Working with Data Sources in Reports

About Data Sources

Each data source that is available in SAS Visual Analytics includes one or more data items that you can use in reports. For example, a data source named Order Information might include standard data items such as Order ID, Product ID, Unit Cost, Order Date, and Order Amount. You decide which data items to use. You can select all of the data items in the data source or a subset of the data items.

Many data sources that are available in SAS Visual Analytics are prepared by a data administrator or analyst so that you can easily define a report. Data administrators load tables into memory. Analysts can use SAS Visual Data Builder (the builder) to design queries that load tables into memory, too.

The Data pane can be used to add or import data sources. If you have permission, then you can import data from a file into SAS Visual Analytics. Supported files are SAS data sets, Microsoft Excel spreadsheets, and delimited text files (such as CSV files). If you can import data sources, the Open Data Source window has an Import tab.

All data sources contain data items, which can refer to calculations or columns in physical data (tables). Reports can include query results from more than one data source.

Add a Data Source to a Report

You can use one or more data sources in a report in SAS Visual Analytics.

1. Do one of the following:
   - In the Welcome to SAS Visual Analytics window, click Data. The Open Data Source window is displayed.
   - If SAS Visual Analytics is already running and you have not selected any data sources, click . The Open Data Source window is displayed.
   - If SAS Visual Analytics is already running and you have already selected at least one data source, click . Click Add, and the select Add data source. The Open Data Source window is displayed.

2. In the Open Data Source window, click either the All tab or the Recent tab to select a data source that is loaded on the CAS server. The Recent tab lists data sources that you have recently used in reports.
Tip: Use the Search field to narrow the list of data sources that are displayed in the Open Data Source window. The search feature searches the Name and Description fields. It is a “begins with” search rather than a “contains” search.

Note: If a recently used table is no longer loaded on the CAS server, it will not be displayed on the All tab. However, it might still be displayed on the Recent tab.

3 (Optional) If the data source that you want to use is not available on either the All tab or the Recent tab, you can use the Import tab to import the file. For more information, see Import a Data Source for a Report on page 3.

4 Select the name of the data source that you want to open, and then click OK. The Data pane is populated with a list of all of the data items that are in the data source.

Add Additional Data Sources to a Report
1 Click Add in the Data pane, and then click Add data source, which displays the Open Data Source window.

2 Select the name of the data source that you want to add, and then click OK.

When you add multiple data sources, the last data source that you selected is displayed in the Data pane. If one of the data sources that you selected is not available, the last available data source that you selected is displayed in the Data pane.

Note: When you open a saved report that has multiple data sources, SAS Visual Analytics displays the same data source that was displayed in the Data pane when the report was saved.

Refresh a Data Source for a Report
You can refresh the columns in a data source at any time. Be aware that refreshing a data source means that all live report objects that are connected to that data source will have their queries rerun.

Here are some key points about refreshing a data source:

- Refreshing a data source adds any new columns that have been added to the table metadata in the CAS server. The default formats and names of existing columns are updated the next time you open the report.
- Data is refreshed from the table that is currently loaded into the CAS server.
- When you refresh a data source for a report, columns that have been deleted from the table metadata in the CAS server are automatically removed if they do not impact any objects in the report.

To refresh a data source for a report, on the Data pane, select the data source, and then click .

Remove a Data Source from a Report
You can remove all references to a data source from a report. Be aware that removing a data source means that all related data items are also removed from the report objects within the report.

Note: Other reports that use the same data source are not affected when you remove a data source from a report.

To remove a data source:
1 In the Data pane, select the data source, and then click .

2 Click beside the data source name in the list.
Import a Data Source for a Report

If you are authorized, then you can import a data source into SAS Visual Analytics. When you import data, the data source is automatically added to the open report.

For information about importing your own data, see SAS Viya: Self-Service Import. For more information about data preparation, see SAS Viya: Data Preparation.

1 Do one of the following:
   - On the Welcome to SAS Visual Analytics window, click Data. The Open Data Source window is displayed.
   - If SAS Visual Analytics is already running and you have not added a data source, click . The Open Data Source window is displayed.
   - If SAS Visual Analytics is already running and you have already added a data source, then click Add on the Data pane, and then click Add data source, which displays the Open Data Source window.

2 Click the Import tab.

3 Specify whether the data source is Local, on a Server, or from Social Media.
   - Local
     You can import data from a Microsoft Excel spreadsheet, a delimited text file (CSV), a SAS data set (SASHDAT or SAS7BDAT), or from the clipboard.

     **Tip** If you select a spreadsheet, then you can specify additional options. For example, you can specify which worksheets to import, whether the first row contains column heading names, and where the data rows begin. If you select a delimited text file, then you can specify additional options. For example, you can specify the delimiter, whether the first row contains column heading names, and where the data rows begin. If you import a SAS data set that uses user-defined formats, then you must ensure that the custom format catalog is available to the CAS server.

   - Server
     After providing connection information, you can transfer a table from a database to a CAS server.

     **Note:** Your site must license and configure the related SAS/ACCESS engine to use this feature.

     **Note:** Tables that you import will not automatically appear in the list of available tables in the Open Data Source window. Click to refresh the list.

   - Social Media
     After authenticating with Twitter, Facebook, Google Analytics, or YouTube and providing search criteria, you can import data to a CAS server.

4 Click OK.

For more information about importing your own data, see SAS Viya: Self-Service Import. For information about preparing data, see SAS Viya: Data Preparation.

View Measure Details

You can view the details about all of the measures in a data source, as long as there are less than 500 measures. To view the details:

1 In the Data pane, click . The Measure Details window is displayed.
Click Close.

Working with Data Items in a Report

About Data Items

You decide which data items to use to define a query for each report object. You can use all the data items in the data source or a subset of data items. Each data item is classified as either a category or a measure.

SAS Visual Analytics can display data items using an existing user-defined format that has already been specified externally for a data column in a data source. However, you cannot specify a new or different user-defined format for a data item. For more information, see User-Defined Formats.

Data Items That Are Available in SAS Visual Analytics

<table>
<thead>
<tr>
<th>Data Item</th>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregated Measure or Time Period Calculation</td>
<td>![Icon]</td>
<td>A data item that represents special predefined operations, like distinct count, percentage of totals, percentage of subtotals, or frequency percent. Or, users can define their own aggregated measure calculations. Aggregate measures can be used in only some report objects. They cannot be used in filters, controls, spark lines, or time series graphs. Percentage of subtotal items (including row total, row subtotal, column total, and column subtotal) can be used only in crosstabs. Some aggregated measure calculations cannot be used in a detail rank.</td>
</tr>
<tr>
<td>Calculated</td>
<td>![Icon]</td>
<td>A data item that is calculated from existing data items by using an expression. For example, you could create a calculated data item called Profit, which is created by using this expression: [Revenue]  –  [Cost], where Revenue and Cost are measures in a data source. Calculated dates and times are treated as categories with distinct values being governed by the date or time format that you have chosen. Numeric calculated items can be treated as measures (with an aggregation type such as Sum, which is applied to each distinct category combination). Or, you can change numeric calculated items into category data items with distinct values being governed by the number of decimal places in the numeric format.</td>
</tr>
<tr>
<td>Category</td>
<td>![Icon]</td>
<td>A data item whose distinct values are used to group and aggregate measures. There are five types of categories: alphanumeric, date, datetime, time, and numeric. Alphanumeric categories can be made up of all letters, all digits, or a combination of the two. Categories that have values that are all digits might be physically stored as character or numeric data. The data type affects how values are handled in relation to some functionality, such as filtering, sorting, and formatting. Examples of alphanumeric categories include data items such as Product ID, Country, Employee Number, and Employee Name. Alphanumeric categories sort lexically. Date, datetime, time, and numeric categories are sorted by their underlying numeric values. Category data items can also be numeric. A category data item sorts differently than an alphanumeric data item. Numeric category data items sort by number.</td>
</tr>
<tr>
<td>Data Item</td>
<td>Icon</td>
<td>Description</td>
</tr>
<tr>
<td>------------------------</td>
<td>------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Custom Category</td>
<td></td>
<td>A data item that you create based on either a category or measure data item. A custom category data item is always a category data item with an alphanumeric value.</td>
</tr>
<tr>
<td>Date and Time</td>
<td></td>
<td>A category data item whose distinct values are used to group and aggregate measures. There are three types of date categories: date, datetime, and time. Examples of date, datetime, and time categories are Order Year, Date and Time of Sale, and Customer Wait Time.</td>
</tr>
<tr>
<td>Frequency</td>
<td></td>
<td>A measure data item whose value represents the number of times an observation occurs in the selected data source. SAS Visual Analytics automatically adds this data item to the Data pane under the Measure heading when you select a data source. You cannot change the classification for the frequency data item. The frequency data item is automatically displayed in a crosstab when no measures are assigned. It is also automatically assigned to objects that require a measure when you have not specified one (for example, a bar chart).</td>
</tr>
<tr>
<td>Frequency Percent</td>
<td></td>
<td>A measure data item whose value is based on the percentage of occurrence in the selected data source. SAS Visual Analytics automatically adds this data item to the Data pane under the Aggregated Measure heading when you select a data source. You cannot change the classification for the frequency percent data item.</td>
</tr>
<tr>
<td>Geography</td>
<td></td>
<td>A category data item whose values are mapped to geographical locations or regions. Geography data items can be used in reports to show your data on a geographic map. For example, a geography data item can identify geographic information that is specific to your organization (for example, sales regions, warehouse locations, oil platforms, and so on).</td>
</tr>
<tr>
<td>Geographic Hierarchy</td>
<td></td>
<td>A hierarchy that is based on geography.</td>
</tr>
<tr>
<td>Hierarchy</td>
<td></td>
<td>A data item whose values are arranged with more general information at the top and more specific information at the bottom. The first level in the hierarchy is the root level. For example, you might have a Date hierarchy, which includes the Year (the root level), the Quarter, and then the Month. You can also have geographic hierarchies.</td>
</tr>
<tr>
<td>Interaction Effect</td>
<td></td>
<td>An interaction effect is a user-created data role that can be used when there is a nonadditive relationship between two variables. That is, the effect of variable A on the model changes as variable B changes. An interaction effect can help capture these changes in your model. Your site must license SAS Visual Statistics to use this feature. For more information about interaction effects, see SAS Visual Analytics: Working with SAS Visual Statistics.</td>
</tr>
<tr>
<td>Measure</td>
<td></td>
<td>A data item whose values can be used in computations. These values are numeric. Examples of measures include Sales Revenue, Units Sold, and Salary. SAS Visual Analytics assigns a default aggregation method to every measure. Almost all measures are assigned Sum. You can change the aggregation method.</td>
</tr>
</tbody>
</table>

### Assign Data Items

You can use the Data pane to manually assign data items. Or, you can drag and drop data items onto a report object, and let SAS Visual Analytics automatically assigns the data item to a data role. For more information, see Automatic Data Item Assignment on page 6.

1. If the Data pane is not already displayed, click 📦.
2 Click the down arrow to display a list of available data sources. Select a data source, and the Data pane is populated with a list of all of the data items that are in the data source.

If the data source that you want is not in the list, click Add, and then select Add data source. The Open Data Source window is displayed. Double-click the data source that you want. The Data pane is populated with a list of all of the data items that are in the data source.

If you do not want to use the data source that you originally selected, click 

3 Do one of the following:
   - Select a report object on the page that uses the corresponding data source name or add a new report object to the page. Then, drag and drop the data item onto the report object.
   - Drag and drop a data item onto the canvas. The data item is automatically assigned a data role. For more information, see Automatic Data Item Assignment on page 6.

   **TIP** To select multiple data items, select the first data item to display a check box beside the data item name. Use the check boxes to select additional data items, and then drag and drop them onto the canvas.

4 (Optional) To see the data item properties, click . The Name, Classification, Format, and Aggregation are displayed below the data item name.

   For a category data item with a user-defined format that has an underlying numeric value, you can specify Sort Options.

**Automatic Data Item Assignment**

When you drag and drop data items on a report object, SAS Visual Analytics automatically assigns them a data role. For a single data item, the data item is assigned to an empty and required data role before you are prompted to replace an already assigned data item. For multiple data items, the data items are assigned to all empty and required data roles that accept the data items. There is a special case for a measure data role that allows multiple data items. In this special case, SAS Visual Analytics automatically assigns all of the data items to the Measure data role.

Note: The Group role, Animation role, and Data tip values role are not automatically assigned.

For more information about data roles, see Working with Data Role Assignments on page 21.

**Duplicate Data Items**

You can duplicate both measure and category data items in SAS Visual Analytics.

Duplicating measure data items enables you to see the aggregations of a data item side by side in a table. For a list of the available aggregation types, see Reference: Aggregations for Measures on page 49. You can duplicate a numeric measure if you want to use it as a category to group other values in some tables or graphs. If you save a report with duplicate data items, then those data items are available when you edit the report the next time.

You can duplicate a calculated data item to make a variation of a calculation. For example, you might make similar calculations involving miles per gallon for a vehicle, but you create one calculation using MPG (City) and another using MPG (Highway). You can duplicate any data item if you want to use it with more than one format in your report. For example, you might change Month to Year for a date data item.

To duplicate a data item:

1 In the Data pane, right-click the data item that you want to duplicate. Select Duplicate.
All of the properties of the original data item are copied to the duplicate data item. The duplicate data item appears in the list of data items in the **Data** pane. For example, if the original data item name is **Engine Size**, then the duplicate data item is displayed as **Engine Size (1)**. If you choose to duplicate the same data item again, then it is displayed as **Engine Size (2)**.

2. **(Optional) Rename the duplicate data item.**

3. **(Optional) Change the format or aggregation for the duplicate data item.**

4. **(Optional) Edit the calculation for a calculated data item or aggregated measure.**

5. **(Optional) Change the sort options for a category data item with a user-defined format that is based on an underlying numeric value.**

6. **(Optional) Change the classification for the data item.** For example, a numeric data item that has been duplicated and is not yet assigned to a report object can be a category or a measure.

### Search for Data Items

Use the search field to narrow the list of data items that are displayed. The search feature uses a “contains” search rather a “begins with” search.

1. In the **Data** pane, click 🔍.

2. Enter the name of a data item in the search field.

3. Click ✗ to clear the search term and display all of the data items in the data source.

4. Click ✗ to hide the search field.

### Modify Data Item Properties

#### Rename Data Items

1. In the **Data** pane, select a data item that you want to rename, and then click 🔍 beside the data item name.

   The **Name** property is displayed below the current data item name.

2. Enter a new name. The name cannot be used by another data item in the same data source.

3. Press **Enter** to update the data item name.

#### Modify a Data Item’s Classification

You can modify a data item’s classification. For example, you might want to modify a measure data item to be a category data item.

A data item’s classification might be able to be modified if that data item is in use in the report. You cannot switch between a category or geography classification and a measure when the data item is in use. You can switch between a category and geography classification regardless of whether the data item is already used. However, if you can change the classification for a geography data item to category while the data item is used in a visualization, then the data item is automatically removed from the visualization role.

Here are some key points about modifying a data item’s classification:
You can modify a category data item to be a measure data item only if the data item started as a numeric measure. For example, if you change a measure to a category in the report, then SAS Visual Analytics allows you to change it back to a measure. In addition, you can change a category to a measure if it was originally in the data source as a numeric column. In this case, your data administrator converted the numeric column to a character string by applying a user-defined format. As a result, you can use SAS Visual Analytics to change the category’s format to one of the standard numeric formats, and then you can change it to a measure.

A data item’s classification cannot be modified if the data item can have only one classification. However, duplicating the data item allows the new data item to have a different classification. For more information, see Duplicate Data Items on page 6.

You cannot change the classification for the frequency data item or the frequency percent data item.

You cannot change the classification for an aggregated measure.

