reported. The \$DATE command is replaced by the date the report was created.
- In order to meet the PCAD format requirements, the "COMPONENT" line must start with an opening brace "{". Since this is the Scripter's comment character, it must be preceded by an escape character "\". The backslash character does not appear in the output. The rest of this line is straight text, except for the \$DESIGNNAME commands that are substituted as noted above.
- The DEVICES line is the heart of the report. Everything following the "\$DEVICES" keyword on the line will be repeated once for each device listed. In this case, each new device will be introduced by the text "{I " (note the escape character required for each brace), followed by the type name (extracted from an attribute field), the device name, then a line terminator (NEWLINE). The second line of the entry will contain the text "{CN " followed by a list of the pins attached to the device. Each device entry will be terminated by two closing braces, matching the opening ones at the beginning.
- the whole file is terminated by three closing braces.

Cadnetix Format

The following script generates a netlist appropriate for a Cadnetix PCB layout system:

```
SCREATEREPORT($DESIGNNAME.NET) $PROMPT
SCOLUMNS(80)
SSIGSOURCE(Ground)
SSIGSOURCE(+5V) &Power
SAUTONUMBER(3)
```

Script Examples

```
$BLANKREPLACE(_)  
$COMBDEVSON  
$PINFORMAT $DEVNAME $PINNUM  
$CONTEND( $)  
$SORT $SIGNALS $SIGNAME  
COPYRIGHT &Copyright &Company  
DESIGNERS: &Designers  
DATE:      $DATE  
FILE:      $DESIGNNAME.NET  
PARTS LIST  
ID &ProjectID  
$SORT $DEVICES &Part  
$DEVICES&Part &Package $DEVNAME  
EOS  
$MAXITEMSPERLINE(8)  
$SORT $DEVICES $DEVNAME  
NET LIST  
$SIGNALS\NN $SIGNAME $PINS  
EOS
```

Note the following unique features of this format:

- The `BLANKREPLACE` command is used to ensure that blank characters do not appear in any names in the file.
- The `$CONTEND` command sets the string "\$" to be placed at the end of any data line that is being continued to the next line because the `$LINEWIDTH` or `$MAXITEMSPERLINE` settings were exceeded.
- a number of design attribute fields are referred to, including `&Company`, `&Designers`, and `&ProjectID`. These must be specified in the Set Design Attributes command or they will not appear in the report file.
- the `$MAXITEMSPERLINE` command is used to specify how many pin entries can appear on a single line before a continuation line is created.
- the Scriptor stops scanning for a keyword once it recognizes something. For example, the escape character could have been omitted from "\$SIGNALS\NN" since the parser stops when it finds a keyword. However, the script will be more clear and confusion will be avoided to always separate keywords from following literal, non-blank text with a backslash.

Part II—Script Keyword Reference

This part of the manual lists all the command keywords defined in the script language, in alphabetical order.

WARNING: Many of the keywords described here were added to the language to support specific netlist formats or customer requirements. We do not guarantee that all keywords and commands have been tested in every possible combination. When using these commands to create critical netlists or reports, please verify your results carefully before relying on them!

For each keyword, the following information is provided:

- **Keyword**—The keyword as it should appear in the script. In some cases, two or more related keywords are grouped together.
- **Status**—This indicates whether this is a new feature in DesignWorks 4.0 or whether any changes have been made since 3.1.x.
- **Synopsis**—A short summary of the usage of the keyword, i.e. what arguments it takes. Note that the following meta-characters are used to indicate optional or alternative constructions in the synopsis:
 - ◆ `[]` surround an optional item, e.g. `$DATE[(format)]`.
 - ◆ `|` indicates an alternative, for example `$SORT $DEVICES|$SIGNALS`.
 - ◆ *italics* indicate an item that should be replaced by text performing the given function, e.g. *msgText* will be replaced by the actual argument text.
 - ◆ **bold type** indicates literal text that should be included exactly as given.
- **Returns**—A description of the "return value" of the keyword, i.e. what value will get substituted for it in the output file. N.A. (not applicable) indicates that this keyword has no value.
- **Type**—This will be either "Data", "Action", or "Definition". This distinction determines how the keyword is handled if it appears by itself on a line. If a line of the script contains only Definition or

Action keywords, then no line terminator is written out to the file. If the line contains one or more Data keywords, then the line is considered to be output data and a line terminator will be written out after all data generated by the keywords.

- **Where**—This indicates where the keyword can be used. The following locations are specified:

Top Level	The keyword must be on a line by itself, starting in column 1. This keyword can operate successfully without any current design.
Top Level - Design	The keyword must be on a line by itself, starting in column 1, and there must be a current design available in order for the keyword to obtain the data necessary to calculate its value or perform its function.
Script	The keyword can be in any executed part of the script, i.e. not in a value mapping table or other areas that are interpreted as raw data. The keyword does not need to refer to any object to perform its function.
Script - Design	As for Script, except that there must be a current design.
Script - Device	As for Script, except that there must be a current device at the position the keyword is at in the script.
Script - Signal	As for Script, except that there must be a current signal at the position the keyword is at in the script.
Script - Pin	As for Script, except that there must be a current pin at the position the keyword is at in the script.

Notation of Changes

There are many other changes, large and small, that are noted in the In the following reference sections. In order to help you discover and make use of these changes, each keyword described here will be flagged with one of the following notations:

New in 4.0—Marks commands that are completely new.

Updated in 4.0—Marks commands that have new options or uses.

New in 3.1.x—Marks commands that were added or updated after the initial 3.0 release, i.e. they are different from the description given in

the 3.0 manual, but were described in the "New Report Features" technical note.

Obsolete—Marks commands that are still supported but the same function can now be obtained using more general new features.

No change in 4.0—Marks commands with no significant change in meaning or usage in the new version.

Keyword	\$ALERT1/\$ALERT2
Status	New in 4.0
Synopsis	\$ALERT1 (<i>message</i>)
Returns	Boolean
Type	Data
Where	Script
Description	Displays an alert box to the user with the given message text. \$ALERT1 displays only one button, OK. \$ALERT2 displays two buttons, OK and Cancel. Returns TRUE for OK, FALSE for Cancel.
Example	<code>\$ALERT1(\$TIME is too late for this kind of thing. Go home!)</code>

NOTE: If \$ALERTx is used on a line by itself, it will insert the value "1" into the output file if OK is pressed, which may not be desired. You can prevent by enclosing the whole thing in a \$NULL command, as in:

```
$NULL($ALERT1(Warning: Some value changes were made.))
```

► See also \$PROMPT1/\$PROMPT2.

Keyword	\$ALIGNCOLSON/\$ALIGNCOLSOFF
Status	No change in 4.0
Synopsis	\$ALIGNCOLSON \$ALIGNCOLSOFF
Returns	N.A.
Type	Definition
Where	Top Level
Description	Turns on/off automatic column alignment.
Example	<code>\$ALIGNCOLSON</code>

When ON causes extra blanks to be inserted between netlist or component list entries to force column alignment. This improves readability when used with a fixed-space font such as Monaco or Courier. If \$ALIGNCOLS is OFF, then the item separator will be a tab if \$TABFIELDS is ON, or a single blank otherwise. Default is OFF.

NOTE: You may have to insert a number of blanks at the front of continuation lines using \$CONTSTART to force correct alignment of the first item in each continuation line.

The column spacing that is used by the \$ALIGNCOLSON option is set by the \$SPACE command.

► See also: \$SPACE.

Keyword	\$AND
Status	New in 4.0
Synopsis	\$AND(<i>string1</i> , <i>string2</i>)
Returns	Boolean
Type	Data
Where	Script
Description	Performs a logical AND operation on its two arguments. Any non-null string in an argument is considered TRUE.
Example	SI F(\$AND(&X1, &X2)) &X1 / &X2 SELSE &X1 &X2 SEND

Keyword	\$ASSIGNINSTNAMES
Status	No change in 4.0. Changed in 3.1.5.
Synopsis	\$ASSIGNINSTNAMES \$DEVICES \$SIGNALS <i>format</i>
Returns	N. A.
Type	Action
Where	Top level - Design
Description	Assigns default names to the InstName field of any device or signal not having one.
Example	\$ASSIGNINSTNAMES \$DEVICES

The \$ASSIGNINSTNAMES command has exactly the same format and operation and the \$ASSIGNNAMES command except that it operates on the InstName field instead of the Name field. It is intended for use when producing flattened netlists from designs created in the Physical Hierarchy mode. The Physical Hierarchy mode allows the InstName field to take on a different value for each physical device represented by a design, and so can be made unique throughout a hierarchical design. By contrast, the Name field is only guaranteed to be unique within a single circuit block and will be the same inside all instances of the same sub-circuit.

► For a complete format summary, see "\$ASSIGNNAMES" on page 67.

Keyword	\$ASSIGNNAMES
Status	No change in 4.0. Changed in 3.1.5.
Synopsis	\$ASSIGNNAMES \$DEVICES \$SIGNALS [\$REASSIGN] <i>format</i>
Returns	N. A.
Type	Action
Where	Top level - Design
Description	Assigns default names to the Name field of any device or signal not having one.
Example	\$ASSIGNNAMES \$DEVICES \$REASSIGN

The \$ASSIGNNAMES command is used to apply names to unnamed devices or signals in the circuit before a listing is generated. If this is not done, any object which has not been named (either manually or by the auto-naming or packaging features) will appear as "unnamed" in a net or component list.

The names assigned by \$ASSIGNNAMES will be invisible but permanently associated with the object. They can be made visible either using the Attributes command associated with the object or the Browser tool.

Note that \$ASSIGNNAMES can be used in conjunction with the \$FIND command to assign names to selected subsets of devices, such as all resistors, etc. See the Examples section for more information.

The "object type" specification (either "\$DEVICES" or "\$SIGNALS") is mandatory, all other items are optional.

Note that the same format and options apply to the \$ASSIGNINST-

NAMES command, mentioned elsewhere in this note.

Note the following examples:

```
SASSIGNNAMES SDEVICES $TYPENAME $FORMAT(format) &pre-
fixField $REASSIGN
SASSIGNNAMES $SIGNALS &prefixField $REASSIGN
```

The \$REASSIGN keyword is optional and indicates what to do if the object in question already has a program-assigned name. If \$REASSIGN does not appear, any existing name will be kept, regardless of how it was created. If \$REASSIGN appears, then all program-assigned names (whether auto-assigned by the Schematic tool while the circuit was being edited, or generated by a previous report) will be removed and replaced with new, sequentially-assigned names.

The \$TYPENAME, \$FORMAT and &prefixField items are all optional and specify how a name is to be generated. If none of these items appears on the line, then the default format will be used. For devices, this is the contents of the prefix field plus an integer. For signals, it is the specified default signal prefix plus an integer.

\$TYPENAME indicates that the device's type name (i.e. the name that appears in the Parts palette) is to be used as a prefix. If a \$FORMAT appears as well, or if the default format is used, the type name is prefixed to the name that would be generated by the \$FORMAT alone.

&prefixField specifies an attribute field to be used as a source for a prefix. If all three format specifications are given, all three prefixes will be concatenated.

NOTE: In normal circuitstances, we do not recommend specifying the following \$FORMAT option in \$ASSIGNNAMES or \$ASSIGNINSTNAMES when assigning to signals. If you specify a format that is anything other than the default, the Schematic tool will assume these are fixed, user-assigned names and will not reassign them during editing operations. This can result in errors if a section of schematic is copied, creating duplicate names.

\$FORMAT specifies a format string consisting of an alphabetic part followed by a numeric part. The alphabetic part will be used as the prefix for every name generated. The numeric part is used simply to specify the number of digits to be used. For example, the default format "D00000" indicates that all names are prefixed with "D" and the numeric part will

have a fixed length of 5 digits. Extra digits are added to the numeric part if needed, so "U0" will generate U123 for the 123rd device.

NOTE: Pre-3.0 versions of DesignWorks also supported a \$PERM keyword anywhere in the \$ASSIGNNAMES line. This indicated that the assigned names were to be made permanent after the report generation was completed. This is no longer an option. All name assignments remain after the report is generated. The \$PERM keyword is ignored.

► See also: \$UNNAMEDDEVS \$UNNAMEDSIGS \$ASSIGNINSTNAMES

Keyword	\$ATTRNUM
Status	Obsolete in 4.0

Keyword	\$AUTONUMBER
Status	No change in 4.0
Synopsis	\$AUTONUMBER (<i>number of pins</i>)
Returns	N. A.
Type	Definition
Where	Top-Level
Description	Specifies a number of pins less than or equal to which a device will have pin numbers automatically assigned in the report output for any reference to \$PINNUM.
Example	\$AUTONUMBER(3) Will automatically provide a pin number whenever a \$PINNUM command appears for an unnumbered device pin on a device which has 3 or less pins.

Any device with less than or equal to the number of pins specified will have pin numbers automatically substituted if the \$PINNUM keyword is used and no pin numbers are present in the circuit file. This option is intended to provide pin numbers for discrete components in a circuit, since they do not normally have pin numbers on a diagram. The default number is zero. Note that this option does not make any change to the circuit data itself, but is simply a substitution that is made during report generation.

Keyword	\$BLANKREPLACE
Status	No change in 4.0
Synopsis	\$BLANKREPLACE (<i>string</i>)
Returns	N. A.
Type	Definition
Where	Top-Level
Description	Specifies a string of characters that will be substituted for a blank in any device or signal name.
Example	\$BLANKREPLACE (_) <p>Will replace each blank in a name with an underscore character.</p>

The \$BLANKREPLACE item specifies a string of characters that will be substituted for a blank in any device or signal name. This is done to accommodate systems which cannot accept blanks in names.

► See also: \$CHARMAP.

Keyword	\$BREAK
Status	New in 4.0
Synopsis	\$BREAK (<i>blockName</i>) \$DEVICES \$SIGNALS [\$FIRSTON/OFF] <i>format</i>
Returns	N. A.
Type	Definition
Where	Top-Level
Description	Sets up a value break condition for a subsequent \$DEVICES or \$SIGNALS listing.
Example	\$BREAK (Partshdr) \$DEVICES &Value <p>Will insert the contents of block "Partshdr" at the front of the next \$DEVICES listing and again every time &Value changes.</p>

The \$BREAK command is used to create listings such as parts lists in which a title block or page break is inserted between groups of lines that are related by some value. For example, you could create a listing in which capacitors are grouped together, resistors are grouped together, etc.

Following is a typical example of usage of this feature:

```
SDEFINBLOCK(PartsHdr)

-- Here are the parts of type &Function

$END
$SORT $DEVICES &Function $DEVNAME
$BREAK(PartsHdr) $DEVICES &Function
$DEVI CESSDEVNAME &Val ue
```

Before each line is generated, the Scripter evaluates the format string, in this case "&Function" and compares the current value to the value in the last line. If the value is different, the contents of the block "PartsHdr" are evaluated and written to the output.

Notes on the \$BREAK command:

- Before performing the listing, you must have specified a \$SORT on the same value that is used for the break, or the listing will not make much sense. This is not checked by the program. If you have not sorted, the program will simply insert a header whenever two adjacent lines have different values of the format string.
- While the header block is being interpreted, the "current object" is the device or signal that is about to be listed. Thus, if you make reference to an attribute or command that refers to an object, it will use the values that would be in effect for the next line.
- You can control whether a header is inserted before the first line using the \$FIRSTON/\$FIRSTOFF keywords. See below.
- A break remains in effect for all subsequent listings once it is established. To turn it off again, you can specify a null format string, as in:

```
$BREAK(PartsHdr) $DEVICES
```

Optional Header Insertion Before First Break

The optional keywords \$FIRSTON/\$FIRSTOFF can be used to control whether a break header is inserted before the start of the listing. If the \$FIRSTON keyword appears immediately after \$DEVICES or \$SIGNALS, then the break header will be inserted immediately before the first device or signal line. If \$FIRSTOFF appears, no header will be inserted until the first value change. The default is \$FIRSTON.

► See also \$HEADER.

Keyword	<code>\$BUSCLOSE</code>
Status	New in 4.0
Synopsis	<code>\$BUSCLOSE(<i>string</i>)</code>
Returns	String
Type	Data
Where	Script - signal
Description	Returns the given string if the current object is in a named bus.
Examples	<pre>SSI GNALS\$BUSNAME() SSI GNAME\$BUSCLOSE()</pre> <p>This will generate a list of the signals in the circuit. If a signal is in a bus, then it will appear as "busName [sigName] ", otherwise it will just appear as "sigName".</p>

► See also `$BUSNAME`.

Keyword	<code>\$BUSNAME</code>
Status	No change in 4.0
Synopsis	<code>\$BUSNAME[(<i>suffixStr</i>)]</code>
Returns	Text
Type	Data
Where	Script - signal
Description	Returns the name of the bus associated with the current object. An optional suffix string allows this keyword to be used with <code>\$SIGNAME</code> to provide a compound name when the signal is in a bus.
Examples	<pre>SSI GNALS\$BUSNAME() SSI GNAME</pre> <p>This will generate a list of the signals in the circuit. If a signal is in a bus, then it will appear as busName_sigName, otherwise it will just appear as sig-Name.</p>

The naming rules in DesignWorks allow signals with the same name to exist in multiple different busses without being connected. This means that any report output referring to `$SIGNAME` risks being ambiguous if busses have been used in the design. For this reason, it is best to qualify signal names with the name of any enclosing bus. `$BUSNAME` allows this by inserting the name of any enclosing bus and an optional separator character in the output.

Because the given separator string is only inserted if the bus name is non-null, \$BUSNAME can always be inserted in front of the \$SIGNAME command without interfering with non-bussed signals. \$BUSNAME can also be used in conjunction with \$BUSCLOSE to give names that are enclosed in parentheses or similar separators. For example:

```
SSIGNALS$BUSNAME(<) $SIGNAME$BUSCLOSE(>)
```

will generate signal names of the form DATABUS<D0>. To take this example one step further, note how we can use a regular expression to create a vector notation for signal names with a numeric component (note that this must all appear on one line in the script):

```
IF($AND($BUSNAME, $REGEXP(\D*(\d+), $SIGNAME))) $BUS-  
NAME<&1>$ELSE$SIGNAME$END
```

For a signal called A13 in a bus called ADDR, this will generate ADDR<13>. For non-bussed signals, it will simply output the signal name.

► See also \$BUSNAMEON/\$BUSNAMEOFF.

Keyword	\$BUSNAMEON/\$BUSNAMEOFF
Status	New in 4.0
Synopsis	\$BUSNAMEON [(<i>prefixStr</i> [, <i>suffixStr</i>])] \$BUSNAMEOFF
Returns	N. A.
Type	Definition
Where	Top-Level
Description	Causes the name of the enclosing bus to be automatically inserted whenever \$SIGNAME is used referring to a signal in a bus.
Examples	\$BUSNAMEON (\[, \]) Specifies that all references to the \$SIGNAME of a bussed signal will now be listed as busName[sigName]. Note: The escape (backslash) character used in front of each of the arguments is not strictly necessary in this case but is used to clarify that these are intended as literal text.

If the bus exists, the prefixStr text is inserted immediately after the bus name and the suffixStr text is inserted immediately after the signal name. This setting remains in effect for all listings until a \$BUSNAMEOFF is encountered.

► See also `$BUSNAME/$BUSCLOSE`.

Keyword	<code>\$BUSPINCLOSE</code>
Status	New in 4.0
Synopsis	<code>\$BUSPINCLOSE(<i>string</i>)</code>
Returns	String
Type	Data
Where	Script - pin
Description	Returns the given string if the current pin is an internal pin inside a bus pin.
Examples	See <code>\$BUSPINNAME</code>

► See also `$BUSPINNAME`.

Keyword	<code>\$BUSPINNAME</code>
Status	No change in 4.0
Synopsis	<code>\$BUSPINNAME[(<i>suffixStr</i>)]</code>
Returns	Text
Type	Data
Where	Script - pin
Description	Returns the name of the bus pin associated with the current bus internal pin, or null if the current pin is not a bus internal pin. An optional suffix string allows this keyword to be used with <code>\$PINNAME</code> to provide a compound name when the pin is in a bus.
Examples	<code>\$DEVPI NFORMAT\$BUSPI NNAME([] \$PI NNAME\$BUSPI NCLOSE([])</code> This sets the format for a pin listing so that if a pin is in a bus pin it will appear as "busPinName [pinName] ", otherwise it will appear as "pinName".