You cannot convert calculated data items into geography data items.

You cannot change the classification for data items that are in use by one or more visualizations.

To change the classification:

1. In the Data pane, select a data item, and then click beside the data item name. The Classification property is displayed below the current data item name.
2. Click to open the drop-down menu. The available classifications depend on the selected data item. Options might include Measure, Category, or Geography. Your change is saved automatically.
3. If you select Geography for the classification, then the Geography Classification window is displayed. You can select a Geography. Additional options might be Country/Region, Latitude (y), Longitude (x), and Coordinate Space.

Modify the Format of a Numeric Measure Data Item or a Date, Datetime, or Time Data Item

You can modify the format of a numeric measure data item or a date, datetime, or time data item. You can also modify the format of a data item with a user-defined format as long as the user-defined format is based on an underlying numeric value. For more information, see Modify User-Defined Formats on page 9.

Note: You cannot modify the format of a data item that is being used in a filter, as part of a calculated or aggregated measure, or in a custom category.

To change the format:

1. In the Data pane, select a data item, and then click beside the data item name. The Format property is displayed below the current data item name.
2. Click the name of the current format. The Format window is displayed.
3. Select a format. You can also select the Width and Decimals (for numeric data items). A sample of your selection is displayed below the Decimals field.
   
   Note: There are different format variations available for some format types for date, datetime, and time data items. Select the format variation based on the sample value displayed below the Decimals field.
   
   Note: The Reset to Default option is displayed only if the format has been changed from the default.
   
   Note: The Reset to Default option is available for user-defined format data items after they have been modified to a standard numeric format as long as the data item is still a category data item.
4. Click OK to save your changes.
Modify User-Defined Formats

In SAS Visual Analytics, user-defined formats that are defined in the CAS server are applied to the results. You can change the format for an underlying numeric data item, but you cannot change the format for an underlying character-based data item. If you change the format for an underlying numeric data item, you can restore the user-defined format by selecting Reset to Default.

The Format property of the data item displays the name for a user-defined format.

The icon identifies a category data item with an active user-defined format in the Data pane.

Modify How a Measure Is Aggregated

You can change the aggregation method for a measure in a data source using the Data pane.

Note: You need to understand your data because some aggregation methods are not always appropriate. For example, an average of an average is not valid.

1. In the Data pane, select a measure data item, and then click beside the data item name.

2. Click beside the Aggregation property. A drop-down list is displayed with aggregations. For more information, see Reference: Aggregations for Measures on page 49.

   When you select an aggregation, your change is saved automatically.

   Note: All of the report objects in the report that use this data item are affected by this change unless you have selected a local aggregation override.

   Note: Depending on the aggregation, formats might be overridden when they are used in report objects. For example, skewness becomes a floating point number with four decimals.

Create a Distinct Count for a Category Data Item

A distinct count query is useful in many ways. For example, you might want to know the number of distinct products that were purchased during a specific time period. Or, you might want to know which products have the most customers or which products have the most customers in a particular geographic region. You can create a distinct count for category data items only.

Note: If your category contains missing values, then distinct count is increased by one.

To create a distinct count aggregated measure data item:

1. In the Data pane, right-click a category data item, and select Create calculation for data item. The Create Calculation window is displayed.

2. In the Type drop-down list, make sure that Distinct count is selected.

3. Click OK.

   The distinct count data item appears below the Aggregated Measure heading in the Data pane with a name that is derived from the original name. For example, if the original data item name is Date, then the distinct count data item is displayed as Date (Distinct count) 1.
Create Derived Items for Measures

You can create derived data items that are aggregated measures. The aggregated measure does not contain data values in itself, but when it is used in a report object, it displays the value for the measure and formula type on which it is based. An example is a percentage of total.

Here are some key points about derived items:

- Derived data items cannot be used in filters or controls.
- Period calculations cannot be derived from measures with certain aggregations.

1. In the Data pane, right-click a measure data item, and select Create calculation for data item. The Create Calculation window is displayed.

2. Use the Type drop-down list to select one of the following:

   - **Difference from previous period**
     - Displays the difference between the value for the current time period and the value for the previous time period. For example, you might derive the difference between sales for the current month and sales for the previous month.
     - **Note:** This derived item is not available if your data source does not contain a date data item that includes the year.

   - **Difference from previous parallel period**
     - Displays the difference between the value for the current time period and the value for the previous parallel time period within a larger time interval. For example, you might derive the difference between sales for the current month and sales for the same month of the previous year.
     - **Note:** This derived item is not available if your data source does not contain a date data item that includes the year.

   - **Percent difference from previous period**
     - Displays the percentage difference between the value for the current time period and the value for the previous time period. For example, you might derive the percentage difference between sales for the current month and sales for the previous month.
     - **Note:** This derived item is not available if your data source does not contain a date data item that includes the year.

   - **Percent difference from previous parallel period**
     - Displays the percentage difference between the value for the current time period and the value for the previous parallel time period within a larger time interval. For example, you might derive the percentage difference between sales for the current month and sales for the same month of the previous year.
     - **Note:** This derived item is not available if your data source does not contain a date data item that includes the year.

   - **Percent of subtotals**
     - Displays the percentage of the subtotal value for the measure on which it is based. You can create a percentage of subtotal only when the source data item has an aggregation of Sum or Count.
     - **Note:** The Percent of subtotals derived item is available only for crosstabs.
     - **Note:** The Percent of subtotals derived item is relative to the subset of data that is selected by your filters and ranks.

   - **Percent of total - sum**
     - Displays the percentage of the total value for the measure on which it is based. You can create a percentage of total only when the source data item has an aggregation of Sum or Count. For example, you might create the percentage of the total value for a measure that contains revenue values. If you
create a bar chart of the aggregated measure and a category that contains product lines, then the bar chart shows the percentage of total revenue for each product line.

**Note:** The **Percent of total - Sum** value is relative to the subset of data that is selected by your filters and ranks.

**Period to date**
Displays the aggregated value for the current time period and all of the previous time periods within a larger time interval. For example, you might derive the year-to-date total for each month.

**Note:** This derived item is not available if your data source does not contain a date data item that includes the year.

**Year to date**
Displays the aggregated value for the current time period and all of the previous time periods within the year. For example, you might derive the year-to-date total for each month.

The year-to-date calculation subsets the data for each year using today's date (where today is evaluated each time you view the report). To use all data for every period, edit the expression for the derived item.

**Note:** This derived item is not available if your data source does not contain a date data item that includes the year.

**Year to Date growth**
Displays the percentage difference between the year-to-date value for the current time period and the year-to-date value for the same time period of the previous year. For example, you might derive the difference in year-to-date sales between the current month and the same month of the previous year.

The year-to-date calculation subsets the data for each year using today's date (where today is evaluated each time you view the report). To use all data for every period, use a **Period to date** item or edit the expression for the derived item.

For the month that contains today's date, the data for an earlier year is subset to the same corresponding date.

**Note:** This derived item is not available if your data source does not contain a date data item that includes the year.

**Year over year growth**
Displays the percentage difference between the current time period and an equivalent time period from the previous year. For example, you might derive the difference in sales between the current month and the same month of the previous year.

The year-over-year growth calculation subsets the data for each year using today's date (where today is evaluated each time you view the report). To display a percentage of growth using full periods, use **Percent difference from previous parallel period** or edit the generated formula.

For the month that contains today's date, the data for an earlier year is subset to the same corresponding date.

**Note:** This derived item is not available if your data source does not contain a date data item that includes the year.

1. **Click OK.**

The distinct count data item appears below the **Aggregated Measure** heading in the **Data** pane with a name that is derived from the original name. For example, if the original data item name is **outstanding Balance**, and the type is **Difference from previous parallel period**, then the data item is displayed as **Outstanding Balance (Difference from previous parallel period)**.

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**Create a Percentage of Total**

A measure is required to have a Sum or Count aggregation before you can create a percentage of total.
To create a percentage of total from a measure data item:

1. In the Data pane, right-click a measure data item, and select Create calculation for data item. The Create Calculation window is displayed.

2. Use the Type drop-down list to select either Percent of total - Sum or Percent of total - Count, depending on the aggregation of the measure.

3. Click OK.

The percentage of total measure data item appears in the list of aggregated data items with a name that is derived from the original name. For example, if the original measure data item name is Revenue, then the percentage of total measure data item is displayed as Revenue (Percent of total - Sum).

Delete Data Items

You can delete data items that you have created in SAS Visual Analytics (for example, calculated data items or duplicated data items) so that they no longer appear in the Data pane.

Here are some considerations about deleting data items:

- You cannot delete a data item that is inside a hierarchy if it reduces the hierarchy to a single level.
- You cannot delete a data item if it is the last or only reference to a column in the original data source.
- You cannot delete a data item if it is used in a calculated data item, aggregated measure, a geography data item, or a custom category.

In the Data pane, right-click the data item that you want to delete, and select Delete. The data item is removed from the list of data items, as well as from any report objects, filters, or ranks that were using it.

Working with Hierarchies in a Report

About Hierarchies

Creating hierarchies enables you to add drill-down functionality to your reports. A hierarchy is an arrangement of category columns that is based on parent-child relationships. The levels of a hierarchy are arranged with more general information at the top and more specific information at the bottom. For example, you might create a hierarchy of datetime columns with Year as the top level, Month as the next level, and Day as the bottom level.

You can also have a date hierarchy or a geographic hierarchy. For example, you might have a hierarchy with Region as the top level, State as the next level, and City as the bottom level.

Keep the following considerations in mind:

- List tables and gauges do not support hierarchies.
- Crosstabs can have either a hierarchy or categories on each row or column, but not both.
- Time series plot report objects allow only datetime data items in a hierarchy.
- Geo bubble maps, geo coordinate maps, and geo region maps allow only geographic data items in a hierarchy.

If you drag and drop a hierarchy onto either the report prompt area or the page prompt area, then a set of linked controls is created. Controls are created for each level of the hierarchy. For example, you might have a hierarchy for cars, which has Country of Origin as the top level, Manufacturer as the next level, and Model as the bottom level. When you drag this hierarchy and drop it onto the page prompt area or the report prompt area, the auto control feature in SAS Visual Analytics creates a button bar for the Country of Origin, a drop-down list for the
Manufacturer, and a text input for the Model. The Country of Origin button bar filters both Manufacturer and Model. The Manufacturer drop-down list filters only Model.

Add a New Hierarchy to a Report
1 If the Data pane is not already displayed, click .
2 Click Add, and then select Add hierarchy. The Add Hierarchy window is displayed.
3 Enter a Name.
4 Select at least two categories in the Available items list, and move them to the Selected items list.
5 (Optional) Use the up and down arrows to arrange the data items in the list.
6 Click OK to save the new hierarchy. The icon identifies the new hierarchy, which is displayed under the Hierarchy heading in the Data pane.

TIP If you use a date data item, it must have a format that specifies the year or the Add hierarchy option is not available.

Edit a Hierarchy for a Report
1 Right-click the hierarchy name in the Data pane, and select Edit. The Edit Hierarchy window is displayed.
2 (Optional) Edit the Name.
3 Add and remove categories. There must be at least two categories.
   Note: If a geographic hierarchy is used in a geo bubble map, geo coordinate map, or geo region map, only geographic data items are displayed when you edit the hierarchy.
4 Click OK to save the updated hierarchy.
If the hierarchy that you edit is already used in a report object and is drilled or expanded, it returns to the top level after it is edited.

Delete a Hierarchy for a Report
Right-click the hierarchy name in the Data pane, and select Delete. The hierarchy is removed from the list of data items, as well as from any report objects, filters, or ranks that were using it.

Working with Custom Categories in a Report

About Custom Categories
You can create a custom category based on either a category or measure data item. A custom category data item is always a category data item with an alphanumeric value. When you create a custom category from a measure, you can use intervals, ranges, or specific values to group the data.
Create a Custom Category

1. If the Data pane is not already displayed, click 📊.
2. Click Add, and then select Add custom category. The Add Custom Category window is displayed.
3. Specify a Name for the new custom category. The default name is Custom Category 1.
4. Click beside the Based on field to select the category or measure data item that the custom category is based on.
5. Select the Values that you want to include. Drag and drop the values onto the right pane under the Value Groups label.

TIP To rename a custom group label, right-click the label name, and select Edit group name.

6. (Optional) Specify the Remaining Values. You can specify a name when you select Group as. The default label for Group as is other. Alternatively, you can specify Show as is or Show as missing.

Note: The Show as is option is available only for data items that are based on string categories. It is not available for numeric or date values.

7. Click OK. The icon identifies the new custom category in the Data pane.

Working with Calculated Items in a Report

About Calculated Data Items

SAS Visual Analytics enables you to calculate new data items from your existing data items by using an expression. For example, you might want to calculate a company’s profits by subtracting expenses from revenues.

In addition to performing mathematical calculations on numeric values, you can use calculated data items to create date and time values. For example, if your data contains separate categories for month, day, and year, then you can calculate a date value from those categories.

Here are some key points about calculated data items:

- All calculations are performed on unaggregated data. The calculation expression is evaluated for each row in the data source before aggregations are performed. To perform calculations on aggregated data, see Add a New Aggregated Measure to a Report on page 16.
- Calculated data items can accept parameters. For more information, see Working with Parameters in Reports on page 18.
- A hierarchy can contain calculated data items as long as they are categories.
- Calculated data items can be changed into geographic data items and used in geo maps.

You can work with calculated data items or aggregated measures.
Add a New Calculated Data Item to a Report

1. In the Data pane, click Add, and then select Add calculated item. The Add Calculated Item window is displayed.

2. Enter a Name.

3. Select a result type from the drop-down list. Numeric is the default result type.

   Calculated data items always default to the following formats, which are based on the data type:
   - Date: DATE9
   - Datetime: DATETIME10
   - Time: TIME8
   - Numeric: COMMA12.2

   After you create the new calculated data item, you can change its format by using the Data pane unless it is a character calculated data item. You cannot specify a format for a character calculated data item.

   Sum is the default aggregation for new numeric calculated data items in SAS Visual Analytics. You can change the aggregation for numeric calculated data items using the Data pane by clicking beside the data item name.

4. Use the Visual layout to build the expression for your calculated data item by dragging Data Items and Operators onto the expression in the right pane. For each rectangular field in the expression, you can insert a data item, an operator, or a specific value.

   When you drag and drop data items or operators onto your expression, the precise location of the cursor determines where and how the new element is added to the expression. As you drag the new element over the expression, a preview appears that displays how the expression changes if you drop the element at that location. For example, if your current expression is (Profit / Revenue), and you drag and drop the - y (subtract) operator inside the open parenthesis symbol, then the expression changes to ([number] - (Profit / Revenue)). If you drag and drop the operator over the division symbol, then the expression changes to (Profit - Revenue), and so on.

   Alternatively, you can use the Text layout to enter the expression.

   There are a large number of operator types available to perform mathematical functions, process datetime values, handle text, and evaluate logical processing such as IF clauses. For more information, see Reference: Operators for Data Expressions on page 50.

5. Click OK. The new calculated data item appears in the Data pane.

Preview the Expression for a Calculated Data Item

For calculated data items only, you can preview the results of your expression by clicking in the Add Calculated Item window.

You can preview the results of a subset of your expression by right-clicking a part of your expression, and then selecting Preview Sub-expression Results. The results are displayed in the Preview Result window.

Edit a Calculated Data Item

1. Right-click on a calculated data item in the Data pane, and select Edit. The Edit Calculated Item window is displayed.
2 Modify the **Data Items** and **Operators** for the calculated data item as needed. For more information about the operators that are available, see Reference: Operators for Data Expressions on page 50.

   *Note*: If the calculated data item has not been used in a report, then you can modify the result type.

3 Click **OK**.

You can duplicate, rename, and delete calculated data items using the same steps as any other data item. If a calculated data item is used inside another calculated data item, then it cannot be removed.

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**TIP**  You can cut and paste from the **Text** layout between different reports to transfer calculations or to email them to others. For more information, see Reference: Editing a Data Expression in Text Mode on page 47.

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### Add a New Aggregated Measure to a Report

Aggregated measures enable you to calculate new data items by using aggregated values. For example, you might want to calculate a company's profit margin by region by taking the aggregated sum of the profit for all of the stores in a region group and dividing it by the aggregated sum of the revenue for all of the stores in that same region group. Aggregations are evaluated as part of a calculated expression.

To add an aggregated measure:

1 In the **Data** pane, click **Add**, and then select **Add calculated item**. The Add Calculated Item window is displayed.

2 Click **beside Numeric**, and select **Aggregated Measure**.

3 Enter a **Name**.

4 With the **Visual** layout selected, build the expression for your aggregated measure by dragging and dropping **Data Items** and **Operators** onto the expression in the right pane. For each field in the expression, you can insert a data item, an operator, or a specific value.

   *Note*: To create an aggregated measure, your expression must contain at least one aggregated operator.

   When you drag and drop data items and operators onto the expression, the precise location of the cursor determines where and how the data item or operator is added to the expression. As you drag the new element over the expression, a preview appears, which displays how the expression would change if you drop the element at the current location.

   Alternatively, you can use the **Text** layout to enter the expression.

   There are a large number of operator types available to perform mathematical functions and evaluate logical processing such as IF clauses. For more information, see Reference: Operators for Data Expressions on page 50.

5 For each aggregation in your expression, select the aggregation context. A drop-down list beside each aggregation enables you to select one of the following context values:

   **ByGroup**  
   calculates the aggregation for each subset of the data item that is used in a visualization. For example, in a bar chart, an aggregated measure with the **ByGroup** context calculates a separate aggregated value for each bar in the chart.

   **ForAll**  
   calculates the aggregation for the entire data item (after filtering). For example, in a bar chart, an aggregated measure with the **ForAll** context uses the same aggregated value (calculated for the entire data item) for each bar in the chart.
By using the **ForAll** and **ByGroup** contexts together, you can create measures that compare the local value to the global value. For example, you might calculate the difference from mean by using an expression such as the following: \( \text{Avg ByGroup}(X) - \text{Avg ForAll}(X) \)

6 Click **OK**. The icon identifies the new aggregated measure in the **Data** pane.

### Edit an Aggregated Measure

1 Right-click on an aggregated measure in the **Data** pane, and select **Edit**. The **Edit Calculated Item** window is displayed.

2 Modify the **Data Items** and **Operators** for the aggregated measure as needed. For more information about the operators that are available, see **Reference: Operators for Data Expressions** on page 50.

3 Click **OK**.

You can duplicate, rename, hide, and delete aggregated measures using the same steps as any other data item.

**TIP** You can cut and paste from the **Text** layout between different reports, to transfer calculations, or to email them to others. For more information, see **Reference: Editing a Data Expression in Text Mode** on page 47.

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### Working with Geography Data Items

#### About Geography Data Items

A geography data item is a category whose values are mapped to geographical locations or regions. Geography data items can be used with geo maps and other report objects to visualize your data on a geographic map.

You can create a geography data item by using predefined roles such as country names, or you can define a custom geographic role. Custom geographic roles require you to provide latitude and longitude coordinates within your data source.

**Note:** For predefined geographic roles, the values of your geography data items must match the lookup values that are used by SAS Visual Analytics. To view the lookup values, see [http://support.sas.com/va81geo](http://support.sas.com/va81geo).

#### Create a Geography Data Item

1 In the **Data** pane, click beside the name of the category that you want to use for the geography data item. The **Classification** property is displayed below the current category name.

2 Click beside the current classification. Select **Geography**. The Geography Classification window is displayed.

3 Beside the **Geography** field, click . Then, select one of the following items:

   **Country or Region Names**
   - specifies countries or regions by name.

   **Country or Region ISO 2-Letter Codes**
   - specifies countries or regions by using two-letter country codes from the ISO 3166-1 standard.
Country or Region ISO Numeric Codes
specifies countries or regions by using three-digit numeric country codes from the ISO 3166-1 standard.

Country or Region SAS Map ID Values
specifies countries or regions by using the two-letter codes that are used with the MAPSGFK library that is included with SAS/GRAPH.

Note: The two-letter SAS Map ID country values are identical to the ISO 3166-1 two-letter country codes.

Subdivision (State, Province) Names
specifies country subdivisions (for example, states and provinces) by using the subdivision names.

Subdivision (State, Province) SAS Map ID Values
specifies country subdivisions (for example, states and provinces) by using the two-letter codes that are used with the MAPSGFK library that is included with SAS/GRAPH.

Custom
specifies a custom geographic role using latitude and longitude values from your data.

US State Names
specifies states and territories in the United States by using the state and territory names.

US State Abbreviations
specifies states and territories in the United States by using two-letter postal codes.

US ZIP Codes
specifies five-digit ZIP codes for the United States.

4 For the Subdivision (State, Province) Names geography type, select a Country/Region.

5 For the Custom geography type, specify the Latitude (y), Longitude (x), and the Coordinate Space that is used to project the longitude and latitude.

Note: For Latitude (y) and Longitude (x), you can enter the first letter of the column name to search for it in the drop-down menu.

Note: The coordinate space should match the projection that your data is in.

6 Click OK. The icon identifies the new geography data item in the Data pane.

Working with Parameters in Reports

Overview of Parameters in Reports
A parameter is a variable whose value can be changed and that can be referenced by other report objects. SAS Visual Analytics supports parameters for controls in reports. If a control has an associated parameter, then when the value of the control changes, the parameter is assigned that changed value. When the value of the parameter changes, any report objects that reference the parameter detect the change accordingly.

Whenever a parameter value is updated, then all display rules, ranks, calculations, and filters that use that parameter are updated. Any report object in the report that uses the display rule, rank, calculation, or filter is updated accordingly. For an example of how parameters can be used in a complex report, see Example: Using Parameters in a Report on page 20.

Where Parameters Can Be Used
You can use parameters in calculations, display rules, filters, and ranks. You can create, modify, and manage parameters using the Data pane.
The following controls support parameters:

- The text input control supports a character parameter or a numeric parameter.
- The button bar control or drop-down list control accepts a character parameter.
- The slider (single-point only) accepts a numeric parameter.

Parameters can be used with the following features:

- **Calculations**
  - Calculated items and aggregated measures allow parameters. Parameters are supported wherever it makes sense to have a numeric or character value.

- **Display rules**
  - Numeric parameters can be specified as the value of an expression rule.

- **Filters (detail filters, aggregated filters, and data source filters)**
  - A character or numeric parameter is supported wherever it makes sense to have a numeric or character value. The data source filter is a special case. Ordinarily, a data source filter applies to all of the report objects on the canvas. However, if the data source filter contains a parameter, then the filter is not applied to the control that has that parameter assigned to it.

- **Ranks**
  - For a rank, the parameter can be included for the \textit{n} value of the rank. It is supported for \textit{Top Count} or \textit{Bottom Count} and \textit{Top Percent} or \textit{Bottom Percent}.

- **URLs**
  - Parameters in a report URL can be modified. For example, suppose that you have the following URL for a report: 
    The first parameter is called \textit{Origin Parameter}, which enables you to specify a different country name. The second parameter is called \textit{Cost of gas}, which enables you to specify different costs to see how different gas prices change the report.

  \textbf{Note:} A parameter cannot be used to pass credentials. However, credentials can be used as the value of a parameter.

### Create a New Parameter for a Report

Here are some key points about creating parameters:

- You cannot create a parameter for a control that uses a date.
- If you duplicate a control with a parameter, the parameter is not copied from the original control.

To create a new parameter:

1. In the Data pane, click Add, and then select Add parameter. The Add Parameter window is displayed.
2. (Optional) Modify the Name of the parameter.
3. Select the Type for the parameter. You can select \textit{Numeric} or \textit{Character}.
4. For character parameters, specify a Current value.
5. For numeric parameters, specify a Current value. You must also specify the following options:
   - Minimum value (which is required).
   - Maximum value (which is required).
Format. Click Select to open the Format window, where you can select a format type, **Width**, and **Decimals**. Click OK in the Format window.

**Current value** (which is required).

6 Click OK. The icon identifies the new parameter in the **Data** pane.

**Edit a Parameter for a Report**

1 Right-click the parameter in the **Data** pane, and select **Edit**. The **Edit Parameter** window is displayed.

2 Make changes to the parameter.

3 Click OK to save your changes.

**Delete a Parameter for a Report**

Right-click the parameter in the **Data** pane, and select **Delete**. The parameter is removed from the list of data items in the **Data** pane.

**Note**: You cannot delete a parameter that is being used by a calculation, rank, filter, or display rule.

**Example: Using Parameters in a Report**

You can use parameters to adjust values that affect multiple report objects. Here is an example of a report with a parameter:

The report has a slider, a list table, and a bar chart. The slider lets you adjust the number of miles that you drive each day. The parameter value from the slider is used to calculate the daily fuel consumption for each model of car. For example, you can see what happens to the list table when you change the parameter for **Miles per Day** from 25 to 100. The values of the calculated data item are also displayed in the bar chart.
About Data Roles

A data role is a designation that describes how a particular data item is to be used in a report object. In SAS Visual Analytics, each report object has data roles, some are required and others are optional. For example, the data roles for a bar chart are Category, Measure, Group, Lattice columns, Lattice rows, Data tip values, and Animation. For the bar chart, the category and measure data roles are required.

If a report object does not have the required data roles assigned, an informational message is displayed in the middle of the report object.

SAS Visual Analytics assigns data roles automatically when you drag and drop data items on a report object in the canvas. Or, you can use the Roles pane to add or modify data roles. For more information about automatic assignment, see Automatic Data Item Assignment on page 6.

For more information about specific data roles for each report object, refer to the following:

- SAS Visual Analytics: Working with Report Content
- SAS Visual Analytics: Working with SAS Visual Data Mining and Machine Learning
Add Data Role Assignments to a Report Object

1. If the Roles pane is not already displayed, click .

2. Click Add under a data role label, and then select the data item or data items that you want to assign to the role.
   
   If only one data item can be added to the role, selecting a data item adds it to the role. If more than one data item can be added to the role, then you must click OK to add your selections.

3. (Optional) Drag a data item from one role, and drop it onto the Add field of another role in the Roles pane.

   Alternatively, you can do one of the following:
   
   - Drag one or more data items from the Data pane, and drop them onto the Add field for the target role in the Roles pane.
   
   - Drag one or more data items from the Data pane, and drop them onto a report object in the canvas. SAS Visual Analytics determines the roles to which the items are assigned. You can later modify the assigned data roles using the Roles pane.

Add Data Roles for Lattice Columns or Lattice Rows in a Graph

A lattice is a multi-cell graph in which you create each cell independently. Each cell can contain different types of plots. In SAS Visual Analytics, you can create a multi-cell graph by using data roles to add lattice columns, lattice rows, or both.

1. Select a report object in the canvas that has one or more data items assigned and that allows a lattice data role.

2. If the roles are not already expanded, click beside the Lattice columns or Lattice rows role. Click Add, and then select one or more data items in the Add Data Items window.

   Note: There is a limit of 15 unique values on any lattice role.

3. Click OK.

   TIP Scroll bars are generated by the graph if you have a lot of data. These scroll bars work differently than other scroll bars in SAS Visual Analytics. They initially fill the maximum area so that you can see all of the bars in the lattice row or lattice column. To zoom in and see specific bars, you have to drag the top or the bottom of the scroll bar to adjust the height of the scrolling bar. Labels are added as space becomes available.

Modify Data Role Assignments

You can modify a data role assignment that you have made or modify one that was automatically assigned. For example, SAS Visual Analytics automatically assigns frequency to a measure role when it enables you to see the data quickly. You can replace frequency by dragging a different data item and dropping it on the role that has frequency assigned. For more information, see Automatic Data Item Assignment on page 6.

To modify a data role:

1. Select a report object in the canvas that has one or more data items assigned.
2 Do one of the following:
- Select the data item in the Roles pane that you want to replace. The Replace Data Item window is displayed so that you can select a replacement data item.
- Drag a data item (or data items) from the Data pane, and drop it (or them) onto the data role in the Roles pane that you want to replace.
- Drag a data item from one role, and drop it onto the Add field of another role in the Roles pane.

For data roles that allow multiple items, you can reorder the data items in the Roles pane by dragging an item and dropping it in a new position within the same role.

Remove Data Role Assignments from Report Objects

To remove data items from their assigned data roles in a specific report object:

1. Select a report object in the canvas.
2. Right-click a data item in the Roles pane, and select Remove <data-item>, where <data-item> is the name of the data item.

If multiple data items are assigned to a data role, then you can select Remove all. All data items are removed from the assigned data role as well as from data-dependent features like display rules. An informational message is displayed in the middle of the report object to let you know that the required data roles are not assigned.

Alternatively, you can click for the report object in the canvas. Click , and then select Remove all role assignments.

Sorting Data in Reports

How Sorting Can Help with Analysis

Information can be easier to understand when it appears in an intentional order. Applying a sort order to one or more data items in SAS Visual Analytics enables you to arrange rows and columns in tables and axis labels on charts in some order, such as alphabetically or highest to lowest numerically. Interactively changing the order of data can provide you with a different perspective that often facilitates valuable insight. For example, in a report, sales employees who are initially arranged alphabetically can be re-sorted by sales amount.

Ranking can help reduce the amount of visible data and is often used in combination with sorting. For more information, see Add a New Rank on page 41.

Note: SAS Visual Analytics uses the locale of the CAS server to sort data items. For example, if you want to sort data items in the Swedish language, then the table needs to be loaded into a CAS server that is initialized for the Swedish locale (sv_SE).

Sort Data in a List Table

To sort values in a list table, right-click a column heading, and select Sort. Then, select either Ascending or Descending.

TIP Use the Ctrl key to select and sort multiple columns.
Sort Data in a Graph

To sort by values in a graph, right-click on a measure name or category name, and select Sort. Then, select either Ascending or Descending.

Note: Sorting in a pie chart is based on the measure. If you do not use a measure, then sorting is based on the frequency (and automatically applied).

Working with Display Rules

About Display Rules

Display rules include all types of highlighting of report objects. They provide a flexible structure to specify conditions. There are several types of display rules. Display rules enable conditions to be shared across objects, but not all display rules apply across all report object types.

The Rules pane enables you to populate intervals, add intervals, or add color-mapped values for the report object that is currently selected in the canvas. You can use this pane to specify both report-level or object-level display rules, depending on what you have selected in the canvas.

Note: Heat maps and network analysis objects do not support display rules.

For list tables and graphs, you can create display rules that reference a measure that is not included in the currently displayed report object. This feature is not available for crosstabs.

Here are some key points about color-mapped display rules:

- Color-mapped display rules are not allowed if there are multiple overlays.
- Color-mapped values for a report object can be applied only to category data items.
- Color-mapped values cannot be applied to date or datetime data items.
- Color-mapped display rules are not applied if there are two measures.
- If a color-mapped display rule is applied to one measure and you add a second measure, the display rule is removed.

Add Report-Level Display Rules

A report-level display rule applies to all report objects in a report.

1. If the Rules pane is not already displayed, click .
2. Without any report objects or the page selected in the canvas, click Add, and then select Add color-mapped values. The Add Display Rule: Color Map window is displayed.
3. Click . Enter a value for the display rule in the field.
4. Select a color for the display rule.
5. (Optional) Repeat the steps for entering a value and selecting a color.
6. (Optional) Select the Other check box. Then, select a color so that any of the other categories that do not have a color will have the one that you just selected.
Click OK. The report objects in the report update with the new report-level display rule.