The naming rules in DesignWorks allow pins with the same name to exist in multiple different bus pins without being connected. This means that any report output referring to `$PINNAME` risks being ambiguous if bus pins have been used in the design. For this reason, it is best to qualify pin names with the name of any enclosing bus pin. `$BUSPINNAME` allows this by inserting the name of any enclosing bus pin and an optional separator character in the output.

Because the given separator string is only inserted if the bus pin name is non-null, \$BUSPINNAME can always be inserted in front of the \$PIN-NAME command without interfering with non-bussed pins. \$BUSPIN-NAME can also be used in conjunction with \$BUSPINCLOSE to give names that are enclosed in parentheses or similar separators.

► See also: \$BUSNAME, \$BUSPINCLOSE.

Keyword	\$CALLTOOL
Status	New in 4.0
Synopsis	\$CALLTOOL(<i>toolName</i> , <i>argumentString</i>) \$CALLTOOL(<i>toolName</i>)
Returns	Boolean
Type	Data
Where	Script (Note: Whether or not an object is required depends on the tool)
Description	Transfers control to another DesignWorks tool (MEDA module) and passes some argument information. Returns TRUE if the tool returns success, FALSE otherwise.
Examples	\$CALLTOOL(Prompter, &FileName) Calls the Prompter tool and passes the contents of the FileName attribute or variable as an argument.

This command was implemented specifically to allow the Scripter to work with the Prompter, but can also be used to invoke any other tool. The effect of this command is the same as if the tool was invoked by selecting its name in the Tools menu. Note that the "toolName" argument that is the string known as the tool's "alias" that is hard-coded when the tool is created. In most cases these are the same, but they may be different if any file names have been changed or if DesignWorks has been localized.

Keyword	\$CHANGECOUNT
Status	No change in 4.0
Synopsis	\$CHANGECOUNT
Returns	Decimal integer.
Type	Data
Where	Script - Design
Description	The number of changes (i.e. editing operations) performed on the circuit since it was created, represented as a decimal integer. This number can be used to check for matching versions of a circuit file.
Example	<pre> SIF(\$SNE(\$CHANGECOUNT, &01 dChange)) \$SETATTR(&01 dChange, \$CHANGECOUNT) \$NULL(\$ALERT1(The desi gn has changed!)) \$END </pre> <p>This will display an alert if the design has been edited since the last check.</p>

Keyword	\$CHARMAP
Status	New in 4.0
Synopsis	\$CHARMAP (<i>blockName</i> , <i>string</i>)
Returns	Text
Type	Data
Where	Script
Description	Used to map the characters making up a string using a predefined table.
Example	<pre> \$DEFINBLOCK(PkgTable) . _DOT_ / _SLASH_ & _AMPERSAND_ \$END \$DEVICES\$CHARMAP(CharTable, \$DEVNAME) </pre> <p>This will output device names, mapping characters according to the given table. For example, a name "U1.1" will be output as "U1_DOT_1". Note that the white space shown in this example is representing a single tab character. Blanks do not count as separators and may be included in the values.</p>

This command allows you to map characters in strings by looking them up in a table. This can allow you to translate data for use in systems that

may have a more restricted character set.

The \$CHARMAP function uses the same table format as the \$MAP command, but differs in that it operates on one character of the input string at a time. The values in the left hand column of the table (i.e. before the separating tab) must be single characters, whereas the values in the right hand column can be any string. This command operates by taking each character in succession from the input string, matching it against a character in the left hand column, and replacing it by the corresponding string in the right hand column. If a match is not found, the input character is passed through to the output without modification. That is, only characters that are enumerated in the left column will be modified.

Note these additional points regarding the \$CHARMAP command:

- If a string with more than one character appears in the left column, only the first character is used as a match value.
- If an empty string appears in the left column (i.e. a tab or line terminator is found immediately), it is ignored.
- If you want to match with unprintable ASCII characters, you can use the ^ notation described in “Control and Escape Characters” on page 13.
- Special characters like backslash “\” or the open comment “{” can be mapped by preceding them with a backslash.

► See also: \$MAP and “Mapping Table Format for \$MAP, \$CHARMAP and \$VERIFY” on page 133.

Keyword	\$CHECK
Status	Obsolete in 4.0. Use \$IF and \$ALERT.

Keyword	\$CHECKSUM
Status	New in 4.0
Synopsis	\$CHECKSUM
Returns	Decimal integer.
Type	Data
Where	Script - Device
Description	Returns the checksum of the device type associated with the current object.
Examples	<p>SDEVICES\$DEVNAME \$CHECKSUM</p> <p>Will generate a listing of all devices in a circuit with their associated checksum.</p>

The checksum of a device type is a program-generated 32-bit value which is generated from a random number each time a device type (i.e. a library symbol definition) is created or modified. It is used to distinguish between different versions of a symbol with the same name. This value is not normally of interest to the user, but it can be useful for error checking or locating cases where two device types of the same name have been used in a design inadvertently.

Keyword	\$CHILDNAME
Status	No change in 4.0
Synopsis	\$CHILDNAME
Returns	Text
Type	Data
Where	Script - Pin
Description	If the current pin is associated with a device that has a subcircuit, then this keyword returns the name of the signal attached to the corresponding port in the subcircuit. If the device has no subcircuit, then this simply returns the name of the pin. This is intended specifically for use in generating netlist formats that pin-to-port associations through the name of the signal in the subcircuit, for example SPICE.
Examples	<p>SDEVPIFORMAT \$CHILDNAME</p> <p>SDEVICES\ .SUBCKT \$TYPE \$PINS</p> <p>Will generate a ".SUBCKT" macro definition header line in for a SPICE-format netlist.</p>

Keyword	\$CIRCUITNAME
Status	Changed in 4.0
Synopsis	\$CIRCUITNAME
Returns	Text
Type	Data
Where	Script - Any object
Description	This returns the name of the circuit associated with the current object.
Examples	<p>\$DEVPI NFORMAT \$CHILDSI GNAME \$DEVI CES\ . SUBCKT \$STYPENAME \$PI NS</p> <p>Will generate a ".SUBCKT" macro definition header line in for a SPICE-format netlist.</p>

This keyword is intended for use in hierarchical designs to get the name of the circuit associated with the current object. The following rules determine the value that is returned:

- If the current object is itself, or is inside, the top-level circuit in a hierarchical design, then this is the design name and is the same as \$DESIGNNAME.
- If the circuit is a subcircuit and the design is in Physical hierarchy mode, then the hierarchical path to the circuit is returned.
- If the circuit is a subcircuit, it is not open for editing, and the design is in Pure mode, the a name derived from the type name is returned.
- If the circuit is a subcircuit that is open for editing, and the design is in Pure mode, a complete path is returned, as in Physical mode.

NOTE: In earlier versions of DesignWorks, \$CIRCUITNAME was equivalent to \$DESIGNNAME in all cases.

Keyword	\$CLEARERRORBIT
Status	New in 4.0
Synopsis	\$CLEARERRORBIT (<i>bitNum</i>)
Returns	N. A.
Type	Action
Where	Script - Any object
Description	Clears the given bit number in the binary error set represented in the object's "OKErrors" attribute field.
Examples	<p>\$DEVICESIF(\$ALERT2(Remove "Mark as OK" setting in \$DEVNAME?)) \$CLEARERRORBIT(7) SEND</p> <p>Will prompt the user if it's OK to remove the "Mark as OK" setting on the each device.</p>

This call is one of a set of commands designed to implement a "Mark as OK" feature in error checking scripts.

▶ See the description of this feature under "Implementing Mark as OK in Error Checking Scripts" on page 26.

▶ See also: \$SETERRORBIT, \$ERRORBITON/OFF, \$CLEARERRORS.

Keyword	\$CLEARERRORS
Status	New in 4.0
Synopsis	\$CLEARERRORS
Returns	N. A.
Type	Action
Where	Script - Any object
Description	Sets the object's "OKErrors" attribute field to null.
Examples	<p>\$DEVICES\$CLEARERRORS</p> <p>Will remove all "Mark as OK" settings in all devices.</p>

This call is one of a set of commands designed to implement a "Mark as OK" feature in error checking scripts.

▶ See the description of this feature under "Implementing Mark as OK in Error Checking Scripts" on page 26.

► See also: `$SETERRORBIT`, `$ERRORBITON/OFF`, `$CLEARERRORSBIT`

Keyword	<code>\$CLOSECIRCUIT/\$CLOSEDESIGN</code>
Status	No change in 4.0
Synopsis	<code>\$CLOSECIRCUIT</code> <code>\$CLOSEDESIGN</code>
Returns	N. A.
Type	Action
Where	Top level - design
Description	Closes the current design, exactly as if the user had selected the Close Design menu command.
Examples	<code>\$CLOSEDESIGN</code>

Keyword	<code>\$CLOSEREPORT</code>
Status	No change in 4.0
Synopsis	<code>\$CLOSEREPORT</code>
Returns	N. A.
Type	Action
Where	Top level
Description	Closes the current report file.
Examples	<code>\$CLOSEREPORT</code>

The `$CLOSEREPORT` command causes the current report output file to be closed. This can be followed by another `$CREATEREPORT` command to create another output file, thus allowing a single script file to generate multiple report files. The output file is normally closed automatically at the end of the script file, so this command is only necessary to create multiple output files. If `$CLOSEREPORT` is not followed by a `$CREATEREPORT` command, and subsequent listing commands attempt to write output data, then the user will be prompted to provide a name for a new output file.

Note that report files can be "nested" to any desired depth. I.e. if you do multiple successive `$CREATEREPORT` commands without intervening `$CLOSEREPORT`s, output will be directed to the file created by the most

recent one. When it is closed, subsequent output will be directed to the next most recent one, etc.

Keyword	<code>\$CLOSETRANSCRIPT</code>
Status	New in 4.0
Synopsis	<code>\$CLOSETRANSCRIPT</code>
Returns	N. A.
Type	Action
Where	Top level
Description	Closes the current transcript file.
Examples	<code>\$CLOSETRANSCRIPT</code>

This command closes the current transcript file, or does nothing if no transcript file is open. If no transcript file remains open, any subsequent uses of `$WRITETRANSCRIPT` will have no effect until another file is created using `$CREATETRANSCRIPT`.

Note that transcript files (like normal output files) can be "nested" to any desired depth. I.e. if you do multiple successive `$CREATETRANSCRIPT` commands without intervening `$CLOSETRANSCRIPT`s, output will be directed to the file created by the most recent one. When it is closed, subsequent output will be directed to the next most recent one, etc.

► See also `$CREATETRANSCRIPT`.

Keyword	\$COL
Status	No change in 4.0
Synopsis	\$COL(<i>n</i>)
Returns	Text
Type	Data
Where	Script
Description	If the current position in a line is less than N spaces from the left hand end then blanks are inserted until the Nth column is reached. If the output is already at or past the Nth column, nothing is output. For instance \$COL(20) will force any output to be indented to the 20th column of each line.
Examples	<pre>Name\$COL(20) Part Type\$COL(40) Package Code \$DEVI CES\$DEVNAME\$COL(20) \$TYPENAME\$COL(40) &Package</pre> <p>Will generate a simple bill of materials with items aligned at column 20 and 40.</p>

Note that the column alignment generated by \$COL(*n*) is strictly based on character count, and so will depend on using a fixed-space font to generate printed output that is correctly aligned. If you intend to transfer the data to a word processor or spreadsheet for printing, it will probably be more appropriate to use tab separators between columns.

► See also \$TAB.

Keyword	\$COMBDEVSON/\$COMBDEVSOFF
Status	No change in 4.0
Synopsis	\$COMBDEVSON \$COMBDEVSOFF
Returns	N. A.
Type	Definition
Where	Top-Level
Description	When ON, causes any subsequent \$DEVICES listing to merge all devices with the same sort value onto one line of output. The default value is OFF. If a \$DEVICES listing is requested with \$COMBDEVSON and no sort, a warning message will be issued.
Examples	<pre>SSORT \$DEVICES &Part \$COMBDEVSON \$DEVICES&Part \$TAB\$DEVNAME</pre> <p>This will produce a simple bill of materials with each line showing the part name followed by a listing of the devices with that part type. If \$COMBDEVSON was not used, the output would contain one line per device with only a single name on each line.</p>

► *More information on sorting and merging can be found in "Sorting and Merging" on page 21.*

Keyword	\$COMBPINSON/\$COMBPINSOFF
Status	No change in 4.0
Synopsis	\$COMBPINSON \$COMBPINSOFF
Returns	N. A.
Type	Definition
Where	Top-Level
Description	When ON causes multiple pin connections on the same device to be combined without repeating the device name. The default is OFF. For example: With \$COMBPINSON: IC1-2,5,6,12 With \$COMBPINSOFF: IC1-2 IC1-5 IC1-6 IC1-12
Examples	\$COMBPINSON

Keyword	\$COMBSIGSON/\$COMBSIGSOFF
Status	No change in 4.0
Synopsis	\$COMBSIGSON \$COMBSIGSOFF
Returns	N. A.
Type	Definition
Where	Top-Level
Description	When ON, causes any subsequent \$SIGNALS listing to merge all signals with the same sort value onto one line of output. The default value is OFF. If a \$SIGNALS listing is requested with \$COMBSIGSON and no sort, a warning message will be issued.
Examples	\$SORT \$SIGNALS \$PAGENUM \$COMBSIGSON \$SIGNALS\$PAGENUM\$TAB\$SIGNALNAME This will produce a list of signals by page number with one line per page.

► More information on sorting and merging can be found in "Sorting and Merging" on page 21.

Keyword	\$CONTEND
Status	No change in 4.0
Synopsis	\$CONTEND(<i>string</i>)
Returns	N. A.
Type	Definition
Where	Top-Level
Description	This command specifies a string to be added at the end of any line that will be continued on the next line due to the line width or item count being exceeded.
Examples	\$CONTEND(+)

► See also: \$CONTSTART.

Keyword	\$CONTREPEATON/\$CONTREPEATOFF
Status	No change in 4.0
Synopsis	\$CONTREPEATON \$CONTREPEATOFF
Returns	N. A.
Type	Definition
Where	Top-Level
Description	This command specifies that the last item generated by a repeating command on the current line should be repeated on any continuation line. This is specifically intended for some netlist formats that use the repetition of a pin item to indicate a continuation line.
Examples	\$CONTREPEATON

Keyword	\$CONTSTART
Status	No change in 4.0
Synopsis	\$CONTSTART (<i>string</i>)
Returns	N. A.
Type	Definition
Where	Top-Level
Description	This command specifies a string to be inserted at the start of any continuation line generated due to the line width or item count being exceeded.
Examples	\$CONTSTARTD(+) This will insert a "+" continuation character, typical of SPICE-based netlist formats.

► See also: *\$CONTEND*.

Keyword	\$COUNT
Status	No change in 4.0
Synopsis	\$COUNT
Returns	Decimal integer
Type	Data
Where	\$DEVICES or \$SIGNALS listing
Description	This keyword returns the number of different Name values held by devices or signals merged on the current line. This is intended for use in flat PCB designs in which the package assignment is stored in the Name field. In this case \$COUNT in effect returns the number of physical devices represented by this line.
Examples	<pre>SSORT \$DEVI CES &Part \$DEVI CES&Part \$COUNT</pre> <p>This will produce a listing showing the number of each part type required by the current design. Devices with multiple gates per package will count as 1 because they have the same value in Name.</p>

► For a corresponding count in Physical hierarchy designs, see \$COUNTINST.

Keyword	\$COUNTINST
Status	No change in 4.0
Synopsis	\$COUNTINST
Returns	Decimal integer
Type	Data
Where	\$DEVICES or \$SIGNALS listing
Description	This keyword returns the number of different InstName values held by devices or signals merged on the current line. This is intended for use in physical mode PCB designs in which the package assignment is stored in the InstName field. In this case \$COUNTINST in effect returns the number of physical devices represented by this line.
Examples	<pre>SSORT \$DEVI CES &Part \$DEVI CES&Part \$COUNTI NST</pre> <p>This will produce a listing showing the number of each part type required by the current design. Devices with multiple gates per package will count as 1 because they have the same value in InstName.</p>

► For a corresponding count in Flat mode designs, see `$COUNT`.

Keyword	<code>\$COUNTVALUES</code>
Status	New in 4.0
Synopsis	<code>\$COUNTVALUES (string)</code>
Returns	Decimal integer.
Type	Data
Where	Script - any object
Description	When multiple objects with the same sort value are merged on the same line, any object-based value, such as <code>\$DEVNAME</code> , could generate multiple different values. This command provides a count of the number of values generated by the command string given as its argument.
Examples	<pre><code>\$SORT \$DEVICES &Part \$COMBDEVSON \$DEVICES&Part \$COUNTVALUES(\$DEVNAME)</code></pre> <p>This script will list all part types in the circuit with a count of the number of different usages of each type. This takes into account the fact that multiple symbols may be assigned to one package, and will therefore have the same name.</p>

This command is used in conjunction with the sorting and merging features of the Scripter to count the number of different values of a field found in a collection of objects. It can be used for error-checking purposes to ensure that some group of objects have all been assigned the same value, or can be used to generate counts of various kinds in parts lists.

► See also: `$SORT`, `$COMBDEVSON`, `$SINGLE`, `$MERGE`.

Keyword	\$CREATEFOLDER/\$CREATEDIRECTORY
Status	New in 4.0
Synopsis	\$CREATEFOLDER (<i>dirName</i>) \$CREATEDIRECTORY (<i>dirName</i>)
Returns	N. A.
Type	Action
Where	Top level
Description	Creates a directory with the given name. If no path is given, the directory will be created inside the "current" directory, usually the one containing the current design. \$CREATEFOLDER and \$CREATEDIRECTORY are identical in function.
Examples	\$CREATEDIRECTORY (\$DESIGNNAME Reports)

This command creates a directory on disk. This is intended specifically for cases where netlist formats require the generation of multiple files and it is most convenient to place them in a separate directory.

The argument string can contain only the name for the new directory or it can specify a relative or absolute path name. If no path is given, the new directory will be created in the current directory. This is usually the directory containing the current design, unless there is no current design or it has been set by another command.

If a relative path is given, it is relative to the current directory. This command will only create the bottommost directory in the path, the others must already exist.

If an absolute path is given, it must start with the disk name.

If the specified directory already exists, it is left untouched and no error is given. After this command has completed successfully, the current directory will be the newly-created one (or the pre-existing one, if it was already there).

► See more information about directories and path names in "File Names and Paths" on page 36.

► See also \$FOLDER/\$DIRECTORY.

Keyword	\$CREATEREPORT
Status	Changed in 4.0
Synopsis	\$CREATEREPORT[(<i>nameString</i>)] [\$PROMPT] [\$CREATOR(<i>creator-Code</i>)] \$CREATEREPORT \$NULL
Returns	N. A.
Type	Action
Where	Top level
Description	Creates a report output file.
Examples	\$CREATEREPORT(\$DESI GNAME. net) \$PROMPT

This command creates a text file for subsequent report output. This allows you to eliminate or control the automatic file save prompt that occurs when a script generates any output.

Note that output files can be "nested" to any desired depth. I.e. if you do multiple successive \$CREATEREPORT commands without intervening \$CLOSEREPORTs, output will be directed to the file created by the most recent one. When it is closed, subsequent output will be directed to the next most recent one, etc.

If the \$PROMPT option is specified, the user will be prompted with a standard file save box with the given name string as the default file name.

If \$PROMPT is not specified, then the file will be created immediately with no user prompt. If the file already exists, it is replaced with no user prompt. The file is created in the current directory, which is normally the one containing the current design file. Note that \$CREATEREPORT does not accept a pathname as part of the file name. The directory can be specified by using \$FOLDER or \$DIRECTORY to change the current directory.

The \$CREATOR option (Macintosh only) allows you to specify the 4-character "creator type" which associates an application with the file. It is beyond the scope of this manual to go into the background of this mechanism, but the following table lists some commonly-used values.

The \$NULL option causes a "null" file to be created, i.e. all output generated by the script will be discarded. It cannot be used in conjunction with

any of the other options.

► For more information on text output files, see “File Input and Output” on page 36.

► See also `$CLOSEREPORT`, `$CREATETRANSRIPT`.

Keyword	<code>\$CREATETRANSRIPT</code>
Status	New in 4.0
Synopsis	<code>\$CREATETRANSRIPT[(nameString)][\$PROMPT][\$CREATOR(creatorCode)]</code>
Returns	N. A.
Type	Action
Where	Top level
Description	Creates a transcript output file.
Examples	<code>\$CREATETRANSRIPT(\$DESIGNNAME Error Log)</code>

This command creates a text file for subsequent transcript output, i.e. any strings written with the `$WRITETRANSRIPT` command. In terms of format and options, this command is identical to `$CREATEREPORT`.