(Optional) Position your mouse over the report-level display rule name in the Rules pane, and then click to edit the new report-level display rule.

Adding Table-Level Display Rules

You can add three different types of display rules to tables. You cannot create a display rule to highlight dates in a table.

Add Display Rules to a List Table Using an Expression

1. If it is not already selected, select the list table in the canvas that you want to update.
2. If the Rules pane is not already displayed, click.
3. Click Add, and then select Add expression. The Add Display Rule: Expression window is displayed.
4. Select the Column or any measure value.
5. Select the Operator. You can select $=$, $<$, $>$, $\leq$, $\geq$, Missing, or NotMissing. The default is $>$. 
6. Enter or select a Value.
7. Modify the style, size, and color of the font.
8. Specify a Background Color to enable the OK button in the Add Display Rule: Expression window.
9. Select the row or column in the Specify where the style applies drop-down list to specify where you want to apply the colors.
10. Click OK. The list table updates with the new display rule.
11. (Optional) Position your mouse over the display rule name in the Rules pane, and then click to edit the new display rule.

Add Display Rules to a List Table Using Color-Mapped Values

1. If it is not already selected, select the list table in the canvas that you want to update.
2. If the Rules pane is not already displayed, click.
3. Click Add, and then select Add color-mapped values. The Add Display Rule: Color Map window is displayed.
4. Select the column or value to which you want to apply the display rule.
   Note: Color-mapped values for a report object can be applied only to category data items.
   Note: Color-mapped values cannot be applied to date or datetime data items.
5. Click . Enter a value for the display rule in the field.
6. Select a color for the display rule.
7. (Optional) Repeat the steps for entering a value and selecting a color.
8  (Optional) Select the Other check box. Then, select a color so that any of the other categories that do not have a color will have the one that you just selected.

9  Select the row or column in the Specify where the style applies drop-down list to specify where you want to apply the colors.

10 Click OK. The table updates with the new display rule.

11 (Optional) Position your mouse over the display rule name in the Rules pane, and then click to edit the new display rule.

Add Display Rules to a List Table Using a Gauge
1  If it is not already selected, select the table in the canvas that you want to update.

2  If the Rules pane is not already displayed, click.

3  Click Add, and then select Add gauge. The Add Display Rule: Gauge window is displayed.

4  Select a Gauge type from the drop-down list. Your choices are a bullet, an icon, a slider, or a thermometer. Icon is the default.

5  Using the Based on column drop-down list, specify which column the rule should be based on in the report.

6  Specify where the gauge should appear in the column for the Cell placement. Your choices are Left of text, Right of text, or Replace text.

7  Define the intervals and colors for the rule:
   
   ■ Enter the individual values for the intervals, and then select a color. You can click the operator between the intervals to change it.

   ■ Click Auto-populate intervals to automatically populate the intervals. The Populate Intervals window is displayed.

   You can specify Number of intervals, Lower bounds, and Upper bounds. Click OK to return to the Add Display Rule: Gauge window.

8  Select a column to display the gauge using the Specify the column in which the gauge appears list.

9  Click OK. The table updates with the new display rule.

10 (Optional) Position your mouse over the display rule name in the Rules pane, and then click to edit the new display rule.

Add Display Rules to a Crosstab
1  If it is not already selected, select the crosstab in the canvas that you want to update.

2  If the Rules pane is not already displayed, click.

3  Click Add, and then select Add expression. The Add Display Rule: Expression window is displayed.

4  Select the Column or any measure value.

5  Select the Operator. You can select =, <>, BetweenInclusive, <=, >=, Missing, or NotMissing. The default is >.

6  Enter or select a Value.
If your crosstab contains a hierarchy, then you can specify the hierarchy levels in which the display rule is applied.

a Click Specify Intersections. The Specify Intersections window is displayed.

b Select one or more hierarchy levels, the grand total, or all of the levels.

c Click OK to return to the Add Display Rule: Expression window.

(Optional) Modify the style, size, and color of the font.

Specify a color for the background.

Select the row or column in the Specify where the style applies drop-down list. For crosstabs, the Specify where the style applies drop-down list displays only the measures that have been added to the crosstab. There are no row or column options.

Click OK. The crosstab updates with the new display rule.

(Optional) Position your mouse over the display rule name in the Rules pane, and then click to edit the new display rule.

Adding Graph-Level Display Rules

Add Display Rules to a Graph Using an Expression

Here are some key points about adding an expression-based display rules to a graph:

- Display rules can be added to a waterfall chart only if you clear the Color by response sign check box in the Options pane.
- You can create an expression-based display rule for a 100% stacked bar chart, which uses the Grouping style and Grouping scale options. However, the display rule cannot be based on a percentage.

To specify a new expression-based display rule for a graph:

1 If it is not already selected, select the graph in the canvas that you want to update.

2 If the Rules pane is not already displayed, click #.

3 Click Add, and then select Add expression. The Add Display Rule: Expression window is displayed.

4 Select the Column or any measure value.

5 Select the Operator. You can select =, <>, BetweenInclusive, <, <=, >, >=, Missing, or NotMissing. The default is >.

6 Enter or select a Value.

7 If your graph contains a hierarchy, then you can specify the hierarchy levels in which the display rule is applied.

a Click Specify Intersections. The Specify Intersections window is displayed.

b Select one or more hierarchy levels, the grand total, or all of the levels.

c Click OK to return to the Add Display Rule: Expression window.

8 Modify the Background Color, which includes color and graph or background.
Note: **Background Color** is available only for bar charts, waterfall charts, line charts, scatter plots, time series plots, and bubble plots.

9 Click **OK**. The graph updates with the new display rule.

10 (Optional) Position your mouse over the display rule name in the **Rules** pane, and then click **Edit** to edit the new display rule.

Note: A warning badge is displayed on a graph when the color is overloaded. This happens when multiple measures are assigned, a color or group role is assigned, or multiple overlays are present (which have cycling colors).

**Add Display Rules to a Graph Using Color-Mapped Values**

Note: Display rules can be added to a waterfall chart only if you clear the **Color by response sign** check box in the **Options** pane.

To specify a new display rule for a graph using color-mapped values:

1 If it is not already selected, select the graph in the canvas that you want to update.

2 If the **Rules** pane is not already displayed, click **Open**.

3 Click **Add**, and then select **Add color-mapped values**. The **Add Display Rule: Color Map** window is displayed.

4 Select the column or value to which you want to apply the display rule.

Note: Color-mapped values for a report object can be applied only to category data items.

5 Click **Edit**. Enter a value for the display rule in the field.

6 Select a color for the display rule.

7 (Optional) Repeat the steps for entering a value and selecting a color.

8 (Optional) Select the **Other** check box. Then, select a color so that any of the other categories that do not have a color will have the one that you just selected.

9 Click **OK**. The graph updates with the new display rule.

10 (Optional) Position your mouse over the display rule name in the **Rules** pane, and then click **Edit** to edit the new display rule.

**Reorder Display Rules**

If you have multiple display rules, you can change their order using the **Rules** pane. Position the pointer over the display rule name that you want to move. Click and drag the **>>** indicator and drop the display rule in a different position in the list.
Change an Object-Level Display Rule to a Report-Level Display Rule

You can easily change an object-level display rule to a report-level display rule using the Rules pane. Do one of the following:

- Position the pointer over the object-level display rule name in the Rules pane, and then click \( \rightarrow \) to move the display rule below the Report Level heading.
- Position the pointer over the object-level display rule name in the Rules pane. Click and drag the \( \downarrow \) indicator and drop the display rule below the Report Level heading.

Delete a Display Rule

Position your mouse over the display rule name in the Rules pane, and then click \( \times \) to delete the display rule.

Working with Report Filters

About Report Filters

In SAS Visual Analytics, you can create filters to subset your data. These types of filters are available:

- **Detail Report Filters**
  - Basic filters: subset the data for individual report objects in your reports by using a single data item. A basic filter is constrained to use only the data item that was selected when the basic filter was created. For more information, see About Basic Report Filters on page 30.
  - Advanced filters: subset the data for individual report objects in your reports by using any number of data items and operators (for example, OR and AND) in the same expression. For more information, see About Advanced Report Filters on page 31.
  - Data source filters: subset the data for the entire report. The data source filters that you create are applied to every report object in the report that uses that data source. For more information, see About Data Source Filters on page 33.
- **Post-aggregate Report Filters**
  - subset the data for individual report objects in your reports by using the aggregated values, not the summarized values. For more information, see About Post-Aggregate Report Filters on page 35.

Here are some key points about report filters:

- All of your filters are saved when you save your report.
- Filters can accept parameters. For more information, see Working with Parameters in Reports on page 18.
- If you change a report filter from a detail filter to a post-aggregate filter, then all of the selections for the filter will be lost. The same is true if you change a post-aggregate filter to a detail filter. There is a warning message for both cases.
- One data item cannot have both a detail data item filter and a post-aggregate data item filter.
Deselect the button above the report canvas until you are ready to apply your filter changes.

Filters can be added to a report object before the data roles are assigned.

Note: Report linking is a type of filter. The report page that is the target of the link is filtered by the values selected in the linked report object. For more information, see Overview of Report Links on page 37.

Using Detail Report Filters

About Basic Report Filters

For certain report objects, you can subset your data by using the Filters pane. You can base your filters on any data item in the current data source for this report object, regardless of whether the data item is assigned to a report object in the current report.

Note: If you have multiple basic filters, SAS Visual Analytics assumes that there is an AND operator between the filters.

Create a Basic Report Filter

1. If it is not already selected, select the report object in the canvas that you want to filter. The report object must have at least one data item assigned.

2. Click . The Filters pane is displayed.

3. Click Add, and select a data item from the list.

4. Select the data values for the filter.

   For a basic filter that uses discrete values, a check box is displayed for each distinct value that uses the current format applied to the data item. To the right of each value, a bar indicates the frequency. Select the data values that you want to filter or clear the selections for the data values that you do not want to filter.

   For a filter that uses continuous values, a slider shows you the maximum values and the minimum values that exist for the data item using the current data item format. Use the slider to select a range of target values. You can also specify the minimum and maximum values by clicking each slider, and then entering the value in the text box.

   TIP Use the arrow beside the filter name in the Filters pane to expand or collapse the filter details when you are working with multiple filters.

5. (Optional) If your data contains missing values, and you want to exclude those missing values from your report, then clear the Include missing values check box.

6. Click (to the left of the delete icon) for options. The available options depend on whether you are filtering characters, dates, or numerics. You can sort the values or frequencies in the filter.

   For continuous data, you can select the Condition type for your filter. For example, you can change the filter to select values that are outside of the selected range.

7. (Optional) If you cleared the button above the report canvas while you worked on your filter, then select it when you are ready to apply your filter changes.
Create a Basic Report Filter from a Data Selection

1. If it is not already selected, select the report object in the canvas that you want to filter. The report object must have at least one data item assigned.

2. Select the data values in the report object that you want to isolate or exclude.

3. From the object toolbar, select \[\text{Include only selection}\] and then select one of the following options:
   - **Include only selection**: creates a filter that shows only the selected data values.
   - **Exclude selection**: creates a filter that hides the selected data values.

Note: You can edit or remove the filter on the Filters pane.

Edit a Basic Report Filter

1. If it is not already selected, select the report object in the canvas that you want to filter. The report object must have at least one data item assigned.

2. Click \[\text{Edit}\]. The Filters pane is displayed.

3. Edit your filter.

4. (Optional) Edit the expression for your filter. Click \[\text{Advanced edit}\] (to the left of the delete icon) for options. Then, select Advanced edit. The Edit Filter Expression window is displayed.
   - You can create an expression using both Visual and Text modes.
   - You can drag and drop conditions and operators onto the expression in Visual mode.
   - You can enter the expression in Text mode. For more information, see Reference: Editing a Data Expression in Text Mode on page 47.

For more information, see Reference: Conditions for Filters on page 68.

Note: The AND and OR operators can accept more than two conditions. To add a condition to the operator, drag and drop a condition onto the operator name in the right pane. For example, to add a third condition to an AND operator, drag and drop the new condition onto AND in the expression.

**TIP** Right-click the AND or OR operator in the expression, and then select Add \[\text{New Condition}\].

5. Click OK to apply the filter.

Delete a Basic Report Filter

To delete a basic report filter, click \[\text{Delete}\] beside the filter in the Filters pane.

About Advanced Report Filters

For most report objects, you can create advanced filters to subset your data by using the Filters pane in SAS Visual Analytics.

Advanced filters enable you to create filters that use more than one data item.
Create an Advanced Report Filter

1. If it is not already selected, select the report object in the canvas that you want to filter. The report object must have at least one data item assigned.

2. Click \( \text{ Filters pane is displayed.} \)

3. Click \( \text{ Add advanced filter instead of selecting a specific data item. The Add Advanced Filter window is displayed.} \)

4. Specify a \( \text{Name. The filter name identifies the advanced filter in the Filters pane.} \)

5. Create a condition for the filter. You can use Visual mode, Text mode, or a combination of both modes.
   - To create a condition using Visual mode:
     a. From the Data Items list, select the data item on which the condition is based.
     b. From the Conditions list, select a condition. For more information, see Reference: Conditions for Filters on page 68.
     c. Drag and drop the condition onto the expression.
     d. For any required parameters, select the parameter, and enter a value, or right-click on the parameter field, and select Replace with to select a data item.
   - For information about Text mode, see Reference: Editing a Data Expression in Text Mode on page 47.

6. (Optional) Add operators to the expression. You can use Visual mode, Text mode, or a combination of both modes.
   - To add operators using Visual mode:
     a. From the Operators list, select an operator to join the conditions in your expression. For more information, see Reference: Conditions for Filters on page 68.
     b. Drag and drop the operator onto the expression.
     c. From the Conditions list, select another condition. Then, drag and drop the additional condition onto the expression. Complete any required parameters.

   **TIP** Right-click the AND or OR operator in the expression, and then select \( \text{ Add } \Rightarrow \text{ New Condition.} \)

7. Click OK to apply the filter.

8. (Optional) If you deselected the \( \text{ button above the report canvas while you worked on your filter, then select it when you are ready to apply your filter changes.} \)

Edit an Advanced Report Filter

1. If it is not already selected, select the report object in the canvas that you want to filter. The report object must have at least one data item assigned.

2. Click \( \text{ The Filters pane is displayed.} \)

3. Click \( \text{ (to the left of the delete icon) for options. Then, select Advanced edit. The Edit Advanced Filter window is displayed.} \)
4 Edit or add a condition for the filter. You can use Visual mode, Text mode, or a combination of both modes. 

To add conditions using Visual mode:

a From the Data Items list, select the data item on which the condition is based.

b From the Conditions list, select a condition. For more information, see Reference: Conditions for Filters on page 68.

c Drag and drop the condition onto the expression.

d For any required parameters, select the parameter, and enter a value, or right-click the parameter field, and select Replace with to select a data item.

For information about Text mode, see Reference: Editing a Data Expression in Text Mode on page 47.

5 (Optional) Replace a condition by dragging and dropping a new condition onto the existing condition in the expression in the Visual mode. Or, remove a condition using the Text mode.

6 (Optional) Add an operator to the expression. You can use Visual mode, Text mode, or a combination of both modes.

To add an operator using Visual mode:

a From the Operators list, select an operator to join the conditions in your expression. For more information, see Reference: Conditions for Filters on page 68.

b Drag and drop the operator onto the expression.

c (Optional) Add a condition.

TIP Right-click the AND or OR operator in the expression, and then select Add ð New Condition.

7 (Optional) Delete part of an expression by highlighting the part of the expression that you want to delete, and then selecting Delete or Clear.

8 Click OK to apply the advanced filter.

Delete an Advanced Report Filter

To delete an advanced filter, click beside the filter in the Filters pane.

About Data Source Filters

Data source filters are used to restrict the data that is displayed in a report. The data source filters that you create in SAS Visual Analytics are applied to every report object in the report that uses the data source. A report that has multiple data sources can contain multiple data source filters.

You can use either continuous values or discrete values to create a data source filter. Continuous value filters can be used only for measures. Discrete value filters can be used for any character; numeric; or date, datetime, or data item; as long as the total number of distinct values does not exceed a maximum number.

Data source filters are not displayed in the Filters or the Data panes. A data source filter updates the cardinality values that appear in the Data pane.

There is a limit of one data source filter per data source. However, if you want to filter on more than one data source, you can create a combination filter.
Create a Data Source Filter

1. In the Data pane, click \( \text{ } \). The Add Data Source Filter window is displayed.

2. Add a condition for the filter. You can use the Visual mode, Text mode, or a combination of both modes.
   To add conditions using the Visual mode:
   a. From the Data Items list, select the data item on which the condition is based.
   b. From the Conditions list, select a condition. For more information, see Reference: Conditions for Filters on page 68.
   c. Drag and drop the condition onto the expression.
   d. For any required parameters, select the parameter, and enter a value, or right-click the parameter field, and select Replace with to select a data item.

   For information about Text mode, see Reference: Editing a Data Expression in Text Mode on page 47.

3. (Optional) Replace a condition by dragging and dropping a new condition onto the existing condition in the expression on the Visual mode. Or remove a condition using the Text mode.

4. (Optional) Add an operator to the expression. You can use the Visual mode, Text mode, or a combination of both modes.
   To add an operator using the Visual mode:
   a. From the Operators list, select an operator to join the conditions in your expression. For more information, see Reference: Conditions for Filters on page 68.
   b. Drag and drop the operator onto the expression.
   c. (Optional) Add a condition.

   TIP Right-click the AND or OR operator in the expression, and then select Add \( \Rightarrow \) New Condition.

5. (Optional) Delete part of an expression by highlighting the part of the expression that you want to delete, and then selecting Delete or Clear.

6. Click OK to apply the filter. The \( \text{ } \) in the Data pane is highlighted to indicate that a data source filter has been applied.

Edit a Data Source Filter

1. In the Data pane, click \( \text{ } \), and select Edit data source filter. The Edit Data Source Filter window is displayed.

2. Add or modify the condition for the filter. You can use the Visual mode, Text mode, or a combination of both modes.
   To edit conditions using the Visual mode:
   a. From the Data Items list, select the data item on which the condition is based.
   b. From the Conditions list, select a condition. For more information, see Reference: Conditions for Filters on page 68.
Drag and drop the condition onto the expression.

For any required parameters, select the parameter, and enter a value, or right-click the parameter field, and select **Replace with** to select a data item.

For information about **Text** mode, see Reference: Editing a Data Expression in Text Mode on page 47.

3 Edit the operator in the expression. You can use the **Visual** mode, **Text** mode, or a combination of both modes.

4 Click **OK** to apply the data source filter.

**Delete a Data Source Filter**

In the **Data** pane, click and select **Delete data source filter**. The in the **Data** pane is no longer highlighted, which indicates that a data source filter has been removed.

**Use Post-Aggregate Report Filters**

**About Post-Aggregate Report Filters**

Post-aggregate filters subset the data for individual report objects in your reports by using the aggregated values, not the summarized values. You can use the Filters pane to filter data in a report object using an aggregated value instead of a detail value. Post-aggregate filters are available only for measure data items. When a report object has both ranks and post-aggregate filters applied, the ranks are applied before the post-aggregate filters.

Here are some key points about post-aggregate filters:

- Post-aggregate filters are not available for report objects that use detail data.
- Crosstabs, time series plots, and dual axis time series plots do not support post-aggregate filters.

**Create a Post-Aggregate Report Filter**

1 If it is not already selected, select the report object in the canvas that you want to filter. The report object must have at least one data item assigned.

   **TIP** Clear the **Auto-update** check box above the report canvas until you are ready to apply your filter changes.

2 Click . The **Filters** pane is displayed.

3 Click **Add**, and select a measure data item from the list. The filter appears in the **Filters** pane.

4 Select the **Filter aggregate values** check box. A slider shows you the maximum and minimum data values that exist for the data item using the current data item format. Use the slider to select a range of target values.

   **Note:** The post-aggregate filter tracks the aggregation associated with the data item. If you change the aggregation using the **Data** pane, then the filter name in the **Filter** pane reflects that change. For example, if you create a post-aggregate filter for a data item called **Sales**, it is initially displayed in the **Filters** pane as **Sales (sum)**. In the **Data** pane, you change the aggregation to **Average**. In the **Filters** pane, the filter name is displayed as **Sales (Average)**. The post-aggregate filter attempts to keep the same range of data values that you originally selected for the aggregation.
TIP Use the arrow to the left of the filter name in the Filters pane to expand or collapse the filter details when you are working with multiple filters.

5 (Optional) Click the beside the filter name to change the operator. Select Condition type, and then select an operator.

6 (Optional) Change the lower and upper values for the post-aggregate filter by clicking the value sliders, and then entering a new value.

7 (Optional) If your data contains missing values, and you want to exclude those missing values from your report, then clear the Include missing values check box.

8 (Optional) If you deselected the button above the report canvas while you worked on your filter, then select it when you are ready to apply your filter changes.

Delete a Post-Aggregate Report Filter
To delete a post-aggregate filter, click beside the post-aggregate filter in the Filters pane.

Working with Report Actions and Links

Overview of Report Actions
Actions are used to direct a report viewer’s attention to specific results in a report. (Prior to the 8.1 release, actions were known as report interactions.) Actions allow data to be subset to reduce the amount of data, and they enable users to understand the data within a particular context.

The Actions pane in SAS Visual Analytics enables report designers to specify which actions they would like to add to tables, graphs, gauges, and controls in a report.

There are these types of report actions:

linked selection
allows you to show the same data selected simultaneously in two or more tables, graphs, or controls. (Prior to the 8.1 release, linked selection was known as data brushing.) The linked selection highlights a percentage that reflects the number of shared observations in the data set. The linked selection does not highlight a percentage that corresponds to the aggregated value. The data for the linked selection has the same appearance in each object, which makes the data easily apparent to report viewers.

filter
is used to restrict the data that is returned from a query to a data source. Filters are simply a set of rules or conditions that you specify to subset the data that is displayed in a table or graph. The goal is to display only the data that you need to see to perform your analysis.

link
enables single-step access to a report or web page that is related to a report that you are currently viewing. You can add a link from a report object to another report, to a specific page in the current report, or to an external URL. If a destination report contains multiple pages, then you are able (when defining the link) to choose the initial page of the destination report that you want to open first.

Linking has elements of both a filter and an action. A report page that is the target of a link is filtered by the values that are selected in the linked report object.

Tables and graphs can be the source of an action, with the exception of time series plots. Report objects that use detail data cannot be the source of an action. Controls that are used on the canvas can also be the source
of an action. Controls that are used as page prompts are treated as automatic filters and are not displayed in the actions view.

Create a Linked Selection

A linked selection enables you to show the same data selected simultaneously in two or more tables, graphs, or controls.

1. Add the report objects that you want to use to the canvas. For example, you might have a bar chart, a line chart, and a list table.
2. If the Actions pane is not already displayed, click .
3. Click Add, and then select Add linked selection. The Add Linked Selection Action window is displayed.
4. Select a Target (or multiple targets).
5. Click OK. The new linked selection action is displayed in the Actions pane.

Create a Filter

1. Add the report objects that you want to use to the canvas. For example, you might have a bar chart, a line chart, and a list table.
2. If the Actions pane is not already displayed, click .
3. Click Add, and then select Add filter. The Add Filter Action window is displayed.
4. Select a Target (or multiple targets).
5. Click OK. The new filter is displayed in the Actions pane.

Here are some key points about creating filter actions:

- You cannot create actions from list tables, bubble plots, and scatter plots that use detail data. However, a list table that uses detail data can be the target of an action.
- Scatter plots cannot be the source of an action.
- Bubble plots can be the source of an action only if they have a Grouping role assigned.
- Sliders can be the target of an action. However, a slider that has the Set fixed range property set will not do anything when it is filtered because its data is fixed.
- Prompt containers enable you to delay the execution of actions to report objects that are outside of the prompt container. However, actions between report objects that are inside a prompt container are never delayed.

Overview of Report Links

Report links enable single-step access to a report or web page that is related to a report that you are currently viewing. For example, you might be looking at a bar chart that has sales information for each geographical region of your company. If you click the bar for the Northeast region, then a report link associated with the graph could take you to a different report that provides information about employees in each region. You can click in the top left corner of a destination report to return to the previous report.
Using SAS Visual Analytics, you can add a link from a report object to another report, to a specific page or a hidden page in the current report, or to an external URL. If a destination report contains multiple pages, then you are able (when defining the link) to choose the initial page of the destination report that you want to open first. For more information, see “Overview of Pages” in SAS Visual Analytics: Designing Reports.

If you click a page link to go to another page in a report, use the in the upper left corner of the workspace to return to the original page.

Create a Link

Note: The following steps do not apply to text objects. For more information, see Create a Link from a Text Object on page 39.

To add a link from a report object, text, or image to a specific page in the same report, another report, or a URL:

1. Add the report objects and pages that you want to use to the canvas.
2. Select the report object, text, or image that you want as the source for the link.
3. If the Actions pane is not already displayed, click .
4. Click Add, and then select one of the following:
   - Add page link enables you to use the Add Page Link Action window to select the page or pages that you want to link to if your report has multiple pages.
   - Add report link enables you to use the Add Report Link Action window to select the target page and the open page.
   - Add URL link enables you to use the Add URL Link Action window to enter a Name and the URL.

   Note: UTF-8 is supported for URL links.

   TIP Do not add parameters to the URL field. Click to specify additional parameters, such as a Target. These additional parameters are automatically added to the URL.

   (Optional) Add one or more Parameters.

5. Click OK. The new link is displayed in the Actions pane.

Note: You cannot test report links from within SAS Visual Analytics. You must save the report, and then switch to SAS Report Viewer (the viewer). You can test report links in the viewer.

Edit a Link

You can edit report links and URL links using the Actions pane.

1. Click beside the link name in the Actions pane.
2. Make changes to the link.
3. Click OK to save your changes.
Create a Link from a Text Object

You can add a link from a text object to a URL.

1 Double-click inside a text object on the canvas, and enter the text.
2 Select some or all of the text, and then click $\text{🔗}$. The Link window is displayed. **URL** is selected as the Link Type.
3 Select a Protocol. You can choose **http://**, **https://**, **ftp://**, **news://**, or **<other>**. **http://** is the default.
4 Enter a **URL**.
5 Click **OK**. The text that you selected is a link in the text object.

   Note: Text links are not displayed in the **Actions** pane.

Map Data Sources

The source and target of an action or link should be based on the same data source. You might be prompted to map data sources so that an action or link works properly in these situations:

- When you try to create an action or link between a report object that uses one data source and another report object that uses a different data source.
- When you try to create a link between a report object that uses one data source and a report section that uses a different data source.
- When you try to create a link between a report object that uses one data source and a report that uses a different data source.

Here are some key points about mapping columns in data sources:

- A column in one data source can be mapped only once to another data source. If you need to map a column more than once, then the column needs to be duplicated in the data source.
- Mapped columns must share the same format for filters to work. For example, if the format of the source column is MMDDYYYY and the format of the target column is DDMMYYYY, then a filter will not work.

To map data sources using the Map Data window:

1 Use the **Source** drop-down list to select a column from the first data source.
2 Use the **Target** drop-down list to select a corresponding column from the second data source.

Here is an example of the Map Data window for an action between two list tables that have different data sources:
TIP If there are multiple data sources, and you do not want to link to all of them, you can select the Enable data source mapping check box.

For page links, you are not required to map the data sources. If you choose not to map the data sources, then the filters are not carried over.

3 Map additional data items. Click +.

Note: If you create interactions between multiple objects using the same data source, but on different columns in that data source, then you must map each and every column in a Map Data window. If you do not do this, then a subsequent mapping for the data source overrides a previous mapping.

4 Click OK.

Delete a Report Action

To delete a report action, click beside the action name in the Actions pane.
Ranking Values in Reports

About Ranks

Using SAS Visual Analytics, you can rank the data in a report object to show the top (greatest) count or percent or the bottom (least) count or percent for a category that is based on a measure. For a list table, you can also rank across a set of categories for the top value or bottom value in the set. A rank filters the values of a category based on the aggregated measure by the top or bottom of the values. A rank greatly reduces the visible categories to make it easier to focus on the top value or bottom value that interests a user.

For example, you might create a rank of the top 10 countries by frequency to select the 10 countries that are most represented in your report. As another example, you might create a rank of the top 10 countries by population to select the 10 countries with the greatest populations.

Here are some key points about ranks:

- Controls and gauges support ranks.
- Ranks can accept parameters. For more information, see Working with Parameters in Reports on page 18.
- Ranks can be added to a report object before the data roles are assigned.
- A slider control that has a category data item assigned to it cannot have a rank.

Add a New Rank

Note: A single category rank ranks the top of a single category.

1. If it is not already selected, select the object on the canvas that you want to update.

2. If the Ranks pane is not already displayed, click .

3. Click Add.

4. Select a data item. You can select any category or geography data item, regardless of whether it is assigned to the current report object. The new rank is displayed in the Ranks pane.

For list tables only, you can select All visible categories. This rank ranks across the intersection. The top or bottom combination of the visible categories is displayed. For example, you select the region and product data items. You rank on the top 10 by profit. The top 10 region and product combinations are displayed. In this case, the column is no longer considered a single column, it is considered the crossing of the columns.

Note: If a list table has a rank for All visible categories, then that is the only rank that it can have.

The Detail Rank option is available for list tables, bubble plots, and scatter plots that show detail data. If there is an aggregated filter in the data definition, you cannot have a detail rank. If the report object has a detail rank, then it is the only rank that it can have. Otherwise, report objects can have multiple ranks.

5. (Optional) Select the type of rank from the drop-down list. These types are available:

   - Top count specifies that the rank selects the greatest values.
   - Bottom count specifies that the rank selects the least values.
   - Top percent specifies that the rank selects the greatest percentages.
   - Bottom percent specifies that the rank selects the least percentages.
6 If you selected Top count or Bottom count, use the Count field to specify a number for the rank. For example, if you select 5, then the rank selects the five greatest values. The Count field also lets you add a parameter.

Click \( \downarrow \) to select a count or enter a number in the Count field.

To add a parameter:

a Click \( \downarrow \) and select Add parameter.

b Use the Add Parameter window to specify the Name, Type, Minimum value, Maximum value, Format, and Current value.

c Click OK to save your changes. For more information, see Working with Parameters in Reports on page 18.

7 If you selected Top percent or Bottom percent, use the Percent field to enter a number between 1 and 99. The Percent field also lets you add a parameter.

To add a parameter:

a Click \( \downarrow \) and select Add parameter.

b Use the Add Parameter window to specify the Name, Type, Minimum value, Maximum value, Format, and Current value.

c Click OK to save your changes. For more information, see Working with Parameters in Reports on page 18.

8 From the By drop-down list, select the measure that is used to create the rank. You can select any measure.

9 (Optional) Select Ties to include ties in the rank.

If you select Ties, then the rank selects as many values as necessary to include all of the ties. If you do not select Ties, then the rank selects only the number of values that are specified by the rank parameters.

For example, if your rank selects the top three values, but there are five values tied for the greatest value, then the number of values that are selected by the rank depends on the Ties option. If you select Ties, then the rank includes all five of the tied values. If you do not select Ties, then the rank includes only three of the tied values.