► For more information on text output files, see “File Input and Output” on page 36.

► See also `$WRITETRANSRIPT`, `$CREATEREPORT`.

Keyword	\$DATE
Status	Changed in 4.0
Synopsis	\$DATE \$DATE(<i>formatString</i>) \$DATE(<i>formatString</i>, <i>valueString</i>)
Returns	Text
Type	Data
Where	Script
Description	This command is used to display the current date or to convert raw decimal integer date/time values to a desired format. The first form returns the current date in the default format. The second form is used to specify any time or date format using format keywords. The third form is used to provide a raw date value for conversion. When used with an argument list, \$TIME and \$DATE are identical in function.
Example	This report was produced on a \$DATE(\$W) This will generate the day of the week, fully spelled out.

When used without an argument list, \$DATE generates the current date in the default "long" format for the host machine. This behavior can be modified by adding an argument string containing format keywords for the various date and time elements that are available. Any characters in the format string that are not recognized as one of the following items will be included literally in the output string. If a \$ character is needed in the output, it can be escaped by preceding it with a backslash.

If a second argument is provided, it is assumed to be a decimal integer representing a date/time in raw form. This format is used to store dates for a variety of internal purposes such as device date stamping, file modified dates, etc., so \$DATE can be used to convert them for output.

Note that when used with an argument list, \$TIME and \$DATE are identical in function.

See the table of date and time codes under \$TIME.

► See also: \$TIME, \$DATECREATED, \$DATEMODIFIED, and the general information provided in "Controlling Report Page Layout" on page 17.

Keyword	\$DATECREATED/\$DATEMODIFIED
Status	New in 4.0
Synopsis	\$DATECREATED \$DATEMODIFIED \$DATECREATED(<i>formatString</i>) \$DATEMODIFIED(<i>formatString</i>)
Returns	Text
Type	Data
Where	Script
Description	If used without arguments, \$DATECREATED and \$DATEMODIFIED return the created or modified date of the current design in the default format. An argument list can be added to specify any time or date format. When used with an argument list, \$TIMECREATED and \$DATECREATED are identical in function and, similarly, \$TIMEMODIFIED and \$DATEMODIFIED are identical.
Example	Design \$DESIGNNAME was created on \$DATECREATED

These two commands are variations of the \$DATE command and behave identically except that they use the created or modified date of the current design, rather than the current date.

► See also \$DATE, \$TIMECREATED and \$TIMEMODIFIED.

Keyword	\$DEFINEATTR
Status	New in 4.0
Synopsis	\$DEFINEATTR(<i>fieldName</i> / <i>options</i> [<i>maxLength</i>])
Returns	N.A.
Type	Action
Where	Top level
Description	Used to define a new attribute field for the design or modify settings in an existing one.
Example	\$DEFINATTR(TraceWidth/SY) This will define a field called TraceWidth for signals. It will be marked as Primary. If the field already exists, it will be set to Primary if it is not already.

This command allows you to define an attribute field in the current

design, i.e. to add it to the table that appears in response to the Define Attribute Fields menu command. It is not strictly necessary to use this command to define a field before using it in a script. A \$SETATTR on such a field will always define it automatically with default settings in the design's attribute table. However, the default settings may not be the desired ones and may change in future versions of DesignWorks. For this reason, it is preferable to define a field before setting it. This way, you can ensure that settings like the maximum length and the various options are appropriate for its intended usage.

The \$DEFINEATTR command can also be used to change certain settings in existing fields in a design. No changes are allowed that would affect the usage of any existing fields. The items that can be changed are noted in the table below.

The format string that is used to define a new field consists of:

- The name of the field
- A slash character "/"
- A number of upper case letters, each of which indicates an option. At least one option must be specified, that being the allowable object type, i.e. device, signal, pin or design.
- An optional decimal integer indicating the maximum length.

Note that when attribute data is stored internally, it is always allocated as a variable-length string, so there is no wastage of memory space by specifying a longer maximum length. The default value is the maximum value of 32,000 characters.

The following table defines the meaning of the format code letters. Note that letters must be given in upper case.

\$DEFINEATTR Format Codes

Format Letter	Modify Existing Fields?	Meaning
D	No	Device
S	No	Signal
P	No	Pin
C	No	Design/Circuit
V	Yes	Visible by default
F	No	Fixed (i.e. cannot be changed by the user)

\$DEFINEATTR Format Codes

Format Letter	Modify Existing Fields?	Meaning
X	No	Value fixed - i.e. read only
I	No	Keep with instance
R	Yes	Rotate with object
N	No	Name characters only - not implemented
G	Yes - except Name and InstName	Group with name
W	Yes	Show field name
A	No	Allow carriage returns
L	Yes	Location fixed
Y	Yes	In primary list
T	No	Link to Part
U	No	Numeric characters only - not implemented
M	No	Temporary field - not saved with file, not visible to user

IMPORTANT: At least one of D, S, P or C must be specified.

► See also \$SETATTR and \$HIDEALLATTRDEFS and the general information on attribute definitions provided in chapter "Attributes" in the DesignWorks 4.0 User's Guide.

Keyword	\$DEFINEBLOCK
Status	New in 4.0.
Synopsis	\$DEFINEBLOCK (<i>blockName</i>)
Returns	N.A.
Type	Definition
Where	Top level
Description	Indicates the start of a block within a script.
Examples	<pre> \$DEFINEBLOCK(InternalCct) \$DEVICESS\$DEVNAME \$PINS \$END \$DEVICESS\$INTERNAL(InternalCct) </pre> <p>This example creates a block that is referred to by the \$INTERNAL command. I.e. The script lines in the block will be executed to output the internal circuit of each device listed in the last line.</p>

A *block* is simply a contiguous sequence of lines within a script file. The \$DEFINEBLOCK command indicates the start of a block, but does not impose any meaning on it. The interpretation of the contents of the block depends entirely on the command that refers to it. Some commands, such as \$INTERNAL, \$INCLUDE or \$EXECUTE, treat the block as a sort of "subroutine", that is, a sequence of commands to be executed when called upon. Other commands, such as \$MAP, treat the block as a table of literal text values.

The only rules about the contents of a block are imposed by the requirement that the script parser must be able to skip over the contents and find the corresponding \$END. This imposes the following limits on block format:

- If the block contains commands, they must be a complete and valid set of commands. In particular, any structure that requires an \$END (e.g. \$IF) must be completed within the block.
- If the block contains literal data, there must be no data items that might confuse the parser in its search for an \$END. In particular, any items starting with a \$ character must be escaped with a backslash.

When the Scripter encounters a \$DEFINEBLOCK command in the file, it notes the starting point of the block and then skips over it. Execution resumes on the next line past the \$END.

► See also: `$INCLUDE`, `$INTERNAL`, `$MAP`, `$VERIFY`, `$TABLE`, `$INLINE`.

Keyword	<code>\$DEFINECIRCUIT</code>
Status	No change in 4.0.
Synopsis	<code>\$DEFINECIRCUIT</code>
Returns	N.A.
Type	Definition
Where	Top level
Description	Indicates the start of an internal circuit definition within a script. This is actually a special case of <code>\$DEFINEBLOCK</code> and is exactly equivalent to: <code>\$DEFINEBLOCK(_Internal_)</code>
Examples	<pre> \$DEFINECIRCUIT \$DEVICE\$DEVNAME \$PINS \$END \$DEVICE\$INTERNAL </pre> <p>This example creates a block that is referred to by the <code>\$INTERNAL</code> command. I.e. The script lines in the block will be executed to output the internal circuit of each device listed in the last line.</p>

Keyword	<code>\$DESIGNNAME</code>
Status	New in 3.1.5
Synopsis	<code>\$DESIGNNAME</code>
Returns	Text
Type	Data
Where	Script - design
Description	Returns the name of the current design, i.e. the file name with any "." extensions removed.
Examples	This report was generated from <code>\$DESIGNNAME</code>

`$DESIGNNAME` can be used in the following areas:

- In an `$INCLUDE` command, for generating the name of the include file.
- In a `$CREATEREPORT` command, for generating the name of the report output file.

- In a \$HEADER section.
- Anywhere else in the text of a script that is not part of some other definition or listing command.

\$DESIGNNAME vs. \$FILENAME

The operation of the \$DESIGNNAME and \$FILENAME keywords is designed to make it easier to work with "." dot extensions for report files. This is especially an issue when exporting to DOS or Windows-based PCB or other design systems.

- \$DESIGNNAME will be replaced by the name of the currently open design with any "." extension removed. I.e. The program starts at the end of the name and scans forward. If a "." is found, it and all following characters are removed. If no "." is found, the name is not changed.
- \$FILENAME returns the name of the current design file verbatim, including any "." extension.

\$DESIGNNAME vs. \$CIRCUITNAME

In a flat (that is, non-hierarchical) design, \$DESIGNNAME and \$CIRCUITNAME are equivalent. If the current object is, or is contained in, a subcircuit in a hierarchical design, \$DESIGNNAME will always refer to the name of the topmost circuit, whereas \$CIRCUITNAME gives a hierarchical name of the current object's circuit.

► See also: \$CIRCUITNAME, \$CREATEREPORT, \$INCLUDE.

Keyword	\$DESIGNPATH
Status	New in 4.0
Synopsis	\$DESIGNPATH
Returns	Text
Type	Data
Where	Script - design
Description	Returns the directory path to the current design file. If the current design file has not been saved, this returns a null string. This behaviour provides a way of checking if the design has been saved.
Examples	The design is in directory \$DESIGNPATH

This command provides the complete file path to the current design file, not including the file name itself. The format of this string is dependent on the platform that the package is running on. On Macintosh systems, file paths start with the name of the disk, followed by a colon character, followed by the names of any nested directories enclosing the file. For example:

MyDisk: Current Designs: BigProject:

The string returned by \$DESIGNPATH will include a final colon. Thus the sequence:

\$DESIGNPATH\$FILENAME

will generate a completely qualified file name.

NOTE: If the current design has not been saved to disk, this will return a null string.

► See also: \$SCRIPTPATH, \$TEMPPATH, \$PROGPATH, \$FULLPATH.

Keyword	\$DESIGNPINSIGSOURCE/\$DESIGNSIGSOURCE
Status	New in 3.1.5
Synopsis	\$DESIGNSIGSOURCE <i>&fieldName</i> \$DESIGNPINSIGSOURCE <i>&fieldName</i>
Returns	N. A.
Type	Definition
Where	Top level
Description	Specifies a design attribute which will contain a list of device attribute fields to be used as signal sources.
Examples	\$DESIGNSIGSOURCE <i>&SignalSources</i>

The \$DESIGNSIGSOURCE and \$DESIGNPINSIGSOURCE commands allow a single netlist script to be used for multiple different designs that may have different ground and power requirements.

In each case, the name given is the name of a design attribute field which will contain a list of attribute fields to search for pins. I.e. This is equivalent to specifying a \$SIGSOURCE or \$PINSIGSOURCE command for

each field listed in the design attribute.

It is also valid to use these commands in conjunction with the regular \$SIGSOURCE or \$PINSIGSOURCE commands. For example, your script could use \$SIGSOURCE commands to list the standard Power and Ground fields and then add the line:

```
$DESIGNSIGSOURCE &ExtraFields
```

to allow individual designers to add fields for their specific requirements. In this case, for example, placing the value:

```
AnaGnd, AnaPlus12, AnaMinus12
```

in the design attribute ExtraFields would have the same effect as placing the following three commands in the script file:

```
$SIGSOURCE &AnaGnd  
$SIGSOURCE &AnaPlus12  
$SIGSOURCE &AnaMinus12
```

Some additional notes on the usage of this command:

- In the current implementation of the \$DESIGNSIGSOURCE command, there is no way to specify one name for the attribute field and a different name for the net name that appears in the netlist. This can only be done using the \$SIGSOURCE command explicitly for each name.
 - The presence of a \$DESIGNSIGSOURCE or \$DESIGNPINSIGSOURCE command in the script does not add any significant execution time overhead if no values are specified in the given design attribute field. If a value is specified, the note given under the \$PINSIGSOURCE command will apply.
- See also \$SIGSOURCE, \$PINSIGSOURCE.

Keyword	\$DEVCOUNT
Status	No change in 4.0
Synopsis	\$DEVCOUNT
Returns	Decimal integer
Type	Data
Where	Top level
Description	Returns the number of lines in the last \$DEVICES listing. If \$COMBDEVSON has been set, this will mean in effect the number of different sort values in the list.
Examples	<pre> \$COMBDEVSON \$SORT \$DEVI CES &Part \$DEVI CES&Part \$DEVNAME Number of di fferent part types: \$DEVCOUNT </pre> <p>This will generate a simple bill of materials with one line per part type and a final line indicating the number of different part types, i.e. the number of unique values in the Part attribute field.</p>

\$DEVCOUNT is used to get a count of the number of devices on the scripter's current device list. It is only valid after one of the following types of statements has been executed:

```

$DEVI CES
$FI ND $DEVI CES
$SORT $DEVI CES

```

If a \$SORT has been done and \$COMBDEVSON has been set, \$DEV-COUNT returns the number of unique sort values in the devices list, otherwise it returns the number of devices in the list. In other words, it returns the number of lines that would be generated by a \$DEVICES listing.

► For more information on sorting, see "Sorting and Merging" on page 21.

Keyword	\$DEVHIERNAME
Status	No change in 4.0
Synopsis	\$DEVHIERNAME
Returns	Text
Type	Data
Where	Script - device
Description	Returns the hierarchical name of the current device, i.e. the device name prefixed with the names of any parent devices in the hierarchy. In Flat designs, this is equivalent to \$DEVNAME. This is not valid in Pure designs since there is no unequivocal path from a given device to the top-level circuit.
Examples	\$DEVICESS\$DEVHIERNAME \$PINS This will generate a list of devices showing the hierarchical name of each followed by a list of the attached pins.

\$DEVHIERNAME is intended to provide a unique device identifier when generating flattened netlists from hierarchical designs. Here are some important points to remember when using this keyword:

- The hierarchical name consists of the Name value for the current device with the "path" formed by its parent devices prefixed to it, such as:
MEMBLK1/CONTROL/CTR2
- The separator character that is used in generating these names can be set using the \$HIERNAMESEPARATOR command.
- Hierarchical names can be arbitrarily long, depending on the nesting level. For this reason, they may not be suitable as an identifier in many netlist formats.

► See also \$HIERNAMESEPARATOR and "Script Hierarchy Issues" on page 31.

Keyword	\$DEVICES
Status	No change in 4.0
Synopsis	\$DEVICES <i>formatItems</i>
Returns	Text
Type	Data
Where	Top level
Description	Creates a listing of devices using the format items following on the line.
Examples	\$DEVICES\$DEVNAME \$PINS This will generate a list of devices showing the name of each followed by a list of the attached pins.

NOTE: The \$DEVICES keyword also appears as a modifier of the \$FIND, \$SORT, \$ASSIGNNAMES, \$ASSIGNINSTNAMES and \$BREAK commands. See the entries for those commands for more information.

The \$DEVICES command is the primary command for generating any listing by device. The format of the listing is determined by the format items that follow the command on the line and by the various definition options, as outlined here:

- The scope of the listing in hierarchical designs is affected by the \$HIERARCHY command.
- A subset of the devices in the design can be extracted using any desired criteria using the \$FIND command.
- The ordering of devices in the listing is affected by the \$SORT command.
- If the \$COMBDEVSON has been selected, multiple items with the same sort value will appear on one line.
- The \$NEWLINE format command can force multiple lines to be generated for each item.
- Limits on line length imposed by the \$LINEWIDTH and \$MAXITEMSPERLINE commands may cause multiple lines to be generated.
- The format of the listing for each device or signal is completely determined by the text and commands which follow the \$DEVICES or \$SIGNALS keyword. There is no default format, so if no line

format is specified, a sequence of blank lines will be written to the file.

- DesignWorks "pseudo-devices" such as page connectors, signal connectors and bus breakouts are normally not included in any listing.
- Any characters appearing after \$DEVICES that is not part of a format sub-command will be placed verbatim in each line of the listing. For example, blanks, tabs or commas can be used to format each line.

Numerous data-generating commands can be used in defining the output generated on each line. Any command listed in this Appendix with a "Where" value of "Script - Device", "Script - Circuit", "Script - Any object" or "Script" can be used on a \$DEVICES line. Some of the more common format items are summarized in this table. See the corresponding keyword section for each item for more information.

\$DEVNAME	The name of the device.
\$DEVSEQ	The sequence number of the current device, i.e. an integer assigned to the device, starting at "n" for the first device in the sorted sequence and incremented for each subsequent one.
\$TYPENAME	The device's type name, that is, the name used to refer to this type in the library.
\$COUNT	The number of devices being merged to form this line, i.e. the number having the same sort value.
\$SINGLE	Tells the report generator to write only a single value for all items following on the line, regardless of how many items were combined with the same sort value.
\$NUMPINS	The number of pins on the device.
\$PAGE	The circuit page that this device appears on.
\$PINS	A list of the device's pins. The format of each item is determined by the \$DEVPINFORMAT command.
\$COL(N)	If the current position in a line is less than N spaces from the left hand end then blanks are inserted until the Nth column is reached.
\$NEWLINE	Writes a new line character into the file. This allows a device entry to occupy several lines in the output report.
&attr	Inserts the value of the attribute field specified.

► A variety of applications for the \$DEVICES command are described in "Script Examples" on page 46.

Keyword	\$DEVINSTNAME
Status	No change in 4.0
Synopsis	\$DEVINSTNAME
Returns	Text
Type	Data
Where	Script - device
Description	Returns the instance name of the current device, i.e. the contents of its Inst-Name attribute field. This field is normally used to hold the device package assignment in Physical hierarchy mode designs.
Examples	\$DEVICESSDEVINSTNAME \$PINS This will generate a list of devices showing the instance name of each followed by a list of the attached pins.

► For more information on the usage of instance names, see ###Attributes.

Keyword	\$DEVLOC
Status	New in 4.0
Synopsis	\$DEVLOC
Returns	Text
Type	Data
Where	Script - device
Description	Returns the hierarchical locator string for the current device.
Examples	\$DEVICESSDEVNAME \$DEVLOC

The \$DEVLOC command generates a unique identifier string referred to as a "locator". This can be used to uniquely identify any device within a hierarchical design, even if some devices have duplicate or null names. The locator is used by other DesignWorks modules like ErrorScript to locate objects unambiguously.

► The format of the locator string is described in ###.

Keyword	\$DEVNAME
Status	No change in 4.0
Synopsis	\$DEVNAME
Returns	Text
Type	Data
Where	Script - device
Description	Returns the name of the current device, i.e. the contents of its Name attribute field.
Examples	\$DEVICES\$DEVNAME \$PINS This will generate a list of devices showing the name of each followed by a list of the attached pins.

In Flat mode PCB designs, \$DEVNAME is normally used for the device package assignment. In Physical and Pure mode hierarchical designs, \$DEVNAME is the "reference designator", or a logical name that is unique to each symbol within a circuit level, but not necessarily unique in the entire design.

► For more information on names in hierarchical designs, see [###Hierarchy](#). For more information on device package name assignment, see [###Device Packaging](#).

Keyword	\$DEVPINFORMAT
Status	No change in 4.0
Synopsis	\$DEVPINFORMAT <i>formatItems</i> \$DEVPINFORMAT(<i>formatItems</i>)
Returns	Text
Type	Data
Where	First form - Top level Second form - Script - device
Description	Sets the format that will be used for each pin output by the next \$PINS command in a \$DEVICES line. The first form (without parentheses) can only be used on a top-level line. The second form (with parentheses) can be used either on a top-level line or in a \$DEVICES line. This allows the format to be modified on the fly while generating output for a single device. This is required in some netlist formats that require a pin list header followed by a declaration list.
Examples	\$DEVPI NFORMAT [\$PI NNAME, \$PI NNUM] \$I TEMSEPARATOR(,) \$DEVI CES\$DEVNAME \$PI NS This will generate a list of devices showing the name of each followed by a list of the attached pins using the format specified: U1 [A, 1], [B, 2], [Q, 3]

This command sets the format for pin lists (i.e. a \$PINS command) appearing in a \$DEVICES listing. The default format is "\$SIGNAME", meaning the signal name alone will appear for each device pin.

Here are some notes on device pin formats:

- Leading and trailing blanks are always trimmed from the format list, but embedded blanks (i.e. those surrounded by non-blank format items) are not. If you want a leading or trailing blank in a format, it must be preceded by an escape character (backslash).
- Any literal text not recognized as a command or terminator will be placed in the format verbatim.
- If you need to include parentheses in the pin format, they should be preceded by an escape character to ensure that they are not interpreted as argument terminators.
- Any command that is valid for a device, signal, pin or design can be used in a pin format.

- If an attribute reference appears in a pin format, there can be some ambiguity since it can refer to a device, signal or pin. See “Precedence of Field References in Pin Listings” on page 16 for a definition of the search order used by the Scriptor in evaluating these references.

Keyword	\$DEVPINSEQUENCE
Status	No change in 4.0
Synopsis	\$DEVPINSEQUENCE <i>&attrField</i>
Returns	N. A.
Type	Definition
Where	Top level
Description	Sets an attribute field to be searched for a pin order specification while creating a \$PINS listing.
Examples	\$DEVPI NSEQUENCE &Pi nSequence This specifies that the standard field PinSequence is to be searched for a list of pins to output.

Some design programs, such as SPICE-based simulators, require netlist formats in which the device pin order is significant. Since there are no standards for pin order, different packages will likely require different ordering schemes. In order to allow a variety of pin orderings to be stored with each device type, the Scriptor tool can be asked to search a device attribute field for pin order information. The name of this field is specified in the \$DEVPINSEQUENCE command, as follows:

```
$DEVPI NSEQUENCE &attrField
```

Once this field has been specified, if a \$PINS sub-command is encountered in a \$DEVICES listing, each device is searched for an attribute field with the given name. If the field is found (in the device instance or the type attributes), then it is assumed to contain a list of names of the pins to write out to the file. The pin names must be listed exactly as they appear in the DevEditor's pin list, or, in the case of \$SIGSOURCE pins, as the fields are named in the device attributes. If the specified field is not found in a given device, then the normal pin ordering is used.

For example, assume a 2-input gate has pins named A, B and OUT. A pin sequence attribute field could be specified in the device (or in the library

type attributes) as follows:

```
Field      SPICEPINS
ValueOUT, A, B
```

The command:

```
SDEVPI NSEQUENCE &PinSequence
```

in the script would then cause subsequent listings of that device to have pins appear in the specified order. The predefined field PinSequence is intended for this purpose.

► See also \$PINS.

Keyword	\$DEVSEQ
Status	No change in 4.0
Synopsis	\$DEVSEQ[(<i>origin</i>)]
Returns	Decimal integer
Type	Data
Where	Script - device
Description	Returns an integer indicating the position in the sort sequence of this device. If the original is not specified, numbering starts at zero.
Examples	<pre>SSORT \$DEVICES \$DEVNAME \$DEVICES\$DEVSEQ(1). \$DEVNAME</pre> This will generate a listing of devices that looks something the following: 1. C1 2. C2 3. U1 4. U2

\$DEVSEQ returns the sequence number of the current device, that is, an integer assigned to the device, starting at "origin" for the first device in the sorted sequence and incremented for each subsequent one. This number is not permanently associated with the device but it strictly its sequence number in the current sort. The "(origin)" part is optional. If it is omitted the sequence starts at zero. If no sort has been done, all devices will have the origin sequence number.

Keyword	\$DEVTOKEN
Status	No change in 4.0
Synopsis	\$DEVTOKEN
Returns	Decimal integer
Type	Data
Where	Script - device
Description	Returns an integer representing the device's token number.
Examples	\$DEVICES\$DEVNAME \$DEVTOKEN This will generate a listing of devices with the name and token number of each.

► For more information on the meaning and usage of token numbers, see ###.

Keyword	\$DIRECTORY
Status	See \$FOLDER.
Synopsis	\$DIRECTORY (<i>string</i>)

Keyword	\$DWVERSION
Status	New in 4.0
Synopsis	\$DWVERSION
Returns	Text
Type	Data
Where	Script
Description	Returns the version number of the DesignWorks package it is running on.
Examples	* Generated by DesignWorks \$DWVERSION

The keyword is used to insert the current DesignWorks version number into output files for documentation purposes.

Keyword	\$ELSE
Status	See \$IF.

Keyword	\$END
Status	Updated in 4.0. See \$IF, \$DEFINEBLOCK, \$DEFINECIRCUIT, \$HEADER

Keyword	\$ENDHEADER
Status	Obsolete in 4.0. Use \$END. See \$HEADER.

Keyword	\$ENDIF
Status	Obsolete in 4.0. Use \$END. See \$IF.

Keyword	\$EQ
Status	New in 4.0
Synopsis	\$EQ (<i>string1</i> , <i>string2</i>)
Returns	Boolean
Type	Data
Where	Script
Description	Performs an integer conversion on both arguments and returns TRUE if they are equal.
Example	\$IF(\$EQ(\$DATE(\$H), 12)) \$ALERT1(Ti me for lunch.) \$END

IMPORTANT: This is a numerical comparison, not a string comparison. For a string comparison, use \$REGEXP.

Keyword	<code>\$ERRORBITOFF</code>
Status	New in 4.0
Synopsis	<code>\$ERRORBITOFF (bitNum)</code>
Returns	Boolean
Type	Data
Where	Script - Any object
Description	Tests if the given bit number in the binary error set represented in the object's "OKErrors" attribute field is off.
Examples	<code>\$DEVICESSIF (\$AND (\$NOT (\$DEVNAME) , \$ERRORBITOFF (7))) Error\$END</code> Will output the text "Error" for each device that has no name and for which bit 7 of the OKErrors field is 0.

This call is one of a set of commands designed to implement a "Mark as OK" feature in error checking scripts. See the description of this feature in "Implementing Mark as OK in Error Checking Scripts" on page 26.

► See also `$CLEARERRORBIT`, `$ERRORBITON`, `$SETERRORBIT`.

Keyword	<code>\$ERRORBITON</code>
Status	New in 4.0
Synopsis	<code>\$ERRORBITON (bitNum)</code>
Returns	"1" if the given error bit is 1.
Type	Data
Where	Script - Any object
Description	Tests if the given bit number in the binary error set represented in the object's "OKErrors" attribute field is on.
Examples	<code>\$DEVICESSIF (\$ERRORBITON (7)) \$DEVNAME marked as OK! \$END</code> Will output the device name and the given string for each device that has bit 7 of the OKErrors field set.

This call is one of a set of commands designed to implement a "Mark as OK" feature in error checking scripts. See the description of this feature under "Implementing Mark as OK in Error Checking Scripts" on page 26.

► See also `$CLEARERRORBIT`, `$ERRORBITOFF`, `$SETERRORBIT`.

Keyword	<code>\$FILECREATOR</code>
Status	Obsolete in 4.0. See the <code>\$CREATOR</code> option in <code>\$CREATEREPORT</code> .

Keyword	<code>\$FILENAME</code>
Status	New in 3.1.5
Synopsis	<code>\$FILENAME</code>
Returns	Text
Type	Data
Where	Script - design
Description	Returns the name of the current design's file. If the current design has never been saved to a file, this will be the name of the design window.
Examples	This report was generated from <code>\$FILENAME</code>

► See also "`$DESIGNNAME` vs. `$FILENAME`" on page 98.

Keyword	<code>\$FILEEXISTS</code>
Status	New in 3.1.5
Synopsis	<code>\$FILEEXISTS(fileName)</code>
Returns	"1" if the given file exists, null otherwise.
Type	Data
Where	Script
Description	This command is used to determine if a specified file exists on disk. The file name can optionally include an absolute or relative directory path. If the directory is not absolutely specified, it is relative to the "current directory", which is usually the one containing the current design file.
Examples	<code>SI F(\$NOT(\$FILEEXISTS(\$DESIGNNAME. proj)))</code> <code>\$CREATEREPORT(\$DESIGNNAME. proj)</code> Project file for <code>\$DESIGNNAME</code> , created <code>\$DATE</code> <code>\$CLOSEREPORT</code> <code>\$END</code>

► See also `$FOLDER`, `$DESIGNPATH`, `$SCRIPTPATH`, `$TEMPPATH`, `$PROGPATH`, and "File Names and Paths" on page 36.

Keyword	\$FILESUFFIX
Status	Obsolete in 4.0. See \$CREATEREPORT.

Keyword	\$FIND
Status	Changed in 4.0
Synopsis	\$FIND [\$NOCLEAR] \$DEVICES \$SIGNALS[<i>criterion1</i>][<i>criterion2</i>]...
Returns	N. A.
Type	Definition
Where	Top level - design
Description	Scans through the list of devices or signals in the current circuit or design to locate objects meeting the given criteria. After this command has executed, subsequent commands dealing with the same object type will see only the selected objects.
Examples	\$FIND \$DEVICES \$NOT(\$DEVNAME) This will locate all devices having no name, i.e. a null "Name" field.

This command is one of the most important and powerful ones in the scripting language. It allows you to selectively include or omit objects from consideration based on almost any criteria. For example, you can use it to locate:

- Devices of a certain type that require special formatting in a netlist. E.g. Sub-circuit devices in a SPICE file.
- Devices whose pins meet some error condition (e.g. duplicate pin numbers)
- Only signals that have two or more pin connections for netlisting.
- Special device symbols that are used to mark the schematic or pass special parameters to an external system.
- Port connectors that will be used to defined a sub-circuit header in a hierarchical netlist.
- Etc.

In order to implement the \$DEVICES and \$SIGNALS commands, the Scripter keeps two internal lists, one for devices and one for signals. In hierarchical designs, these lists may be derived from a single sub-circuit, or from a flattened view of the whole design, depending on the hierarchy

mode. For the sake of further discussion, we will assume we are dealing with a single circuit.

If no \$FIND has been done, the \$SIGNALS command will by default operate on all the signals in the circuit, and the \$DEVICES command will operate on all non-pseudo-devices in the circuit. The \$FIND command normally starts by creating a new list of all the objects in the circuit. It then runs down this list and evaluates the first "criterion" item on the line for each object on the list. If the criterion produces any non-null string, the object is kept on the list. This process is repeated by running down the resulting list and evaluating the next criterion for each remaining object.

Once a \$FIND has been done, any objects not on the list are gone as far as subsequent script operations are concerned. Device, signal and pin listings will show only selected objects.

If you have finished with a given selection of devices or signals and want to restore future listings to work on the full set of objects, you can simply do a \$FIND with no criteria:

```
$FIND $DEVICES
```

or

```
$FIND $SIGNALS
```

Using the \$NOCLEAR Option

In some cases, you may want to use some property of a sorted list of objects as a find criterion. An example is finding all cases of two objects having the same value in an attribute field. The way to implement such a search is to sort the list by that value, turn on the merging feature (\$COMBDEVSON/\$COMBSIGSON) and count how many objects get grouped together.

However, this is not normally possible, since \$FIND normally starts by creating a new list derived directly from the design. This destroys any sorting of the existing list. The \$NOCLEAR option solves this by overriding this behavior. Note that this option *must* appear immediately after \$FIND on the command line.

With \$NOCLEAR specified, \$FIND skips the extraction of a new list and operates on any existing list of objects, in the order that it is currently sorted. This way, you can use the sort as a source of data for the \$FIND.

This is illustrated in the following example:

```
SCOMBSIGSON
$SORT $SIGNALS $SIGNALNAME
$FIND $NOCLEAR $SIGNALS $GE($COUNT, 2)
$CHECK(Duplicate signals found) $SIGNALS
```

In this case we sort the signals by name, then use the \$COUNT function to tell us when we have two or more objects merged together. If \$NOCLEAR was not specified, the sorted order would be lost and \$COUNT would be meaningless.

► See also: \$SORT, \$COMBDEVSON.

Keyword	\$FOLDER
Status	Updated in 4.0
Synopsis	\$FOLDER (<i>string</i>)
Returns	N. A.
Type	Definition
Where	Top level
Description	Specifies the default directory for use by design-related file commands, such as \$OPENDESIGN, \$CREATEDIRECTORY and \$CREATEREPORT. That is, if these commands do not specify a full directory path, the value specified by \$FOLDER will be used.
Example	\$FOLDER(MyDisk:Designs)

IMPORTANT: This command does not interpret commands or variable references in the given string. All characters are used verbatim.

A synonym for this command is \$DIRECTORY.

Keyword	\$FULLPATH
Status	New in 4.0
Synopsis	\$FULLPATH (<i>string</i>)
Returns	Text
Type	Data
Where	Script
Description	Converts the given directory path name to an absolute path starting with the disk name.
Example	\$FULLPATH(&Di r)

This command is primarily intended to assist in making scripts that are coded only with relative path names for portability while still allowing the generation of full path names for outside processes that require them.

The absolute path name that is generated will use the root directory that contains the current directory as its origin. See more information about root directories under “File Names and Paths” on page 36.

► See also \$FOLDER, \$DESIGNPATH, \$SCRIPTPATH, \$TEMPPATH, \$PROGPATH.

Keyword	\$GE
Status	New in 4.0
Synopsis	\$GE (<i>string1</i> , <i>string2</i>)
Returns	Boolean
Type	Data
Where	Script
Description	Performs an integer conversion on both arguments and returns TRUE if the first is greater than or equal to the second.
Example	\$IF(\$GE(&ErrCnt, 1)) \$ALERT1(&ErrCnt errors!) \$END

IMPORTANT: This is a numerical comparison, not a string comparison. The comparison is done using signed 32-bit arithmetic.

Keyword	\$GRID
Status	No change in 4.0
Synopsis	\$GRID
Returns	Text
Type	Data
Where	Script - any object
Description	Returns a text representation of the location of the object in the drawing grid of the page it is on. For example, an item in the top left corner of a sheet using the default grid layout would return "A1". The results of this command are affected by the Custom Sheet Info setup for the sheet.
Example	\$DEVICES\$DEVNAME &Part \$PAGE- \$GRID This will list devices showing their page and grid location in the schematic.

Keyword	\$GT
Status	New in 4.0
Synopsis	\$GT(<i>string1</i>, <i>string2</i>)
Returns	Boolean
Type	Data
Where	Script
Description	Performs an integer conversion on both arguments and returns TRUE if the first is greater than the second.
Example	SIF(\$GT(&CurDate, &UpdateDate))Time to update!\$END

IMPORTANT: This is a numerical comparison, not a string comparison. The comparison is done using signed 32-bit arithmetic.

Keyword	\$HEADER
Status	No change in 4.0
Synopsis	\$HEADER
Returns	N. A.
Type	Definition
Where	Top level
Description	Defines a block of text to be output whenever a page break occurs.
Example	<p>\$HEADER Bill of Materials for \$DESIGNNAME, page \$PAGE</p> <p>\$END The specified text (with appropriate command and variable substitutions) will be output each time the current line count exceeds the \$PAGELENGTH setting.</p>

► See also "Controlling Report Page Layout" on page 17.

Keyword	\$HEX
Status	New in 4.0
Synopsis	\$HEX(<i>string</i>)
Returns	Hexadecimal integer
Type	Data
Where	Script
Description	Performs a hexadecimal conversion on the argument. The conversion is done using signed 32-bit arithmetic..
Example	\$DEVICES\$DEVNAME \$HEX(&DateStamp.Dev)

Keyword	\$HIERARCHY
Status	No change in 4.0
Synopsis	\$HIERARCHY \$FLATDOWN \$FLAT \$CIRCUIT \$TOPCIRCUIT \$PUREDOW \$PURE
Returns	N. A.
Type	Definition
Where	Top level
Description	Sets the hierarchy mode for the netlist.
Example	\$HIERARCHY \$FLAT This specifies that we want to generate a flattened netlist of the entire design, i.e. starting at the topmost circuit level.

The \$HIERARCHY command specifies the hierarchical scope of subsequent \$DEVICES and \$SIGNALS listings and also the type of netlist that will be generated. The scope can be one of:

\$CIRCUIT	The current circuit only, i.e. the one in the active schematic window. This is the default mode if \$HIERARCHY is not specified in a script.
\$TOPCIRCUIT	The topmost circuit in the current design, regardless of which window is active.
\$FLAT/\$PURE	All unrestricted circuit levels in the current design.
\$FLATDOWN/ \$PUREDOW	All unrestricted circuit levels from the current circuit (the one in the active schematic window) and down.

Netlists that involve more than one circuit level can also be selected to be FLAT or PURE. The options \$CIRCUIT and \$TOPCIRCUIT only deal with a single circuit level and will be flat by definition. Options \$FLAT and \$FLATDOWN generate a "flattened" netlist, that is, one that substitutes the contents of a subcircuit for its parent symbol so that it appears to have been generated from a logically equivalent flat design. Options \$PURE and \$PUREDOW generate "hierarchical" netlists, i.e. where each internal circuit is defined as a separate netlist and is defined only once.

► *There are numerous formatting issues in generating netlists from hierarchical designs. These are described in more detail in "Script Hierarchy Issues" on page 31.*

Keyword	\$HIERNAMESEPARATOR
Status	No change in 4.0
Synopsis	\$HIERNAMESEPARATOR (<i>character</i>)
Returns	N. A.
Type	Definition
Where	Top level
Description	Sets the name separator character used in generating \$DEVHIERNAME and \$SIGHIERNAME. The default is a slash "/".
Example	\$HIERNAMESEPARATOR (_) This specifies that we want to generate hierarchical names using an underscore as a separator character. For example "DEV1_GATE1_Q12" or "BLK4_INBUF1".

Keyword	\$IF
Status	Changed in 4.0
Synopsis	\$IF (<i>conditionString</i>) <i>trueString</i> [\$ELSE <i>falseString</i>] \$END \$IF (<i>conditionString</i>) <i>trueCommands</i> \$END \$IF (<i>conditionString</i>) <i>trueCommands</i> \$ELSE <i>falseCommands</i> \$END
Returns	N. A.
Type	Definition
Where	First form - Script Second and third forms - Top level
Description	Provides a mechanism for conditionally including or executing strings. If <i>conditionString</i> is non-null, then <i>trueString</i> is evaluated and included in the output, otherwise <i>falseString</i> (if specified) is used.
Example	\$IF (&Value) , &Value \$END This example will add a comma and a value to the output line only if the value exists. I.e. This ensures that no comma is output if there is no value.

The \$IF command provides a powerful mechanism to control the format of output and the execution of commands based on text data in the design.

The \$IF command can be used in either of two forms. The single-line form can be used anywhere and requires that the \$IF and its matching \$END (and the \$ELSE, if used) be all on one line. For example:

```
SDEVPI NFORMAT $IF($NOT($PINNUM)) SSETVAR(Errs, 1) $END
```

The other form of \$IF requires all parts to be on top-level lines, for example:

```
$IF(&Errs)
$NULL($ALERT1(Errors were detected))
$ELSE
$NULL($ALERT1(The circuit is clean!))
$END
```

Keyword	\$IFPORT
Status	Obsolete in 4.0. Use \$IF(\$ISPORT).

Keyword	\$INCLUDE
Status	Changed in 4.0
Synopsis	<pre>\$INCLUDE \$BLOCK(<i>blockName</i>)[\$RAW] \$INCLUDE[(<i>fileNameString</i>) \$PROMPT[(<i>promptStr</i>)]] [\$RAW] \$INCLUDE[(<i>fileNameString</i>) \$PROMPT[(<i>promptStr</i>)]] \$EXECUTE(<i>blockName</i>)</pre>
Returns	N. A.
Type	Definition
Where	Top level
Description	Implements several mechanisms for reading and interpreting text from an external text file or from a block delimited within the script.
Example	<pre>\$INCLUDE \$PROMPT(Select the vector file) \$RAW</pre> <p>This line will prompt the user to locate a text file which will then be copied verbatim to the output file.</p>

The \$INCLUDE command is used for several different functions, all related to reading text either from an external file or from a block defined within the script.

Including a Named Block

The first form noted above in effect replaces the line containing the `$INCLUDE` with the contents of the named block. If the `$RAW` option is used, this line has the effect of copying the contents of the block directly to the output file. No processing is done on the contents of the block, other than looking for the `$END` line.

If the `$RAW` option is *not* used then the contents of the block are interpreted line by line as if they had been substituted for the `$INCLUDE` line itself. This could be thought of as being a sort of subroutine call and is intended to be used similarly. It is useful for cases where the same set of script lines could be repeated at several points.

Including an External File

The second form shown above is similar to the first except that an external text file is read. Again, the `$RAW` option determines whether the contents of the file are interpreted as script commands or simply copied to the output.