10 (Optional) For category-specific ranks, you can select All Other to show the measurements for the categories that did not qualify as a top or bottom value. This option is not available if the report object is showing only detail values.

Here are some key points about the All Other option:

- The option is available when you are ranking visible categories in certain types of report objects.
- The option applies only to the category that is being ranked. For example, suppose that you have Region and Product categories assigned to a list table. Then, you apply a Region rank with the All Other option set, so the “All Other” value might appear as a Region value, but not as a Product value.

If you want to combine category values that are excluded by rank into “All Other”, then you need to use the All Other option. For more information, see “Use the Combine Excluded into “All Other” Option” in SAS Visual Analytics: Working with Report Content.

- The option is not available if the rank is on a prompt control, geo bubble map, geo coordinate map, or geo region map.
- When the option is specified for a report object, the total, subtotal, and percent of total show values with respect to all of the data, rather than data just relative to data qualifying under the rank. The data that does not fit into the top or bottom of the rank is aggregated in the All Other category.
You can use this option with a ranking to reduce the number of slices in a pie chart. However, this means the “Other” slice must be removed from the pie chart.

If this option is selected, then any **All Other** value that appears in a table or graph cannot be selected. This means that the **All Other** value cannot be the source value for an action.

If you do not select **All Other**, then the rank shows only the data as filtered by the category values that qualify as the top or bottom value.

By default, your new rank is applied automatically to the report object.

You can add more than one rank to a report object, as long as the first rank is not a **Detail Rank** or an **All visible categories** rank.

Here is an example of a pie chart that shows the profit for multiple product lines before a rank is applied:

![Pie chart before rank](image)

Here is the same pie chart after a rank of the top five product lines is added. The **All Other** option was selected, so the “Other” slice is not displayed.
Delete a Rank

To delete a rank, click beside the rank name in the Ranks pane.

Exporting Data

Overview of Exporting Data

Users can use SAS Visual Analytics to export data from report objects to Microsoft Excel format for future viewing or printing. This exported output can be saved locally on disk, and then opened in Microsoft Excel. Or, you can choose to create a data file. The data file can be a tab-separated values (TSV) file or a comma-separated values (CSV) file.

Here are some key points about exporting data:

- When you export a graph from SAS Visual Analytics, you are exporting the data, not the visual graph representation.
- Not all report objects support the exporting feature. For example, you cannot export data from gauges. If the export feature is not available for a particular report object, the Export data menu item does not appear on the options menu for the object.
- SAS Visual Analytics does not preserve leading blanks in displayed or exported data. However, you can filter for values that contain leading blanks.
- SAS Visual Analytics does not support exporting supplemental characters.
n When you export detailed data from a crosstab or a list table to Excel, totals are not exported.

n SAS Visual Analytics uses the browser locale when exporting data.

**Export Data from a Table or a Graph**

1. If the table or graph that you want to export data from is not already selected, then select it.

2. Click for the table or the graph. Click , and then select Export data. The Export Data window is displayed.

Here is an example of the Export Data window for a list table:

```
Export Data

Rows:
1 - 26

Columns:
☑ Select all
☑ Product Line
☑ Product
☑ Expenses
☑ Profit

Options:
☑ Formatted data
☐ Detailed data

File type:
Excel workbook (*.xlsx)
```

3. Choose the **Rows** to export. This option is always available for tables, and when the **Detailed data** option is selected for other graph objects.

   The number of rows that you can export is the smaller of these two amounts:
   - The range from zero up to the system row limit for the selected export type and the range.
   - The range from zero up to the number of rows actually displayed by the report object (where the displayed rows might have been truncated due to limits associated with a particular object type).

4. Choose **Columns** to export. If you choose individual columns, select the check box (or check boxes) to the left of the column (or columns) that you want to export. At least one column is required.
Export Data from an Analytic Object

To use analytic objects, your site must have a SAS Visual Statistics license or a SAS Visual Data Mining and Machine Learning license. If you are using analytic objects, follow these steps to export data:

1. While in explore mode, click for the analytic object. Click , and then select Export data. The Export Data window is displayed.

Here is an Export Data window for a decision tree with formatted data:

![Export Data Window](image)

2. Specify the data Options:
   - Either select or clear the Formatted data check box. This check box is selected by default.
   
   When this option is selected for analytic objects, the summary tables in explore mode are exported as separate Excel worksheets.
Either select or clear the **Detailed data** check box. When you select this option, all of the columns in the data set are selected. The Export Data window content changes, so you can select the **Rows** and the **Columns** that you want to export.

3. For **File type**, select **Excel workbook (*.xlsx)** to create a Microsoft Excel workbook, or either **Tab-separated values (*.tsv)** or **Comma-separated Values (*.csv)** to create a data file.

   **Note:** The contents in an exported CSV file can display differently depending on the application that opens the file.

4. Click **OK**.

5. When you are prompted, choose either to open the file or to save it.

---

**Reference: Editing a Data Expression in Text Mode**

**Overview of Text Mode**

In SAS Visual Analytics, you create and edit filters, calculated items, and aggregated items by using an expression editor. The **Text** mode of the expression editor enables you to edit the expression as text.

You can add operators and data items to your expression by dragging and dropping them onto the expression or by entering the names of the operators or data items.

When you make changes to your expression, it is automatically evaluated to determine whether it is valid. If the expression is not valid, then an error appears on the **Messages** tab, and the **OK** button is disabled. There might be a brief delay as your expression is evaluated.

**Specifying Operator Parameters**

When you add an operator to the expression, any parameters that are required by the operator are represented between braces `{ }`. For example, if you add the `x – y` operator, then your expression appears as `{Number} — {Number}`.

Each parameter value that you enter should replace the entire string between the braces, including the brace characters. For example, you might replace `{Number}` with 12 or with a data item such as **Expenses**.

You can automatically select the next operator in the expression by pressing Ctrl + Shift + spacebar.

**Specifying Data Item Names and Global Parameter Names**

Data item names and global parameter names can be entered as plain text and are not case sensitive. You can enter names formally by using the format `'data-item-name'n` for a data item, or `'parameter-name'p` for a global parameter. If you switch to **Visual** mode, then all of your names are converted to the formal format.

**Note:** If a name contains quotation marks, then you must use the `\` character to escape the quotes.

**Note:** If a name contains spaces, then you must use the formal format.

**Note:** If a data item or global parameter has the same name as an operator, then you must use the formal format. For example, if you have a category named **Year**, then enter the name as `'Year'n` to avoid conflict with the **Year** operator.
Using Formatted and Unformatted Values

By default, category values and discrete numeric and date values are evaluated as formatted values. Continuous numeric values are evaluated as unformatted values.

To override this default behavior, you can add [raw] (to use unformatted values) or [formatted] (to use formatted values) to the right of the data item.

For example, 'Expenses'n[formatted] specifies that the Expenses measure is evaluated as a formatted value.

Specifying String Values

To enter a string value, you can enter the string between single quotes or double quotes. If your value contains a quotation mark, use the \ character to escape the quote. If you use double quotes to enclose the string, then you do not need to escape the single quotes. If you use single quotes to enclose the string, then you do not need to escape the double quotes. For example, "O'Reilly", 'O\'Reilly', and "Hello" are all valid.

To enter a string that contains a newline character, use \r, \n, or both to specify the newline character.

Specifying Date and Datetime Values

For date and datetime values, specify a formatted value in quotes, followed by the letter “d” for a date value or the letters “dt” for a datetime value.

Here are some examples of date and datetime values:

<table>
<thead>
<tr>
<th>Date</th>
<th>'23JUN2013'd</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>'JUN2013'd</td>
</tr>
<tr>
<td></td>
<td>'2013'd</td>
</tr>
<tr>
<td></td>
<td>'q32013'd</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Datetime</th>
<th>'23JUN2013_5:23:55'dt</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>'23JUN2013_5:23'dt</td>
</tr>
<tr>
<td></td>
<td>'23JUN2013'dt</td>
</tr>
</tbody>
</table>

Specifying Aggregated Values

For aggregated values, specify the format, aggregation-type [context] (value), where context specifies one of the following aggregation contexts:

ByGroup

calculates the aggregation for each subset of the data item that is used in a report object. For example, in a bar chart, an aggregated measure with the ByGroup context calculates a separate aggregated value for each bar in the chart.

ForAll

calculates the aggregation for the entire data item (after filtering). For example, in a bar chart, an aggregated measure with the ForAll context uses the same aggregated value (calculated for the entire data item) for each bar in the chart.
Aggregated (Simple) Operators on page 55 for a list of the aggregation types that are available.

For example, `sum [bygroup] ('cost'n)` aggregates the sum of the measure COST for each BY-group value.

Specifying a Missing Value

Use a period character (.) to specify a missing numeric or date value. Use empty quotes ('') to specify a missing string value.

Reference: Aggregations for Measures

The aggregation that is assigned to a measure determines how its values are summarized in a report object. For example, in a bar chart of Sales by Quarter, a bar represents the aggregated values of the Sales measure for a specific quarter. If the aggregation for Sales is Sum, the bars represent the sum (total) of sales for each quarter. If the aggregation for Sales is Average, the bars represent the average sales for each quarter.

The aggregation types can override the data format that is used to display values in a visualization or report object. For example, if a measure has the Currency format with zero decimal places of precision and you apply the Variance aggregation, then the values are displayed using the Comma format with two decimal places of precision instead.

You can specify the following aggregations for your measures:

- **Sum**: Calculates the sum (total) of the values of a measure.
- **Average**: Calculates the average (mean) value of a measure.
- **Standard Deviation**: Calculates the standard deviation of a measure.
- **Standard Error**: Calculates the standard error of the mean of a measure.
- **Variance**: Calculates the variance of a measure.
- **Count**: Calculates the total number of nonmissing values of a measure.
- **Number Missing**: Calculates the number of missing values in a measure.
- **Minimum**: Calculates the smallest value of a measure.
- **First Quartile**: Calculates the first quartile of a measure.
- **Median**: Calculates the median value of a measure.
- **Third Quartile**: Calculates the third quartile of a measure.
- **Maximum**: Calculates the largest value of a measure.
Skewness calculates the skewness of a measure. Skewness indicates the distribution of values. A positive value indicates that the distribution is heavier for values greater than the mean. A negative value indicates that the distribution is heavier for values less than the mean.

Kurtosis calculates the kurtosis of a measure. The kurtosis value indicates how peaked the distribution is. A larger value indicates a more sharply peaked distribution. A smaller value indicates a flatter distribution.

Coefficient of Variation calculates the coefficient of variation of a measure. The coefficient of variation is the ratio of the standard deviation to the mean.

Uncorrected Sum of Squares calculates the uncorrected sum of squares of a measure. The uncorrected sum of squares is the sum of the squared values.

Corrected Sum of Squares calculates the corrected sum of squares of a measure. The corrected sum of squares is the sum of the squared deviations from the mean.

T-statistic (for Average = 0) calculates the Student’s $t$ statistic for a measure, assuming a mean value of zero.

P-value (for T-statistic) calculates the probability of observing the $t$ statistic value or a more extreme value. A small value indicates that the mean is likely not equal to zero.

---

Reference: Operators for Data Expressions

Overview of Operators for Data Expressions

In SAS Visual Analytics, you can calculate data items and create filters by using expressions that contain operators.

Numeric (Simple) Operators

- $-x$ returns a value with the opposite sign of the input value.
  
  For example, $-1$ returns 1 and $-1$ returns -1.

$\mathbf{x - y}$ subtracts the second value from the first value.

  For example, $2 - 1$ returns 1.

$\mathbf{x * y}$ multiplies the first and second values together.

  For example, $2 * 3$ returns 6.

$\mathbf{x / y}$ divides the first value by the second value.

  For example, $6 / 2$ returns 3.

$\mathbf{x + y}$ adds the first and second values together.
For example, \( 1 + 2 \) returns 3.

**Comparison Operators**

**BetweenExclusive**
returns true if the first value is within the range defined by the second and third values (excluding the bounding values).

For example, \( X \text{ BetweenExclusive}(50, 100) \) returns true if \( X \) is greater than 50 and less than 100.

**BetweenInclusive**
returns true if the first value is within the range defined by the second and third values (including the bounding values).

For example, \( X \text{ BetweenInclusive}(50, 100) \) returns true if \( X \) is greater than or equal to 50 and less than or equal to 100.

**In**
returns true if the first value is in the list specified by the second parameter. Select your list by choosing the values from the drop-down list or the selector window.

For example, \( X \text{ In ('A', 'B', 'C')} \) returns true when the value of \( X \) is either A, B, or C.

**Note:** This operator cannot be used to compare measures.

**Missing**
returns true if the value is a missing value.

For example, \( X \text{ Missing} \) returns true if the value of \( X \) is missing.

**NotBetweenExclusive**
returns true if the first value is outside the range defined by the second and third values (excluding the bounding values).

For example, \( X \text{ NotBetweenExclusive}(50, 100) \) returns true if \( X \) is less than 50 or greater than 100.

**NotBetweenInclusive**
returns true if the first value is outside the range defined by the second and third values (including the bounding values).

For example, \( X \text{ NotBetweenInclusive}(50, 100) \) returns true if \( X \) is less than or equal to 50 or greater than or equal to 100.

**NotIn**
returns true if the first value is not in the list specified by the second parameter. Select your list by choosing the values from the drop-down list or the selector window.

For example, \( X \text{ NotIn ('A', 'B', 'C')} \) returns true when the value of \( X \) is not A, B, or C.

**Note:** This operator cannot be used to compare measures.

**NotMissing**
returns true if the value is not a missing value.

For example, \( X \text{ NotMissing} \) returns true if the value of \( X \) is not missing.

\( x < y \)
returns true if the first value is less than the second value.

\( x \leq y \)
returns true if the first value is less than or equal to the second value.

\( x \neq y \)
returns true if the first value is not equal to the second value.
x = y
returns true if the first value is equal to the second value.

x > y
returns true if the first value is greater than the second value.

x >= y
returns true if the first value is greater than or equal to the second value.

**Boolean Operators**

AND
joins two conditions and returns true if both conditions are true.

For example, (1 = 1) AND (2 = 2) returns true, and (1 = 1) AND (2 = 1) returns false.

IF... ELSE
returns different values, depending on whether the condition is true. The first parameter specifies the condition. The second parameter specifies the value to return if the condition is true. The third parameter specifies the value to return if the condition is false.

For example, if (X > Y) return X else Y returns the value of X if X is greater than Y, but returns the value of Y otherwise.

**Note:** Starting in the 7.1 release, the IF... ELSE operator can also be used in report filters.

NOT
returns true if the condition is false.

For example, not (1 = 2) returns true.

OR
joins two conditions and returns true if either condition is true.

For example, (1 = 1) OR (2 = 2) returns true, and (1 = 1) OR (2 = 1) returns true.

**Numeric (Advanced) Operators**

Abs
returns the absolute value of the input value.

For example, Abs(-3) returns 3.

Ceil
rounds the input value up to the nearest integer.

For example, Ceil(4.2) returns 5 and Ceil(-4.8) returns -4.

Exp
raises the constant e to the power specified by the input value.

For example, Exp(5) returns e to the 5th power (148.41).

Floor
rounds the input value down to the nearest integer.

For example, Floor(4.8) returns 4 and Floor(-4.2) returns -5.

Ln
returns the natural logarithm (base e) of the input value.

For example, Ln(10) returns the eth root of 10 (2.30...).
Log
returns the logarithm of the first value, where the second value specifies the base.
For example, \(64 \log 8\) returns the base 8 logarithm of 64 (2).

Mod
returns the remainder after dividing the first value by the second value.
For example, \(5 \mod 2\) returns 1.

Power
raises the first value to the power of the second value.
For example, \(5^2\) returns 5 to the 2nd power (25).