There are two ways to specify the file to be read. If a name is included in parentheses after `$INCLUDE`, then that is taken as the file to read. The file is read from the current directory, which will be the one the current design is located in, unless it has been changed. Note that the file name specification can contain literal text and commands that refer to the current design, such as in the following examples:

```
$INCLUDE($DESIGNNAME. hdr) $RAW
$INCLUDE(&Model File) $RAW
$INCLUDE($IF(&HdrFile)&HdrFile$ELSE\Default Header$END)
```

A `$PROMPT` option allows you to prompt the user to select a file and optionally specify the text that will appear at the top of the file open box. For example:

```
$INCLUDE $PROMPT(Please select the test vector file) $RAW
```

Using an External File as Data

The third form of `$INCLUDE` allows you to read a file line by line and use the contents as data to be interpreted using script commands, rather than as script commands itself. This facility is intended to be used in conjunction with the `$REGEXP` regular expression command to implement

various types of back annotation or file conversion.

When the \$EXECUTE option is added, the specified block of script commands is executed once for each line in the file. While the block is being executed, the \$TEXTLINE keyword represents the contents of the line. For example, the following script assumes that a file contains a list of device names, one per line. It will display an alert box for every name that is in the file but is not found in the design.

```
SDEFINBLOCK(FindBlock)
$FIND $DEVICES $EQ($DEVNAME, $TEXTLINE)
$IF($EQ($DEVCOUNT, 0))
$NULL($ALERT1(Missing device $TEXTLINE))
$SEND
$INCLUDE(Device List) $EXECUTE(FindBlock)
```

To show how you might use a regular expression to extract an old and new name from a file, consider the following simple back annotation:

```
SREPORTOFF
SDEFINBLOCK(FindBlock)
$IF($NOT($REGEXP((\S+)\s+(\S+), $TEXTLINE)))
$ALERT1(Bad file format at $TEXTLINE)
$ELSE
$FIND $DEVICES $EQ($DEVNAME, &1)
$IF($EQ($DEVCOUNT, 0))
$ALERT1(Missing device &1)
$ELSE
$DEVICESSETATTR(Name, &2)
$SEND
$SEND
$INCLUDE(Device List) $EXECUTE(FindBlock)
```

NOTE: This simple script assumes that changes are to be applied sequentially, i.e. each line assumes that the previous line's change has been implemented in the design. Some back annotation formats specify all "old names" in the first column and all "new names" in the second. Make sure you know which form is required before using this type of script.

This type of script can make major changes to the data in a design and is not Undoable. It is best to warn the user prominently before proceeding with such drastic changes.

Keyword	\$INCLUDEPORTSON/\$INCLUDEPORTSOFF
Status	New in 3.1.5.
Synopsis	\$INCLUDEPORTSON \$INCLUDEPORTSOFF
Returns	N. A.
Type	Definition
Where	Top level
Description	Determines whether Port Connectors are treated as devices for the purposes of netlisting. If ON, port connectors will appear in the list along with all other devices. If OFF (the default), port connectors will not be listed.
Example	\$INCLUDEPORTSON

Port connectors are used in hierarchical designs to link signals in a sub-circuit to a pin on the parent device symbol. Port connector symbols are pseudo-devices and so do not normally appear in any output generated by the Scriptor tool, although their connectivity effect is of course taken into account in generating netlists. For some types of reports, however, it is useful to create a list of a circuit's ports, for example, to generate an interface listing for a circuit. Including the keyword `$INCLUDEPORTSON` prior to performing any listing or searching commands will cause port connectors and their pins to be listed as if they were normal devices.

► See also: `$ISPORT`.

Keyword	\$INLINE
Status	New in 4.0
Synopsis	\$INLINE (<i>blockName</i>)
Returns	Text
Type	Data
Where	Script
Description	This command is a formatting convenience that allows script commands that normally have to be included on one line to be written out on sequential lines.
Example	<pre> \$DEFI NEBLOCK(DevI tems) \$IF(\$NOT(\$REGEXP(\w+, \$DEVNAME))) \$IF(\$NOT(\$ALERT2(Name error in \$DEVNAME))) \$ABORT \$SEND \$SEND \$SEND \$DEVI CES\$I NLI NE(DevI tems) </pre> <p>This script will behave exactly the same as if the contents of the block were strung together on one line with no line breaks and white space between the items.</p>

This command is a convenience used to overcome the formatting restriction that commands like \$DEVICES or \$SIGPINFORMAT must fit on one line. The contents of the block are interpreted as if they existed in place of the \$INLINE keyword, except that all line breaks and leading and trailing whitespace are ignored.

\$INLINE is intended for use in cases where a \$DEVICES or \$SIGNALS line or a pin format specification requires a complex sequence of commands that will not fit conveniently on one line.

Keyword	\$INTERNAL
Status	No change in 4.0.
Synopsis	\$INTERNAL [(<i>blockName</i>)]
Returns	Text
Type	Data
Where	Script - device
Description	Causes the internal circuit or the current device (if any) to be output. If no block name is provided, the format for the subcircuit netlist must have been defined in a \$DEFINECIRCUIT block. If a block name is provided, any block defined in a \$DEFINEBLOCK can be used.
Example	<pre> \$HIERARCHY \$PURE \$DEFINEBLOCK(SubCctBlk) \$SORT \$DEVICES \$DEVNAME \$DEVICES\$DEVNAME \$PINS \$END \$DEVICES\$INTERNAL(SubCctBlk) </pre> <p>This will generate a device pin listing for each subcircuit in the design.</p>

► See keywords \$DEFINECIRCUIT, \$DEFINEBLOCK, \$HIERARCHY and the general description of hierarchical netlists in "Script Hierarchy Issues" on page 31.

Keyword	\$ISPORT
Status	New in 3.1.5.
Synopsis	\$ISPORT
Returns	Boolean
Type	Data
Where	Script - device or pin
Description	Returns TRUE ("1") if the current device is a port connector or is the current pin is a pin on a port connector, FALSE (null string) otherwise.
Example	<pre> \$INCLUDEPORTSON \$FIND \$DEVICES \$ISPORT \$DEVICES\PORT \$DEVNAME </pre> <p>This will generate a listing of ports like the following:</p> <pre> PORT IN1 PORT IN2 PORT CLK </pre>

► See also `$INCLUDEPORTSON`.

Keyword	<code>\$ISUNCONNPIN</code>
Status	No change in 4.0.
Synopsis	<code>\$ISUNCONNPIN</code>
Returns	Boolean
Type	Data
Where	Script - pin or signal
Description	Returns TRUE ("1") if the current pin is unconnected, that is, it has no visible signal lines or name associated with it on the schematic, FALSE (null string) otherwise.
Example	<code>\$FIND \$SIGNALS \$ISUNCONNPIN</code> <code>\$SIGNALS\$SIGNALNAME is unconnected!</code> This will generate a simple error report of unconnected pins.

Keyword	<code>\$ITEMSEPARATOR</code>
Status	No change in 4.0.
Synopsis	<code>\$ITEMSEPARATOR(<i>string</i>)</code>
Returns	N. A.
Type	Definition
Where	Top level
Description	Sets the string of characters to be inserted between items in a repeating list, i.e. <code>\$PINS</code> or multiple-valued items.
Example	<code>\$ITEMSEPARATOR(,)</code> <code>\$DEVICE\$DEVNAME \$PINS</code> This will generate a listing of devices with the pins separated by commas.

► See also `$PINS` and "Display of Multiple Values in Merged Lines" on page 24.

Keyword	\$LE
Status	New in 4.0
Synopsis	\$LE (<i>string1</i> , <i>string2</i>)
Returns	Boolean
Type	Data
Where	Script
Description	Performs an integer conversion on both arguments and returns TRUE if the first is less than or equal to the second.
Example	\$IF(\$LE(&UpdateDate, &CurDate)) Time to update!\$END

IMPORTANT: This is a numerical comparison, not a string comparison. The comparison is done using signed 32-bit arithmetic.

Keyword	\$LINESUSED
Status	No change in 4.0
Synopsis	\$LINESUSED (<i>number</i>)
Returns	N.A.
Type	Definition
Where	Top level
Description	Sets the number of lines to put on a page before writing out a page header. The actual length of the page is specified by <code>PAGELENGTH</code> above. The default value is 32767, that is, page breaks are disabled.
Example	\$LINESUSED(60)

► See also: `$HEADER`, `$PAGELENGTH`.

Keyword	\$LINETERMINATOR
Status	Changed in 4.0
Synopsis	\$LINETERMINATOR (<i>literalString</i>) \$LINETERMINATOR \$DEFAULT \$MAC \$DOS \$WINDOWS \$UNIX \$NONE
Returns	N.A.
Type	Definition
Where	Top level
Description	Sets the line terminator for report output.
Example	\$LINETERMINATOR(- - ^M^J- -) This will set every line to end with two hyphens, a carriage return, a line feed, and two hyphens starting the next line.

Many applications of the Scripter require generating files that are to be read by a software application on a different operating system. This command is intended to allow a script to generate files that will be compatible with that system without translation.

Two formats are available for the \$LINETERMINATOR command. In the first format, a string argument is provided. This string will be output to the report file each time an explicit \$NEWLINE command is encountered or some specified limit requires a newline to be inserted. The string may contain any characters and may specify control characters by using the "^" format used elsewhere. For example:

```
$LINETERMINATOR(^M^J)
```

specifies the common carriage return/line feed combination.

The second format allows you to select one of the predefined formats from the following table:

\$LINETERMINATOR Options

Keyword	Meaning
\$DEFAULT	The standard format for the machine the script is running on. I.e. For Macintosh: Carriage return, for Windows: Carriage return, line feed.
\$MAC	Carriage return
\$DOS	Carriage return, line feed
\$WINDOWS	Same as \$DOS: Carriage return, line feed

\$LINETERMINATOR Options

Keyword	Meaning
\$UNIX	Line feed
\$NONE	No line terminator, i.e. all generated text will appear on one line.

Note that \$LINETERMINATOR does not affect transcript output. The transcript file is always written with line terminators native to the system that DesignWorks is running on.

► See also \$NEWLINE, \$MAXITEMSPERLINE, \$CONTSTART, \$CONTEND.

Keyword	\$LINEWIDTH
Status	No change in 4.0
Synopsis	\$LINEWIDTH(<i>n</i>)
Returns	N. A.
Type	Definition
Where	Top level
Description	Sets the maximum number of characters that will be output on one line by a repeating data item before a line break is inserted.
Examples	\$LINEWIDTH(80) Sets the maximum width of a line to 80 characters.

NOTE: This command only affects repeating items such as \$PINS or merged data items, so it does not guarantee that no line will be longer than the specified amount. For example, consider the simple script:

```
$LINEWIDTH(20)
$DEVICES$DEVNAME &Part
```

In this case, the \$LINEWIDTH will have no effect because no repeating or multiple-value data item is present. If the total width of the device name, &Part and the separating blank add up to more than 20 characters, they will be simply output with no change.

► More information on multiple value items in merged lists is given in "Display of Multiple Values in Merged Lines" on page 24

Keyword	\$LT
Status	New in 4.0
Synopsis	\$LT (<i>string1</i> , <i>string2</i>)
Returns	Boolean
Type	Data
Where	Script
Description	Performs an integer conversion on both arguments and returns TRUE if the first is less than the second.
Example	\$IF(\$LT(&UpdateDate, &CurDate)) Time to update! \$END

IMPORTANT: This is a numerical comparison, not a string comparison. The comparison is done using signed 32-bit arithmetic.

► See also *\$EQ*, *\$GE*, *\$GT*, *\$LE*, *\$NE*.

Keyword	\$MAP
Status	New in 4.0
Synopsis	\$MAP (<i>blockName</i> , <i>string</i>)
Returns	Text
Type	Data
Where	Script
Description	Used to map string values using a predefined table.
Example	<pre> \$DEFINBLOCK(PkgTable) DIP14 D14- 300 DIP16 D16- 300 DIP20 D20- 300 \$END \$DEVICES\$DEVNAME &Part \$MAP(PkgTable, &Package) </pre> <p>This will output for each device the name, part name and a package code determined by locating the contents of &Package in the first column and outputting the corresponding contents of the second column. Note that the white space shown in this example is representing a single tab character. Blanks do not count as separators and may be included in the values.</p>

This command allows you to map string values by looking them up in a

table. This can allow you to translate data in a design that was intended for one usage to a suitable format for a different system. For example, every PCB layout package uses a different set of package codes to select a PCB footprint for a part. The \$MAP command allows you to generate output for a different PCB package than that for which the design was originally created, without making any manual modifications to the codes in the design.

Note that the \$VERIFY command uses the same table format but returns only TRUE ("1") or FALSE (null) to indicate if a given value is present in the table. This can be used for error checking when the actual mapped value is not needed, or may be null.

Mapping Table Format for \$MAP, \$CHARMAP and \$VERIFY

The mapping table used by the \$MAP, \$CHARMAP and \$VERIFY commands is placed in a script *block*, i.e. the first line must be \$DEFINEBLOCK(name) and the last line must be \$END. Note that care must be taken not to include any mapping values that start with a \$ in the first column or contain any tab characters, as this might confuse the script parser. If it is necessary to use such a value, the \$ or tab must be preceded with an escape (backslash) character.

The mapping table consists simply of zero or more lines of text. Each line consists of a match string followed optionally by a tab character and a new value string. The new value string is not used by \$VERIFY and will be ignored if present. The match string must consist of exactly a single character for the \$CHARMAP command. If the new value string is not present, \$MAP or \$CHARMAP will return a null string if it matches the match string. The mapping function searches the strings in the order provided and stops as soon as it finds a match. No checking is done for duplicate values.

Note the following important features of this format:

- The only valid separator character between columns is a tab. Blanks are not considered a separator and may be part of either the match value or the new value string.
- The values provided for both the match string and the new value string are literal text, *not* script commands. Text that looks like a script command, like "&Package" will be taken as literal text exactly as shown and will *not* be substituted with the value of the Package

attribute. More complex matches can be done using regular expressions and other features by using the \$TABLE command, but execution will be much slower.

► See also: \$CHARMAP, \$VERIFY.

Keyword	\$MAXITEMSPERLINE
Status	Changed in 3.1.5
Synopsis	\$MAXITEMSPERLINE (<i>numString</i>)
Returns	N. A..
Type	Definition
Where	Script
Description	Specifies the maximum number of items that will be placed on one line by repeating commands such as \$PINS.
Example	<pre>SDEVPIFORMAT PIN, SPINNAME, SPINNUM SMAXITEMSPERLINE(1) SDEVICES\DEVICE, SDEVNAMESNEWLINESPINS</pre> <p>This will generate a listing like the following:</p> <pre>DEVICE, U1 PIN, A, 1 PIN, B, 2 PIN, X, 3 PIN, Ground, 7 PIN, Power, 14</pre>

This command is used to limit the number of items that will be placed on one line by any repeating command. It is most often used to format pin entries generated by a \$PINS command, but it also affects any item that is repeated due to a merge operation.

► See also *Sorting and Merging* on page “*Sorting and Merging*” on page 21 and the \$PINS keyword.

Keyword	\$MERGE
Status	No change in 4.0
Synopsis	\$MERGE
Returns	N.A.
Type	Definition
Where	Script - In \$DEVICES or \$SIGNALS line.
Description	Indicates that all values for objects merged on this line should be output for the next printing item on the line.
Example	<pre> \$SORT \$DEVI CES \$TYPENAME \$COMBDEVSON \$DEVI CES\$SETATTR(OtherDevs, \$MERGE\$DEVNAME) </pre> <p>In this case, if \$MERGE was not specified, the \$SETATTR command would be iterated at the top level, but the calculation of \$DEVNAME would be done separately for each device. \$MERGE indicates that we want the values of all devices merged in the calculation of the argument to \$SETATTR.</p>

This command is used to override the default behavior when creating an argument string in a sorted listing. In an example of the type shown above, the device list has been sorted by one field, in this case the type name. Since "\$COMBDEVSON" has been specified, all devices with the same sort value (type name in this case) will be merged onto one line. Normally, any keyword at the "top level" of that line (i.e. not an argument to any other command) will be iterated for all the objects represented by that line. On the other hand, commands that are arguments to other commands will only return the value of the specific device being processed at that point. In other words, the iterating is performed on the top-level results of a command, not on its arguments.

In some cases, it is desired to generate a value based on all the objects merged on a line and pass it to another command. The \$MERGE keyword indicates that the next data keyword should be used as many times as necessary for all objects on the line.

In summary, on the top level of a \$DEVICES or \$SIGNALS line, \$MERGE is the default behavior and it can be overridden by specifying \$SINGLE. When calculating an argument to any other command, \$SINGLE is the default behavior and it can be overridden by specifying \$MERGE.

► See also: *\$SINGLE*, *\$COMBDEVSON*, *\$SORT*.

Keyword	\$MIN
Status	New in 4.0
Synopsis	\$MIN (<i>string1</i> , <i>string2</i>)
Returns	Decimal integer
Type	Data
Where	Script
Description	Compares the two values and returns a decimal string of the smallest. \$MIN(&x, &y) is equivalent to \$IF(\$LT(&x, &y))&x\$ELSE&y\$END.
Example	\$SETVAR(Count, \$MINUS(&Count, 1))

Keyword	\$MINUS
Status	New in 4.0
Synopsis	\$MINUS (<i>string1</i> , <i>string2</i>)
Returns	Decimal integer
Type	Data
Where	Script
Description	Performs an integer subtraction and returns a decimal string equivalent of the numerical value of the second argument subtracted from the first.
Example	\$SETVAR(Count, \$MINUS(&Count, 1))

Keyword	\$NE
Status	New in 4.0
Synopsis	\$NE (<i>string1</i> , <i>string2</i>)
Returns	Boolean
Type	Data
Where	Script
Description	Performs an integer conversion on both arguments and returns TRUE if they are unequal.
Example	\$IF(\$NE(&COUNT1, 1))Error: Should have exactly one. \$END

IMPORTANT: This is a numerical comparison, not a string comparison. For example, "1" and "001" will be equal.

Keyword	\$NEWLINE
Status	No change in 4.0
Synopsis	\$NEWLINE
Returns	Text
Type	Data
Where	Script
Description	Inserts a line break into the output.
Example	\$DEVICES\Device \$DEVNAME\$NEWLINE\Type \$TYPENAME This script will generate two lines per device as in the following example: Device U1 Type 74ALS621 Device U2 Type 74ALS00

This command inserts a line break into the output. By default a line break will be the one used on the platform the script is running on, but this can be overridden with the \$LINETERMINATOR command to be any string or no break at all.

► See also \$LINETERMINATOR and "Line Terminators" on page 39.

Keyword	\$NEWPAGE
Status	No change in 4.0
Synopsis	\$NEWPAGE
Returns	N. A.
Type	Action
Where	Top level
Description	Inserts a page break into the output.
Example	\$NEWPAGE

The \$NEWPAGE command causes these actions to be taken:

- If the current page length setting is zero, an ASCII form feed character is written to the output file.
- If the current page length setting is greater than zero and the current line count has already exceeded this setting, a single line terminator is written.
- If the current page length setting is greater than zero and the current line count is less than this value, then line terminators are written until the page length is reached.

In all cases, if any header has been specified in a \$HEADER section, it is written out.

► Also see \$PAGELENGTH, \$HEADER and "Controlling Report Page Layout" on page 17.

NOTE: Although this looks similar to \$NEWLINE, it can only be used on a top-level line and does not return a value that can be used as an argument to another command.

Keyword	\$NONBLANK
Status	New in 4.0
Synopsis	\$NONBLANK (<i>string</i>)
Returns	Boolean
Type	Data
Where	Script
Description	Returns TRUE if the given string contains any non-blank characters, FALSE otherwise. Allows you to treat a string of blanks as a "FALSE" value.
Example	<pre>\$DEVPI NFORMAT \$I F (\$NOT (\$PI NNUM)) Error! \$END \$DEVI CESSI F (\$NONBLANK (\$PI NS)) \$ALERT1 (Err i n \$DEVNAME) \$END</pre> <p>This script will put up an alert box if any empty pin numbers are found. \$NONBLANK is needed in this case because \$PINS inserts a default blank separator between each pair of pin entries.</p>

Keyword	\$NOT
Status	Changed in 4.0
Synopsis	\$NOT (<i>string</i>)
Returns	Boolean
Type	Data
Where	Script
Description	Performs a Boolean inversion on the argument.
Example	<pre>\$I F (\$NOT (\$ALERT2 (OK to continue?))) \$ABORT\$END</pre>

NOTE: Another, obsolete form of \$NOT is supported for compatibility with 3.x report forms. In a \$FIND line, \$NOT inverts the meaning of the next item on the line, as in:

```
$FIND $DEVICES $NOT $DEVNAME
```

to find unnamed devices. In this version it is preferred to write this as:

```
$FIND $DEVICES $NOT($DEVNAME)
```

for consistency.