Root
returns the \(n\)th root of the first value, where the second value specifies \(n\) (the base of the root).
For example, \(27^{1/3}\) returns the 3rd (cube) root of 27 (3).

Round
rounds the first value to the number of decimal places that is specified by the second value. Select the second value from the drop-down list.
For example, \(7.354 \text{ Round } 2\) returns 7.35.

Note: If you select 0 decimal places, then the values are rounded to the nearest integer.

TreatAs
allows a numeric, date, or datetime value to be used as a different data type within other operators. Select one of the following:

_\_Date\__
allows the value to be used as a date.

_\_Datetime\__
allows the value to be used as a datetime value.

_\_Number\__
allows the value to be used as a number.

The value is treated as a raw value instead of being converted. Date values are the number of days since 01JAN1960. Datetime values are the number of seconds since 01JAN1960.

For example, \(\text{TreatAs(\_Date\_, 19600)}\) returns 30AUG2013 as a date value.

Note: The TreatAs operator is useful for calculating elapsed time between two datetime values. For example, \((\text{TreatAs(\_Number\_, '23OCT2013'd) } - \text{TreatAs(\_Number\_, '15JAN2013'd)})\) calculates the number of days between 15JAN and 23OCT, which is 281.

Trunc
truncates the input value to an integer.
For example, \(\text{Trunc(8.9)}\) returns 8 and \(\text{Trunc(-8.9)}\) returns -8.

**Date and Time Operators**

**Note:** Date and time operators are not supported for aggregated items.

DateFromMDY
creates a date value from separate month, day, and year values. The first value specifies the month as a number from 1–12. The second value specifies the day as a number from 1–31. The third value specifies the year as a four-digit number.

For example, \(\text{DateFromMDY(1, 15, 2013)}\) returns 15JAN2013.
DateFromYQ creates a date value from separate year and quarter values. The first value specifies the year as a four-digit number. The second value specifies the quarter as a number from 1–4.

For example, DateFromYQ(2013, 1) returns 01JAN2013.

Note: The date is generated using the first day of each quarter.

DatePart
converts a datetime value to a date value.

For example, DatePart('15JAN2013_17:15'dt) returns 15JAN2013.

DateTimeFromDateHMS
creates a datetime value from a date value and separate hour, minute, and second values. The first value specifies the date. The second value specifies the hour as a number from 0–23. The third value specifies the minute as a number from 0–59. The fourth value specifies the second as a number from 0–59.

For example, DateTimeFromDateHMS('15JAN2013'd, 17, 15, 23) returns January 15, 2013 05:15:23 PM.

DateTimeFromTimeMDY
creates a datetime value from a time value and separate month, day, and year values. The first value specifies the time. The time value must be specified as a datetime value where the date is 01JAN1960. The second value specifies the month as a number from 1–12. The third value specifies the day as a number from 1–31. The fourth value specifies the year as a four-digit number.

For example, DateTimeFromTimeMDY('01JAN1960_17:15:23'dt, 1, 15, 2013) returns January 15, 2013 05:15:23 PM.

TIP You can use the TimePart or TimeFromHMS operators to create a time value for the first parameter.

DayOfMonth
returns the day of the month from a date value as a number from 1–31.

For example, DayOfMonth('15JAN2013'd) returns 15.

DayOfWeek
returns the day of the week from a date value as a number from 1–7 (1 is Sunday).

For example, DayOfWeek('15JAN2013'd) returns 3 (Tuesday).

DayOfYear
returns the day of the year from a date value as a number from 1–366.

For example, DayOfYear('15FEB2013'd) returns 46.

Hour
returns the hour from a datetime value as a number from 0–23.

For example, Hour('15JAN2013_17:15:23'dt) returns 17.

Minute
returns the minute from a datetime value as a number from 0–59.

For example, Minute('15JAN2013_17:15:23'dt) returns 15.

Month
returns the month from a date value as a number from 1–12.

For example, Month('15JAN2013'd) returns 1.

Now creates a datetime value from the current date and time.
For example, `Now()` returns the current date and time.

**Quarter**
returns the quarter from a date value as a number from 1–4.

For example, `Quarter('15AUG2013'd)` returns 3.

**Second**
returns the second from a datetime value as a number from 0–59.

For example, `Second('15JAN2013_17:15:23'dt)` returns 23.

**TimeFromHMS**
creates a time value from separate hour, minute, and second values. The first value specifies the hour as a number from 0–23. The second value specifies the minute as a number from 0–59. The third value specifies the second as a number from 0–59.

For example, `TimeFromHMS(17, 15, 23)` returns January 1, 1960 05:15:23 PM.

**Note:** Time values are expressed as datetime values where the date is January 1, 1960.

**TIP** You can use the `Time` format to hide the date portion of a datetime value.

**TimePart**
converts a datetime value to a time value.

For example, `TimePart('15JAN2013_17:15:23'dt)` returns January 1, 1960 05:15:23 PM.

**Note:** Time values are expressed as datetime values where the date is January 1, 1960.

**TIP** You can use the `Time` format to hide the date portion of a datetime value.

**WeekNumber**
returns the week of the year as a number from 0–53, where week 1 begins on the first Sunday of the year. Dates before the first Sunday of the year return 0.

For example, `WeekNumber('04AUG2013'd)` returns 31.

**Year**
returns the year from a date value as a four-digit number.

For example, `Year('15JAN2013'd)` returns 2013.

**Aggregated (Simple) Operators**

**Avg**
calculates the average (mean) value of a measure.

**Count**
calculates the total number of nonmissing values of a measure.

**Distinct**
calculates the number of distinct values in a data item. If the data item contains missing values, then “missing” increases the distinct count by one.

**Max**
calculates the largest value of a measure.

**Median**
calculates the median value of a measure.

**Min**
calculates the smallest value of a measure.
NumMiss
calculates the number of missing values in a data item.

Q1
calculates the first quartile of a measure.

Q3
calculates the third quartile of a measure.

StdDev
calculates the standard deviation of a measure.

StdErr
calculates the standard error of the mean of a measure.

Sum
calculates the sum (total) of the values of a measure.

Var
calculates the variance of a measure.

**Aggregated (Advanced) Operators**

CoefVar
calculates the coefficient of variation of a measure. The coefficient of variation is the ratio of the standard deviation to the mean.

CSS
calculates the corrected sum of squares of a measure. The corrected sum of squares is the sum of the squared deviations from the mean.

First
calculates the first value of a measure based on chronological order. The first parameter specifies the measure. The second parameter specifies the sequence data item that is used to determine the chronological order. The sequence data item can be either a date or datetime data item or a numeric data item. The third parameter specifies whether missing values are included. Select _IncludeMissing_ to include missing values or select _ExcludeMissing_ to exclude missing values.

**Note:** If there are multiple measure values for the first value of the sequence data item, then the minimum measure value is selected.

**Note:** The First aggregation always calculates measure values by using the sequence data item that you specify. If your report object uses a different date or datetime data item, then the results might be misleading to viewers who do not know the expression for the aggregated data item.

Kurtosis
calculates the kurtosis of a measure. The kurtosis value indicates how peaked the distribution is. A larger value indicates a more sharply peaked distribution. A smaller value indicates a flatter distribution.

Last
calculates the last value of a measure based on chronological order. The first parameter specifies the measure. The second parameter specifies the sequence data item that is used to determine the chronological order. The sequence data item can be either a date or datetime data item or a numeric data item. The third parameter specifies whether missing values are included. Select _IncludeMissing_ to include missing values or select _ExcludeMissing_ to exclude missing values.

**Note:** If there are multiple measure values for the last value of the sequence data item, then the minimum measure value is selected.

**Note:** The Last aggregation always calculates measure values by using the sequence data item that you specify. If your report object uses a different date or datetime data item, then the results might be misleading to viewers who do not know the expression for the aggregated data item.
Percentile
calculates the specified percentile of a measure. Specify a number between 0 and 100. For example, 85 specifies the 85th percentile, the value for which 85% of the values are lower.

PvalT
calculates the probability of observing the $t$ statistic value or a more extreme value. A small value indicates that the mean is likely not equal to zero.

Skewness
calculates the skewness of a measure. Skewness indicates the distribution of values. A positive value indicates that the distribution is heavier for values greater than the mean. A negative value indicates that the distribution is heavier for values less than the mean.

TStat
calculates the Student’s $t$ statistic for a measure, assuming a mean value of zero.

USS
calculates the uncorrected sum of squares of a measure. The uncorrected sum of squares is the sum of the squared values.

Periodic Operators

About Periodic Operators
Periodic operators aggregate values over a period of time.

If you assign a periodic aggregated item to a report object that contains dates, the aggregated item displays the aggregated values for each time period in the report object.

In a report object that does not contain dates, the aggregated item displays values that use today’s date as a reference. If the date data item for the operator does not contain data for the interval that contains today’s date, then the operator returns missing values.

Periodic operators are evaluated using time intervals. Intervals specify whether the aggregation is applied on a monthly basis, a quarterly basis, and so on. You can specify a specific interval, or you can specify that the interval is inferred. For an inferred interval, the aggregation is evaluated based on its context in the report object. For example, if your report contains a bar chart of sales by month, then the inferred interval is monthly.

Note: Periodic operators return a missing value in the following scenarios:

- Data does not exist for the specified time period.
- The date data item for the period calculation does not match the date data item in the report object. You must use the same date data item or a duplicate data item that is based on the same data item.
- The interval for the operator is smaller than the interval of the date format in the report object (for example, if your interval is by month, but the date format is Year).
- For operators that use inner and outer intervals, the inner interval is larger than the outer interval.
- The inferred interval is by week of the year or by an interval smaller than a day.
- The inferred interval is by day for any operator that has an offset other than 0.
  - The ParallelPeriod and RelativePeriod operators always return a missing value when the inferred interval is by day.

The following periodic operators are available:
Periodic Operators

<table>
<thead>
<tr>
<th>Operator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CumulativePeriod</td>
<td>returns the aggregated value for a period of time and all of the previous periods of time within a larger period of time (for example, the year-to-date total of monthly values).</td>
</tr>
<tr>
<td>ParallelPeriod</td>
<td>returns the aggregated value for a period of time that is parallel to the current period of time (for example, the value for the same month of the previous year).</td>
</tr>
<tr>
<td>Period</td>
<td>returns the aggregated value for a period of time (for example, the value for the current month).</td>
</tr>
<tr>
<td>PeriodWithDate</td>
<td>returns the aggregated value for a specific, constant period of time (for example, the value for the month that includes 15OCT2013).</td>
</tr>
<tr>
<td>RelativePeriod</td>
<td>returns the aggregated value for a period of time that is relative to the current period (for example, the value for the previous month of the same year).</td>
</tr>
</tbody>
</table>

CumulativePeriod

The CumulativePeriod operator returns aggregated values for a period of time and all of the previous periods within a larger period of time (for example, the year-to-date total of monthly values).

Note: The CumulativePeriod operator resets at the beginning of each calendar year. You cannot have a CumulativePeriod operator with a date range that overlaps two calendar years.

Specify the following parameters:

Parameters for the CumulativePeriod Operator

1. The aggregation that is applied to the measure.
2. The measure to aggregate over time.
3. The date data item for the period calculation. Only data items whose formats specify year are available.
4. The inner interval (smaller time period) for which the values are aggregated. For example, specify __ByMonth__ as the inner interval and __ByYear__ as the outer interval to aggregate the year-to-date values for each month.

Select one of the following:
- **Inferred**
  - specifies that the interval is determined automatically from the report object that displays the aggregated item.
- **ByMonth**
  - specifies a monthly interval.
- **ByQuarter**
  - specifies a quarterly interval.
- **ByYear**
  - specifies a yearly interval.

5. The outer interval (larger time period) that provides the context for the cumulative aggregation. For example, specify __ByMonth__ as the inner interval and __ByYear__ as the outer interval to aggregate the year-to-date values for each month.

Select one of the following:
- **Inferred**
  - specifies that the interval is determined automatically from the report object that displays the aggregated item.
- **ByMonth**
  - specifies a monthly interval.
- **ByQuarter**
  - specifies a quarterly interval.
- **ByYear**
  - specifies a yearly interval.

6. The number of outer intervals to offset from the current period. 0 specifies that the period from the current outer interval is used. A negative value indicates a previous interval.

   For example, if your inner interval is by month and your outer interval is by year, then -1 specifies the year-to-date monthly values for the previous year.

7. The scope for the period. The scope specifies how much of each period is aggregated.

Select one of the following:
- **Full**
  - aggregates the values for the entire period.
- **ToDate**
  - aggregates only the values up to a specific day of the outer interval.
- **ToToday**
  - aggregates only the values up to the equivalent of today’s position in the current interval. For example, if today is the 40th day of the quarter, and the outer interval is by quarter, then only the values up to the 40th day of each quarter are used.

   The value for today is evaluated dynamically whenever the aggregated item is viewed in a report object.

8. If you select **ToDate** as the scope, then select the date that is used to subset each period.

   For example, if you select 09NOV2013, and the outer interval is by year, then only the values up to November 9 of each year are used in the aggregation.
For example, `CumulativePeriod(_Sum_, 'Expenses'n, 'Date'n, _ByMonth_, _ByYear_, 0, _Full_)` aggregates the sum of year-to-date monthly values for the Expenses measure using date values from the Date data item.

**ParallelPeriod**

The ParallelPeriod operator returns aggregated values for a period of time that is parallel to the current period (for example, the value for the same month of the previous year).

Specify the following parameters:

*Parameters for the ParallelPeriod Operator*

1. The aggregation that is applied to the measure.
2. The measure to aggregate over time.
3. The date data item for the period calculation. Only data items whose formats specify year are available.
4. The inner interval (smaller time period) for which the values are aggregated. For example, specify _ByMonth_ as the inner interval to aggregate the values for each month. Select one of the following:
   - _Inferred_ specifies that the interval is determined automatically from the report object that displays the aggregated item.
   - _ByMonth_ specifies a monthly interval.
   - _ByQuarter_ specifies a quarterly interval.
   - _ByYear_ specifies a yearly interval.
5. The outer interval (larger time period) that provides the context for the parallel period aggregation. For example, specify _ByMonth_ as the inner interval and _ByYear_ as the outer interval to aggregate the monthly values for a different year. Select one of the following:
specifies that the interval is determined automatically from the report object that displays the aggregated item.

specifies a monthly interval.

specifies a quarterly interval.

specifies a yearly interval.

6 The number of outer intervals to offset from the current period. 0 specifies that the period from the current outer interval is used. A negative value indicates a previous interval.

For example, if your inner interval is by month and your outer interval is by year, then -1 specifies the monthly values for the previous year.

7 The scope for the period. The scope specifies how much of each period is aggregated.

Select one of the following:

aggregates the values for the entire period.

aggregates only the values up to a specific day of the outer interval.

aggregates only the values up to the equivalent of today’s position in the current interval. For example, if today is the 40th day of the quarter, and the outer interval is by quarter, then only the values up to the 40th day of each quarter are used.

The value for today is evaluated dynamically whenever the aggregated item is viewed in a report object.

8 If you select _ToDate_ as the scope, then select the date that is used to subset each period.

For example, if you select 09NOV2013, and the outer interval is by year, then only the values up to November 9 of each year are used in the aggregation.

For example, `ParallelPeriod(_Sum_, 'Expenses'n, 'Date'n, _ByMonth_, _ByYear_, -1, _Full_)` aggregates the sum of monthly values for the Expenses measure for the previous year using date values from the Date data item.

**Period**

The Period operator returns aggregated values for a period of time (for example, the value for the current month).