Keyword	\$NOTES
Status	No change in 4.0
Synopsis	\$NOTES <i>text</i> \$END
Returns	N. A.
Type	Definition
Where	Top level
Description	Defines a block of text to be displayed to the script user when the "Format Notes" command is selected. This text has no effect on the script output or action.
Example	\$NOTES The script generates a netlist for Acme PCB. \$END

NOTE: Notes are not the same as comments (enclosed in "{}"). Notes in a \$NOTES section are specifically intended to give the user information about the usage of the script, required attribute fields, etc.

Keyword	\$NULL
Status	New in 4.0
Synopsis	\$NULL (<i>string</i>)
Returns	N. A.
Type	Definition
Where	Script
Description	Discards the value of the argument string.
Example	\$NULL(\$ALERT1(We' re still working!))

This command in effect converts any data command into a definition command, eliminating any output from it and eliminating a line terminator that would normally be inserted if it appeared by itself on a line. This is used when it is desired to execute a command for its action, but the value is not wanted in the output.

► See also \$REPORTON/\$REPORTOFF.

Keyword	\$NULLSIGSON/\$NULLSIGSOFF
Status	Obsolete in 4.0. Use \$FIND \$SIGNALS \$GT(\$NUMPINS,1).

Keyword	\$NUMINPS
Status	No change in 4.0
Synopsis	\$NUMINPS
Returns	Decimal integer
Type	Data
Where	Script - device
Description	Returns the number of pins on the device that are defined as INPUT or BIDIR. This is strictly a count of pins defined on the symbol and does not include SIGSOURCE pins and is not summed when multiple symbols are combined onto one line.
Example	\$DEVI CESS\$DEVNAME \$NUMINPS- >\$NUMOUTS

Keyword	\$NUMOUTS
Status	No change in 4.0
Synopsis	\$NUMOUTS
Returns	Decimal integer
Type	Data
Where	Script - device
Description	Returns the number of pins on the device that are defined as OUTPUT or BIDIR. This is strictly a count of pins defined on the symbol and does not include SIGSOURCE pins and is not summed when multiple symbols are combined onto one line.
Example	\$DEVI CESS\$DEVNAME \$NUMINPS- >\$NUMOUTS

Keyword	\$NUMPINS
Status	No change in 4.0
Synopsis	\$NUMPINS
Returns	Decimal integer
Type	Data
Where	Script - device
Description	Returns the number of pins that would be output by a \$PINS command on the current device. This includes all devices merged on the current report line and all SIGSOURCE pins.
Example	\$DEVICES\$DEVNAME \$NUMPINS\$NEWLINES\$PINS

Keyword	\$ONEPINSON/\$ONEPINSOFF
Status	Obsolete in 4.0. Use \$IF(\$GT(\$NUMPINS, 1)) <i>format</i> \$END.

Keyword	\$OPENDESIGN
Status	No change in 4.0
Synopsis	\$OPENDESIGN(<i>fileName</i>)
Returns	N. A.
Type	Action
Where	Top level
Description	Opens the specified design file.
Example	\$OPENDESIGN(MyDisk: Designs: Timing Board)

NOTE: A synonym, \$OPENCIRCUIT, is also supported for compatibility with older report forms.

Here are some notes on the operation of \$OPENDESIGN:

- The new design becomes the current design for all subsequent script actions.
- The file name specified as an argument can include a relative or absolute directory path name.

► See more information on file and path specifications in “File Names and Paths” on page 36.

Keyword	\$OR
Status	New in 4.0
Synopsis	\$OR (<i>string1</i> , <i>string2</i>)
Returns	Boolean
Type	Data
Where	Script
Description	Performs a logical OR operation on its two arguments. Any non-null string in an argument is considered TRUE.
Example	SIF(\$OR(&X1, &X2))&X1/&X2\$ELSE\No data\$END

Keyword	\$PAGE
Status	No change in 4.0
Synopsis	\$PAGE
Returns	Decimal integer
Type	Data
Where	Script
Description	This command has one of two meanings, depending on context. If used in the context of a device, signal or pin, it refers to the schematic page the object is located on. If it is used in a header, it refers to the page number of the report output.
Example	SDEVICE\$DEVNAME \$PAGE- \$GRID

Keyword	\$PAGELENGTH
Status	No change in 4.0
Synopsis	\$PAGELENGTH (<i>numLines</i>)
Returns	N. A.
Type	Definition
Where	Top level
Description	This command specifies the total number of lines that make up a page, that is, the number of lines actually used plus the number of blank lines between pages. If this is set to zero, a page break generates a form feed character in the output. The default value is 66.
Example	\$PAGELENGTH(0)

► See also *\$LINESUSED*, *\$NEWPAGE* and "Controlling Report Page Layout" on page 17.

Keyword	\$PARENTPIN
Status	New in 4.0
Synopsis	\$PARENTPIN (<i>string</i>)
Returns	String
Type	Data
Where	Script - Pin
Description	Generates a string by evaluating the arguments as if the parent pin was the current pin. Used to extract information about the pin on the parent symbol associated with a pin on a port connector in a subcircuit.
Example	<pre> \$INCLUDEPORTSON \$FIND \$DEVICES \$ISPORT \$DEVPI NFORMAT \$IF(\$NOT(\$PARENTPIN(\$PINNAME))) No match! \$END \$DEVICES\$PINS </pre> <p>This will generate the string "No match" for each pin for which there is no matching parent pin.</p>

This command allows you to get information about the pin on a parent symbol that is associated with a port connector in a hierarchical design. This is intended to be used to generate a port list for a hierarchical netlist, or for port-to-pin error checking.

The string passed to \$PARENTPIN may contain commands that extract data from the parent pin itself or the parent device itself.

IMPORTANT: The information that can be extracted using this command is limited to data associated directly with the pin itself or the parent device itself. The attached signal, other pins attached to the same pin, etc. are not available.

If the current pin is not a port or has no associated parent pin, this function will return null.

► See also: \$ISPORT, \$INCLUDEPORTSON.

Keyword	\$PINCOUNT
Status	Obsolete in 4.0. Use \$NUMPINS for device pin counts and variables to count report totals.

Keyword	\$PINDIR
Status	No change in 4.0
Synopsis	\$PINDIR
Returns	Text
Type	Data
Where	Script - pin
Description	Returns a string representing the direction the pin is facing on the schematic.
Examples	\$DEVPI NFORMAT \$PINNAME- \$PINDIR

\$PINDIR returns a two-character code representing the orientation of the current pin, as shown in the following table:

Output String	Direction
E1	East
N1	North
W1	West
S1	South

These codes cannot be modified, although you could make use of the

\$MAP function to translate them to another format.

Keyword	\$PINFORMAT
Status	Obsolete in 4.0. Use \$DEVPINFORMAT or \$SIGPINFORMAT.

Keyword	\$PINNAME
Status	No change in 4.0
Synopsis	\$PINNAME
Returns	Text
Type	Data
Where	Script - pin
Description	Returns the pin name associated with the current pin, i.e. as it would appear in the DevEditor's pin list. If the current pin is an automatically-generated SIG-SOURCE pin, the name of the associated signal is returned.
Examples	\$DEVPI NFORMAT \$PI NNAME- \$PI NNUM

Keyword	\$PINNUM
Status	No change in 4.0
Synopsis	\$PINNUM
Returns	Text
Type	Data
Where	Script - pin
Description	Returns the pin number associated with the current pin. If the current pin is an automatically-generated SIGSOURCE pin, the number specified in the SIG-SOURCE attribute is returned.
Examples	\$DEVPI NFORMAT \$PI NNAME- \$PI NNUM

Keyword	\$PINS
Status	No change in 4.0
Synopsis	\$PINS \$PINS(<i>n</i>) \$PINS(<i>m..</i>) \$PINS(<i>m..n</i>) \$PINS(& <i>attrField</i>)
Returns	Text
Type	Data
Where	Script - device or signal
Description	Returns a list of the pins associated with the current device or signal. The optional argument forms shown above apply only to device pin listings.
Examples	\$DEVICES\$DEVNAME \$PINS

The \$PINS command is used to generate a list of pins associated with a device or signal. Here are some notes on the usage of this command:

- \$PINS will normally appear on either a \$DEVICES or \$SIGNALS line unless the script has been run from a context that implies a current device or signal.
- The rules for sorting the pins before writing them out depend upon whether signal pins or device pins are being listed. These rules are described in the following sections.
- For device pins, the format of each pin is determined by the \$DEVPINFORMAT command, for signal pins, by the \$SIGPINFORMAT command.
- The overall format of the pin list is affected by the \$ITEMSEPARATOR, \$MAXITEMSPERLINE, \$LINEWIDTH, \$CONTSTART, \$CONTEND and other format definition commands.
- When used on a \$DEVICES line, \$PINS can take optional arguments that determine the number and order of pins output. The numeric range format is intended to assist in generating netlist formats that require a different position or format for the first pin (typically the output of a logic element) than the remaining pins. This table summarizes the available formats:

\$PINS All pins are listed.

\$PINS(n)	The single pin whose ordinal position in a complete \$PINS listing would be n is output. If there is no such pin, nothing is output.
\$PINS(m..n)	The pins whose ordinal positions in a complete \$PINS listing would be in the range m..n (inclusive) are output.
\$PINS(m..)	The pins whose ordinal positions in a complete \$PINS listing would be greater than or equal to m are output.
\$PINS(..n)	The pins whose ordinal positions in a complete \$PINS listing would be less than or equal to n are output.
\$PINS(&attrField)	The pins whose names are listed in the given device attribute field are output in the order specified. The pins must be listed in the attribute field by pin name, separated by commas. If the attribute field is empty, no pins will be listed. Any names that don't match are ignored.

Sorting of Pin Entries in Device Pin Listings

Pin entries in a device pin listing are sorted according to the following rules, in decreasing order of priority:

- If an attribute field has been specified in the form \$PINS(&attrField), then exactly the pins listed are output in the order given. Any items that don't match are ignored. If the field is empty, no pins are output.
- If a \$DEVPINSEQUENCE command has been executed and the specified attribute field is non-null, then exactly the pins listed are output in the order given. Any items that don't match are ignored. Unlike the \$PINS(&attrField) format described above, if the attribute field is empty, all pins are output.
- If neither of the above formats apply, then pins are sorted by pin number, whether or not the pin number is displayed.

Sorting of Pin Entries in Signal Pin Listings

The report generator has no explicit method of specifying the sorting to be used for the pins listed within a single signal using the \$PINS statement. The pin list will be sorted by whichever type of device name (\$DEVNAME, \$DEVINSTNAME, \$DEVHIERNAME) is used in the \$SIGPINFORMAT statement. If no name is used, they will be sorted by the Name of the associated device. For pins on the same device, entries will be sorted by pin number.

Keyword	\$PINSEQ
Status	No change in 4.0
Synopsis	\$PINSEQ[(<i>origin</i>)]
Returns	Decimal integer
Type	Data
Where	Script - pin
Description	Returns a sequence number starting at "n" for the first pin listed on this device or signal. If not specified, zero is assumed for the origin.
Example	\$DEVPINFORMAT \$PINSEQ(1) - \$PINNAME

Keyword	\$PINSIGSOURCE
Status	No change in 4.0
Synopsis	\$PINSIGSOURCE &fieldName
Returns	N. A.
Type	Definition
Where	Top level
Description	Specifies a pin attribute field from which will be extracted additional pin numbers to be added to the same net as the current pin during \$PINS listings.
Example	\$PINSIGSOURCE &ExtraPins

The \$PINSIGSOURCE facility allows multiple pins in a netlist to be represented by a single pin on the schematic. For example, some types of components have multiple package pins joined internally to the same physical point on the device, in order to increase current handling capacity. The \$PINSIGSOURCE command specifies the name of a pin attribute field which will list additional pins to attach to the one on which the attribute is found.

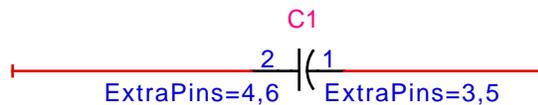
The \$PINSIGSOURCE command line must appear before any \$DEVICES, \$SIGNALS, \$FIND or other commands that may operate on a device or signals list. The field specified must be defined using the Define Attribute Fields command in the Schematic tool. The format of the pin list that is inserted in this field is the same as for the \$SIG-SOURCE items, that is, a list of pin numbers separated by commas. If a given pin has no value specified for this field, then its netlist entry will be

unaffected.

For example, the following command sequence will add extra pins to the netlist from the field ExtraPins:

```
$PINSIGSOURCE &ExtraPins  
$SIGNALS$SIGNAME $PINS
```

The following circuit fragment is shown with the values of ExtraPins shown on each pin. It is important to note that this is an attribute of each individual pin, not of the associated device or signal.



Pins 1 and 2 are specified using the normal pin numbering scheme. The items in ExtraPins will be added to the same net as the associated pin. In a typical netlist format, this will generate the following results:

```
SIG1 C1-2 C1-4 C1-6  
SIG2 C1-1 C1-3 C1-5
```

NOTE: The \$PINSIGSOURCE command will significantly slow down report generation because every pin listed in the netlist must be searched for the specified attribute field. For this reason, we do not recommend inserting it as a general-purpose addition to your netlist forms if you are not using it.

► See also: \$SIGSOURCE, \$DESIGNPINSIGSOURCE.

Keyword	\$PINTYPE
Status	No change in 4.0
Synopsis	\$PINTYPE
Returns	String
Type	Data
Where	Script - pin
Description	Returns a string representing the type of the current pin. The string used for each pin type can be set using the \$PINTYPEFORMAT command.
Example	\$SDEVPI NFORMAT \$SPI NNAME\(\$SPI NTYPE\)

Keyword	\$PINTYPEFORMAT
Status	Changed in 4.0
Synopsis	\$PINTYPEFORMAT <i>literalString1 literalString2 ...</i>
Returns	N.A.
Type	Definition
Where	Top level
Description	Specifies the string used to describe each pin type, i.e. the string that will be returned by \$PINTYPE.
Example	\$PINTYPEFORMAT I O O B This indicates that the single letter I will be returned by \$PINTYPE for input pins, O for output and 3-state pins and B for bidirectional pins.

This format command specifies the way the type (i.e. input, output, etc.) of a device pin is presented in reports. Whenever the \$PINTYPE keyword is encountered, the program uses the pin type of the current pin to look up a string in this list and that is substituted into the output.

The \$PINTYPEFORMAT command must be followed on the line by a sequence of literal strings separated by blanks which described the appearance of each item. The strings are given in the following order, separated by blanks:

\$PINTYPEFORMAT Item Order

Item order	Function	Default string
1	Input	INPUT

\$PINTYPEFORMAT Item Order

Item order	Function	Default string
2	Output	OUTPUT
3	3-state	3STATE
4	Bidirectional	BIDIR
5	Not used	?????
6	Open Collector	OC
7	Undefined	?????
8	Bus	BUS
9	Perm. low	LOW
10	Perm. high	HIGH
11	Latched input	LTCHIN
12	Latched output	LTCHOUT
13	Clocked input	CLKIN
14	Clocked output	CLKOUT
15	Clock input	CLOCK
16	Open Emitter	OE
17	No connection	NC

Note: “Undefined” can only occur if a device was being created in the DevEditor and was closed before all its pins had been specified.

If less than 17 strings are specified, the trailing items retain their default value.

Generating a Warning for Invalid Pin Types

The \$PINTYPEFORMAT command also provides the ability to generate a warning to the user if a pin type is used that is invalid for the type of output being generated. If the keyword \$WARN is inserted in the list of type strings, if any of the following items are used, a warning will be generated. \$NOWARN turns this back off again. For example:

```
$PINTYPEFORMAT I 0 0 B $WARN ? ? ? ? ? ? ? ? ? ? ? ?
```

This specifies that if any pin type other than the ones specifically allowed are found in the design, the user will be warned and a "?" will be placed in the output.

► See also \$PINTYPE.

Keyword	\$PLUS
Status	New in 4.0
Synopsis	\$PLUS(<i>string1</i> , <i>string2</i>)
Returns	Decimal integer
Type	Data
Where	Script
Description	Performs an integer addition and returns a decimal string of the result.
Example	\$SETVAR(ErrCount, \$PLUS(&ErrCount, &NewErrs))

Keyword	\$PLACETEXTBLOCK
Status	New in 4.0
Synopsis	\$PLACETEXTBLOCK(<i>text</i>)
Returns	N.A.
Type	Action
Where	Top level
Description	Places a miscellaneous text block on the current schematic page containing the given text.
Example	\$PLACETEXTBLOCK(\$UNUSEDUNITS) Generates a text block containing a list of the unused gates in the current design.

► See also \$UNUSEDUNITS.

Keyword	\$PORTNAME
Status	New in 4.0
Synopsis	\$PORTNAME
Returns	Text
Type	Data
Where	Script - Pin
Description	If the current pin is a port, this returns its port name, if not, null. This is used to get the name of a port connector from within a subcircuit. This is only valid for port pins, i.e. when \$ISPORT is TRUE.
Example	<pre>\$INCLUDEPORTSON \$FIND \$DEVICES \$ISPORT \$DEVPI NFORMAT \$PORTNAME \$DEVI CES\$PI NS</pre> <p>This will produce a list of all the ports in a circuit.</p>

This keyword is used to create a port list when working from a subcircuit upwards. It returns the "port name" associated with a pin on a port connector, i.e. the name that will be used to associate the port with a parent symbol. For any non-bus port connector, there is only one pin and this will return the name applied by the user to the port connector symbol itself. For bus port connectors, for pin 1 (i.e. the bus pin) it will return the port connector name. For pins 2 and up (i.e. the internal signal pins), it will return the pin name.

The keyword is not valid for non-port connector pins.

► See also *\$ISPORT*, *\$INCLUDEPORTSON*.

Keyword	\$PRIMNAME
Status	No change in 4.0
Synopsis	\$PRIMNAME
Returns	String
Type	Data
Where	Script - device
Description	Returns the primitive type name of the current device, that is, the name of the DesignWorks primitive type that was used in creating the symbol.
Example	<code>\$DEVICE\$DEVNAME \$TYPENAME\(\$PRIMNAME\)</code>

► See more information on primitive types in ###.

Keyword	\$PROGRESS
Status	New in 4.0
Synopsis	<code>\$PROGRESS (string) [\$ON \$OFF] [\$PERCENTON \$PERCENTOFF]</code> <code>\$PROGRESS (string)</code>
Returns	N.A.
Type	Definition
Where	First form - Top level. Second form - Script
Description	Controls the display of the progress window.
Example	<code>\$DEVICE\$PROGRESS(Now generating \$TYPENAME) \$INTERNAL</code> This will display the current type name in the progress window.

This command allows you to override the default behavior of the progress window that is displayed during script execution. Especially in complex scripts, the display of percentages may be meaningless and it may be better to display a single message indicating the current function. In other case, you may want the script to execute invisibly by disabling the progress window completely.

When it appears at the top level of a script (i.e. on a line by itself) \$PROGRESS can take a number of options:

\$PERCENTOFF - This disables the display of the percentage

complete.

\$PERCENTON - This enables the display of the percentage complete for subsequent iterating commands, e.g. **\$DEVICES**.

\$OFF - This completely disables the progress window, removing it from the screen.

\$ON - This re-enables the progress window or has no effect if it is already displayed.

When it appears in a script line such as **\$DEVICES**, **\$PROGRESS** can only be used to specify the string that will appear in the window.

Keyword	\$QUIT
Status	New in 4.0
Synopsis	\$QUIT
Returns	N.A.
Type	Action
Where	Top level
Description	Causes the DesignWorks program to quit immediately with no user prompts or file saving.
Example	\$QUIT

WARNING: This command causes the program to quit unceremoniously without saving any open files or prompting the user in any way!

Keyword	\$REGEXP
Status	New in 4.0
Synopsis	\$REGEXP (<i>regularExpression</i> , <i>string</i>)
Returns	Boolean
Type	Data
Where	Script
Description	Matches the regular expression supplied against the given string. May also set the values of match variables &1 through &9. Returns TRUE if the match is successful, FALSE otherwise.
Example	<p>IF(\$REGEXP(.*(\d+).*, &Value)) The numeric part is &1\$END</p> <p>The given regular expression means "match any sequence of characters followed by one or more digits followed by any sequence of characters". Because the "digits" part of the expression is in parentheses, it will be assigned to match variable &1 if it is successful. If \$REGEXP is successful, it returns TRUE ("1") and the numeric value will be output.</p>

This command applies a Unix-style regular expression against a given string. This can be used to check the format of any text values in a design or to extract sub-fields out of any data string, as shown in the above example. This can be used in conjunction with the \$INCLUDE \$EXECUTE command to read arbitrary text data from a file for back annotation or other purposes.

Because regular expressions are a major topic, they are covered in more detail in "Regular Expressions" on page 41.

Keyword	\$REPEATITEMON/\$REPEATITEMOFF
Status	No change in 4.0
Synopsis	\$REPEATITEMON \$REPEATITEMOFF
Returns	N.A.
Type	Definition
Where	Top level
Description	This option, when ON, forces the last item in any \$PINS list or repeating data item to be repeated at the start of any continuation line. This is used by some systems to recognize continuations.
Example	\$REPEATITEMON

Keyword	\$REPORTON/\$REPORTOFF
Status	New in 4.0
Synopsis	\$REPORTON \$REPORTOFF
Returns	N.A.
Type	Definition
Where	Top level
Description	Enables and disables report output.
Example	\$REPORTOFF

These commands are used to enable or disable the generation of an output file during script execution. By default, any literal data in a script or any data generated by commands is output to a text file. If no output file exists at the time this data is encountered, the user is prompted to create a file. This behavior may not be desired in cases where a script is being used for non-reporting purposes such as updating values in a design. In this case, the \$REPORTOFF command disables the default file output. Note that transcript output is not affected.

► See also \$CREATEREPORT.

Keyword	\$ROWS
Status	Obsolete in 4.0. Use \$LINESUSED.

Keyword	\$SAMEPINCOUNT
Status	New in 4.0
Synopsis	\$SAMEPINCOUNT
Returns	Decimal integer
Type	Data
Where	Script - Pin
Description	Returns a decimal integer indicating how many pins on the same device as the current pin have the same pin number. Used to detect duplicate pin numbers on devices.
Examples	<pre> SSORT \$DEVICES \$DEVNAME \$COMBDEVSON \$DEVPI NFORMAT \$IF(\$GT(\$SAMEPINCOUNT, 1))Dupli cate pin! \$END \$DEVI CESS\$I F(\$NONBLANK(\$PINS)) \$SELECT\$END </pre> <p>This script will select any device in the circuit with duplicate pin numbers. The sort is necessary to merge symbols with the same package name.</p>

This keyword is valid in a device pin format and is used to detect cases of duplicate pin numbers on a device. Note that if two pins have the same pin number and are attached to the same signal, they are not counted as duplicates. This is done because power and ground pins in attributes and other common pins are frequently repeated on multiple symbols assigned to the same package. As long as there is no conflict, this is not considered to be an error.

Keyword	\$SELECT
Status	New in 4.0
Synopsis	\$SELECT
Returns	N.A.
Type	Definition
Where	Script - any object
Description	Selects the current object on the schematic, i.e. highlights it for user operations.
Examples	<pre>SSORT \$DEVICES \$DEVNAME \$COMBDEVSON \$DEVPI NFORMAT \$I F(\$GT(\$SAMEPI NCOUNT, 1)) Dupl i cate pi n! SEND \$DEVI CESS\$ I F(\$NONBLANK(\$PI NS)) \$SELECTSEND</pre> <p>This script will select any device in the circuit with duplicate pin numbers.</p>

This keyword is used to create interaction between the execution of the script and the user. It allows the script to select objects in the schematic so that they can be located by the user with the Go To Selection command or operated on with the Browser tool, etc.

Keyword	\$SELECTED
Status	New in 4.0
Synopsis	\$SELECTED
Returns	Boolean
Type	Data
Where	Script - any object
Description	Returns TRUE if the current object is in a selected state on the schematic. Allows the script to locate objects selected by the user on the schematic for subsequent operations.
Examples	<pre>\$FIND \$DEVICES \$SELECTED \$DEVI CESS\$DEVNAME</pre> <p>Makes a list of the selected devices.</p>

Keyword	\$SETATTR
Status	New in 4.0
Synopsis	\$SETATTR (<i>fieldName</i> , <i>string</i>)
Returns	N.A.
Type	Definition
Where	Script - any object
Description	Sets the given attribute field to the given string value in the current object. If the field does not exist, it is created.
Examples	\$SETATTR(ReportDate, \$DATE(\$R))

The \$SETATTR command allows you to define and set attribute fields to a specified string value. This command can be used anywhere, e.g. on a top-level line of the script, on a \$DEVICES or \$SIGNALS line or within a \$SIGPINFORMAT or \$DEVPINFORMAT. This command always operates on the "current object" which may depend on context. In particular, if used in a \$SIGPINFORMAT or \$DEVPINFORMAT, it always operates on the current pin. If you want to extract information from a pin and apply it to the parent device or signal, you have to assign it to a variable and apply it to the device or signal on the \$DEVICES or \$SIGNALS line.

► See more information about the current object in "Current Design or Current Object" on page 10.

NOTE: If the given attribute field is not defined in the design's attribute table, it will be added automatically with default settings. It is generally preferable to define a field explicitly using \$DEFINEATTR before setting it to ensure that you get the definition settings you want, e.g. Primary vs. Secondary.

Keyword	\$SETERRORBIT
Status	New in 4.0
Synopsis	\$SETERRORBIT (<i>bitNum</i>)
Returns	N. A.
Type	Definition
Where	Script - Any object
Description	Sets the given bit number in the binary error set represented in the object's "OKErrors" attribute field.
Examples	<pre>SFIND \$DEVICES \$SELECTED \$DEVICES\$SETERRORBIT(7)</pre> <p>Sets the "Mark as OK" setting on the given bit on each device that is selected in the circuit.</p>

This call is one of a set of commands designed to implement a "Mark as OK" feature in error checking scripts.

► See also: \$CLEARERRORBIT, \$ERRORBITON/OFF, \$CLEARERRORS, and "Implementing Mark as OK in Error Checking Scripts" on page 26.

Keyword	\$SETSIGWIDTH
Status	New in 4.0
Synopsis	\$SETSIGWIDTH (<i>numString</i>)
Returns	N.A.
Type	Definition
Where	Script - Signal
Description	Sets the given "line width" setting for the given signal to the integer value expressed in decimal in <i>numString</i> .
Examples	<pre>SFIND \$SIGNALS \$SELECTED \$SIGNALS\$SETSIGWIDTH(3)</pre> <p>This script will set the width on selected signals in the current circuit to 3.</p>

This command intended to assist in applications where signal lines are used to represent vectors or busses and it is desired to show this graphically using different line widths on the schematic. The normal width for a signal line is 1.

Keyword	\$SETVAR
Status	New in 4.0
Synopsis	\$SETVAR (<i>varName</i> , <i>string</i>)
Returns	N.A.
Type	Definition
Where	Script
Description	Sets the given variable to the given string value. If the variable does not exist, it is created.
Examples	\$SETVAR(ErrMsg, The number of errors was &NumErrs)

The \$SETVAR command allows you to define and set variables to a specified string value. This command can be used anywhere, e.g. on a top-level line of the script, on a \$DEVICES or \$SIGNALS line or within a \$SIGPINFORMAT or \$DEVPINFORMAT. Variables are "global" and "static" in the sense that a variable set anywhere will hold its value and be known anywhere else in the script until it is explicitly changed. For example, you can set use \$SETVAR to set a variable to some value in a \$SIGPINFORMAT used by a \$SIGNALS \$PINS listing. The last value set will still be known after the \$SIGNALS listing is complete.

Note that an empty string is a valid string value, so \$SETVAR(BadPins,) is a valid usage of this command.

IMPORTANT NOTE REGARDING VARIABLE REFERENCES

If a variable is not known at the time a reference to it is encountered by the script parser, a null value is assumed. This is done for two reasons:

- 1) The parser cannot distinguish between attribute references and variable references because they both use the same syntax. It therefore doesn't want to create a variable in response to this reference if it was intended as an attribute reference.
- 2) For efficiency, references to variables and attribute fields that don't exist are compiled out so that repeatd executions will not waste time looking the values up.

Because script lines are compiled a line at a time, unexpected results may occur if you refer to a variable value before the \$SETVAR that sets it on

Keyword	\$SIGHIERNAME
Status	No change in 4.0
Synopsis	\$SIGHIERNAME
Returns	Text
Type	Data
Where	Script - signal
Description	Returns the hierarchical name of the current signal, i.e. the signal name prefixed with the names of any parent devices in the hierarchy. In Flat designs, this is equivalent to \$SIGNAME. This is not valid in Pure designs since there is no unequivocal path from a given signal to the top-level circuit.
Examples	\$SIGNALS\$SIGHIERNAME \$PINS This will generate a list of signals showing the hierarchical name of each followed by a list of the attached pins.

\$SIGHIERNAME is intended to provide a unique signal identifier when generating flattened netlists from hierarchical designs. Here are some important points to remember when using this keyword:

- The hierarchical name consists of the Name value for the current signal with the "path" formed by its parent devices prefixed to it, such as:
MEMBLK1/CONTROL/CTR2
- The separator character that is used in generating these names can be set using the \$HIERNAMESEPARATOR command.
- Hierarchical names can be arbitrarily long, depending on the nesting level. For this reason, they may not be suitable as an identifier in many netlist formats.

► See also \$HIERNAMESEPARATOR and "Script Hierarchy Issues" on page 31.

Keyword	\$SIGINSTNAME
Status	No change in 4.0
Synopsis	\$SIGINSTNAME
Returns	Text
Type	Data
Where	Script - signal
Description	Returns the instance name of the current signal, i.e. the contents of its Inst-Name attribute field.
Examples	\$SIGNALS\$SIGINSTNAME \$PINS This will generate a list of signals showing the instance name of each followed by a list of the attached pins.

IMPORTANT: The signal instance name is not automatically assigned by the program. \$SIGINSTNAME is not normally used to identify signals in netlists for this reason. It is more common to use \$SIGHIERNAME unless the target system has a strict name length or character set limit that makes this impossible. If \$SIGINSTNAME is used it is the user's responsibility to ensure that every signal in the design has been assigned a unique value.

► *For more information on the usage of instance names, see ###Attributes.*

Keyword	\$SIGLOC
Status	New in 4.0
Synopsis	\$SIGLOC
Returns	Text
Type	Data
Where	Script - Signal
Description	Will be replaced the "locator" or hierarchical token number of the current signal object.
Examples	\$SIGNALS\$SIGHIERNAME \$SIGLOC

The \$SIGLOC command will be replaced by a unique identifier string referred to as a "locator". This can be used to uniquely identify any signal

within a hierarchical design. The locator is used by other DesignWorks modules like ErrorFind to locate objects unambiguously without relying on internal memory addresses.

The format of the locator string is described elsewhere in this manual.

Keyword	\$SIGNALFORMAT
Status	Obsolete in 4.0. Use \$DEVPINFORMAT.

Keyword	\$SIGNALS
Status	No change in 4.0
Synopsis	\$SIGNALS <i>formatItems</i>
Returns	Text
Type	Data
Where	Top level
Description	Creates a listing of signals using the format items following on the line.
Examples	\$SIGNALS\$DEVNAME \$PINS This will generate a list of signals showing the name of each followed by a list of the attached pins.

NOTE: The \$SIGNALS keyword also appears as a modifier of the \$FIND, \$SORT, \$ASSIGNNAMES, \$ASSIGNINSTNAMES and \$BREAK commands. See the entries for those commands for more information.

The \$SIGNALS command is the primary command for generating any listing by signal. The format of the listing is determined by the format items that follow the command on the line and by the various definition options, as outlined here:

- The scope of the listing in hierarchical designs is affected by the \$HIERARCHY command.
- A subset of the signals in the design can be extracted using any desired criteria using the \$FIND command.
- The ordering of signals in the listing is affected by the \$SORT command.
- If the \$COMBSIGSON has been selected, multiple items with the

same sort value will appear on one line.

- The `$NEWLINE` format command can force multiple lines to be generated for each item.
- Limits on line length imposed by the `$LINEWIDTH` and `$MAXITEMSPERLINE` commands may cause multiple lines to be generated.
- The format of the listing for each signal is completely determined by the text and commands which follow the `$SIGNALS` keyword. There is no default format, so if no line format is specified, a sequence of empty lines will be written to the file.
- Any characters appearing after `$SIGNALS` that is not part of a format sub-command will be placed verbatim in each line of the listing. For example, blanks, tabs or commas can be used to format each line.

Numerous data-generating commands can be used in defining the output generated on each line. Any command listed in this Appendix with a "Where" value of "Script - Signal", "Script - Circuit", "Script - Any object" or "Script" can be used on a `$SIGNALS` line. Some of the more common format items are summarized in this table. See the corresponding keyword section for each item for more information.

<code>\$SIGNAME</code>	The name of the signal, that is, the contents of its Name attribute field.
<code>\$SIGSEQ(n)</code>	The sequence number of the current signal, i.e. an integer assigned to the signal, starting at "n" for the first device in the sorted sequence and incremented for each subsequent one.
<code>\$COUNT</code>	The number of signals being merged to form this line, i.e. the number having the same sort value.
<code>\$SINGLE</code>	Tells the report generator to write only a single value for all items following on the line, regardless of how many items were combined with the same sort value.
<code>\$NUMPINS</code>	The number of pins attached to the signal.
<code>\$PAGE</code>	The circuit page that this signal appears on. Since signals can connect across pages, this can generate multiple values.
<code>\$PINS</code>	A list of the signal's pins. The format of each item is determined by the <code>\$SIGPINFORMAT</code> command.
<code>\$COL(N)</code>	If the current position in a line is less than N spaces from the left hand end then blanks are inserted until the Nth column is reached.
<code>\$NEWLINE</code>	Writes a new line character into the file. This allows a device entry to occupy several lines in the output report.
<code>&attr</code>	Inserts the value of the attribute field specified.

► A variety of applications for the \$SIGNALS command are described in "Script Examples" on page 46.

Keyword	\$SIGNAL
Status	No change in 4.0
Synopsis	\$SIGNAL
Returns	Text
Type	Data
Where	Script - signal
Description	Returns the name of the current signal, i.e. the contents of its Name attribute field. The name can be optionally prefixed with the name of any enclosing bus by using the \$BUSNAMEON command.
Examples	\$SIGNAL \$SIGNAL \$PINS This will generate a list of signals showing the name of each followed by a list of the attached pins.

► See also \$BUSNAME, \$BUSNAMEON/\$BUSNAMEOFF.

Keyword	\$SIGPINFORMAT
Status	No change in 4.0
Synopsis	\$SIGPINFORMAT <i>formatItems</i> \$SIGPINFORMAT (<i>formatItems</i>)
Returns	Text
Type	Data
Where	First form - Top level Second form - Script - signal
Description	Sets the format that will be used for each pin output by the next \$PINS command in a \$SIGNALS line. The first form (without parentheses) can only be used on a top-level line. The second form (with parentheses) can be used either on a top-level line or in a \$SIGNALS line. This allows the format to be modified on the fly while generating output for a single signal.
Examples	\$SIGPINFORMAT [SIGNALNAME, PINNUM] \$ITEMSEPARATOR(,) \$SIGNAL \$SIGNAL \$PINS This will generate a list of signals showing the name of each followed by a list of the attached pins using the format specified: U1 [A, 1], [B, 2], [Q, 3]

► See the notes on the usage of pin formats under "\$DEVPINFORMAT" on page 107.

Keyword	\$SIGSEQ
Status	No change in 4.0
Synopsis	\$SIGSEQ [(<i>origin</i>)]
Returns	Decimal integer
Type	Data
Where	Script - signal
Description	Returns an integer indicating the position in the sort sequence of this signal. If the original is not specified, numbering starts at zero.
Examples	<pre>SSORT \$SIGNALS \$SIGNALNAME \$SIGNALS\$SIGSEQ(1) \$SIGNALNAME</pre> <p>This will generate a listing of devices that looks something the following:</p> <ol style="list-style-type: none"> 1. C1 2. C2 3. U1 4. U2

\$SIGSEQ returns the sequence number of the current device, that is, an integer assigned to the device, starting at "origin" for the first device in the sorted sequence and incremented for each subsequent one. This number is not permanently associated with the device but it strictly its sequence number in the current sort. The "(origin)" part is optional. If it is omitted the sequence starts at zero. If no sort has been done, all devices will have the origin sequence number.

Keyword	\$SIGSOURCE
Status	No change in 4.0
Synopsis	\$SIGSOURCE(<i>sigName</i>) [<i>&fieldName</i>]
Returns	N. A.
Type	Definition
Where	Top level
Description	Defines a "signal source" attribute field. If <i>fieldName</i> is not specified, it is assumed to be the same as the signal name.
Examples	SSIGSOURCE(Plus5V) &Power This will cause the attribute field "Power" to be searched in each device for pin numbers to add to the net "Plus5V".

The "signal source" facility allows you to name certain signals to be treated as power and ground nets. This has the following two effects:

- It allows you to create common connections in a circuit using attribute entries in devices. This can be used to create power and ground entries in the netlist without having to show all these connections explicitly on the diagram.
- It informs the netlist generator that the given signals should be merged across hierarchy levels.

► See more information on power and ground nets in hierarchy in "Script Hierarchy Issues" on page 31.

Any device attribute field may be specified as a signal source by the command:

```
SSIGSOURCE(signal Name) &fieldName
```

signalName is the name of the signal to attach pins to in the netlist.
fieldName is the name of the attribute field to search for in each device to look for pin numbers to attach to the named signal. If *&fieldName* is omitted, the signal name is taken to be the name of the attribute field to search.

The named device attribute field is assumed to contain a list of pin numbers to attach to the signal. This can consist of a single pin entry, such as "7", or a list, such as "5,6,9,14".

For example, Ground connections can be created as follows:

- Using the Attributes command on a selected device, create an entry such as "7" in the Ground attribute for a device, in this case connecting pin 7 to the Ground net.
- Place the command \$SIGSOURCE(Ground) in the script. This causes Report to search all device attributes for fields named Ground and use the field value as a pin number.

There is no fixed limit to the number of SIGSOURCE entries that can be created.

NOTE: The predefined fields Ground and Power are normally used for standard power and ground connections. These pin connections are prespecified for all digital components in the standard DesignWorks libraries. Corresponding \$SIGSOURCE statements are included, where appropriate, in all standard netlist script files. You can create your own special-purpose power nets by using the Define Attribute Fields command to define a new field, then adding the appropriate SIGSOURCE statement to the netlist script. Alternatively, the \$DESIGNSIGSOURCE command can be used to allow special-purpose signal sources to be specified per design.

► See also: \$DESIGNSIGSOURCE, "Reporting Power and Ground Nets" on page 28, and ### (signal connect).

Keyword	\$SIGTOKEN
Status	No change in 4.0
Synopsis	\$SIGTOKEN
Returns	Decimal integer
Type	Data
Where	Script - signal
Description	Returns an integer representing the signal's token number.
Examples	SSIGNALSSSIGNALNAME \$SIGTOKEN This will generate a listing of signals with the name and token number of each.

► For more information on the meaning and usage of token numbers, see ###.

Keyword	\$SINGLE
Status	No change in 4.0
Synopsis	\$SINGLE
Returns	N.A.
Type	Definition
Where	Script - In \$DEVICES or \$SIGNALS line.
Description	Indicates that only a single object value should be output for the next printing item on the line.
Example	<pre> \$SORT \$DEVI CES \$TYPENAME \$COMBDEVSON \$DEVI CES\An example of a \$TYPENAME is \$SINGLE\$DEVNAME </pre> <p>In this case, if \$SINGLE was not specified, \$DEVNAME would cause the names of all devices having the same type name to be output on that line. \$SINGLE indicates that we only want one.</p>

The \$SINGLE command is used to override the default "merging" behavior when outputting a sorted listing. In an example of the type shown above, the device list has been sorted by one field, in this case the type name. Since "\$COMBDEVSON" has been specified, all devices with the same sort value (type name in this case) will be merged onto one line. If any keyword appears on that line that generates data derived from a device, all the values associated with objects included in that line will be shown. In this case, the \$DEVNAME keyword would cause a list of the names of all devices of each type to appear together on the line.

In some cases, it is desired to put out only a single value on a line, regardless of how many objects are represented. The \$SINGLE keyword indicates that the next data keyword should be used only once. Note that only the first item found on the list is output and there is no guarantee of which object this will be or that the same order will be preserved after the design has been edited.

► See also: \$MERGE, \$COMBDEVSON, \$SORT.