Specify the following parameters:

*Parameters for the Period Operator*

<table>
<thead>
<tr>
<th>Period</th>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Sum</em></td>
<td><em>Sum</em></td>
</tr>
<tr>
<td>2</td>
<td>Measure</td>
<td><em>Measure</em></td>
</tr>
<tr>
<td>3</td>
<td>Choose periodic item</td>
<td><em>PeriodicItem</em></td>
</tr>
<tr>
<td>4</td>
<td><em>Inferred</em></td>
<td><em>Inferred</em></td>
</tr>
</tbody>
</table>
The aggregation that is applied to the measure.

The measure to aggregate over time.

The date data item for the period calculation. Only data items whose formats specify year are available.

The interval for which the values are aggregated. For example, specify _ByMonth_ as the interval to aggregate the values for each month.

Select one of the following:

- **_Inferred_**
  - specifies that the interval is determined automatically from the report object that displays the aggregated item.

- **_ByMonth_**
  - specifies a monthly interval.

- **_ByQuarter_**
  - specifies a quarterly interval.

- **_ByYear_**
  - specifies a yearly interval.

For example, `Period(_Sum_, 'Expenses', 'Date', _ByMonth_)` aggregates the sum of monthly values for the Expenses measure using date values from the Date data item.

**PeriodWithDate**

The PeriodWithDate operator returns aggregated values for a specific, constant period of time (for example, the value for the month that includes 15OCT2013).

Specify the following parameters:

**Parameters for the PeriodWithDate Operator**

1. The aggregation that is applied to the measure.
2. The measure to aggregate over time.
3. The date data item for the period calculation. Only data items whose formats specify year are available.
4. The interval for which the values are aggregated. For example, specify _ByMonth_ as the interval to aggregate the values for each month.

Select one of the following:

- **_Inferred_**
  - specifies that the interval is determined automatically from the report object that displays the aggregated item.
_ByMonth_  
specifies a monthly interval.

_ByQuarter_  
specifies a quarterly interval.

_ByYear_  
specifies a yearly interval.

5 The reference date for the period aggregation.

For example, PeriodWithDate(_Sum_, 'Expenses'n, 'Date'n, _ByMonth_, '15OCT2013'd) aggregates the sum of monthly values for the Expenses measure using date values from the Date data item.

**RelativePeriod**

The RelativePeriod operator returns aggregated values for a period of time that is relative to the current period (for example, the previous month of the same year).

Specify the following parameters:

**Parameters for the RelativePeriod Operator**

1 The aggregation that is applied to the measure.

2 The measure to aggregate over time.

3 The date data item for the period calculation. Only data items whose formats specify year are available.

4 The interval for which the values are aggregated. For example, specify _ByMonth_ as the interval to aggregate the year-to-date values for each month.

   Select one of the following:
   
   _Inferred_  
   specifies that the interval is determined automatically from the report object that displays the aggregated item.

   _ByMonth_  
   specifies a monthly interval.

   _ByQuarter_  
   specifies a quarterly interval.

   _ByYear_  
   specifies a yearly interval.
5 The number of intervals to offset from the current period. 0 specifies that the period from the current interval is used. A negative value indicates a previous interval.

For example, if your interval is by month, then -1 specifies the monthly values for the previous month.

6 The scope for the period. The scope specifies how much of each period is aggregated.

Select one of the following:

- **_Full_**
  - aggregates the values for the entire period.

- **_ToDate_**
  - aggregates only the values up to a specific day of the interval.

- **_ToToday_**
  - aggregates only the values up to the equivalent of today's position in the current interval. For example, if today is the 40th day of the quarter, and the outer interval is by quarter, then only the values up to the 40th day of each quarter are used.

The value for today is evaluated dynamically whenever the aggregated item is viewed in a report object.

7 If you select _ToDate_ as the scope, then select the date that is used to subset each period.

For example, if you select 09NOV2013 and the outer interval is by quarter, then only the values up to the 40th day of each quarter are used in the aggregation.

For example, RelativePeriod(_Sum_, 'Expenses'n, 'Date'n, _ByMonth_, -1, _Full_) aggregates the sum of monthly values for the Expenses measure for the previous month using date values from the Date data item.

### Text (Simple) Operators

**Note:** All text operators are case sensitive.

**Note:** Text operators are not supported for aggregated items.

**Concatenate**
- appends the second input string to the first input string.

  For example, Concatenate('A', 'B') returns **AB**.

**Contains**
- specifies that a matching value must contain the specified string.

  For example, 'Catcher' Contains 'Cat' returns **true**.

**EndsWith**
- specifies that a matching value must contain the specified string at the end of the value.

  For example, 'Catcher' EndsWith 'her' returns **true**.

**Format**
- applies a SAS format to the input value. Click the format field to select the format that you want to apply. The output from the Format operator is a string.

  For example, Format(1015.35, 'DOLLAR6.2') returns **$1,015.35** as a string value.

**Note:** Standard date formats in SAS Visual Analytics display date and datetime values in the locale of your browser. You can display date and datetime values in the locale of the data source by using national language formats. The names of national language formats begin with “NL.” For example, the NLDATE format displays date values by using the locale of the data source.

**LowerCase**
- changes all of the characters in a text string to lowercase.
For example, `LowerCase('SAS INSTITUTE')` returns `sas institute`.

**NotContains**

specifies that a matching value must not contain the specified string.

For example, `'Catcher' NotContains 'Dog'` returns true.

**Parse**

interprets a numeric or datetime value from the input string. Click the format field to select the format that is used to interpret the string. The output from the Parse operator is either a number or a datetime value, depending on the format that you select.

For example, `Parse('15JAN2013', 'DATE9.')` returns 15JAN2013 as a date value.

**StartsWith**

specifies that a matching value must contain the specified string at the start of the value.

For example, `'Catcher' StartsWith 'Cat'` returns true.

**UpCase**

changes all of the characters in the text string to uppercase.

For example, `UpCase('sas institute')` returns `SAS INSTITUTE`.

---

**Text (Advanced) Operators**

**Note:** All text operators are case sensitive.

**Note:** Text operators are not supported for aggregated items.

**FindChar**

finds the position of a character or any of a set of characters within a text string. The position of the first match is returned as a numeric value. If no matches are found, then 0 is returned. The first input string specifies the value to search within. The second input string specifies the list of characters to search for.

For example, `FindChar('mystring', 'sz')` returns 3.

**FindString**

finds the position of a string within another string. The position of the first match is returned as a numeric value. If no matches are found, then 0 is returned. The first input string specifies the value to search within. The second input string specifies the string to search for.

For example, `FindString('mystring', 'st')` returns 3.

**GetLength**

returns the length of an input string as a numeric value.

For example, `GetLength('mystring')` returns 8.

**GetWord**

returns a word from an input string where the words are separated by spaces, periods, or other special characters. The first parameter specifies the input string. The second parameter specifies the number of the word to return where 1 is the first word.

For example, `GetWord('my test string', 2)` returns `test`.

**RemoveBlanks**

removes space characters from the input string. The first parameter specifies the input string. The second parameter specifies which space characters to remove. Select one of the following:

- **_All_**
  removes all spaces from the string.

- **_Leading_**
  removes spaces at the beginning of the string.
LeadingAndTrailing_ removes spaces at the beginning and end of the string.

Trailing_ removes spaces at the end of the string.

For example, RemoveBlanks('my test string', '_ALL_') returns myteststring.

RemoveChars removes all instances of a set of characters from the input string. The first parameter specifies the input string. The second parameter specifies the list of characters to remove.

For example, RemoveChars('my_test_string', '_') returns myteststring.

RemoveWord removes a word from an input string where the words are separated by spaces or special characters. The first parameter specifies the input string. The second parameter specifies the number of the word to remove where 1 is the first word.

For example, RemoveWord('my test string', 2) returns my string.

Note: In addition to spaces, the following characters are used as delimiters in the input string: . < ( ) + ! $ * ; ^ - / , % | '

Replace replaces a substring within the input string with a replacement string. The first parameter specifies the input string. The second parameter specifies the substring to replace. The third parameter specifies the replacement string. The fourth parameter specifies which instances of the substring to replace. Select one of the following:

ALL_ replaces every instance.

FIRST_ replaces the first instance only.

LAST_ replaces the last instance only.

For example, Replace('my test string test', 'test', 'new', '_ALL_') returns my new string new.

ReplaceWord replaces a word from an input string where the words are separated by spaces, periods, or other special characters. The first parameter specifies the input string. The second parameter specifies the number of the word to replace where 1 is the first word. The third parameter specifies the replacement string.

For example, ReplaceWord('my test string', 2, 'new') returns my new string.

Reverse reverses the order of the characters in the input string.

For example, Reverse('A B C') returns C B A.

Substring returns a substring from the input string based on the position of the characters. The first parameter specifies the input string. The second parameter specifies the position of the first character to return. The third parameter specifies the number of characters to return.

For example, Substring('my test string', 4, 3) returns tes.

Update replaces a substring from the input string based on the position of the characters. The first parameter specifies the input string. The second parameter specifies the position of the first character to replace. The third parameter specifies the number of characters to replace. The fourth parameter specifies the replacement string.
For example, `Update('my test string', 4, 3, 'nex')` returns `my next string`.

**URLDecode**
removes URL encoding from the input string. URL encoding replaces some characters with a % character followed by a two-digit hexadecimal code.

For example, `URLDecode('support.sas.com%2Fmy%20string')` returns `support.sas.com/my string`.

**URLEncode**
applies URL encoding to the input string. URL encoding replaces some characters with a % character followed by a two-digit hexadecimal code.

For example, `URLEncode('support.sas.com/my string')` returns `support.sas.com%2Fmy %20string`.

### Calculating Compound Annual Growth Rate

Compound annual growth rate (CAGR) is an investing and business term for the effective constant year-over-year rate of return that produces a target result value at the end of multiple years, assuming that the CAGR is compounded at the end of each year. For example, you might use CAGR to compare trends over multiple years in revenue or in the number of units sold. For SAS Visual Analytics, you can calculate the yearly CAGR using the expression builder.

This example compares trends in the growth rate for yearly sales amounts between different product types or regions.

The basic data items are:

- **sales**
  This is a numeric measure with a currency format and a default aggregation of Sum.

- **ProductType**
  This is a string category data item.

- **RegionName**
  This is a string category data item.

- **TransactionDate**
  This is a date data item with a format of Month, Day, Year (MMDDYYYY).

The duplicate data item is:

- **TransactionDateYear**
  This data item is a duplicate of the `TransactionDate` data item, but with the Year format.

The calculated data items are:

- **BeginningYearNum**
  This data item should be a numeric type with a Float4.0 format and an aggregation of Minimum.
  
  `BeginningYearNum = Year('31DEC2010'd)`

- **EndingYearNum**
  This data item should be a numeric type with a Float4.0 format and an aggregation of Minimum.
  
  `EndingYearNum = Year('transactionDate'n)`

The aggregated measure data items are:

- **NumYears**
  This data item has a Float4.0 format.

  `NumYears = Min [__ByGroup__] ('EndingYearNum'n) - Min [__ByGroup__] ('BeginningYearNum'n)`
BeginningValue

This data item needs to be set to the same currency format as the sales data item.

\[
\text{BeginningValue} = \text{PeriodWithDate}(_\text{Sum}_, \text{sales'}n, \text{transactionDate'}n, _\text{ByYear}_, \text{31DEC2010'd})
\]

EndingValue

This data item needs to be set to the same currency format as the sales data item.

\[
\text{EndingValue} = \text{Period}(_\text{Sum}_, \text{sales'}n, \text{transactionDate'}n, _\text{ByYear}_)
\]

NormalizedRatio

This data item has a Float12.2 format.

\[
\text{NormalizedRatio} = \text{'EndingValue'}n / \text{'BeginningValue'}n
\]

CAGR

This data item has a Percent format.

\[
\text{CAGR} = (\text{'NormalizedRatio'}n \text{ Power ( 1 / 'NumYears'n ) }) - 1
\]

To use the CAGR, you should add TransactionDateYear, CAGR, and any other categories of interest (for example, RegionName, ProductType, and so on) to a list table, a crosstab, or a graph.

---

**Reference: Conditions for Filters**

In SAS Visual Analytics, filters are based on expressions that contain operators. Conditions enable you to easily add the most common operators to your expression. Depending on the type of data that is used by the filter, you can select from the following categories of filter conditions:

**Conditions for Character Data**

<table>
<thead>
<tr>
<th>Operator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>=</td>
<td>Specifies that a matching value must match one of the filter values exactly.</td>
</tr>
<tr>
<td>Contains</td>
<td>Specifies that a matching value must contain the filter value.</td>
</tr>
<tr>
<td>EndsWith</td>
<td>Specifies that a matching value must contain the filter value at the end of the value.</td>
</tr>
<tr>
<td>In</td>
<td>Specifies that a matching value is in the list that you select. To select your list, choose the values from the drop-down list.</td>
</tr>
<tr>
<td>Missing</td>
<td>Specifies that a missing value matches the filter.</td>
</tr>
<tr>
<td>NotContains</td>
<td>Specifies that a matching value must not contain the filter value.</td>
</tr>
<tr>
<td>NotIn</td>
<td>Specifies that a matching value is not in the list that you select. To select your list, choose the values from the drop-down list.</td>
</tr>
<tr>
<td>NotMissing</td>
<td>Specifies that a nonmissing value matches the filter.</td>
</tr>
<tr>
<td>StartsWith</td>
<td>Specifies that a matching value must contain the filter value at the start of the value.</td>
</tr>
</tbody>
</table>

**Conditions for Numeric Data and Date and Time Data**

<table>
<thead>
<tr>
<th>Operator</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;&gt;</td>
<td>Specifies that a matching value must not be equal to the filter value.</td>
</tr>
</tbody>
</table>
### Conditions for Date and Time Data

<table>
<thead>
<tr>
<th>Condition</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Last 30 days</td>
<td>Specifies that a matching value is within thirty days of today's date.</td>
</tr>
<tr>
<td>Current month</td>
<td>Specifies that a matching value is within the current month.</td>
</tr>
<tr>
<td>Current year</td>
<td>Specifies that a matching value is within the current year.</td>
</tr>
</tbody>
</table>

---

### Date and Time Conditions

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>=</td>
<td>Specifies that a matching value must be equal to the filter value.</td>
</tr>
<tr>
<td>&lt;</td>
<td>Specifies that a matching value must be less than the filter value.</td>
</tr>
<tr>
<td>&lt;=</td>
<td>Specifies that a matching value must be less than or equal to the filter value.</td>
</tr>
<tr>
<td>&gt;</td>
<td>Specifies that a matching value must be greater than the filter value.</td>
</tr>
<tr>
<td>&gt;=</td>
<td>Specifies that a matching value must be greater than or equal to the filter value.</td>
</tr>
<tr>
<td>BetweenExclusive</td>
<td>Specifies that a matching value must be greater than the first filter value and less than the second filter value.</td>
</tr>
<tr>
<td>BetweenInclusive</td>
<td>Specifies that a matching value must be greater than or equal to the first filter value and less than or equal to the second filter value.</td>
</tr>
<tr>
<td>In</td>
<td>Specifies that a matching value is in the list that you select. To select your list, choose the values from the drop-down list.</td>
</tr>
<tr>
<td>NotBetweenExclusive</td>
<td>Specifies that a matching value must be less than the first filter value or greater than the second filter value.</td>
</tr>
<tr>
<td>NotBetweenInclusive</td>
<td>Specifies that a matching value must be less than or equal to the first filter value or less than or equal to the second filter value.</td>
</tr>
<tr>
<td>NotIn</td>
<td>Specifies that a matching value is not in the list that you select. To select your list, choose the values from the drop-down list.</td>
</tr>
<tr>
<td>NotMissing</td>
<td>Specifies that a nonmissing value matches the filter.</td>
</tr>
</tbody>
</table>

**Note:**

This condition is not available for continuous numeric data.