Keyword	\$SORT
Status	No change in 4.0
Synopsis	\$SORT \$DEVICES \$SIGNALS [\$ASCENDING \$DESCENDING] [\$LEXICAL \$NUMERIC] [\$NULLLOW \$NULLHIGH] <i>sortItems</i>
Returns	N. A.
Type	Action
Where	Top level
Description	Sorts the device or signal list according to the sort items specified.
Examples	\$SORT \$DEVI CES \$TYPENAME This will generate a listing of devices sorted by their type name.

The \$SORT command provides the ability to sort device and signal listings on any data field. Items with the same value in any field can be optionally merged into a single line. This allows listings to be organized to suit various applications, for example:

- Device or signal lists can be sorted by name to enhance readability.
- Device lists can be sorted by type so that each line lists one device type with all information common to that type and a list of instances of the type.
- A device list can be sorted by page number to show the devices used on each page.
- Signals can be sorted by an attribute field, for example to give priority to certain nets so they are listed first for autorouting purposes.
- Devices can be sorted by any attribute field, for example by component value, stock number, cost, etc.

The \$SORT command has the following basic form:

```
$SORT objectType field1 field2 . . .
```

objectType must be either "\$DEVICES" or "\$SIGNALS".

field1, *field2*, etc. are identifiers indicating which fields to sort on. The list is sorted first on the first field. If any items in the list have identical values in that field, then the groups of like-valued items are sorted on the next specified field, etc.

IMPORTANT: Sort fields are limited to the specific keywords shown in the table

below. In this version, it is not possible to use arbitrary Scriptor functions and expressions as sort values.

Once a sort has been done, it remains in effect for all subsequent listings on that object type until the next \$SORT or \$FIND command. Each \$SORT clears the previous \$SORT.

Sort Options

A number of options can be specified that will affect the sorted order:

\$ASCENDING/ \$DESCENDING	Specifying one of these two keywords indicates the desired sort order. If \$ASCENDING is given, the list will be sorted by increasing values of the sort key, \$DESCENDING will produce the opposite order. \$ASCENDING is the default.
\$LEXICAL/ \$NUMERIC	These options determine how numeric values are treated as part of a sort value. If \$LEXICAL is specified, sorting is done strictly on ASCII character values. If \$NUMERIC is specified, any sequence of numeric characters found in a sort item is taken as an integer value. For example, if you were sorting three devices named U2, U9 and U11, a lexical sort will produce U11, U2, U9, whereas a numeric sort will produce U2, U9, U11. The numeric sort is generally preferable for items numbered with integers, whereas the lexical sort is better for component values, part numbers or other cases where a value should just be treated as a sequence of characters even if it contains digits. \$NUMERIC is the default.
\$NULLLOW/ \$NULLHIGH	These options determine the handling of null valued items, i.e. empty strings. If \$NULLLOW is set, null items will be considered to have a low value. In other words, if an \$ASCENDING sort is done, they will appear first. \$NULLHIGH is the default.

Sort Field Keywords

The following table describes the sort fields available..

\$SORT Item Keywords

Sort Item Key-word	Object Type	Meaning
\$DEVNAME	\$DEVICES	The device name.
\$DEVHIERNAME	\$DEVICES	The device hierarchical name.

\$SORT Item Keywords

Sort Item Keyword	Object Type	Meaning
\$DEVINSTNAME	\$DEVICES	The device instance name.
\$SIGNALNAME	\$SIGNALS	The signal name.
\$SIGHIERNAME	\$SIGNALS	The signal hierarchical name.
\$SIGINSTNAME	\$SIGNALS	The signal instance name.
\$SIGSOURCE	\$SIGNALS	An integer value that is 1 for the first SIGSOURCE name declared in the script, 2 for the next one, etc. Nets that are not declared as SIGSOURCES get a high value. This is used to give a higher priority to power and ground nets in netlists.
\$POSX	\$DEVICES	The X position on the schematic.
\$POSY	\$DEVICES	The Y position on the schematic.
\$TYPENAME	\$DEVICES	The type name.
\$PAGE	\$DEVICES \$SIGNALS	The schematic page number the object appears on. For signals that connect across pages, this may be any one of the pages, randomly chosen.
\$DEPTH	\$DEVICES	An integer indicating how many layers of hierarchy exist below this symbol. Sorting by this value will produce a "define before use" hierarchical netlist.
\$NUMPINS	\$SIGNALS	The number of pins attached to this net.
\$RAW	\$DEVICES \$SIGNALS	This causes the list to be marked as sorted without sorting it. This is used to merge all items in the list onto one line without performing any sort.
&field	\$DEVICES \$SIGNALS	An attribute field value.

► See also: \$COMBDEVSON, \$COMBSIGSON, and "Sorting and Merging" on page 21.

Keyword	\$SPACE
Status	No change in 4.0
Synopsis	\$SPACE (<i>numCols</i>)
Returns	N.A.
Type	Definition
Where	Top level
Description	Specifies a column spacing for repeated items used when \$ALIGNCOLSON has been enabled. Default is 16.
Examples	\$SPACE(32)

► See also: \$ALIGNCOLSON.

Keyword	\$SYSPIN
Status	No change in 4.0
Synopsis	\$SYSPIN
Returns	Decimal integer
Type	Data
Where	Script - pin
Description	Returns the systems internal pin sequence number for the current pin. This is valid only for pins actually defined on the device symbol on the schematic and is number from 1 to N. For pins added by a \$SIGSOURCE, this number will be zero.
Examples	\$DEVPIFORMAT \$PINNAME- \$SYSPIN \$SORT \$DEVICES \$STYPENAME \$COMBDEVSON \$DEVICES\$STYPENAME \$PINS This script will produce a listing of the pins defined on each device type in the design.

► See also: \$PINNUM and \$PINSEQ.

Keyword	<code>\$SYSTEMOPEN</code>
Status	New in 4.0
Synopsis	<code>\$SYSTEMOPEN(filePathandName)</code>
Returns	N.A.
Type	Definition
Where	Top level
Description	Asks the Finder to open the specified file.
Examples	<code>\$SYSTEMOPEN(MyDisk: Applications: Microsoft Word)</code>

The `$SYSTEMOPEN` command provides a mechanism of starting up other Macintosh applications from within a script and requesting that document files, such as report output, be opened. The specified file can be either an application or a document. In either case, the action is as if the user double-clicked on the file in the Finder. If it is an application, it will be launched, or, if it is already running, brought to the front. If it is a document, the application specified as its "creator" will be asked to open it.

For Scripter output files, the default creator type is "ttx" which will cause the "SimpleText" text editor application to be started up when they are opened. The 4-character creator type can be specified using the `$CREATOR` keyword in the `$CREATEREPORT` command, although this requires some knowledge of Macintosh programming issues.

► See also: `$CREATEREPORT`.

Keyword	\$TAB
Status	New in 4.0
Synopsis	\$TAB
Returns	A tab character.
Type	Data
Where	Script
Description	This keyword is intended to make the intent of a script more clear by using an explicit keyword to insert a tab instead of a literal tab character, which may be misinterpreted by a human reader of a script as one or more blanks.
Examples	<pre>Devi ce Name\$TAB\Val ue \$DEVI CES\$DEVNAME\$TAB&Val ue</pre> <p>This creates a simple device listing with 2 columns separated by a tab character.</p>

Keyword	\$TABFIELDSON/\$TABFIELDSOFF
Status	No change in 4.0
Synopsis	\$TABFIELDSON \$TABFIELDSOFF
Returns	N. A.
Type	Definition
Where	Top level
Description	This command specifies that repeating data items should be separated by a tab character. The default is OFF.
Examples	\$TABFIELDSON

► See also: \$TAB, \$ITEMSEPARATOR, \$ALIGNCOLSON.

Keyword	\$TABLE
Status	New in 4.0
Synopsis	\$TABLE (<i>blockName</i> [, <i>prefixString</i> [, <i>suffixString</i>]])
Returns	Text
Type	Data
Where	Script
Description	Evaluates a list of IF THEN ELSE conditions specified in the block. If <i>prefixString</i> is specified, it is inserted at the front of the generated string <i>only if</i> the table generates some non-null text. Similarly, if <i>suffixString</i> is specified it will be appended to the generated string if any non-null value is produced.
Examples	<pre> \$DEFI NEBLOCK(SYMParams) &X_BLKNM , BLKNM=&X_BLKNM &X_HBLKNM , HBLKNM=&X_HBLKNM &X_LOC , LOC=&X_LOC &X_LOC_NOT , LOC<>&X_LOC_NOT \$END \$DEVI CES\$TABLE(SYMParams) </pre> <p>Every time the \$TABLE command is encountered (i.e. for each device in this case), all the lines in the block are evaluated as follows: The item in the first column (i.e. up to the tab character) is evaluated. If it produces any non-null string, the item in the second column is evaluated and output. If the first column produces a null string, the third column (if any) is evaluated and output. Note that the columns are separated by a single tab character.</p>

The \$TABLE command is intended as a shortcut format for specifying a long sequence of IF/THEN/ELSE conditions. It was created for use in netlist formats that may have a large number of optional fields that depend on attribute values specified in the design. Instead of a very long line of \$IF/\$ELSE/\$END sequences, the \$TABLE allows optional fields to be laid out in a more readable vertical format.

The format of a table is as follows:

```

$DEFI NEBLOCK(blockName)
testExpressi on1 tabtrueExpressi on1 tabfalseExpressi on1
testExpressi on2 tabtrueExpressi on2 tabfalseExpressi on2
testExpressi on3 tabtrueExpressi on3 tabfalseExpressi on3
.
.
.
$END

```

The `tab` notation indicates a tab character. Each *testExpression* can be any combination of commands that produces a string. As shown in the above example, this will typically be "&attrField" to test for the existence of an attribute field, but any other expression can be used. Although it is legal, it normally won't make sense for *testExpression* to contain any literal characters, since this would result in the expression always being non-null, or "true".

trueExpression similarly can be any combination of commands and literal characters. If *testExpression* is non-null this expression is evaluated and the resulting string is concatenated to the output. The second tab character and *falseExpression* are optional. If present, *falseExpression* is evaluated and the result concatenated if *testExpression* is null (false).

Note that all lines in the table are evaluated and the results concatenated in the order they are found. The `$TABLE` (at least, if used without the optional prefix and suffix arguments) is exactly equivalent to:

```
IF(testExpression1)trueExpression1ELSEfalseExpression2...ENDIF
```

The tabs between the columns of the table and the newline characters at the ends of the lines are never included in the output. A tab can be included in any of the expressions by escaping it with a backslash, and a newline can be included by using the `$NEWLINE` command.

The `$TABLE` command allows for the optional inclusion of a prefix and suffix string. This can allow for a separator character, such as a comma or tab, to be inserted before or after any text generated by the `$TABLE`. Note that a comma must be escaped with a backslash in this usage so that it is not confused with an argument terminator. For example:

```
TABLE(ArgList, \,)
```

If the backslash was not used, the comma would be taken as an argument separator and this would be interpreted as specifying null strings for the prefix and suffix.

Keyword	\$TEXTLINE
Status	New in 4.0
Synopsis	\$TEXTLINE
Returns	Text
Type	Data
Where	Script
Description	Returns the current line read from a text file using the \$INCLUDE \$EXECUTE option. Used in conjunction with the \$EXECUTE option of the \$INCLUDE command, this keyword represents the value of the latest line of text read from the file, not including the line terminator.
Example	<pre> \$DEFINEBLOCK(LineBlock) \$NULL(\$REXEXP((\w)\s+(\S+), \$TEXTLINE)) \$FIND \$DEVICES \$EQ(\$DEVNAME, &1) \$DEVICES\$SETATTR(Value, &2) \$END \$INCLUDE(\$DESIGNNAME.BAK) \$EXECUTE(LineBlock) </pre> <p>The block LineBlock will be executed once for each line in the specified include file. During the execution of this block, the \$TEXTLINE keyword represents the value of the line just read from the file. In this case, the regular expression command is used to extract two text fields from each line. The first field is used to locate a device by name and the second field is used as a new setting for the Value attribute field.</p>

► See more information in the \$INCLUDE command.

Keyword	\$TIME
Status	Changed in 4.0
Synopsis	\$TIME \$TIME(<i>formatString</i>) \$TIME(<i>formatString</i>, <i>valueString</i>)
Returns	Text
Type	Data
Where	Script
Description	The first form returns the current time of day in the default format. If a first argument is provided, it is taken as a format specification and the time and date are displayed in that format. If a second argument is provided, it is taken as the date value integer to use for conversion.
Example	\$DEVICE\$DEVNAME was created on \$TIME(\$m/\$d/\$y at \$h/\$n, &DateStamp. Dev) This will output the date and time represented by the date stamp on each device.

When used without an argument list, \$TIME generates the current time of day in the default "long" format for the host machine. This behavior can be modified by adding an argument string containing format keywords for the various time elements that are available. Any characters in the format string that are not recognized as one of the following items will be included literally in the output string. If a \$ character is needed in the output, it can be escaped by preceding it with a backslash.

\$DATE and \$TIME Format Codes

Code	Meaning
\$M	Month, long (text) form
\$m	Month, numeric form
\$D or \$d	Day of the month, 1..31
\$y	Year, two digits
\$Y	Year, four digits
\$h	Hour, 24-hour format
\$H	Hour, 12-hour format
\$N or \$n	Minute, 00..59
\$S or \$s	Second
\$R or \$r	Raw date value
\$P	AM/PM long form

\$DATE and \$TIME Format Codes

Code	Meaning
\$p	AM/PM short form
\$W	Day of week, long form
\$w	Day of week, short form

If second argument is provided, it is taken as a decimal integer raw date value. These values represent the number of seconds since January 1, 1904 and are used to store dates throughout DesignWorks. For example, the file modified and created dates, device and circuit date stamps are stored in this format. These can be converted to human-readable format by inserting them as a second argument to \$TIME.

Note that \$DATE and \$TIME are identical in function when used with arguments.

► See also \$DATE, \$TIMECREATED, \$TIMEMODIFIED.

Keyword	\$TIMECREATED/\$TIMEMODIFIED
Status	New in 4.0
Synopsis	\$TIMECREATED \$TIMEMODIFIED \$TIMECREATED(<i>formatString</i>) \$TIMEMODIFIED(<i>formatString</i>)
Returns	Text
Type	Data
Where	Script
Description	If used without arguments, \$TIMECREATED and \$TIMEMODIFIED return the created or modified time of day of the current design in the default format. An argument list can be added to specify any time or date format. When used with an argument list, \$TIMECREATED and \$DATECREATED are identical in function and, similarly, \$TIMEMODIFIED and \$DATEMODIFIED are identical.
Example	Created at \$TIMECREATED on \$DATECREATED

These two command are variations of the \$TIME command and behave identically except that they use the created or modified date of the current design, rather than the current date.

► See also \$DATECREATED and \$DATEMODIFIED.

Keyword	\$TYPENAME
Status	No change in 4.0
Synopsis	\$TYPENAME
Returns	String
Type	Data
Where	Script - device
Description	Returns the type name of the current device, that is, the name of the type definition as it would appear in the parts palette.
Example	SSORT \$DEVI CES \$TYPENAME \$COMBDEVSON \$DEVI CES\$TYPENAME \$DEVNAME This will generate a simple bill of materials, sorted and merged by type name.

NOTE: For most "bill of materials" listings, the Part attribute should be used instead of \$TYPENAME. In the standard DesignWorks libraries, the Part field contains the actual manufacturers part number, whereas the type name may be contracted or include some gate packaging information. In addition, the type name cannot normally be edited in a schematic, so it gives less flexibility.

Keyword	\$UNCONNPINSOFF/\$UNCONNPINSON
Status	No change in 4.0
Synopsis	\$UNCONNPINSOFF \$UNCONNPINSON
Returns	N. A.
Type	Definition
Where	Top level
Description	When ON, allows device pins that have no signal lines attached to them and are not connected to any other signals by name to appear in the netlist, otherwise they are suppressed. Default is ON.
Example	\$UNCONNPI NSOFF

► See also: \$ISUNCONNPIN.

Keyword	\$UNNAMEDDEVS
Status	No change in 4.0
Synopsis	\$UNNAMEDDEVS (<i>string</i>)
Returns	N. A.
Type	Definition
Where	Top level
Description	This command sets the string to be output when \$DEVNAME is referred to for an unnamed device. The default is "unnamed".
Example	\$UNNAMEDDEVS() This specifies that nothing (a null string) should be output when the name of an unnamed signal is requested.

Keyword	\$UNNAMEDSIGS
Status	No change in 4.0
Synopsis	\$UNNAMEDSIGS (<i>string</i>)
Returns	N. A.
Type	Definition
Where	Top level
Description	This command sets the string to be output when \$SIGNAME is referred to for an unnamed signal. The default is "unnamed".
Example	\$UNNAMEDSIGS() This specifies that nothing (a null string) should be output when the name of an unnamed signal is requested.

Keyword	\$UNSELECTEDPINS
Status	New in 3.1.5
Synopsis	\$UNSELECTEDPINS [\$ON \$OFF] [\$WARN \$NOWARN]
Returns	N. A.
Type	Definition
Where	Top level
Description	This command determines what action is taken when an attempt is made to list a pin which is linked to a signal that is not selected for listing. The default is \$ON \$WARN.
Example	\$UNSELECTEDPINS \$OFF This specifies that any pins that are attached to signals that are not selected for listing should be skipped.

When the Scriptor generates a netlist report from a design, it makes its own internal list of the devices and signals to be included. The list takes into account the hierarchy mode of the report and any \$FIND commands that have been executed. It is possible using \$FIND commands to create a situation in which you are creating a \$DEVICES \$PINS listing (e.g. a SPICE-format netlist) which is requesting information about a pin that is not in any selected signal.

The \$ON/\$OFF setting lets you choose whether pins on unselected signals are included in the listing. Setting this to \$OFF means that such signals are not included. The default is \$ON.

The \$WARN/\$NOWARN setting determines if a warning is issued if an attempt is made to extract data about a signal that is not selected. The default is \$WARN.

The setting \$UNSELECTEDPINS \$OFF \$NOWARN is primarily useful in cases where it is desired to completely omit some device pins if they are not attached to anything in the schematic. This can be useful especially in FPGA netlists where logic can be omitted if not used.

Keyword	\$UNUSEDUNITS
Status	New in 4.0
Synopsis	\$UNUSEDUNITS
Returns	Text
Type	Data
Where	Script - Design
Description	Generates a text list of the free gate units in the current design. There is no control over the format of this listing.
Example	<pre> UNUSEDUNITS This will generate a listing like this one: U12 74ALS00DN a c U34 74ALS1120 b c etc.</pre>

This command produces a text string which enumerates the gate units in the Packager's free gate table. This type of report can be used to optimize use of gate packages or to provide documentation on the schematic itself of unused units.

► See more information on packaging in the chapter "Device Packaging and Naming" in the DesignWorks 4.0 User's Guide.

Keyword	\$USECOUNT
Status	Obsolete in 4.0. Use \$COUNT.

Keyword	\$USERNUM
Status	Obsolete in 4.0

Keyword	\$VERIFY
Status	New in 4.0
Synopsis	\$VERIFY (<i>blockName</i> , <i>string</i>)
Returns	Boolean
Type	Data
Where	Script
Description	Used to determine if a given string value is in a list of allowable values. Returns TRUE if the given string is in the mapping table.
Example	<pre>SDEFI NEBLOCK(GoodPkgs) DI P14 DI P16 DI P20 \$END \$IF(\$NOT(\$VERIFY(GoodPkgs, &Package))) Bad pack- age! \$END</pre>

This command allows you to determine if a given string value exists in a table of values. The table format is exactly the same as that used for the \$MAP command but in this case the second column of the table (if specified) is ignored. You can therefore use the same table in two different places, once for error checking and elsewhere for actually mapping an output value.

► See the \$MAP keyword for the table format.

Keyword	\$WRITETRANSSCRIPT
Status	New in 4.0
Synopsis	\$WRITETRANSSCRIPT (<i>string</i>)
Returns	N.A.
Type	Definition
Where	Script
Description	Writes the specified string to the current transcript file.
Example	\$WRITETRANSSCRIPT (We got &ErrCnt errors!)

This command writes the specified string to the current transcript file. Note that the string argument can be a literal string or any combination of

script commands that generates a string.

If there is no current transcript file (i.e. if no `$CREATE TRANSCRIPT` has been done), no output is generated and this command is ignored.

► See also `$CREATETRANSCRIPT` and “File Input and Output” on page 36.

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